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This Special Issue of TeMA - Journal of Land Use, Mobility and Environment, collects twenty-seven contributes of international researchers and technicians in form of scenarios, insights, reasoning and research on the relations between the City and the impacts of Covid-19 pandemic, questioning about the development of a new vision and a general rethinking of the structure and urban organization.

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Special Issue

Covid -19 vs City -20

scenarios, insights, reasoning and research

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COVID-19 vs CITY-20
SCENARIOS, INSIGHTS, REASONING AND RESEARCH

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Given the short time to produce the volume, the Editorial Board of TeMA Journal carried out the scientific quality audit of the contributions published in this Special Issue.

The cover image is a photo collage of some cities during the Covid-19 pandemic quarantine (March 2020)

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TeMA Journal of
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Contenets

TeMA Journal of
Land Use, Mobility and Environment

EDITORIAL PREFACE

Special Issue 1.2020
Covid-19 vs City-20

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During the darkest weeks of the pandemic, walking through the empty streets of my city and trying to make sense out of this tragedy, not only as a person –with the fears and uncertainties of many– but also as a scholar of urban phenomena, the introductory phrase to the first volume of "Method", by Edgar Morin, 1977, occurred to me. "Nous avons besoin d'une méthode de connaissance qui traduise la complexité du réel, reconnaisse l'existence des êtres, approche le mystère des choses. La méthode de la complexité demande: de concevoir la relation entre ordre/désordre/ organisation et d'approfondir la nature de l'organisation; de ne pas réduire un objet à ses éléments constitutifs ni l'isoler de son environnement; de ne pas dissocier la problème de la connaissance de la nature de celui de la nature de la connaissance. Tout objet doit être conçu dans sa relation avec un sujet connaissant, lui-même enraciné dans une culture, une société, une histoire".

In these few lines, Edgar Morin highlights the main aspects of the new manifesto of contemporary scientific thought, based on which every scientific discipline can completely revise methodological and operative approaches than in the past.

For the sciences that study the city and the territory, the holistic approach, the theory of systems and the complexity paradigm seem to allow for an interpretation of the urban and territorial phenomena in progress that is more relevant to reality. Considering and studying the city and the territory as dynamic, complex and chaotic systems offers the greatest guarantees of relevance, especially if we consider the number and variety of catastrophic events that have been occurring in recent decades: from events related to the effects induced by climate change to the current viral pandemics; events that are difficult to predict and so significant that they are considered real challenges for the lives of many populations. On the other hand, in order to know these phenomena - which the chaos theory defines as random - and to understand their effects, it is essential to read them within the context in which they occur: the city and the territory (Gargiulo & Lombardi, 2016; Zucaro & Morosini, 2018).

From these premises and without any limits, neither disciplinary nor content, we invited some colleagues who study, with different skills, the urban and territorial environment to develop a reflection on what was going on in our country. Everyone answered our call with enthusiasm and agreed, despite what usually happens in scientific practice, whereby the flow of time is a necessary condition to develop opinions, that verifying procedures and discussing about the advancements of scientific community could have been adding elements for the quality of each contribute, also considering the emotional boost driven by these exceptional experiences.

This Special Issue collects contributes developed in the last weeks with the aim of stopping our thought for the tragedy and lay the foundation for a broader reflection that will commit us in near future.

In the Editorial preface, I like to report a summary of the main topics developed in the contributes, which confirms that the sense and objectives of this initiative have been completely fulfilled.

The contributes have been included in the summary in alphabetic order, according to the surname of the first author.

In the first, "Covid-19 and simplification of urban planning tools. The residual plan", Pasqualino Boschetto aims to develop an initial reflection on the Residual Plan, which could represent the urban plan coherent

with Postmodernism. The Covid-19 pandemic is further complicating the fate of the Urban Plan, increasingly complex, uncertain and unable to regenerate itself according to the new paradigms of the organization of the territory.
In the next paper, "Covid-19. Some moments of the 21st century, with a look at Milan**",** Roberto Busi argues how the relative pathos of death and poverty unleashed on Milan is, in fact, a contingency on the endless flux of the urban body in the long history of the city. The text temporally describes the impact of the pandemic and it is developed as a Gaussian curve: the two extremes being in points before and after the beginning of the curvature, the center with the peak of the curve and the two intermediates in its ascending and descending sections, respectively.
In the third article, "Health emergency and economic and territorial implications. First considerations", Salvatore Capasso and Giuseppe Mazzeo provide an overview of the territorial and economic implications related to the epidemic event on the basis of a set of economic, settlement and environmental indicators applied to the two territorial dimensions of the Italian Regions and Provinces. The connection with epidemic data was analysed to verify the possible presence and consistency of the correlation indices. Aim of the article is to highlight some territorial characteristics that may have facilitated the spread of the epidemic by identifying, at the same time, some actions that will positively affect them, in an evolutionary perspective. Then, Alessandra Cesaro and Francesco Pirozzi, in "About the effects of CoViD-19 on solid waste management" discuss the impact of the CoViD-19 emergency on both the generation and the management of solid waste originating from both household and healthcare activities. Data about the amount of waste produced and associated ordinary handling procedures were gathered in order to highlight how both have been affected by the measures implemented to cope with the emergency.
The next article "The city and natural resources. Pandemic disaster can be a driving force for new perspective", by Donatella Cialdea, contains some reflections, born during the preparation of the next National Table for River Contracts. Focal point of the reflection is that the pandemic can be a driving force for new perspectives, in which the urban condition can be revisited with a view to improving quality.
The sixth paper, "Evolution of mobility sector during and beyond Covid-19: viewpoint of industries, consultancies and public transport companies" by Pierluigi Coppola and Francesco De Fabiis, presents the results of a survey carried out between April and May 2020, among a panel of chief executives of industries, consultancies in the mobility sector, and Public Transport (PT) companies. The survey is focused on the analysis of their own business and their opinions about the effectiveness and the sustainability of the measures proposed for coping with the impacts of Covid-19 pandemic in the short-medium term.
Then, the theme of tourism is the focus of the paper by Fabio Corbisiero and Rosa Anna La Rocca titled "Tourism on demand: a new form of urban and social demand of use after the pandemic event". The authors particularly investigate the possible evolution of the tourist demand due to the pandemic occurred aiming at outlining the possible urban as well as social scenarios that will characterize the tourism-city relationship in the next future.
Following, Giancarlo Cotella and Elisabetta Vitale Brovarone in their paper "Questioning urbanisation models in the face of Covid-19: The crisis as a window of opportunity for inner areas" introduce the challenges that the present sanitary emergency raises for contemporary urban environments particularly focusing on the reasons behind the progressive abandonment of remote rural areas, and on the increasingly scarce accessibility to services for the inhabitants of these areas. The authors argue that policies dedicated to counteracting these trends are needed to enhance the overall resilience of societies in inner areas.
The next paper by Claudia de Luca, Simona Tondelli and Hanna Elisabeth Åberg, "The Covid-19 pandemic effects in rural areas. Turning challenges into opportunities for rural regeneration" presents some responses to the Covid-19 crisis collected through an open call for action within the RURITAGE project. It aims at show how rural areas can cope with emergencies and it builds the basis to rethink the current crisis as a crucial tipping point for a resilient development of rural territories.
The following paper by Diego Deponte, Giovanna Fossa and Andrea Gorrini, "Shaping space for ever-changing mobility. Covid-19 lesson learned from Milan and its region" raises a question on the established transit-oriented development approach, focusing on spaces "in between" and not only on nodes and networks. The results show that the streets represent by far the most strategic asset of the urban public realm. They can be reshaped in resilient infrastructure capable to respond to new forms of mobility based on a renewed Mobility-as-A-Service paradigm, as final result of different travel behaviors of the post

pandemic scenario, among which an expected reduction of the overall "mobility consumption" (space) and new temporal urban rhythms (time).
Then, the paper "From social distancing to virtual connections: How the surge of remote working could remold shared spaces", by Luisa Errichiello and Daniele Demarco, offers a critical reflection on how ICTs can influence our perceptions of places and argues that places play a key role in influencing the patterns of remote workers' identity construction. The authors caution about the dark side of digital connectivity, pointing at the risks that a prolonged detachment from reality and the loss of places can put on remote workers' identity.
Following, the paper "The paradigms of urban planning to emergency-proof. Rethinking the organisation of settlements at the time of a pandemic" by Isidoro Fasolino, Michele Grimaldi and Francesca Coppola, offers a critical reflection on how this health crisis can be an opportunity to rethink the functioning of the city, its spaces, its times and its forms of social and economic interaction, according to the most recent scientific paradigms widespread within the urban planning field.
The next paper, by Romano Fistola and Dino Borri "Virucity, Rethinking the urban system", proposes a reflection about the virus impacts on urban system and envisages possible post-Covid urban scenarios hoping a general rethinking of the time and the space use of the future cities.
The following paper "The role of the urban settlement system in the spread of Covid-19 pandemic. The Italian focus", by Carmela Gargiulo, Federica Gaglione, Carmen Guida, Rocco Papa, Floriana Zucaro and Gerardo Carpentieri, proposes a focus on three main aspects of the spread of coronavirus in our country: on any correlations that have been established between the spread of the Covid-19 virus and the settlement system of our country; on urban and territorial phenomena that can be associated, positively or negatively, with the spread of the virus; on any correspondence between homogeneous clusters of Italian provinces (due to the current most significant phenomena of a settlement nature) and the intensity and spread of the infection.
The authors of the next contribution, Paolo La Greca, Francesco Martinico and Fausto Carmelo Nigrelli, in "Passata è la tempesta ..". A land use planning vision for the Italian Mezzogiorno in the post pandemic" highlight issues that are deemed relevant for including inner areas of Italian Southern regions into the process of economic recovery after the pandemic, in order to avoid the deepening of the long-lasting North-South imbalance, in the light of the growing depopulation of this part of Italy. They especially focus on the role of Health Services, Education, Built-up Environment, and Transports, considered as key elements for promoting a well-balanced use of existing territorial assets.
The next paper, "Covid-19 and Spatial Planning. A few issues concerning public policy" by Sabrina Lai, Federica Leone and Corrado Zoppi, examines various issues of territorial planning such as collective public spaces and shopping centers, urban and regional mobility infrastructures and services, changes in food supply and on the mitigation of negative impacts connected to climate change in order to focus more attention on public administrative bodies, professionals, entrepreneurs and authorities participating in the profit and non- profit sectors, and local communities and a fresh start to planning after the lockdown period, especially in an attempt to provide new approaches to mitigate risk related to Covid-19 and which represented a great challenge for a number of commonplaces of the current planning culture.
Then, the paper "Take advantage of the black swan to improve the urban environment" by Antonio Leone, Pasquale Balena and Raffaele Pelorosso, discusses the current Covid related environmental issues providing recommendations for more effective actions that would address the urban planning towards a comprehensive sustainability of future cities.
The next contribute is by Giulia Mastrodonato and Domenico Camarda and it is titled "Imagining living spaces in extreme conditions: suggestions from a case study in Bari", which describes how the coronavirus emergency influenced the perception of the surrounding spaces by submitting a survey to the students of the Polytechnic University of Bari (Italy), both during the lockdown phase and immediately after.
Then, Pierluigi Matteraglia, with the paper "Risk, health system and urban project, highlights the relationship between risk and the Veneto health system", which is analysed from the point of view of urban project. The focus is the reorganization and the strengthening measures (health presidium) to face new pandemics and / or health crises.
The following paper, "Geographical analyses of Covid-19's spreading contagion in the challenge of global health risks. The role of urban and regional planning for risk containment", written by Beniamino Murgante, Ginevra Balletto, Giuseppe Borruso, Giuseppe Las Casas and Paolo Castiglia, questions about the outbreak of Covid-19 out of China in Europe, dealing with why and why with such strength Italy has been seriously

hit. In order to try to give an answer to these questions, authors realized a vast and articulated database of indicators at provincial level in Italy, performing several geographical and statistical analyses, that suggest that policies based on urban regeneration, sustainable mobility, green infrastructures, ecosystem services can create a more sustainable scenario able to support the quality of public health.
The paper which follows, "The resilient city and adapting to the health emergency. Towards sustainable university mobility", by Francesca Pirlone and Ilenia Spadaro aims to highlight the importance of the Quadruple Helix principle by analysing the specific measures that each actor can implement in order to reduce health risk. The focus is on the Prince project about sustainable university mobility.
Then, Piergiuseppe Pontrandolfi in their paper "Physical spacing and spatial planning. New territorial geographies and renewed urban regeneration policies" pay particular attention to the responses to limit the impact of the Covid-19 pandemic on the growth and development of the country imply a reconfiguration of territorial and institutional geographies. The paper, in addition to giving general reinterpretation of the administrative geographical areas, investigates the functions and skills necessary after the lockdown in the new territorial governance tools, on flexible forms of planning, adaptable to the spaces to be governed.
In the next paper by Elmira Shirgir, "Megacities facing Covid-19 pandemic. How to use urban spaces in Tehran after the new pandemic", the new ways people are using the city in Tehran after arrival of the pandemic have been studied and suggestions for guaranteeing the safety of urban spaces from now on have been discussed.
Then, Maria Rosaria Stufano Melone and Stefano Borgo, in the paper "Rethinking rules and social practices. The design of urban spaces in the post-Covid-19 lockdown", deepen the consequences that pandemic, particularly the adaptation to social distancing, is having on the design of urban public and private areas. The motivation for this analysis is to investigate and raise awareness of the consequences of changes in social practices. The work shows just one way to analyse architectural design, and should be considered as a contribution to a much needed broad and inclusive discussion about how we want urban spaces to be.
The following paper, "Data analysis and mapping for monitoring health risk. What has the spread of the Covid-19 pandemic in northern Italy taught us?" by Michela Tiboni, Michéle Pezzagno, David Vetturi, Craig Alexander and Francesco Botticini, offers a reflection on what we have learned from this pandemic regarding the need to have a monitoring system for phenomena related to health risk, in order to reduce the vulnerability of the health system.
The last paper is from Maurizio Tira, "About the sustainability of urban settlements. A first reflection on the correlation between the spread of Covid-19 and the regional average population density in Italy, Milan", who argues that sustainable urban development solutions is a dramatically urgent need. Even if it is not yet clear if a link exists between the spread of the virus, the health consequences and the environmental conditions, what probably will need to be assessed is the effect of population density on the spread of contamination, and that will probably force decision-makers to rethink the whole organization of our urban life to defend ourselves from largely unknown threats.
Finally, I would like to remind that this volume is the first editorial product since TeMA Journal has been added is the A-category of scientific journals. There could not be a better start for this new phase of higher responsibility and commitment for our editorial work and for this I have to thank all those who contributed to create this volume. First, I want to thank the colleagues that, with their works, have given scientific rigor and methodological approach to many of the topics that have been discussed during these months, with some approximations and superficialities. One further vote of thank is also due to the Board that encouraged us to follow up this initiative, not forget about Associate Editors and Editorial Staff that, with their engagement and the know-how gained during these years, made the publication of the Special Issue possible.

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Covid-19 and simplification of urban planning tools. The residual plan

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Abstract
This paper aims to develop an initial reflection on the Residual Plan can be. The Urban Plan has always coincided with the offer of public power, leaving deliberately aside the continuous 'dynamic of the real', mainly coming from the private component of our society (The demand plan).
In the transition from Modern to Postmodern, the environmental question undermined the consolidated certainties of the Offer Plan; opening up increasingly consistent operational gaps with the Residual Plan, which could represent the urban plan coherent with Postmodernism.
Covid-19 is further complicating the fate of the Urban Plan, increasingly complex, uncertain and unable to regenerate itself according to the new paradigms of the organization of the territory. In this sense, at least in the Covid-19 transitional period, the Residual Plan could be experimented to understand its real capability of answering to the dynamics of the organization of the territory.

Keywords
Simplified operational tools; Urban and territorial planning; Post Covid phase

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1. Introduction

A relevant part of our discipline (of town planning) tried to understand how space has changed over the time, to identify more or less recognizable roots that may possibly represent elements of continuity and support for the present era and, may be, a sort of future projection.

Certainly, we don't miss the complexity of this investigation and often the frustration of remaining with a few cognitive fragments capable of projecting ourselves into our task of organizing (planning) the urban space over the time.

Time is one of few axioms of our discipline, it's the main actor of all spatial transformations and of the organization of our in becoming civilization, a rewarding certainty to which we can lean on with confidence. Time is a certainty of sequential connection, questioned almost exclusively by utopian instances, almost always borne as inevitable corollaries, which sooner or later would have adapted at the "right time in / in the right space".

The revolutionary thought of modern relativism has introduced unknown paradigms, indecipherable with our ordinary disciplinary tools, but which require at least an effort of "conceptual adjustment". It is necessary to probe complex cognitive levels in search of absolutely innovative factors, generators of new and different spatialities, not consequential but merged in the space-time dimension.

The gratifying and understandable series of the "spatial figuration" of the organization / planning of our urban space has been irreparably endangered by the new dogma of temporal and spatial relativism.

Then, how is possible opening new paths in the unexplored forest of our future state? How is possible to look for new approaches and tools that can, at least, try to re-generate our discipline, with a minimum of coherent scientific assumptions?

Almost dramatically: how to understand, organize and govern our liquid society?

A challenge that we must inevitably take up, with immense patience and intelligence. We have to establish a simple starting hypothesis: the awareness of having reached a point of "no return", but more intense and meaningful than others, considered as such, encountered during our long journey[1].

The past instantly loses (or must lose) its operational value, to become a cultural reference of collective memory, to which historical elaboration can attribute appropriate value.

2. The mantra of Simplification

Not only in our discipline, the "simplification" is a theme and an objective now considered fundamental, essential, absolutely transversal to the various operating levels, and especially in the regulatory and procedural subsets.

For a long time and from several parts, the simplification of building and urban planning regulations, but also of the related administrative processes, of the entire procedures, of the same final checks and ex-post controls, even the same technical-scientific disciplinary language. This language, unfortunately, is too often self-referential, "incomprehensible" to the same users: whether they are administrators and/or public or private decision-makers, whether the same "representative citizenship" than has now become an active subject in the decision-making process through "participation"[2].

The Covid-19 tsunami (still in progress) seems to indicate precisely the "simplification" as a possible (almost certain and necessary) reference to which to attempt to anchor the complex and difficult subsequent "reconstraction".

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1 The thought runs almost instinctively to the "seven messengers" (see: Buzzati, 1968).

2 We refer to the Italian situation where the "active participation" in the decision-making process of urban planning is a recent compared to other foreign situations where is widely practiced and consolidated for some time.

In this specific situation, we will limit ourselves to carrying out some technical-scientific reflections on the urban planning context and, in particular, on the contents of the "urban plan" in the era of Covid-19, and in the necessary suborder of reference, its structural and morphological regulatory framework.

3. The plan of the offer (the offer plan)

The (urban) plan[3] in "modern urbanism" represents the purpose and instrument of our scientific-disciplinary work, in its countless forms and contents. Referring in particular to the Italian situation, the urban planning community hasn't certainly skimped on studies, analyses and plans which, over the years, have achieved pachydermic features and forms, where the plan/project has transformed itself into a "Double-faced Janus".
On the one hand, the normative quagmire, unfortunately often blurred in some of its fundamental components; on the other hand, the centrifugal force, gradually increasing, of the reproductive centralities of cognitive analysis that are multiplying at all levels. Too often the culture of the Plan has tried to rest firmly on the utopian solidity[4], which has always been practiced with ups and downs by the constituted power. Fixity, certainty, security, uniformity - but also: dirigisme, collectivism, geometrism, perfectionism, fixism, etc.[5]. - are just some of the founding elements of the Plan that power offers to itself and its subjects. Changes are always dangerous, harbinger of questioning, of interruptions, of disconnections, of dangerous confrontations, not contemplated in the structure of the Urban Plan. By its own nature, the Plan is incompatible with the dynamics of reality. The effects and instances of the real (unquestionably variegated and complex even in its dynamics) are looking for new balances, but they are absolutely incompatible with the constituted power, which bases its preservation and its identity precisely on its static, immovable, unquestionable and therefore immutable balance (as much as possible, at most in very small doses).
The Urban Plan has always incorporated in itself the utopian components that were functional and necessary in a specific moment and in those spatial situations, sometimes in a not very conscious way.
In the introduction of a multi-handed publication on the "Utopian Presences", Giordani specifies: «Unlike the past (pre-industrial and paleo-industrial) during which, in general, the utopian drives were "lateral" to the corporate context (usually clearly distinct or even opposed), in the contemporary and, in particular, in the governance of the territory of our country in the last thirty years, the aforementioned impulses are frequently filtered through institutions, appropriating to varying degrees the public opinion, the prevailing mental constructs, settling into the positive norm and policies, coexisting - albeit between oppositions (but without obvious traumas) - with the coordinates and the becoming of the system.» (Giordani, 1996, p. 9).
Historically the urban plan is mainly a design and representation of the "offer" of the power of reality «…leaving to the individual and private liberties an increasingly restricted area» (Leoni, 2008)[6]. Without forgetting the legislative component that "formalizes the plan", which, due to its actual inflation, has made the Plan its less light, comprehensible and feasible. Unfortunately, the urban plan is now too often a traumatic dogmatic prefiguration of abstract collective interests.

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3 It would be necessary to specify what is meant by town-planning and a town projecting. In our meditation, we will refer mainly to the Plan and only partially to the Project, as we believe that in this specific case it is sufficient to consider the urban project as an integral part of the "planning". It may be useful to refer to a definition by Giordani: «In the broadest sense, the project presumes anticipation, underlies the projection of (any) intellectual production. A creative path –ideative and operative– proper to the individual, to the subject; which, in this way, is exteriorized into a result. In particular, the architectural or urban planning project has, as a final result, the creation of a space, respectively internal or external; in fact, an identity, as one is resolved in the other. [...] in a dynamic space, [...] marked by quality.» See: Giordani, 2001, p. 12.

4 Starting from the Ruyer's classic definition: mental exercise on possible side effects. Moving on to Trousson's observation (paraphrased by Giordani) that utopia is in an immutable present that knows neither the past nor the future. See: Giordani, 2001, p. 13 and p. 16.

5 Elements of the utopian genre (see: Giordani, 2001, p. 15).

6 In our observations, for "individual freedom" we want to mean everything that has some main connection with the "plan question".

If we should analyze the vicissitudes of the Italian story of the urban plan, it would be enough to have punctual confirmation of this. The enthusiasm for the young national unity acquired is mainly embodied in the Plan of the capital, which arrives from Turin to Rome via Florence. And it is precisely the Poggi Plan that seems for the first time to link Italy to the European industrial modernity, playing more on the prefiguring form than on the dynamic contents in progress. Despite the distortions of self-exaltation, the Fascist period certainly caught the rationalist lesson, elaborating, in a significant way, the fundamental principles and obtaining concrete and positive results especially in the field of territorial planning (agricultural reclamations of vast national areas and related urban foundation systems).

This long beginning of national unification finds its first moment of coagulation of the Plan ("of the offer") right at the beginning of the Second World War, once again as a two-faced Janus, perfectly distinguishable. On the one hand, there is the inevitable condensation of late-romantic thought, still prevalent in Italian culture (B. Croce), which finds its automatic exemplification in the two laws of 1939.[7]

On the other hand, there is the law 1150 of 1942 (the fundamental urban planning law in Italy), absolutely stubborn, in a manifest attempt to put itself on a par with the other European advanced countries, even in the awareness of the lack of its socio-economic support of concrete reference.[8]

Analyzing with attention, without disciplinary prejudices, we would have the possibility to verify, without great difficulty, the structural permanence of the utopian immanence in the fundamental urban planning norms that inevitably refract in all Italian planning practice, at all levels. Utopian continuity that is punctually found in all the urban planning norms of the following decades and in its main product (the Plan) until the "fall of the wall" (by convention now widely accepted and shared).

In recent decades, and especially in the transitional period between Modern and Postmodernism, the Plan has inevitably had to include the "environmental question", which has represented (and still represents) the real main element of the crisis of the Plan itself. In this sense we can at least hypothesize that the "environmental question" may represent the main cause of the inevitable value decrease of the Plan in terms of "offer" and the corresponding complementary growth of the "question" component.[9]

Hargrove argues that the "environmental question" (or «environmental ethic» as he defines it) is first of all to be sought in an incomprehensible lack of Western philosophy, if not in a deliberate and stubborn mystification. If the environmental theme had taken other directions and contents within the Western philosophical and scientific thought, we could say that the same urban plan would have had very different trajectories and paths and that almost certainly the history of the (town planning) plan would not have been merely an imposition of the offer of power. In continuity with Greek and Roman thought much of Western culture up to Descartes and beyond: «…the human soul was, once again, permanent and indestructible» and furthermore «…since the existence of physical matter depended directly on the exercise of God's power, an appropriate context for human involvement and interest was still lacking. Changes in nature, good or bad, were simply manifestations of God's will and therefore beyond human control» (Hargrove, 1990).

The absence of the "environmental question" in main body of philosophy and science must be sought, precisely, in the persistence of this incomprehensible distinction between «…primary and secondary properties. The observations made by geologists and biologists focused on secondary properties – colors, tastes, smells,

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7 With the law 1497/1939 for the first time the landscape spatial Plan is introduced as the only instrument (absolutely utopian) for "protection of natural beauty" (and its landscape).

8 Demonstrating once again, and perhaps more than in other cases, the natural utopian propensity for Italian norms and urban planning. The simple proof, irrefutable, lies in the implementation (in space and time) of the law itself, including its countless integrative adaptations, as well as its implementation and procedural overturning with respect to what was established (initially foreshadowed): we refer to the pyramidal system for consequential levels of prescribed planning, completely disregarded in practice, if not completely "overturned".

9 Recalling that is a complementarity and it certainly cannot be directly transferred equally in absolute terms, mainly because of the greater degree of complexity of the environmental issue.

sounds – that were considered and perceived subjectively rather than objectively. [...] this interest in secondary properties means that naturalists were often closer to poets and painters than physicists and chemists» (Hargove, 1990, p. 51). It seems paradoxical understand the mystery (and perhaps the inevitable related doubts) that Darwin captures in his attempts to base his science solely on fact and the same time: «The loss of aesthetic tastes implies a loss of happiness, perhaps it damages the intellect and more likely it damages moral qualities, because it weakens the emotional part of the personality» (Hargove, 1990, p. 54).[10]. Unfortunately (as Hargrove maintains) «…the philosophy of science has constantly invalidated the legitimacy of the natural and environmental sciences; in full awareness» (then, and today in an even more alarming and urgent way) that: «The environmental crisis is certainly the most serious problem facing civilization today» (Hargove, 1990, p. 57).

3.1 The Demand Plan (the plan of the demand)

«Minimalism, flexibility, public-private negotiation, radically transform the animus of the plan. The plan becomes a "demand plan", a strategic interpreter of the becoming of society, instead of a plan-offered prefigured by the public, authoritative and discretionary (as in the past), a genesis derived from society as "operative hive"» (Giordani, 1996, p. 45).

Few clear elements, such as those just mentioned, allow us to make some important considerations. The "minimality" should be understood not so much as a diminution of the Plan, but rather, as its operational necessity. The Plan, still too unbalanced on the public-administrative offer side, has acquired a really complex mass (of contents, normative references, prescriptive levels and degrees, relational links, etc.) to be (correctly and effectively) transferred into practice, but above all to be a sure reference both in the authorization and implementation-management phase. Minimality, therefore, must be also understood as careful and correct "simplification", perhaps the only "instrument-method" on which we can really count for the same recovery of value (and credibility) of the Plan itself. We have to accept the challenge of having to face considerable efforts, both theoretical and analytical, for the identification of new innovative paradigms to support the new Plan, where simplification can be correctly combined with the effective increase in the ability to govern complexity, without altering its constitutive, shared values.

Flexibility has always been, with the various graduations in time and space of reference, one of the main enemies of the "plan offer"; it is therefore easy to understand, if not automatic, that this represents a fundamental instrumental objective of the "plan demand".

Only recently, the public-private relationship has found significant spaces within the Urban Plan. The "invisible hand" has always tried to break through the various phases and seasons of the Plan ("offered" by the power of turn, however definable "public"), almost always with laughable results, certainly not recognized for obvious power relations. The absolute necessity to research for new and more complex levels of balance (stubbornly stable) of the Plan has entailed (and involves) the indispensable contribution also of its "private" component, decisive pawn for the definitive passage to Postmodernism. The (postmodern) Plan has the absolute necessity to certify that the "private" component, after its long formative path, has finally become (in its whole variegated and dynamic) main actor of the urban plan. In the continuous negotiation process between public and private, flexibility is an inalienable factor, as in the DNA of the private, but also as the main matrix of the "development". Flexibility perhaps represents the main objective of the private component (and its "plan demand") [11].

It is precisely in these terms, as we shall also recall later on, that the same "minimal plan" – interpreter of the evolutionary process of reality, aimed at development [which] in order to be feasible [must] necessarily be

[10] Hargove recalls Darwin, 1980, p. 77.

[11] Development is by its very nature transient, precisely of the ineluctability of becoming, therefore of the continuous demand for coherent transformation.

flexible [i.e.] a transformation plan in continuous updating (Giordani, 1996, p. 45) – can be understood, first, as a determining component of the same "request plan", but also, subsequently, as a determining component of the constituting "residual plan". The analytical-propositional reflection of the whole environmental question remains, in our opinion, still absolutely insufficient and inadequate within the content lexicon of the "plan question", even if interesting cues in the international scene do not seem to be missing.

4. The complexity

The degree of complexity of our discipline grows over time, in inevitably varied forms and ways. In the panorama, which is the subject of our present reflections, we believe that the "environmental theme" represents a fundamental knot of the path we are practicing. The need to deal with the environmental issue in analytical and scientific terms within the (urbanistic) Plan has entailed and involves a substantial revision of the procedure and of the theoretical and implementing, practiced or practicable contents. Contents and operative practices related to the "territory" and the "landscape" have found their adequate and coherent spaces within the (urbanistic) Plan itself, at least in terms of recognizable historical-cultural value, because they were sufficiently consolidated and shared.[12]

With the introduction of the environment (and its many corollaries), a surge (perhaps unexpected, certainly not foreseen) in the complexity of the Plan is manifested. The "environmental theme", in a short time, has led to the introduction of new scientific paradigms in our discipline and in the Plan (its main workhorse), and among these: objective multidisciplinary innovative experimentations, capable of unhinging (or at least reconfiguring) necessarily languages, styles and processes of urban government now no longer adapted to the new reality. So, this is an action of "opening", of space-time disconnection, which many tend to identify in the passage from Modern to Postmodern, which could be an opportunity to deal a mortal blow to the utopia of order, of prefigurative geometrism, of political-administrative dirigism. All they are never synchronous with the effective demands of the incessant transformation of the dynamics of reality. Finally, the "seven messengers" will be able to look only in front of them, with the analytical and proactive priority of trying to understand and understand the objective factuality of the present, which day after day is able to condense into a "young past", directly verifiable; but also they will be able to concentrate with greater strength and determination in the "possible future", with great freedom and dynamic creativity. If the outcome of the environmental issue (which some even make coincide with the end of the "short century") has led, as it seems, to new levels of complexity (both in terms of quantity and quality), it seems now well established that Covid-19 is inexorably pushing us into new and more binding levels of complexity of the Plan and the governance of its most innovative contents. Covid-19, even in terms of urban planning itself, only accentuates, and will accentuate, the many grey areas present in the current Plan, due to the evident lack of new reliable reference points to which we consciously, responsibly and inevitably hook ourselves. The increase in complexity due to Covid-19 forcibly forces us to practice strenuous extra time, in an increasingly slippery playing field, where we can invent new trajectories and strategies. It seems appropriate, therefore, to refer first of all to the fundamentals of the discipline, old and new, in order to try to identify a new dynamic balance (hardly stable and lasting) where the surge of emergency complexity (due to the pandemic Covid-19) can very appropriately find significant coherent answers in the Plan.

It becomes therefore necessary to try to identify, with shared technical-scientific precision, the main point of the "environmental question" practiced so far. The time has come (surely Covid-19's accomplice) to realize that the urban planning discipline and his favourite son (the Plan) is coming (or perhaps he has already passed

[12] In these terms we can therefore consider that the joint action of the consolidated territory-landscape combination within the Plan has not led to major upheavals in terms of significant discontinuity of values and degrees of complexity. Highlighting in all this a certain specific incremental regularity.

without his knowledge) those «limits of scientific knowledge so dear to Wittgensteinen (paraphrased and reported by Hargrove within the "environmental" discipline) (Hargove, 1990, p. 200).
And if it is true that the long and exhausting path taken by the "environmental theme" has managed to reach the fence of scientific knowledge, the correctness (and clarity) of the language becomes essential. This is why the "environmental issue" (structural and strategic support of the Plan, recent and future) must necessarily distinguish clearly its main words: territory, environment and landscape. It seems to us that the arguments developed by Valerio Romani can be a specific reference set, sufficiently correct and shareable. In extreme synthesis (in the hope of having grasped at least the instrumental "semplification" of his technical-scientific reasoning) we could associate each individual "root vocabulary" with its own autonomous domain: set-territory; set-environment; and set-landscape. And, always simplifying as much as possible, to think that the single definitions are above all marked by the priority operativeness of the Plan[13].
The "territory", in urban planning disciplines, has been traditionally and commonly used in its economic meaning, to the application of the economy to the real space, and «to the problems of the geographical distribution of economies and the consequent settlement phenomena» (Romani, 1994, p. 54). And even more precisely: «The territory is therefore only "surface available", more or less suitable to satisfy the needs of the economic organization of the space, as an inert support of the anthropic interventions linked to the demographic dynamics, to the processes of colonization, of production, of urban localization and, in general, of distribution of human activities, independently of presence or natural attributes» (Romani, 1994, p. 54).
The "set-landscape" and the "set-environment" are more technically and scientifically complex than the "set-landscape". And it is precisely to their specification (definition) that several scholars of the "environmental" disciplines have dedicated themselves. Just the "polysemic" nature of the landscape has complicated its understanding in scientific terms. As well as its almost natural mixture (overlapping) with its main derivative: the environment. It is no coincidence that on several occasions today the two root-vocabulary is still used imprecisely, and too often as synonyms. We can say, however, that we are now able and must absolutely strive to use the two terms in an appropriate way in the absolute necessity to govern the "complexity" with the instrumental intelligence of the concrete "simplification".
The "landscape" for Romani (1994, p. 47): «is a dynamic system of ecosystems in mutation, readable only as an evolutionary process. It includes all the active or inert elements of spontaneous or anthropogenic origin that make-up the ecosphere, as well as their structural and functional interrelationships. This system also constitutes the highest level of organization».
And let's complete the frame of reference with the definition of "environment" with some initial clarification: «environment is a relative and not an absolute term», unlike territory and landscape which are terms in themselves specifically absolute (at least in reference to their specific unitarity). Moreover: «the environment does not exist in absolute, but only if related to a subject, individual or collective, living or inanimate. Finally, to arrive at its synthetic but effective definition: Having determined a certain landscape P and having fixed a subject S "inside P" [we define] environment relative to S, the set of elements and processes belonging to P with which the subject S has one or more determinable relations, as well as the set of the relations themselves» (Romani, 1994, p. 47). It seems to us absolutely fundamental to close this paragraph with a disheartening warning, but at the same time it can represent a certain reference for urban planning:«how much confusion has been generated precisely because of a sloppy and approximate use, as well as wrong, of terms and concepts that instead take a fundamental role in specialist arguments, in decisions, even in laws, which deal with landscape and environment, so particularly affect our existence» (Romani, 1994, p. 47).

[13] In this sense, with acceptable approximation, one could configure the three different "root vocabulary" as a simple triad of corresponding matrioske.

4.1 The plan of the remaining

With the usual methodological clarity, already in 1996, Giordani (p. 43) had expressed the need to move without delay to the «plan of the remaining». On that occasion we find all the necessary ingredients to build the new "residual plan" (or minimal or modest as also recalled by the author himself); with a fundamental clarification, which represents the small contribution that I intended to put at the base of my reflection.

With his arguments, Giordani inevitably tends to make the "plan question" coincide with the "plan residual", as both, in his view, interpreters of the "market". This simplifies the problem, since, at least in the first instance and with a good degree of approximation, the initial three variables are reduced to two. In particular, the "residual plan" is understood as: «[instrument] interpreter of the market, [...] at the service of the interpretation of becoming (to be understood as an unintended result of a spontaneous evolutionary process), not a virtual anticipation of an alternative deliberate project» (Giordani, 1996, p. 44).

Our reflections have tried to better specify that the "plan question" has its own precise characterization, an unquestionable substantial importance and its authority now widely recognized in practice. We think, instead, that the "residual plan" must and can be the best possible balance between the intersections as much-qualitative of the "plan offered" (finally cleaned and regenerated, in form and spirit, by the innovative and efficient instrumentation of the "simplification") and of the "plan question". Reminding ourselves that the scientific clarification of the "environmental question" represents the turning point towards the maturity of the "plan demand".

The "residual plan", can represent the concrete solution of the Postmodern Urban Plan, even if perhaps not yet sufficiently equipped, understood and shared.

Covid-19 has unset almost everything: one of the few certainties seems to be the persistence of the Covid-19 pandemic in a certainly not short time span.

So, why not try experimenting with the "residual plan" right in the "transitory" of the Covid-19? By now even the last messenger is about to join us, he will be tired, maybe old, as old and blurry as the information he carries within himself. After a few days of rest, perhaps, we can send ahead him too, like his companions, towards the limit of our present knowledge, and maybe even beyond.

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Covid-19. Some moments of the 21st century, with a look at Milan

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Abstract

Critically narrating some impacts on the *civitas* and *urbs* of the pandemic, the paper argues how the relative pathos of death and poverty unleashed on Milan is, in fact, a contingency on the endless flux of the urban body in the long history of the city. The text, divided into five paragraphs - then (May 2019), yesterday (March 2020), today (April 2020), tomorrow (May 2020) and later (May 2030) -, in addition to the bibliography, develops as in a Gaussian curve, the two extremes being ("then" and "later") in points before and after the beginning of the curvature, respectively (i.e., describing situations "at full throttle"), the centre ("today") the peak of the curve and the two intermediates ("yesterday" and "tomorrow") in its ascending and descending sections, respectively.

The style varies from calmness at the extremes (with mainly hypotactic periods) to the unease of the intermediates, namely, at its peak (with mainly paratactic periods).

Keywords

Metropolis; Catastrophe; Permanence; Milan.

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1. Then (May 2019)

When it happened, at the time, I could hardly believe it.

It was an article about Milan, expressly requested of me by the dear daughter of a dear friend and colleague who was trying to make her debut in the scientific community through a curatorship of certain pretentiousness. I was glad to provide it. I managed, at once, to produce a piece that, from the title alone, sounded like a passionate declaration (in Milan, precisely) of a disappointed lover (I, being Milanese). Acknowledging this, I was very pleased because that was my intention at the time. But I aborted the girl's initiative - albeit not through my fault.

I had completely forgotten it when, sometime later, another dear friend and colleague asked me, amongst other things, for a contribution of a certain piece for an editorial operation he was dedicating to me. The writing came to my mind; yes, but it would clearly have needed updating. I read it again: there was no need. In fact, it was still very topical.

Ten years later (Busi, 2011)!

In fact, the explanation - as I realised a few moments later - was simple: already in its first draft, in fact, the article - far from being current - focused on the basic characteristics of the urban planning body dealt with. Milan, therefore, was outlined there, not on the episodicity of the contingency, but through the marked clues of its profound nature. And these do not age or deny themselves: it is only possible, in a critical analysis, to integrate and, at best, outline them.

Let's see these basic features of Milan's profound nature.

First and foremost, industriousness and, even more so, an aptitude for entrepreneurship.

Certainly, of course. But these characteristics of the *civitas* are translated into precise - and connotative - peculiarities of the *urbs*. With roots that date so far back in time: even in the 12th century, which saw the construction of the *Naviglio Grande* [Grand Canal], which extended the range of action of the economy of Milan through inland navigation to approximately 200 km - a true world record in modernity - from a few dozen to those times made possible with a load-bearing mule track (Busi, 2018, La *"riapertura"...).*

Then there were the other canals (Busi, 2018, La *"riapertura"...),* railways (Ogliari, 1974), trams (Ogliari, 2010), motorways (Bortolotti, 1992) and undergrounds (Ogliari, 2010).

Therefore, a strong focus on the territory. Thus, bringing together, in essence, "capturing" and "leading" to the city with the very extensive and endless movement of things and - even more so - of travelers. The daily transhumance of people - over a twenty-four-hour period on weekdays - is a rite of all the metropolises and of Milan, above all.

A city bustling with business. This is the reason why there is so much movement of goods. Also, of employees, always as regards manual skills and increasingly more so since the services sector was added.

It should be noted, as an example and confirmation of what was stated earlier, that this character of the Milanese trait - like the others, amongst the many connotations, generally for the good, the city and those who live in it - comes from afar.

Since Roman times? No, from before that: Celtic Milan was already, by the standards of the time, a reference metropolis for the whole Po plain. Its name says it, which means medium-land; that is: in the middle of the plain. Thus it was, at the time of the Ligurians (and perhaps even their predecessors) and then: the Celts (as has been said), the Romans and the Lombards, when it was municipalities and seignories, under the Spanish and French and Austrians, when it was the monarchy and then fascism and now the republic.

Are these peoples, these governments and, in general, each of these experiences important? Yes, very much so because they had various influences on it. But it was always a matter of contingencies, even if they operated for centuries.

Thus, even under the - to observe the enlightened and, in general, well-thinking, Manzoni - Spanish misgovernment, Milan even expressed the majestic and enlightened urban plan - consecrated, in the middle of the 16th century, by the relative circle of the "Bastioni" walls - which supported, with what was foreseen for the precisely "urban" and "extra-urban" context, the expansion and the virtuous relationship of phenomenological inclusion of the surrounding territory for more than three centuries, up to the Beruto plain, in the late 19th century.

Thus, also, the several decades with Austria, albeit unassailable due to the impeccable "first moment" - the Teresian moment - marked, amongst other things, for our disciplinary interests, by the activation of the valuable land registry -, even in the "second" moment, the post-French era, although massacred by the rhetoric of the Risorgimento, no one can deny that they have left a legacy amongst other things, as far as we are interested here, a non-trivial railway network (Briano, 1977) that connected Milan, in its hinterland, with Gallarate, Como, Bergamo, Treviglio and Brescia (as well as, over medium and long distances, with Turin and Venice and, from there, with Udine and Trieste and then with Central Europe), second - by a little - only to that intended in Piedmont by the very efficient modernism of Cavour and, in any case, very predominant over the modest - and not interconnected - Tuscan, Latium and Campania achievements, also, then, the only other ones in the Peninsula.

Relationships always - and increasingly over time - strong, inclusive and symbiotic between Milan and its territory, therefore; and gradually, with the progress of transport technologies, over an increasingly longer range. Another profound character of the city has always been the desire - and the ability - to enjoy leisure time. Especially by practicing the pleasure of taste.

The subject, perhaps not present in the contemporary common imagination, was universally so from past times, until the first decades of the last century.

In this regard, two authoritative testimonies from which we extract as many gems: in the 16th century, Matteo Bandello wrote that Milan is "the most opulent and abundant city in Italy and that where it is most expected to make the table fat and well-stocked" (Montanari, 1997); and, in the 19th century, utopian idealist Ugo Foscolo, indignant for the Ambrosian lingering power over rich and calorific foods, branded it with the epithet of "Paneropoli", that is, of: "*city of the panera*", the latter word being a Milanese term for "cream" (Savinio, 1944). Then, after replacing the Milanese cuisine from the south first and then from the ethnic group, the time spent at the table decreased. But it remained the impelled exercise of conviviality expressed, in an increasingly connoted way, with the practice of the aperitif: Milan has become a world capital of cocktails and, what goes with it, even refined and/or abundant. Furthermore, in extension, Milan has also become a world capital of nightlife.

Let us now concentrate on what the Milanese-type day looks like. Going to and from work, to and from the aperitif, pizzeria and/or nightlife; by car or, better - there is too much traffic, and someone is busy discouraging its use (Busi 2017) -, by train or metro or tram, or bus or on foot. And being at work, or at the aperitif bar, or at the pizzeria, or in the street for the nightlife. Then a few hours later - but only a few hours - at home, for rest. That is, except for these last "few hours", you are constantly at close (or very close) distance to each other: a few meters walking in the street and in the office, a few decimeters at the bar and the nightlife, crowded on the train and on the underground. This is unavoidable because, as in the most enlightened disciplinary theorization (Consonni, 2019), proximity is the proper and positive nature of urbanity. On the contrary, there are those who maintain - and argue, and demonstrate - that even the bicycle is exceeding the proper use of urban spaces, because it takes over the pavements bothering the pedestrians who, in their masses, walk along them; urban spaces all, instead, to be reserved for the pedestrian and, in the appropriate locations, for collective transport (Busi, 2018, Pianificazione... Busi, 2018, Potenzialità...)!

More: because... Milan is beautiful (Busi, 2015; Consonni. 2015; Savinio, 1944) and it is also a renowned tourist destination. Therefore, during every season, adding to the crowds of Milanese are those of visitors.
On the other hand, the Milanese - who don't want to miss anything - during every season and, especially, during the upcoming summer, tend to flock to the beaches, bars, restaurants and other nightlife areas.
In short (and in summary):...this is Milan, beauty!

2. Yesterday (March 2020)

That there might be something new there began to be perceived in the second fortnight of last month. In fact, rumours of an infection in China were spreading; hearing them, a few medical friends, whilst not convincingly justifying why, became angry; from the Chinese city of Wuhan (who has ever heard of it?) came disturbing images of streets populated by people all wearing masks and hospital wards with doctors and nurses, wrapped in protective suits, sitting exhausted on the beds.
The final week of February is Carnival. Like every year, I celebrate, in my own way, the privilege granted to us Milanese people by having "Ambrosian rite" - with the consequent postponement of its duration from midnight on Tuesday to the following Saturday - by spending all those days at my house on the lake where, as the "Roman rite" is in force,... you can enjoy, during Lent, the utmost tranquility. Muffled, I hear voices that: even in Italy... especially in Lombardy... especially in Milan... yes, near there, in Codogno... !
At the beginning of March, I was in Milan. Sure: Codogno and its surroundings in isolation... many cases... it was the "red zone"... government decrees, the Prime Minister, regional measures, the "Governor"... but also in Milan.
There was a strange air in Milan. Some - quite a few - businesses were closed; commuter trains were almost deserted, and the undergrounds were depopulated; traffic was reduced to light use: it seemed a Ferragosto of the '50s.
At the end of the first week, I felt, in the late afternoon on the Saturday, I deserved a proper reward; which, as a Milanese, can only consist of a good aperitif. In a completely reliable bar, which I've always frequented and where I know and am known, I ordered a Negroni: the barman, embarrassed but perhaps more regretful, informs me that he can only serve me sitting down - you know, there is a certain measure... - and showed me a coffee table with a chair desolately isolated along the wall (but it's a joke! the cocktail alone and seated? no, it's a ritual to be consumed standing up, joking with the many superficial acquaintances of those moments of periodic and fleeting escape, shoulder to shoulder with many strangers, in that cheerful promiscuity and contiguity indispensable - maybe even more than the drink - to give the right quality to the gratification of that moment).
I fit in there. In the squalor of how much - far from being the end of the pleasure of tasting an exquisite drink, I was living like the gulp of a concoction - I looked to the side and I saw him, isolated at his coffee table in his chair, one of the strangers I have glimpsed in that bar for years. Forced by the case, we exchange a few words. And immediately we discovered that we are colleagues, that we have quite a few acquaintances in common and even that we already know each other by name. Spontaneously, leaning over the chairs, we shook hands. We immediately withdrew them, blushing and looking around fearful of having been caught committing an illegal act. As in fact, for a certain measure, it already was.
The next morning, I was, as always on Sunday, with my wife in another bar, even one of the temples of the Milanese cocktail, for a Sbagliato. Even there they confined us to a secluded table, against the window facing the street. We looked around sad. That bar, on feast days and at that time always crowded, was almost deserted: missing crowds of regular customers, the few present, like us, were lined up on isolated tables along the walls.

Rumours were also circulating that the splendid Milanese nightlife, which, for decades, has crowded dozens of streets in the city all night long, was practically switched off.
Only one consideration can be drawn from the serious clues mentioned above: Milan was indeed no longer the same.
And from the day after, state regulations tightened by regional regulations required it: Lombardy Region, in fact, was subject to lockdown with the closure of all businesses and serious restriction on personal freedoms. With Lombardy, it was the same for the whole of Italy. But elsewhere the much lesser pressure of the severity of the infection made the formulation and application of the prohibitions less harsh.
There were certainly good intentions in this - of which, however, we know how paved the road to hell is - by those who issued them (the State Government; and, in the operational specifications, the Prime Minister) and those who aggravated them (in Lombardy: the "Governor"). However, beyond the - possibly positive - future (on which, lacking the counter-evidence regarding its attribution to the contents of such norms, we cannot comment), for the scientific interests of the present paper it is in any case right to remind ourselves of its essential contents and hint at the perplexities that already, at the first critical glance, become apparent.
We are forbidden to leave the house except for: work (but only in the very few cases permitted at the state level; even less so in Lombardy), necessity, health or returning home (or to a dwelling or residence). And this only if certified by self-certification supported by adequate evidence, with no minor fines and also, until a certain moment, criminal penalties. Permitted (tolerated?) is the shopping in the supermarket under the house (within 200 meters?!?) and walking the dog (still within 200 meters?!?). No one, however, is to go out with their baby!
But that's not all.
It is said that sneezing, in the absence of specific equipment, is to be done in the inner elbow of your jacket; this gave a well-known TV presenter the relative testimonial task that he carried out with an enthusiasm and conviction worthy of a better cause, even mimicking the scene (but do you realize how the poor man's wardrobe would have reduced after a week? and with the dry cleaners closed... !?!); that, in front of our fathers and grandparents who have been through two world wars, we are only required to spend "two weeks on the couch", as per the patronizingly smug message of an important television journalist ("two weeks"?!? that much... !?!); "stay at home", everyone tells us, on television and on the Internet (but is it really necessary? and is it really healthy? doesn't it also depend on who else is in the house?!?); and "wash your hands", this too, said to us by everyone, in all places (certainly, we agree! but perhaps it was already practiced in the days of Cardinal Federico...).
An unthinkable March, then.
But next month... everything will be over... !
(Or, at least, one strives to believe it. But will it be?)

3. Today (April 2020)

This is not the case: the tension climax of March continues.
Distraught, in the media, by news and tragic images of intensive care hospital wards, coffins lined up, military trucks leaving for distant destinations where cremation possibilities are still available (in Brescia, things are going very badly; in Bergamo things are even worse; Milan is on the turn and Brescia and Bergamo are there, just outside Milan; Lombardy is the worst hotbed in the World...) we try to survive the day in the best possible way by juggling the prohibitions.
The city is violated by the impossibility of expressing its innate functions and it is even vilified by the denial of its reasons for being.
Its metabolism is at a minimum.

The closure of schools and universities and the substantial cancellation of production have wiped out mobility on both the territorial and urban scales: trains travel with a few units of travelers per carriage and so do underground trains, trams and buses; it is rare to see a car or motorcycle in any urban street. And it is misleading to say and believe that this is positive, because crowds and traffic represent negativity; it is true instead that, as in the enlightening and irreplaceable metaphor of the (human) body, they are for the city the equivalent of blood circulation which, although it has to be - always and constantly - monitored and - depending on the cases and moments - moderated, it must be continuously kept active, on pain of bloodlessness and even the extinction of the vital capacities of the individual, so much so that it should even - when appropriate - stimulate them.

This has also led to the desertification of production areas. This has only - however serious - economic consequences for those of the secondary sector, but it is supplemented, especially, by the retail trade and, above all, by the catering sector, which is an integral and essential part of the system of collective outdoor and indoor spaces and - using the above metaphor - the true airways of the organism-city and the maximum expression of its liveliness.

And again: the life of proximity has been mortified, made up of the myriad micro-functions of the "under house" - the neighborhood, in short - completely indispensable for the weakest of the family: the child and the grandfather, as well as the permanently or temporarily disabled; and also - or in any case of relief - for the woman, when busy - or even overwhelmed by extra-family commitments - as housewife.

In light, however, of the abnormal overload of the roles attributed to the home that, to the current physiological functions of relaxed family conviviality - with the various components of this minimal social core who meet, relaxed, after the factory or office, school and sociality - and also rest, but nothing more than housework and school work, must also be a place of work and distance learning as well as physical exercise. All this in spaces that are generally too narrow and, in any case, unequipped, with current overlapping of conflicting needs. You are hammered by the ban on going out and, added to this, also psychologically constrained by the continuous messages on the media of the most diverse testimonials that would like to convince us of how all this is the rediscovery, in a context dripping with "smart", of the pleasure of being together.

A completely distorted use, in short, of the city. And Milan, and with it all its territory, cannot but suffer.

But, of course, it is the Milanese who are affected; both the few who, if they are clear-sighted about the health dangers of the present, unfortunately also perceive the devastating consequences of certain measures; and the many who, living in terror because of the undoubted danger, do not know how to refrain from reacting to it except with the search for the guilty party, who is undoubtedly their neighbor, perhaps not as zealously uncritical as they are in literally sticking to the ban.

Everyday life is made up of shocks.

Here are a few at random.

I have to stay in the house! Yes, to stay safe! But who else is in the house? Perhaps someone who works in the supermarket, or the bus, or the pharmacy, or the hospital? And this guy, on his way home at night, what does he bring us? But do they know that we share the cutlery and the tablecloth, the chair and the sofa... and maybe even the bed?

I have to stay in the house! Yes, to stay healthy! But how can I satisfy the cardiologist who told me that my everyday walk of a few kilometers is essential? Sure: the other day I walked the corridor in my slippers a hundred times (maybe two kilometers... ... and yesterday too, but today... I'm dizzy just thinking about it... They tell me that, for "health reasons", I could go for a walk... but it has to be "proven". How? With a prescription! I asked the cardiologist for it by email. I hear he's now working a shift at the hospital in a new intensive care unit... . Will he answer me?

I have to stay in the house! Yes, to protect my health! But I also need to feed myself! It's a great reason to - legally - go out: great! Should I go down now? No: the queue on the pavement to enter the supermarket is only about fifty meters... better in the late morning, when maybe it will be two hundred... a couple of hours in the open air... what an opportunity!

I have to stay in the house! Yes, in Milan! But the beach house is empty... couldn't I ... ? The second house!?! And outside the region!?! It's forbidden! But... I'd drive there... alone... and there I'd be alone... and take a few walks alone in the woods... . No: it's forbidden! And then didn't you hear that in Liguria they revolted against a family from Turin who had fraudulently gone to their second home? And what about the municipality in Bergamo that equipped itself with a drone to capture and sanction a deserving subversive stranger who used to wander alone in the woods? (Well... ! I continue, deep inside, to believe that, perhaps, if instead of "at home" he had been invited to stay "secluded" in any available niche - firstly the second home - and allowed to move freely on his own, it would have been better, both to keep the individual in better health and to preserve him from infection... at home... . Well!)

The only sure improvement in living conditions this month compared with the previous month has been - let me make a joke - the no longer existing requirement to sneezing into the crook of your elbow, a good sign of some critical sense.

And then there is another gem: the bicycle, that means of transport towards which the writer here has not concealed strong suspicion about its use - particularly in the city - even if previously mentioned in this paper. Well: if it is confirmed here that such mistrust has a strong foundation in a situation of cities in full working order - for the disturbance and insecurity that the improper use of the pavement by the cyclist causes to the pedestrian and for the cannibalization of collective transport - all this would not apply now, with the deserted carriageways and the high risk of infection in the metro and tram. Yet instead... the measures in force demonize it, as the runner is demonized, both seen as a source of infection. But why?

Apart from that, the air you breathe is increasingly heavier: there is no way out.

What about next month? Something better?

Maybe!?! Let's not despair!

4. Tomorrow (May 2020)

It has been realized that cases of infection are much lower. It had been happening, in fact, since the second fortnight of March, but in essence it was denied by ambiguously denying it and hinting instead at the relative stationarity with phrases like "we are plateauing... ". It was the uncertainty of the doctors, the only category of experts - with that of managers with a degree in economics - involved by the decision-makers, who, not knowing the specificity of the virus in question, continued to lean towards an enormous prudence, the result of fear.

Now, some awareness has leaked out that lockdown, if a possible beneficial tool for containing the infection, is undoubtedly a factor in the collapse of the production system and perhaps not only of this deviance.

The delivery has therefore changed: now it is "open"; but the medical experts still make themselves heard with their uncertainties and fears; and the specification follows, which, in essence, is: "yes, but with caution."

A first evident result is the (correct) rehabilitation of the cyclist and runner, with the (correct) extension of the benefit of walkers and (also correct) hikers also being able to go about; yes, also of those who perform some kind of movement as advised by the cardiologist. But, here you get into a crisis if you find him resting for a moment on a bench in the park: in fact, the doubt arises as to whether he has thus become a spreader.

In short: the new measures continue to be as nagging as the previous measures, not expressing themselves with the generality and abstractness proper to good law, but omitting the list of cases and sub-causes and,

therefore, falling repeatedly into contradiction and even achieving - beyond the seriousness of things and the tragedy of some health contexts that continue to persist - some level of comedy.
The "cautious opening" thus comes to be translated into a painstaking and tedious rigmarole, over the period of three weeks - until the middle of next month - of who opens now and who later, but with none of the legal certainties resulting from the generality and abstractness of the formulation mentioned above, all in a discouraging inaccuracy both at the first perception of the instruction and - above all - at every subsequent analysis: the passage between the who first and the who later is entrusted with the following verifications, both on the categories of activity and on a territorial level, both regional and sub-regional (following what? which verifications? carried out when?).
The Sword of Damocles is, however, in the requirements so that the opening is done "in safety" (but who reassures that the - moreover, problematic - execution of the measure indeed achieves "safety"? would it not have been more humble - but correct - to say "legally"?).
Even if on different themes and with different pathos than before, we continue to live with shocks.
Here are a few.
If there are crowds: trouble!?!? But what is a "gathering"? Wasn't it said that interpersonal distances of up to three feet are tolerable?
On collective transport, passengers must not be near each other! And so, on railway trains - especially those commuting to Milan - and on underground trains, but also on trams and buses, the seats that can be used are marked one by one, which are in a conspicuous minority compared with those that must be strictly free. And also marked on the floor are the rare standing positions that can be occupied in addition to the sitting positions. Such is the case on trams and buses. Access to the platforms is restricted to the barriers at the entrance, so that there are only those who will be able to access the wagons according to the available seating and standing space. On trams and buses, the people counters automatically control the entries and exits and inform the driver of any excess in relation to the permitted total. The other day, on the trolleybus on which I was travelling, the driver declared a surplus of three units and ordered the intruders to get off, otherwise the vehicle would be stopped indefinitely: three - the kindest of those present - took heed. What if no one was adequately willing to do so? And, above all: if the demand for mobility were far greater than the miserable supply, what would be the consequence on the reliability of the system? And, further still: how can the inescapable economic deficit from the budgets of transport companies be sustainable?
Why, however, do we find that in these first few weeks the number of travelers on the collective service and on the roads is relatively modest? And this with the not few - even if in reality... not many - production categories legally admitted to business these days? In order to be able to do this, we need to be aware of the many limitations imposed in order to prevent people from gathering in the workplace, namely: interpersonal distances to be respected and hygienic practices to be implemented. But the two fulfilments are not of obvious implementation. On the contrary: the first sees the emergence of new numbers of possible people actually admitted to the workplace, created by hasty demands of current events - with distances and physical barriers - against consolidated acquisitions of ergotechnics that have forged, over the decades, machinery and proxemics of operators; the second new and disturbing terminologies - firstly, sanitization - with disturbing implications; both with underlying - but, for all parts, announced - inspections and heavy penalties, either administrative or criminal. The consequences are staggering: open... work... produce... ...and not just a few people are experimenting... we'll see this later.
This issue is emphasized in terms of the reality and the next prospects for trade and catering. In any case, the presence of the adventurer is to be limited: waiting, in the queue, on the pavement, one at a time along a unique path that sees the entrance clearly distinct from the exit. Additional staff are then required to control the customer's movement and these new employees combine firmness with action - penalty: the sanction

always threatened - with courtesy (otherwise the customer is lost). In the trade then follows the exhibition of the product and, in the case of an item of clothing or footwear, the inevitable test on the garment; all this must, however, be legally followed by the inevitable notorious sanitation that, in this case, adds to the previously mentioned problems the safe - or, at least, feared - incompatibility of treatment to the delicacy of the fabric and leather. The case is even worse is for bars and restaurants, where the (minimum) distance between tables is added to the (minimum) interpersonal distance of one meter. Terrifying images are exhibited of possible tables with diners inevitably encapsulated in three directions - front and sides - by Plexiglass barriers. And one has to figure, in the squalor of those tables with some chairs desolately floating around on the floor of the business, a service carried out by maître and waiters aseptically expropriated from the captivating professional friendliness by the mask that hides facial features and expressions. It is certainly true that, for weeks, take-aways have been allowed, but, by now, there is no longer any pleasure in it: that of catering lies in the complexity of the physical and social environment and the service of the restaurant, as well as, of course, the food. And it is not comparable to swallowing, at home and with the sole presence (always) of family members, of the same - though delicious - food (but at home, with take-aways, no more than the same temperature as the service in the restaurant room). For the aperitif and the nightlife, the discourse is even more delicate: the surrounding environment - physical and social - is fundamental for the pleasure that is promised, in which drinks are certainly essential, but far from sufficient. The result of all this is that most of the businesses remain closed. The manager of a nightlife bar, on the towpath of the Naviglio Grande, which is now open, yesterday stated that the daily cash drawer is 40 euros, compared with a monthly rent of 300 (with a daily incidence, therefore, of 30). A well-known TV chef has said that, whilst providing a take-away service, the chance of survival of his restaurant in the Centre cannot exceed one more month. These are all disturbing clues, including the low turnout (of (employees and customers) in collective transport constitutes the terrible stigma and the disheartening summa.

And the "at home"... what's left of it? The peremptoriness of having to be there and stay there is formally unchanged. But now it is a tired and desolate refrain: a survivor of the speed of events. It has been ascertained that 25% of infections have occurred "at home", but these rumors circulate quietly: those who write or speak about it do so with modesty, as if fearing to stain themselves with injured majesty towards an indisputable must. We are made to think that if, to this enormous percentage is added the one - perhaps even greater - generated by the enormous numbers developed in environments of care homes (*residenza sanitaria assistita* - RSA), there would remain very few other ways to be somehow responsible for the numbers of the pandemic (with good peace of mind perhaps - paradoxically - of the recurrent heavy criminalization of "gatherings"). Certainly, there is the fact that the lockdown of more than two months leaves very a heavy legacy: physical and mental disorders due to inaction - in confined spaces, sometimes in absolute solitude or, more frequently, in stressful overcrowding and unbearable promiscuity - from which traumas will descend; exacerbation of matrimonial tensions, with soaring applications for divorce; moral and physical gender and intergenerational violence; deficits in school learning and productive performance (eh,... the rhetoric of smart applied simply to the remote teaching and remote working...); worrying about being overweight and having flaccid muscles. There are males who were already depressed before and girls who have always been anorexic and bulimic and who now, in addition, refuse to even think about leaving the reassuring nest of their home. We hear of many families that continue - and do not want to consider deadlines - to voluntarily maintain absolute isolation by receiving supplies at home, disinfecting the packages before taking them in and paying for them by bank transfer. The whole situation is indeed worrying.

Even more worrying is the future that is emerging, both in the medium and long term. The picture of possible holidays next summer is bleak. In the reality of international frontiers which, in the perspective of reopening, never contemplate Italy (in which, moreover, Lombardy, like a stone guest, hovers in the background as

absolute evil) and, in our country, of hotel reservations cancelled, seriously meandering, as ineluctable, ideas to counteract the infection in everyday holiday life that clearly appear for what has already been seen for bars, pizzerias and restaurants. We now assume that it is established that the structure of the daily accommodation shall follow to the sea, even bathing facilities would not be excluded: there are squares with no less than meters between the shafts of the parasols and between the deckchairs. We watch a television service from Forte dei Marmi with willing lifeguards who, with collaborative enthusiasm worthy of a better cause, appear satisfied with the relative sample with a rare presence of equipment in the sand desert after, of course, an access control barrier and, there on the coffee table, the digital infrared forehead thermometer which customers must be subject to; not far away, the colleague of the toilets next door shakes his head and, with two jokes, denies the economic and managerial feasibility of all this. In another service in Riccione, the lifeguards say that you can't even go in: better, perhaps, to keep it closed. In a further service, there is something even more impossible: a hemispherical Plexiglass canopy to provide further cover - entirely, starting from the sand - parasol and deckchair in a context of even more rare presences, in order to preserve even more surely from infection.

The greatest discomfort is hearing unanimous and confident voices telling us that everything in transport, work, services, living and holidays will always be like this: we have to get used to this - it will be the future! And even that this is good! Things were bad before... no account was taken of the danger of a pandemic... but now... new rules... masks... social distancing... and spaces to rethink... because the infection will last a long time... and after that there will be another one... and another one... we will discover other values... !

But don't they realize that this is confusing and inapplicable? That it's inhuman?

Uh... the Milan of before!

5. Later (May 2030)

Milan is flourishing and in full development.

The railway system has been greatly enhanced not, of course, by the unworkable construction of new lines, but by modernizing both the technology and the management of existing lines. Now, trains are all the faster and more comfortable than in previous decades. In addition to high speed, much - and above all - has been focused on local railways, so much so that the daily gravitation area on our metropolis has seen an almost doubling of the radius of influence of the capital, with the almost quadrupling of its surface area.

Urban transport has also improved a great deal; above all, in addition to the completion of line 4 of the underground, with the construction of three others, which brings the total to eight (line 5 already existed); all of them now have their heads of line radially forwarded outside in multiple branches of many kilometers, thus making the service in the hinterland much more widespread. As a result, the supply of the tramway, trolleybus and bus, in support of all these aspects, has also been extended and improved in quality.

On the other hand, car traffic has reduced by a lot: it could not have been otherwise, given that the important strengthening of Milan's territorial projection could not be supported by private motorization, if only due to of the size of the vehicles, which are inconsistent with urban space; it has gained the quality of the environment and the serenity, health and safety of the inhabitants.

It was finally realized that the bicycle - and, with it, every means of micro-mobility - is incompatible with the city; so, after the hasty construction of cycle paths, the original sections of the pavements have been restored and, indeed, are being increasingly widened at the expense of the carriageways. The bans on the use of bicycles - and micro-mobility - have also benefited the constant demand for collective transport that previously saw falls on good days, even though it still had to be reduced for bad days, when the use of bicycles, scooters and the like is not pleasant.

Certainly: on trains, undergrounds, trams, trolleybuses and buses you're getting squashed. But physical proximity is in human nature and, specifically, in the character of urban life.
The pavements are crawling with pedestrians. This is the primary indicator of social well-being and, above all, of the good quality of the relationship between *civitas e urbs*, in addition to, as no secondary factor ... of beauty of the urban landscape due to the relaxed joy with which the crowding infuses the observer.
Production is strong: in the manufacturing and production sector - mainly industrial - in the hinterland, in the services sector - and crafts - in the city.
But especially everywhere - and especially in the city - trade and, even more so, hospitality is fierce: restaurants and bars are crowded with customers; sitting, densely side by side, indoors - and even more so in the outdoor areas - and out in the open on the pavements, enjoying beers and cocktails, sushi, pizzas, lasagne and kebabs.
From the late afternoon to the early morning, the nightlife rages. It has become increasingly lively, over time, in the areas that have hosted it since the early '80s of the last century - the Navigli, the Darsena and Piazza San Lorenzo, above all; but also Corso Como, Brera and the beginning of Corso Sempione - from there, it has expanded towards the centre in Via Torino, Via Verdi and Via Manzoni, Via Dante and Piazza Cordusio, until all these axes of nocturnal liveliness in Piazza del Duomo have merged: it is now a single articulated labyrinth of dozens of kilometers of streets and squares, the undisputed kingdom of late risers even - especially on weekends - until dawn with a foggy glass in one hand and a snack in the other, in cheerful gatherings. Naturally, standing up, elbow to elbow, and with their breaths blending into talking and laughing.
Tourists play a big part in all of this. Worldwide guests contribute to the fervor of the nightlife after today in a conference or business meeting and tomorrow in museums or in historic buildings: as Milan is well known for, in addition to being one of the international capitals of work, being a prestigious city of art.
All this whilst the Milanese, recently having returned from a business trip, are preparing to leave for tourism, even out of season, to distant lands.
In short: Milan, with its work, moving around it and enjoying it is more alive than ever. And the gathering of locals and outsiders is the most effective indicator of this.
But what about Covid-19?
Ah, yes... ten years ago, maybe... .
It was a real burial in 2020: so many bereavements at first, to which we reacted with the lockdown. And, immediately afterwards, so much uncertainty because, prey to the lack of specific knowledge of that infection, there was fear of reopening.
However, the vaccine quickly became available, as it had long been the case during an epidemic. But the infection had already weakened, perhaps due to the increase in temperature with the arrival of the summer, perhaps due to the reduction in virulence of the pathogen. And, as with other viruses, did the effects dampen - or was it also the concomitant action of vaccination-induced herd immunity? - until it very gradually disappeared.
The closure, for so many months, of practically all economic activities led to poverty. The recession caused a severe selection in the corporate world, especially in the hospitality sector, with generally virtuous effects on quality even with distortions for the preventive expulsion of excellent companies mowed down by the lack of liquidity.
But we recovered quickly. The civitas, in fact, had retained a great deal of liveliness.
Milan, above all, with its hinterland, immediately expressed its desire to work ... and to enjoy the fruits of work.
Its profound nature reacted quickly and effectively. , Thus, it had been over the millennia, when the destruction of Attila and Uraia, followed by that of Barbarossa and the aerial bombing of the Second World War had gutted it since its foundations(Busi, in edit mode; Busi, in publication; Comune di Milano, 1955).

And, in light of this, Covid-19: was, traumatically, there ever anything like it?!?

The *urbs* was completely intact; it was, therefore, more simply, one of the many massacres induced, over time, by epidemics: in the 1900s, the Spanish Flu, in the 1800s, Cholera, in the 1700s the Plague of Marseilles, in the 1600s the Great Plague. If a rough simplification would ascribe them all to the year 20 of the relative century, there were, however, phenomena of varying duration spread around this recurring date, of which history tells us, some monuments and tombstones in our cities and sometimes literature, as is the case of *Il mulino del Po* [The Mill on the Po] by Bacchelli (for the cholera of the 1800s) and *I promessi sposi* [The Betrothed] by Manzoni (for the Great Plague of the 1600s). But not the shared memory that, whilst great-grandparents and grandparents conveyed to us the horrors and difficulties of the two world wars, this was not the case the Spanish Flu, immediately following the first one, of which nothing reached us more than some memories - conveyed to us laughing - of days in bed with fever and, perhaps, of an old uncle who had not made it.

Milan, in short, resurges from Covid-19 as if waking up from a nightmare, with the desire to quickly reaffirm all of itself and its vitality: the industrial manufacturing and production sector, especially in the hinterland; the crafts and services sector, especially in the city; mobility; having fun; travelling; hosting; all of this being - as is proper of human nature and, specifically, of life in the city - shoulder to shoulder, in the city crowd.

It is, on the other hand, a firm rule of history: to leave solid footprints over time is what is manifested in the long term (Bloch, 2014; Braudel, 1986; Febvre 1976;) - that is, specifically, for a city, in expression of the basic characteristics of its urban body (Columbo, 1966; Mazza, 2013; Morini, 1963) - and not in the contingency, as it is for catastrophes - in the fields of hydraulics, hydrology, geology, volcanology, seismology and, obviously, also infectiology - with long return times (Rossi and Salvi, 2003), in this case, Covid-19, of the agenda of the century.

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Author's profile

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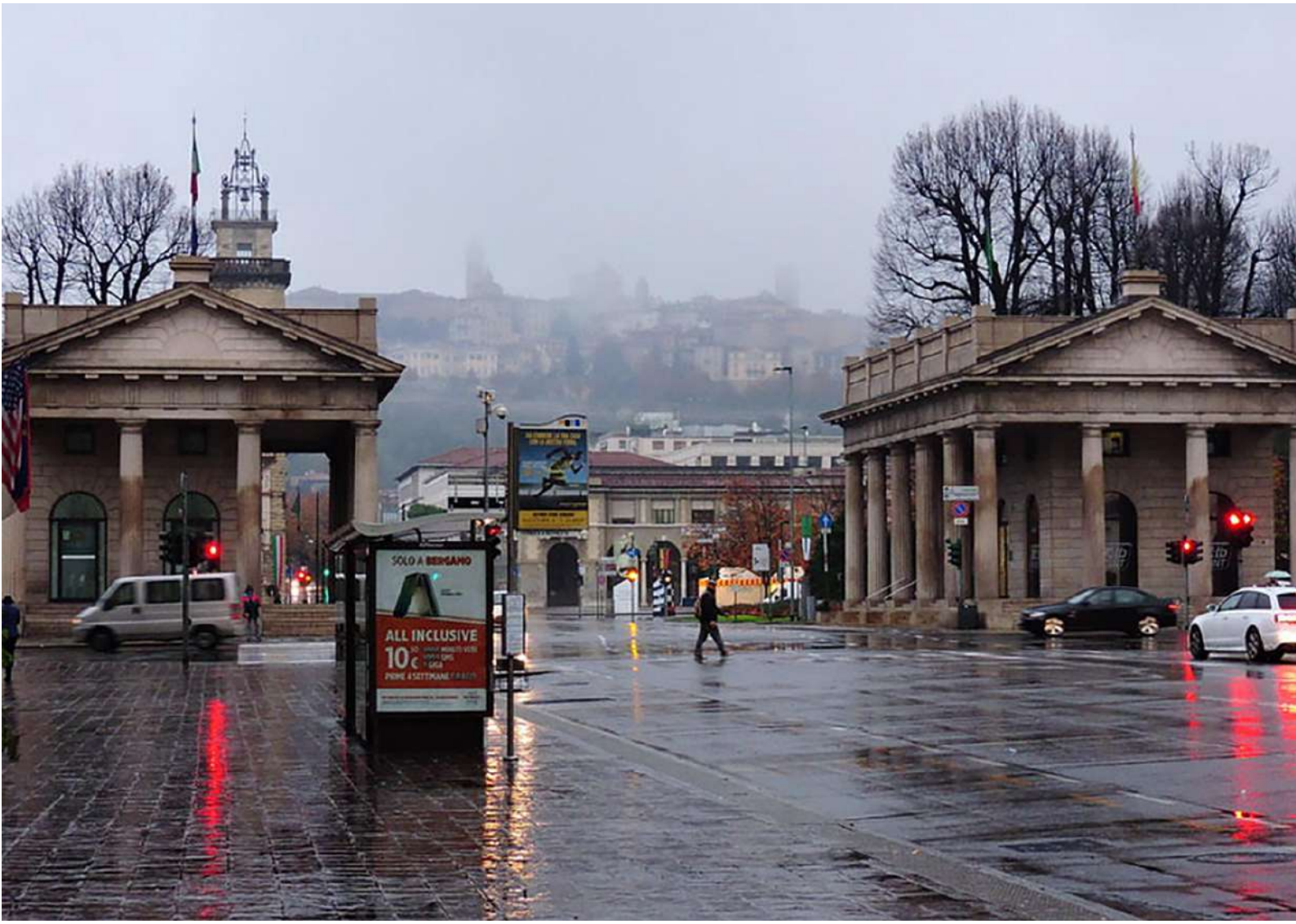
Roberto Busi, Milan-based, is Professor Emeritus of Technical and Urban Planning. He studied at Politecnico di Milano and the worked, in various capacities, in six Universities as he was one of the founders of University of Basilicata and University of Brescia, where he concluded his academic career. His research is focused on environmental issues related to city and territory; moreover, it deals with the requalification of urban public open spaces and, more in general, with the urban factors that influence city life.



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Geographic Information and Covid-19 outbreak Does the spatial dimension matter?

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Abstract

The Covid-19 pandemic in Europe started its outbreak in Italy in January 2020, and since early March 2020, it rapidly spread in most European Countries with growing diffusion rates. EU Countries applied lock-down measures accordingly. While Government across Europe relied in experts' advice, scientific advisory teams were often lead by virologists and epidemiologists, and no evidence is easily found about the involvement of experts in spatial planning and design in emergency response. Often in the uncertainty of a new hazard emergency response, lock-down measures were based on national or regional scale planning, applying to large administrative units boundaries with little or no local differentiations.

This paper argues that a large-scale approach may be more effective in emergency response planning and management as it may better take into account local variations. This approach might be an important and still missing step for balancing the conflict between the two most urgent goals in the current emergency response: public health and safety vs economy re-start after the emergency lock-down.

Keywords

Coronavirus; Covid-19; Geographic information; GIS, Planning support systems (PSS); Geodesign.

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Preface

At the time of starting to write this paper the author is completing the phase 1 period of national lock-down to address Covid19 epidemic in Italy, and approaching the phase 2, in which the progressive release of lock-down measures is foreseen if the number of positive cases will continue to diminish as in the previous weeks after the peak of infection spread was reached and passed. In this situation the content of the paper is grounded on a constantly evolving situation and fluctuating availability (or lack, in some respects) of data and information.

Nevertheless, the paper aims at formalizing, as far as possible in a systematic way, the author's evolving observations and reflections along the lock-down phase 1 (i.e. strict home confinement rules) and 2 (i.e. gradual releasing of lock-down rules and guidelines) focusing on Italy, on the background of the European context, with the support of the analysis of scattered information gathered through the news media and data available in official and volunteered data sources.

The perspective offered in this contribution is that one of an academic with a background in spatial planning and design, and planning support systems. The aim is to offer a preliminary discussion which may provide some useful hints for addressing the current Covid19 pandemic and in planning effectively the return to pre-epidemic "normality".

As is it discussed and documented in the paper, up to the extent which is currently possible, the underlying assumption is that to date little or no attention was given in Italy by institutions to the large-scale spatial dimension of pandemic, neither in understanding the phenomenon nor in the design of containment and response measures.

This contribution is inspired by and dedicated to all those individuals around the world, who without any reserve offered their own skills and hard work, often scarifying and putting at risk their own and their families' safety to help their communities.

A disclaimer statement is appropriate. It is not intention of the author to provide sound scientific knowledge for recommendation to decision-makers: this would be far too ambitious in dealing with an unprecedented phenomenon of this magnitude and its implications in the very short term. Rather, this paper is intended to offer hypotheses for a workable approach in addressing emergency and post-emergency phases from a scholar perspective of an observer with a theoretical and applied background experiences in spatial planning, design and decision-making. As such, it may be considered as a sort of discussion paper, which may possibly help in identifying urgent issues to be addressed by the research agenda in spatial planning and design in the short and medium term, supporting a possible role spatial planners and designer may contribute.

1. Data availability at the time of Covid19: focus on Italy

Covid-19 pandemic was unprecedented in current times. Covid-19 viral behaviour is novel and uncertain. As such, preparedness was understandably very low in many Countries, notwithstanding some Countries were (or were supposed to be) prepared at least in principles to such kind of epidemic hazards, which happened already in the recent past, still with a lesser degree of magnitude and impacts.

In Italy, as well as in many European Countries however, emergency response often appeared frantic, controversial, and paramount decisions where taken on a day-by-day basis and iteratively, as the outbreak diffusion was unusually fast, and data and information were limited, fragmented, and often inconsistent in different regions and countries. The latter situation generated not few factors of uncertainty in understanding the phenomenon and in planning the urgent emergency response, which is understandable, but also an urgent issue to be addressed.

1.1 Official data sources

At the global level, notably, the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University, already since February 2020, when the awareness of Covid-19 spreading outbreak in the news appeared limited to China and Italy only, made available a web/mobile app monitoring real-time the epidemic worldwide relying on novel ESRI geographic dashboard technology (Dong et al, 2020). Providing real-time data at various resolutions, the geographic dashboard was a useful tool to monitor and understand the situation at the global scale.

In Italy, two major sources of official information were given public access, namely a daily tabular report on new cases at the Province level by the Department of Civil Protection of the Presidency of the Council of Ministers (PCM-DCP) and a weekly analysis detailed in a report by the Italian National Institute of Health (ISS). The PCM-DPC provides tabular data through the github.com platform (https://github.com/pcm-dpc/COVID-19/), while the ISS publishes a text report in pdf format in its website (https://www.epicentro.iss.it/corona-virus/) with the national and regional progress updates. The latter provided by region maps of the diffusion at the municipal level (hence, data were available!), however they were reported only in static choropleth maps in pdf format, hence of limited use for further analysis, unless long and tedious digitizing procedures would have been applied by the prospective volunteer investigator, still with a high risk of loss in accuracy.

Indeed, this lack of large scale data easily available in the public domain might have potentially hindered the mass of skilled researchers and specialists to join the critical mass of investigators and designers aiming at providing reliable solutions to the pandemic understanding and responding issue. In fact, many analysis and forecasting models were published in the web by volunteer analysts worldwide, but to a much lesser extent, they involved the use of maps and spatial analysis and statistics.

To put this issue in context, it should be noted that since the United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters was adopted on 25 June 1998 in the Danish city of Aarhus (Århus) it was accepted the assumption that environmental information should available to the wider public. Accordingly, and in line with broader policies aiming at implementing the principles of Sustainable Development (Campagna, 2005), the INSPIRE Directive, establishing an infrastructure for spatial information in Europe to support Community environmental policies which may have an impact on the environment entered into force in May 2007 (Directive 2007/02/EC). INSPIRE requires public authorities in the Member States to provide seamless access to spatial data themes as detailed in its Annex I, II, and III. Notably, Annex III lists a series of spatial data themes including "Human health and safety" which concerns among other issues the "*Geographical distribution of dominance of pathologies (allergies, cancers, respiratory diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics)*". Applying the INSPIRE principles in this respect, would have been of potentially paramount benefits for not only spatial data and planning specialists could have contributed to earn deeper insights on the pandemic dynamics, but also for concerned citizens could have earned a deeper sense of the diffusion rates in their localities and apply confinement protocols and guidelines (to be possibly designed to address specific local conditions) accordingly.

I will support at first the assumption of the importance of a local approach based on large scale data with an example taken from reality (specific reference to individuals are omitted, but the fact was reported by the news, such as in The Guardian as by 22 May 2020). The case features a presidential mandate which declared churches, mosques and synagogues "essential services" and threatened to override governors who refuse to reopen them. As answer to the presidential call, one of the concerned governors (as reported by ABC 10 News also in 22 May 2020), responded adopting an approach based on the differentiation, the large mega-churches versus more neighbourhood-style churches and different styles of pews and sanitation protocols, synagogues

versus working with other faiths. Developing sectoral guidelines, possibly based on local territorial conditions, seems definitely as a sensible approach. Indeed such an approach would require major resources dedicated to data collection, analysis, planning and design, and implementation, but would also overcome, where reasonable, limitations to individuals in exerting their right of freedom of worship. In other words, simple, strict, general common national lockdown rules and guidelines may be the proper sensible cautious approach as far as information is missing and pandemic dynamics are unclear. However, as soon as, data and information would be available they should be made value of, and lockdown measures should perhaps be carefully differentiated by regional and urban contexts, in order to reduce the many negative impacts on economy and quality of life of the local socio-economic systems produced by strict lockdown measures. If this is true, seamless access to large-scale data and information would enable local decision-makers to devise contextual rules and protocols to balance the fulfilment of both human health and economic and social well-being locally. In addition, it would possibly enable individuals in local communities to adopt a responsible approach based on better local information. Indeed, while many Countries in Europe in a state of extreme emergency adopted strict mandatory lock-down rules (and this was possibly the only responsible approach in many cases), others, such as Sweden, rather than issuing compulsory measures, opted for informing the public and providing recommendations and indicative guidelines to citizens. While it is too early to measure the success or failure of such alternative approaches, which may also substantially depend by local social attitude and behaviours to apply guidelines vs normative rules, the two different approaches are worth to be considered as alternative possibilities, as the underlying respective positive and negative may be expectedly substantially different, not to mention the implications on the varying degree of limitation on the freedom of individuals.

1.2 May volunteer geography be of help?

Following widespread diffusion of Internet in the last two decades, geospatial web technologies started their advances and diffusions as well, and together with pervasive diffusion of locational sensors with individual hand-held devices (i.e. smartphones) and location-based services (i.e. apps) the first decades of the new century saw the rise of citizens observation and volunteered geography (or geographic information, VGI), neo-geography, and citizens (geographic) science (Goodchild, 2007; Haklay, 2010; Wilson & Graham, 2013). All together these phenomena concern the production and sharing of (geographic) information generated by geo-browsers or collected by hand-held GPS-enabled devices or other locational sensors by interested citizens, in many case to contribute to solve a common issue of concern (i.e. active VGI), or just as a side product derived by the everyday use of social media (i.e. passive VGI, or Social Media Geographic Information, SMGI. Campagna, 2016). In such domain, many initiative flourished and many were proven successful in helping to map uncharted territories (e.g. openstreetmap.org), to develop community initiatives (e.g. Ushaidi.com), to support emergency mapping and response (Scholtz et al. 2018), or citizens science research (e.g. projectnoah.org), to name only few examples developed in the possible many application domains.

With particular reference to the Covid-19, the use of smart-phones' location sensors was proposed in many Countries to monitor individuals contacts (using the Bluetooth technology) for contacts tracing, and to use this information to monitor the network of individuals social contacts in case contagion (Boulos & Geraghty, 2020). While the privacy in the use of this kind of app and its acceptability by citizens may be controversial (Abeler et al., 2020), it is reasonable to assume that technology issues concerning privacy protection can be solved, and in the case of unprecedented emergency as the current one, many concerned citizens would be willing to share georeferenced information about their state of health, especially if the resulting big data would help ensuring more timely, location dependent, near real-time emergency response, including the definition of local containment measures planning and design which would ensure safety, while minimizing side socio-economic effects and negative impacts. In fact, such an approach was proven successful in addressing other urgent

environmental concerns such as air quality (EEA, 2019), and it might be likely to be effective in an even more urgent issues concerning society at large such as the effective Covid-19 emergency response and epidemic containment.

2. Against pandemic: think globally, act locally!(?)

The 2020 coronavirus pandemic is indeed a global problem of unprecedented magnitude since World War II for a major share of the population in many Countries worldwide. Surely, this is the case in Italy. The global reaction by state governments and international institutions worldwide accordingly has been unprecedented. In many Countries in the European Union national lockdown measures were introduced, starting from Italy on 9 March 2020, where the outbreak spread first with accelerating rates of diffusion; they followed soon after in other Countries, such as Spain and France, and most of other Member States thereafter.

When the national lockdown measures started in Italy, the outbreak was affecting different regions at quite different rates. Figure 1, shows the number of known cases (PCM-DPC, 2020) on 9 March 2020. Looking at the evolution of the outbreak in Italy, severe nationwide lockdown measures proved to be successful to date in order to slow down the diffusion. In Italian regions (and some EU Countries, such as Greece) where the lockdown started earlier with respect to the outbreak spread, the overall diffusion remained lower. Table 1 shows the diffusion growth between 9 March and 1 May 2020 by region.

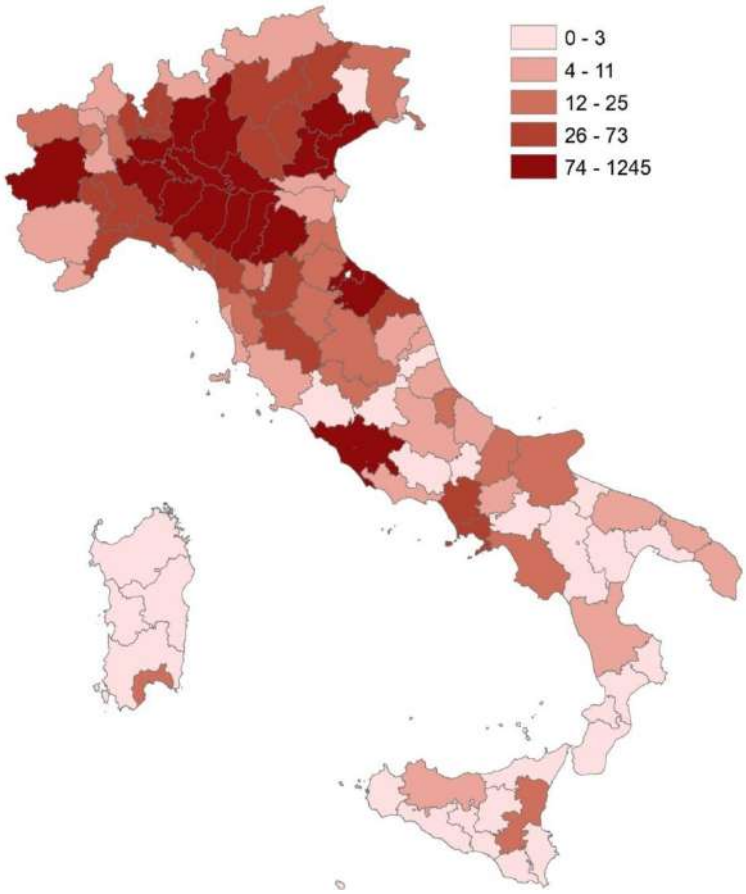


Fig.1 Distribution of coronavirus positive cases in the Italian Provinces on 9 March 2020

In Italy, in particular, looking at the number of positive cases in provinces, it is possible to identify four groups of provinces with similar behaviour along time (Figure 2). The blue group includes the provinces (i.e. Turin, Milan, Bergamo and Brescia) where the number of cases increased to the highest values (outliers).

Region	N° cases 9 March 2020	N° 1 May 2020	Increase 9 March - 1 May 2020	Population 2020	Area [sqkm]	Density [cases/sqkm]
Lombardy	5,469	76,469	71,000	10,060,574	23,864	2.98
Emilia-Romagna	1,386	25,644	24,258	4,459,477	22,453	1.08
Veneto	744	18,098	17,354	4,905,854	18,345	0.95
Piedmont	350	26,684	26,334	4,356,406	25,387	1.04
Marche	323	6,275	5,952	1,525,271	9,401	0.63
Toscana	208	9,445	9,237	3,729,641	22,987	0.40
Campania	120	4,444	4,324	5,801,692	13,671	0.32
Liguria	109	8,126	8,017	1,550,640	5,416	1.48
Lazio	102	6,672	6,570	5,879,082	17,232	0.38
Friuli Venezia Giulia	93	3,041	2,948	1,215,220	7,924	0.37
Sicily	54	3,194	3,140	4,999,891	25,832	0.12
Apulia	50	4,099	4,049	4,029,053	19,541	0.21
P.A. Trento	33	4,132	4,099	541,098	6,207	0.66
Abruzzo	30	2,948	2,918	1,311,580	10,832	0.27
Umbria	28	1,393	1,365	882,015	8,464	0.16
Sardinia	19	1,313	1,294	1,639,591	24,100	0.05
Valle d'Aosta	15	1,133	1,118	125,666	3,261	0.34
Molise	14	300	286	305,617	4,461	0.06
Calabria	11	1,112	1,101	1,947,131	15,222	0.07
P.A. Bolzano	9	2,528	2,519	531,178	7,398	0.34
Basilicata	5	378	373	562,869	10,073	0.04

Tab.1 Increase of Covid19 positive cases during lock-down (9 March – 1 May 2020; Source PCM-DCP, 2020)

The green group (Piacenza, Lodi and Cremona) includes those provinces where starting from high values the diffusion was somehow contained. The orange group, with a higher number of provinces than the first two, includes provinces where the number of cases started high but contagion containment was higher than the green group. Notably, the orange group includes provinces which are spatially contiguous with those with higher values, with the exception of the provinces of Pesaro and Urbino, of Rome and of Naples. The latter two represents spatial islands in the orange group; this might be explained considering their population size and density, and their territorial connectivity and centrality. Most likely territorial factors and dynamics may have an effect on the outbreak, as suggested by some with regards to climate and air quality (Bashir et al.,

2020). The red group represents the set of provinces (and regions) where the number of positive cases was very low when the lockdown started and the overall diffusion remained relatively low to date.
In addition, further focusing on response to emergency, as mentioned earlier in this paper, Covid19 epidemic in Europe affected Italy first at the beginning of 2020, followed by France, Spain, Germany and UK. As by March 9, 2020 The Italian National Government applied nationwide the same lock-down measures in the most affected provinces as well as in the less affected, with the number of cases varying between 1245 and less than 3. At that time, being the diffusion rates, and deriving risk, very high, information little, and understanding of the dynamics low, this was possibly the most pre-cautionary and sensible decisions. Indeed, the epidemic diffusion rates slowed down in the following weeks, and in those provinces where severe lock-down measure were applied at an early stage, numbers continued to be overall low, limiting the spread. The situation was though slightly different on 4 May 2020, when thanks to the reduction in diffusion rates, the National Government implemented the so-called Phase 2 of the Italian national response epidemic. Again the same identical measure were to be applied no matter the location, according to the National policies, and notwithstanding several Regional Governments (notably in the South of the Country and in two island regions) advocated the condition were favourable to the application of looser measures in order to re-ignite economic processes, reduce negative impacts on quality of life, and unbound personal right limitations. Whether the overly cautious approach of the National Government was the best choice also in phase 2 it may too early to be properly assessed. Nevertheless, whether the regional instances were also a possible sensible choice in the light of the potential social and economic benefits deriving from a faster realise of lock-down measure should possibly have been also matter of serious consideration, assessment, and planning and decision-making accordingly.

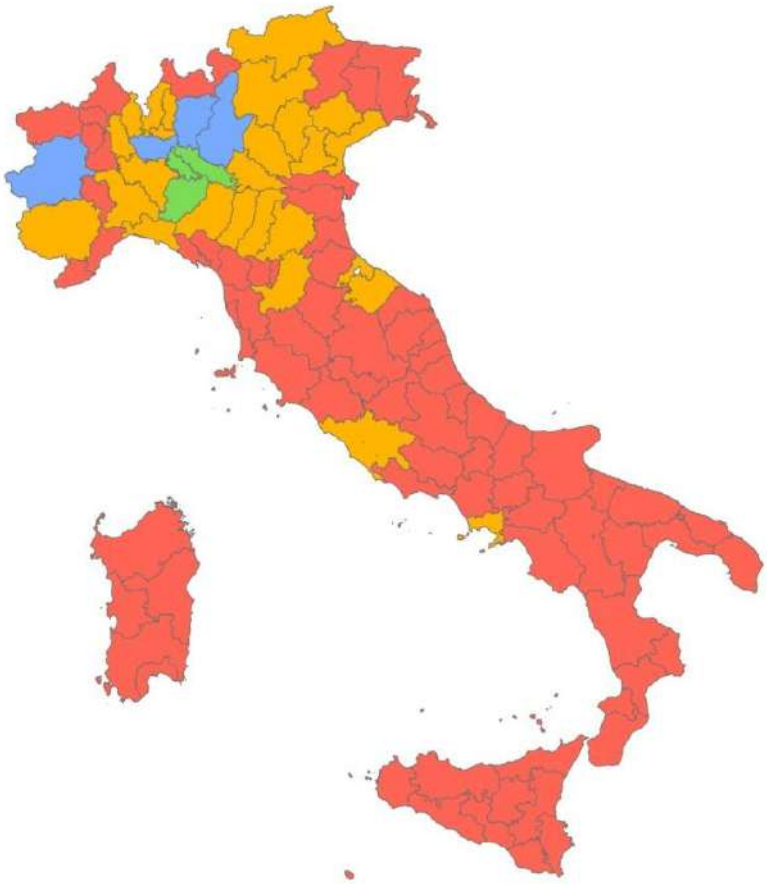


Fig.2 Groups of provinces with similar behaviour in Covid19 diffusion between 9 March, 1 May, and 30 May 2020 (Source PCM-DCP, 2020)

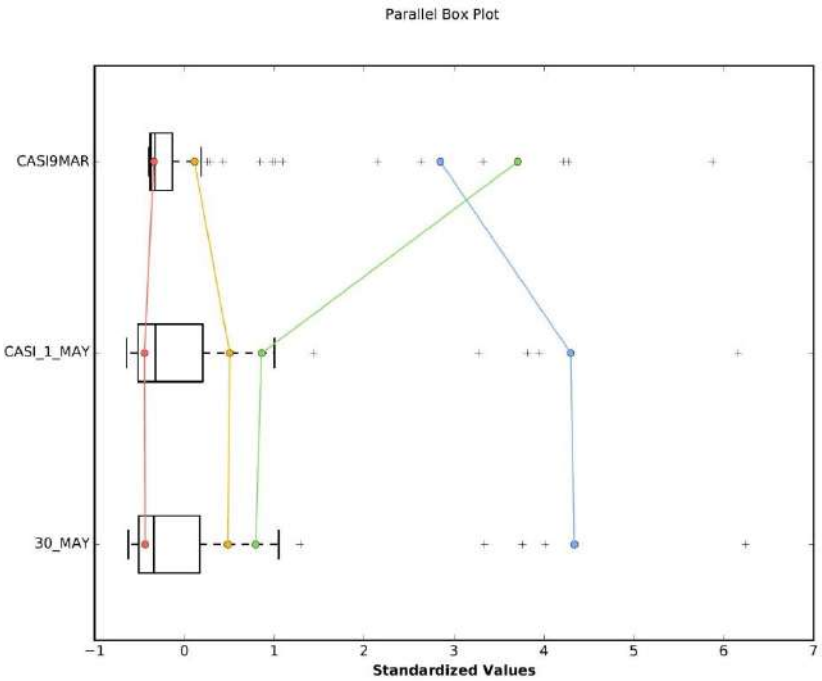


Fig.3 Distribution of positive Coivid19 cases in Italian provinces in 9 March, 1 May, and 30 May 2020 (Source PCM-DCP, 2020)

3. Common global vs customised local measures: the case study of Sardinia Italy

As further real-world example, the case of Covid19 epidemic in Sardinia, Italy during phase 2 of Italian lock-down in May 2020 will further underpin the analysis of potential values of a local, large scale, geographically grounded approach to emergency response, as detailed in this section.

Examining the regional ordinances issued in May 2020, there is no evidence that the Regional Government of Sardinia considered a local geographically based approach, notwithstanding advocating it for Sardinia itself at the National level, where considered for the lower level of Governments. Notably, the Sardinian Government allowed the municipal level the right of decision-making on the application of some selected measures following the National President of the Council of Minister 26 April 2020. Nevertheless, no evidence of a sound official regional planning associated to that decision was found. It should be noted that the facts are not reported here with criticism, rather the analysis of the evolution of the National, Regional and local responses to emergency is proposed aiming at contributing a further perspective taking into account the spatial dimension of the phenomenon, aiming at achieving a more careful balance between public health and socio-economic objectives in emergency response.

3.1 The spatial dimension does matter!

One of the underlying hypotheses in this paper is that the spatial dimension of the epidemic is not taken into sufficient account in emergency response. Indeed, no clear evidence in the available news, nor in available public documents have been found, with the noteworthy exception of using satellite geospatial data by the Copernicus Emergency Management Service mapping temporary health facilities (such as triage facilities, field hospitals and so on) as well the gathering places in Italy (Posaner, 2020). In principles, it may be the case, that other responsible bodies did use geospatial intelligence to plan and coordinate emergency response. Nevertheless, it is reasonable to assume this is not the most common case for the prospective actors which may make a contribution in addressing the emergency for several reasons, and among them low public data

accessibility, low diffusion of skills in understanding and analysing spatial data, low awareness of the usefulness of handling problems spatially among the many involved responsible actors as well as the whole community which may actually give a substantial contribution in mitigating the outbreak. To support this assumption, the following examples are given relying on use cases taken from the news or by the personal observation of the author during the epidemic in Sardinia, Italy. The twofold aim in providing these examples is ì) to demonstrate that the spatial dimension and geography matter at all scales, and ii) to provide practical hints for more responsive and thorough actions to those who can contribute in addressing the epidemic at various scale, but might currently, fully or partially, ignore the influence of considering the spatial dimension in making their decisions.

The general background assumption is that global strict measures calibrated to worse local hazard are possibly more cautious, but they also have higher and diffused negative socio-economic impacts on communities. Thus, a local custom approach may be the most sensible approach in some cases to achieve a balanced and sustainable emergency response, possibly reducing its evident secondary negative impacts on economy and society at large.

3.2 Regional scale emergency response planning

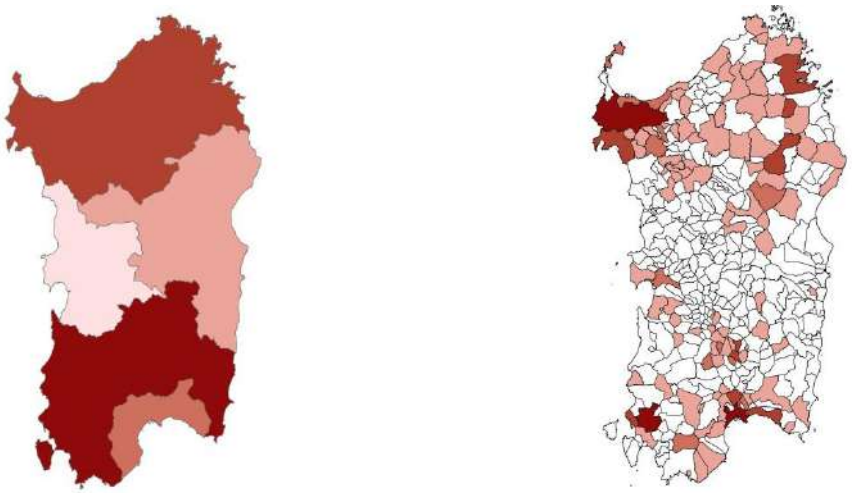
This example aims at showing how the change of scale from the province to the municipal scale may be of great help when planning emergency response at the sub-regional level. In an island region such as Sardinia, which include 377 municipalities, depending on the epidemic diffusion rates emergency response planning could possibly include such measure as differentiation of lock-down measures in different areas, and/or limitation in the flows of people between different sub-regions, and/or optimised organization of police control and enforcement in hot-spots. Indeed in Sardinia during March and April 2020, as reported frequently in the news, the Regional Forestry Corps patrolled coastal areas to enforce the deny of access to beaches to the public. The news reported the number of infringements, however no evidence was given where the patrolling activity took place. On the one hand, it is possible to assume that the enforcement took place in all beaches around the island, no matter whether the beaches were located in epidemic hot-spot or in areas with no evidence of epidemic presence. On the other hand, targeting beaches in epidemic hot-spot areas would have help to optimize the use of police force resources, achieving a more effective public control action. While it also possible to assume that the latter approach was adopted by police in organizing control, there is no evidence it was the case, making the government enforcement control activities no transparent to the public. In addition, regional orders regarding re-opening of beaches as well as other kind of economic and commercial activities to date where to be applied throughout the whole region, irrespectively of local epidemic diffusion rates. Is this the best choice?

In order to show how substantial local differences were in place, figure 4 depicts the situation of epidemic diffusion in Sardinia at the end of May 2020. The reader please be informed that the number of positive Covid19 cases by municipalities may be fairly inaccurate in the example as it was obtained by manual digitization process from a choropleth map of low accuracy issued by the ISS weekly reports, and the underlying ancillary data are not available to public. Thus, it should be considered "fictional" in strict terms. Nevertheless, it can used to show in principle the potential improvement achievable from the increase of data resolution from the province to the municipal level.

Figure 4 shows a) the distribution of cases at the province level, and b) the distribution of cases at the municipal level.

While in figure 4a it is possible to deduce that all island is overall affected by epidemic (actually with no dissimilar rates in order of magnitude), thus justifying no differentiation in local emergency response, Figure 4b show that actually several sub-regions in the island were, and many still can be considered substantially

Covid19-free, having had no official cases to the reference date. Thus, it is possible to assume, or at least to take it in serious consideration as an issue for further investigation, that while some measure may have been appropriate for some areas, they might have been released in others which constitute substantially wide sub-regions with no positive cases occurrence, possibly focusing on limiting the connections and flows between affected and not-affected sub-regions, while releasing movement limitations within not affected regions.



a) b)

Fig.4 Change of scale in Covid-19 epidemic data in Sardinia. Data may be inaccurate as they are obtained by manual digitization by the author (original static image source: ISS, 2020), however they provide an overall idea about the spatial pattern of the phenomenon (thus legend is omitted).

3.3 Local scale emergency response planning

The second example aims at showing the implications for local emergency response planning, and it is based on a random-generated datasets at the higher possible resolution, that is the point coordinates locations of cases. While these high resolution data can be, and surely are, collected by medical institutions assisting Covid19 patients, they are not discovered but in aggregate form, and given public access only at the province level, limiting the potential for analyses. In addition, while it is possible to assume that they could be also acquired by a large-scale citizens science initiatives aiming at mapping negative and positive cases, however so far no information about such kind of initiative was found.

Let us consider the official number of positive Covid19 positive cases in the Cagliari Metropolitan City (CMC), which includes 17 municipalities, and corresponding to the province level administrative boundary. In 25 May 2020, the CMC featured 249 cases. Figure 4b shows that the municipal distribution in the CMC was uneven so the same consideration made in the previous section can be applied to this case as well. In addition, when we look at data at the largest possible scale we can assume that in general different distributions may occur. The effect of an even vs biased distribution in space are evident if the aim is to calibrate emergency responses at the large local administrative (e.g. district, neighbourhood) or geographic scale. From the ISS weekly report is it possible to estimate approximately 150 Covid19 positive cases in the municipality of Cagliari (Figure 5a). In the example in figure 5 b, c, d different local distributions of cases, which are randomly generated in this case to assess the hypothesis, may help to adapt general containment measures to local districts or neighbourhood at the municipal level. Overlaying large-scale data with other spatial data themes may be of great help in understanding the local dynamics and planning emergency response.

Fig.5 Hypothetical distribution of local cases: a) Metropolitan City of Cagliari, b) Cagliari: random generated even distribution, c) random generated uneven distribution, d) random generated uneven distribution and land-use.

3.4 Large scale common citizens' behaviour

An example taken from real-life experience by the author is used to demonstrate how geography matters in applying social distancing rules up to the largest scale with implications for planning and design. Social distancing measures were proven to be one of the most powerful mean for containing the viral diffusion, and the period of strict lock-down containment is a sound proof. There is a common general agreement that two main rules would help to reduce interpersonal probability of contagion, namely maintaining an interpersonal physical distance of at least 1 meter (or 2 meters in the case of outdoor sport activities), and using personal safety devices (i.e. mask) indoor and in any situation in general where the physical distance could not be ensured. Let us focus on the case of outdoor sport activities, as in the example in figure 6, which depicts a multilane track for sport activities along the seaside in Cagliari. As by 4 May 2020, Italy entered in containment

phase 2. Accordingly, sport activities as well as walking were allowed back after two months of restriction. Many people, after two months of strict home confinement took the chance to do some sport and enjoy the pleasant spring weather.

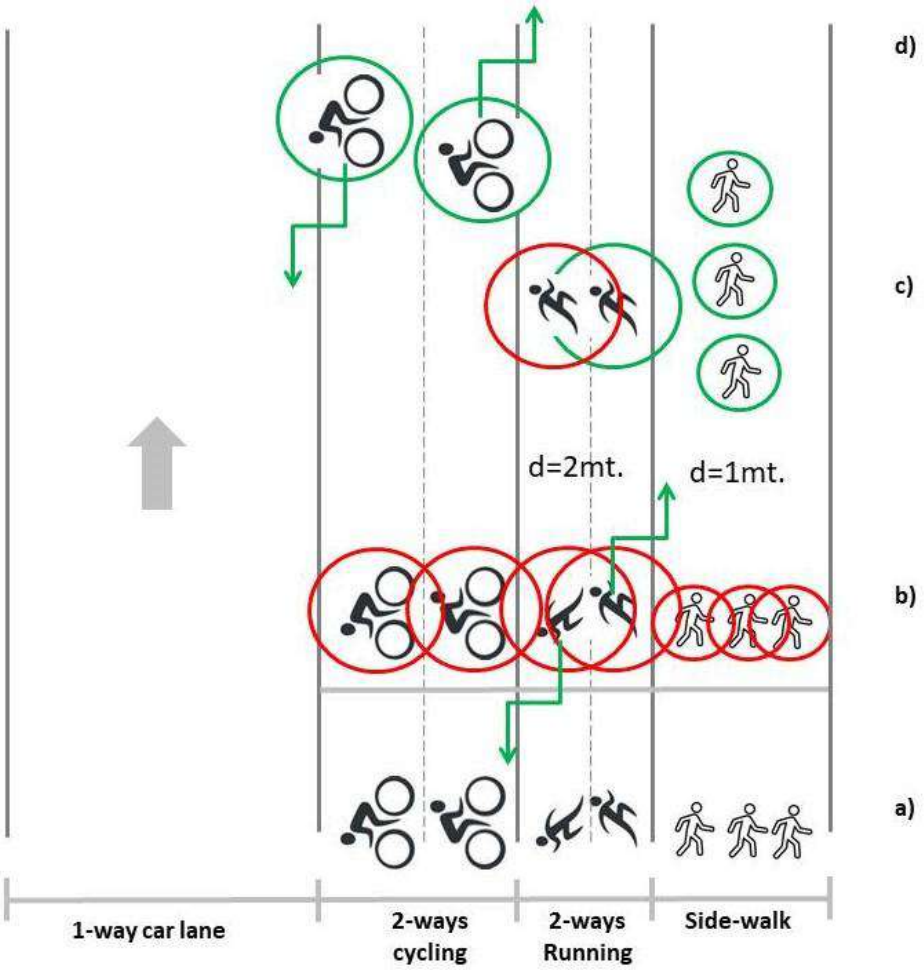


Fig.6 Influence of distancing in outdoor sport activities (i.e. cycling, running and walking)

The new rule according to the public ordnance for outdoor activities was to maintain the interpersonal distance of 1 meter, or 2 meter in case of sport activities such as running or biking. Section a) in figure 6 depicts the common situation in pre-Covid-19 times: the physical dimensions of the multi-lane track would allow two bikers and two runners to occupy the same section in parallel, as well as up to three-four pedestrian in the sidewalk. With the introduction of social distancing, the physical dimension of the lanes would require to change behaviour as depicted in figure 6 b-d. While common sense would possibly lead individuals towards the smart application of the new rules, this is not often the case, and in reality the situation depicted in section b) and c) in figure 6 (in red) was observed very frequently. This very trivial example aims at showing that the application of an apparently simple distancing rule as "maintain distance x from others" may be not as effective as it should in reality. In such situation, further guidelines, paying attention on how the rule application may require change of personal behaviour in space would be probably appropriate. Developing such kind of guidelines would probably be a specialty for architect and engineers. In fact, such detailed rules were widely communicated to the public with regards to other simple behaviour such as hand-washing and handling masks, so their importance should be not underestimated, in the face of the overall fallacy of the common sense of the crowd.

4. The possible contribution of Geodesign to emergency response

Among possible approaches to Coiv-10 outbreak response planning, geodesign in principles may be of help. As argued by Steinitz geodesign as a methodology approach may help to handle the complexity of territorial phenomena (2012).

In geodesign a number of characteristics of the methodology are indeed relevant:

- Scales matter: as in any design issue scale matters, and as in any planning and design problem, geodesign may help to adapt the design of emergency response and containment measures to local geographic and physical conditions at all scale, as discussed in the previous section;
- Systems-thinking: Covid-19 outbreak is very likely to be related to environmental phenomena and addressing a complex problem by systems may help relating epidemic risk to other environmental systems such as air, transport infrastructures, settlement density, and allegedly others;
- Geodesign is holistic in bridging science and design: in that, it may help to provide methods and tools for collaborative multi-disciplinary design, integrating knowledge stemming from design, science, information and communication technology, as well as from the local community (i.e. the people of the place) to address emergency response;
- Offering interactive computational models, it allows to devise alternative solutions for action and contextual impact assessment in very short time (compared to other design methods), allowing to quickly adapt design solutions to the rapidly evolving conditions of emergency.

Fully digital geodesign workshops were recently tested by the author in same-time/different place mode, demonstrating how fast the design process can be implemented relying on internet group-ware technology such as the geodesignhub (www.geodesignhub.com) web-based planning support systems and Zoom (www.zoom.us) teleconferencing platform, enabling a high number of participant/experts (i.e. 30 and more) to address complex planning and design problems as fast as in half-a-day time.

5. Final considerations

Covid-19 pandemic is an outbreak of unprecedented magnitude, but is not he first one afflicting regions worldwide in the last decade.

The impetuous and rapid diffusion is interrelated with current globalization in environmental and socio-economic dynamics, and according to many, to the current state of the terrestrial ecosystem including climate change. If this hypothesis will turn to be true, we might expect similar phenomena might occur again in the short-medium term. As a precautionary approach suggests, we would better to be ready, as the risk are highs and possible implications catastrophic.

Hence, the question is: who can contribute to effectively address this unprecedented, poorly understood, and very complex challenge? For sure such specialist as virologists, epidemiologists, and physicians will play, as they are doing in the current state of things, a major role. However, if the spatial dimension of the phenomenon is so relevant as it seems to be, at all scales, as briefly the author tried to argue here with some preliminary examples and reflections, the role of (geographers and) spatial planners and designers may be as much relevant in planning emergency response supporting spatially informed decision-making as well as developing guidelines and protocols to be applied by single individuals and communities.

In summary, a number of issues for urgent research emerge for spatial planners and designers from the preliminary reflections proposed in this paper, including but not limited to:

- Data collection
- Data availability (and relating privacy issues)
- Spatial analysis (if large scale geographic data are made available to researchers and planners)

- Planning and design
- Communication to the public

Indeed, shading light on the issues above in the unprecedented context of pandemic urgency might help to contribute, together with the findings and recommendations originating from other the disciplines involved, to help achieving a more holistic and comprehensive response to the complex emergency we are facing nowadays, and to others we might expect to experience also in the future as territorial dynamics become global and often unexpectedly fast.

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Image Sources

All figures are original produced by the author for this paper.

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Health emergency and economic and territorial implications

First considerations

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Abstract

The Covid-19 epidemic has caused a lot of economic and social damages and has generated territorial imbalances that are not yet quantifiable. Many research groups are currently committed to deepen their understanding of the impact of the crisis using different disciplinary methodologies and focusing on different aspects of the phenomenon.

These researches reveal causal links between the variables involved that have not been explored up until now and raise relevant questions for the economic and social future of our Country.

This paper wants to provide an overview of the territorial and economic implications related to the epidemic event on the basis of a set of economic, settlement and environmental indicators applied to the two territorial dimensions of the Italian Regions and Provinces. For each of them, the connection with primary epidemic data (number of cases and number of deaths) was analysed to verify the possible presence and consistency of the correlation indices.

Aim of the article is to highlight some territorial characteristics that may have facilitated the spread of the epidemic by identifying, at the same time, some actions that will positively affect them, in an evolutionary perspective.

Keywords

Urban planning; Economy; Geographical data analysis; Post-Covid actions.

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1. Aims and data

Some data can provide a real idea of the present and future dynamics of the processes underway, their consequences and impacts on the development scenarios of the crisis both on the economic and social systems, from a temporal and territorial point of view. In particular, some empirical observations can lead to understand collective and individual behaviours that have affected the different spread of the epidemic at the regional and even provincial level.

It is evident, in fact, that the pandemic did not cross all the territories with the same virulence (Figure 1). The data on the number of provincial cases on 13 May 2020 report a significant difference between minimum values (57 cases in the Province of Isernia) and maximum values (21,731 cases in the Metropolitan city of Milan) (DPC, 2020), a gap that cannot be exclusively coincidental and that raises many questions.

Two of these questions are particularly relevant and interesting to analyse.

The first has to do with the very nature of these differences. What are the causes? What factors determined them? Are they due to behavioural models or institutional differences?

The second is related to the future consequences. Are there active policies that can increase the resilience of a territory? How will the economic and productive structure of the Country and of the individual regions be influenced? Will the fault line separating the North from the South widen further?

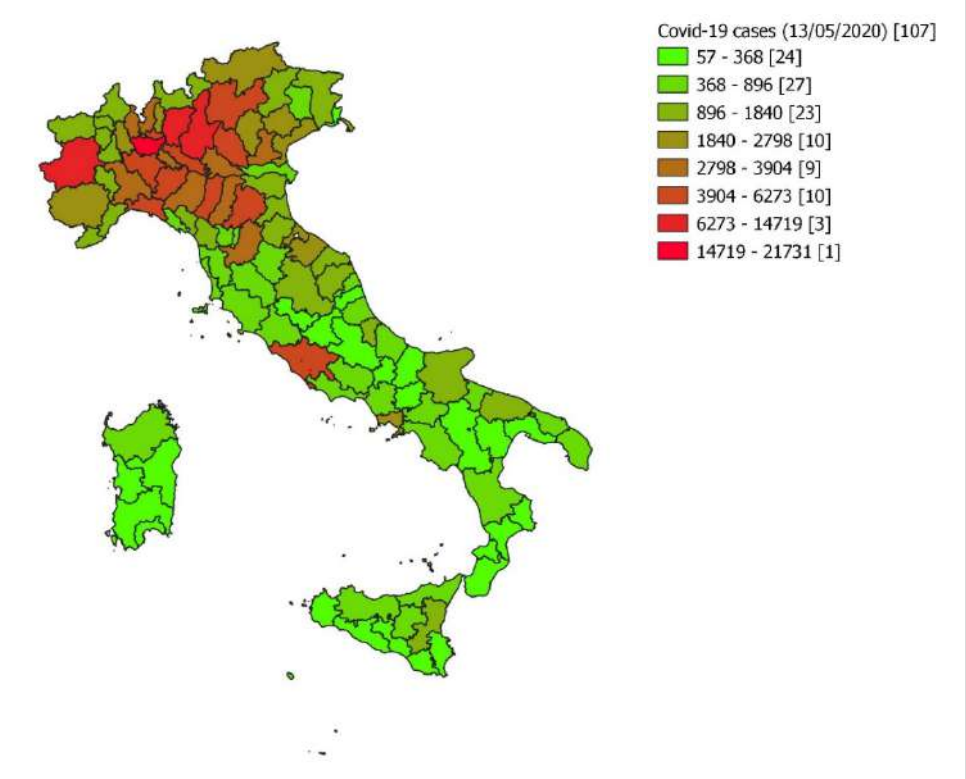

Fig.1 Provincial distribution of the cases of Covid-19 at 13 May 2020. Source: Authors on data DPC (2020)

This second set of questions also opens up a methodological and perspective question. The pandemic has questioned the same methods of actions on the territories, to the point that it seems increasingly evident to most that it is appropriate to redesign policies and interventions to recovery the Country.

Many analyses are based on the assumption that this awareness is an acquired fact and that we are moving towards a new renaissance in the relationship between man and territory. This hypothesis is certainly fascinating but highly unlikely. Much more likely, instead, is the repetition of deeply rooted and difficult to modify models.

Significant is the note of Yascha Mounk (2020) about the tendency of man to "chronocentricity", a term coined by the sociologist Jib Fowles (1974) showing the belief of the contemporary man that own age is prominent compared to the others, hence the tendency to believe the latest disastrous event as the cornerstone of an epochal revolution that, in real life, does not occur, except for small adjustments of route.
In our view, it is more useful to follow an objective and pragmatic approach, and to understand, through quantifiable and measurable indicators, the differences in land use, economic processes and social relationships that may have affected the spread of the pandemic.
For this purpose, we focused on the following 7 indicators: mortality rate, gross domestic product, population density, percentage of the elderly population out of total, land consumption, air pollution. The first couple of indicators are measured at the regional level, the last five at the provincial level. They are supposedly related, although to a different extent, to the spatial distribution of the epidemic. This set of indicators, although not exhaustive, can well describe the table of content of the co-factors that guided the spread of the virus.
The epidemic data used in the following analysis date back to 13 May 2020 and can be found on the website of the Department of Civil Protection (DPC, 2020).

Mortality (Regional datum)

The regional mortality rate clearly expresses the territorial differences that have arisen between the various regions. It is also strongly correlated by construction with the spread indicator of the virus.
This index is enough to clearly describe the high variability of the incidence of mortality in the different areas. At the date of 13 May 2020, the total number of deaths in Italy was 31,106, with 222,104 cases. Figure 2 shows specifically the mortality rate of each Region at that date. The national ratio is of 14.01%, while the regional data fluctuate from a maximum value of 18.23% of Lombardy to a minimum of 5.07% of Umbria. The median value is between 10.34 (Autonomous Province of Trento) and 10.01 (Friuli-Venezia Giulia). By comparison, world value at the same date is 6.87%.
One of the reasons given to explain the high mortality rate occurring in Italy is the average age of the population. This interpretation is partially confirmed by the data of other European countries, but it falls when we look at non-European countries with a high percentage of elderly people (see Japan, 4.17%). The lack of a specific correlation between the old age of the population and the mortality from Covid-19 is better highlighted by the subsequent provincial data.

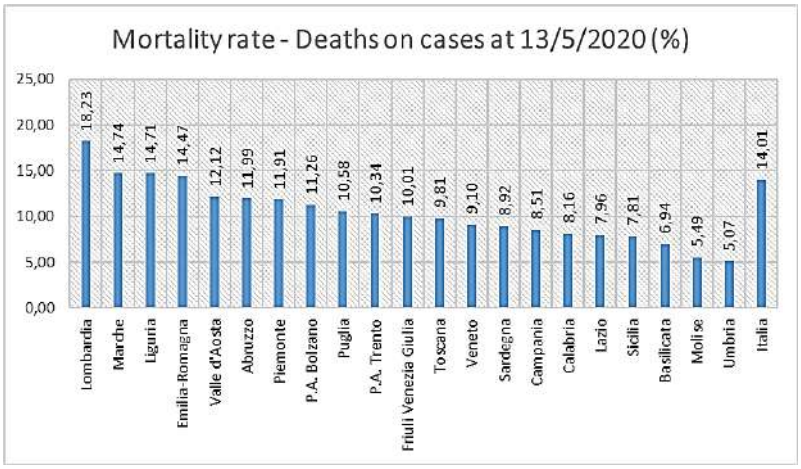

Fig.2 Regional mortality rate at 13 May 2020. Source: Authors on data DPC (2020)

GDP (Regional datum)

The following diagrams compare the number of cases (Figure 3) and the number of deaths (Figure 4) for Covid-19 with the regional gross domestic product (GDP) per capita in 2017, last available data (ISTAT, 2018). The regional GDP is a statement of the degree of development of the economy and it is correlated with the health costs determined on a regional basis.

The correlation coefficient of the relation between number of cases and GPD is 0.4425, while the same coefficient for the relation between number of deaths and GSP is 0.4125. The correlation is inflated by the highest incidence of the epidemic being recorded in the Northern regions, and in particular in Lombardy, which are also the highest-income regions.

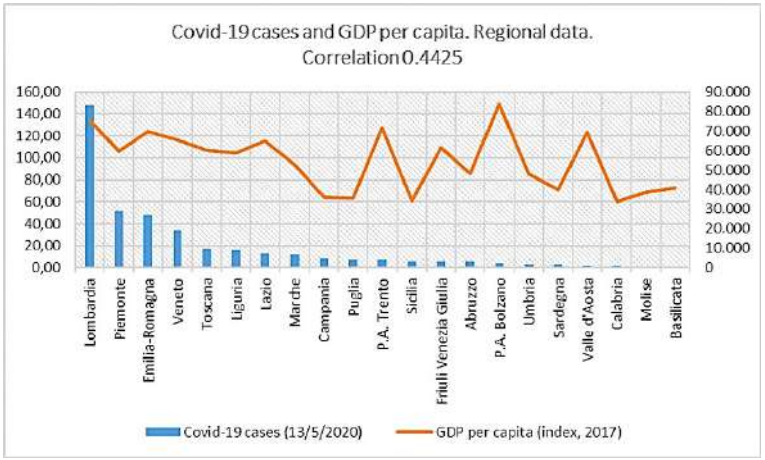

Fig.3 Covid-19 cases and GDP per capita. Source: Authors on data DPC (2020) and ISTAT (2018)

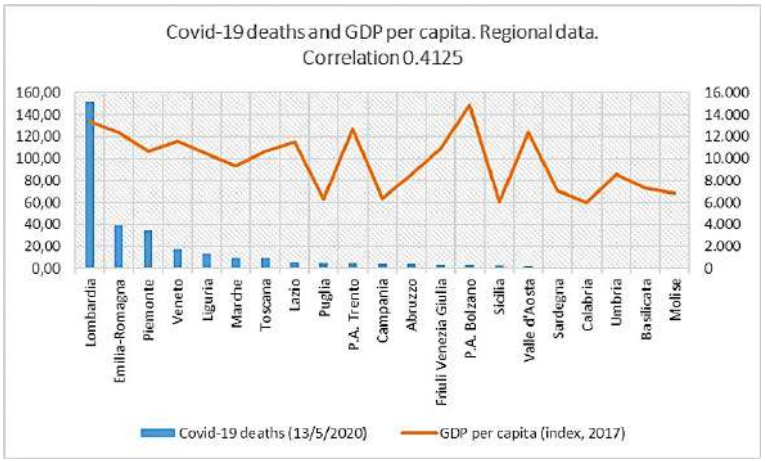

Fig.4 Covid-19 deaths and GDP per capita. Source: Authors on data DPC (2020) and ISTAT (2018)

Population density (Provincial datum)

Figure 5 shows a map with the distribution of the population density in the 107 Italian Provinces. It shows that there is a very uneven distribution of density ranging from a minimum of 37 inhab./Sq.Km in the Province of Nuoro, to a maximum of 2,617 inhab./Sq.Km in the Metropolitan city of Naples. The largest number of provinces (68 out of 107) is positioned in the narrow range of density from 89 to 331 inhab./Sq. Km.

Figure 6 shows the relation between number of cases of Covid-19 (always at the date of 13 May 202) and population density at provincial level. The correlation coefficient is 0.4402. It is clear that housing density and

population density positively influence social proximity and consequently the speed of circulation of the virus and the number of infections.

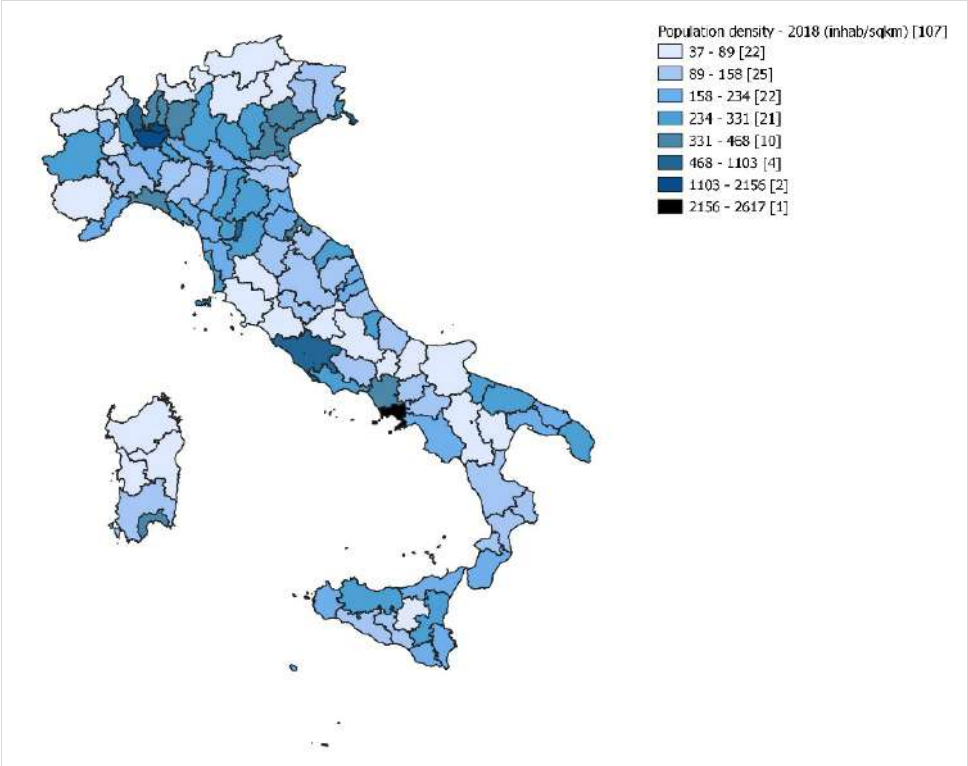

Fig.5 Density of population (inhab./Sq.Km). Provincial data. Source: Authors on data ISTAT (2020)

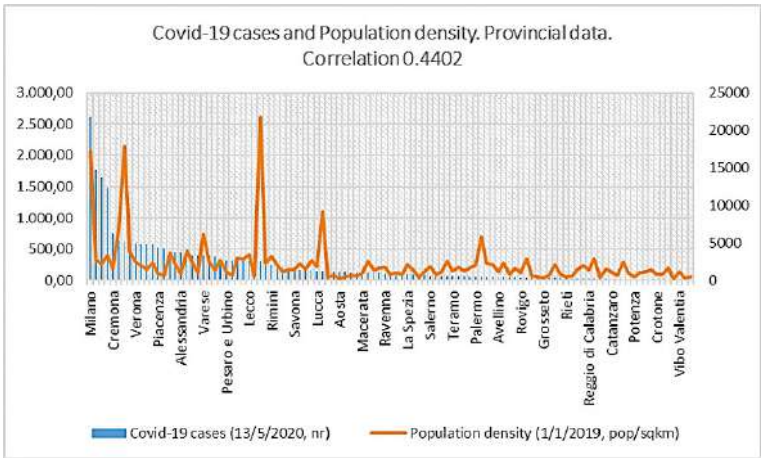

Fig.6 Covid-19 cases and density of population (inhab./Sq.Km). Source: Authors on data DPC (2020) and ISTAT (2020)

Number of senior citizens (Provincial datum)

Italy is one of the countries with the highest average age of the population. The country's demographic dynamics are expected to further accentuate this aging phenomenon in the future. In our country, the percentage of the senior citizens, with an age of 65 and over, ranges from a minimum of 17.5% in the Province of Caserta to a maximum of 28.9% in the Province of Biella. As stated, all national, regional and provincial data regarding this percentage are growing, as evidence of the progressive aging of the population.

It is noteworthy that the correlation coefficient between the number of cases of Covid-19 and the elder population (population with 65 and more years old) seems to be the less significant among all the coefficients calculated (Figure 7). The value of -0.0849 shows almost no relationship, so the two variables appear to be

perfectly independent. This evidence downsizes the idea that the virus has penalized the areas with the higher average age of the population.

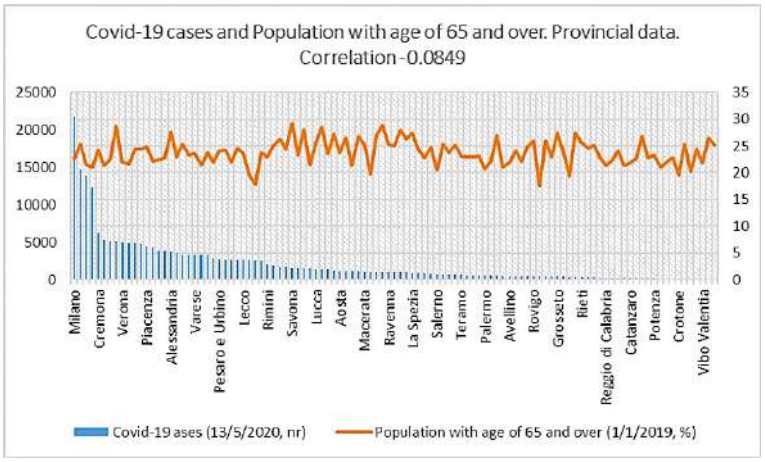

Fig.7 Covid-19 cases and population with age of 65 and over. Source: Authors on data DPC (2020) and ISTAT (2020)

Land consumption (Provincial datum)

Figure 8 shows the relations between land consumed and number of cases. The data are referred to the Italian provinces and comes from ISPRA (Munafò, 2019). The correlation index between land consumed and number of Covid-19 cases is very significant (0.5806).

Land consumption is considered one of the critical index in this epidemical crisis. For a number of scholars, a high level of land consumption decreases the ability of the territory to create an effective response to growing environmental risks and, consequently, also to the ability to respond to health crises.

It is evident, in fact, that land consumption is in turn correlated with variables that influence the spread of the disease and its containment: the degree of urbanization, the management of common resources, the degree of economic backwardness, the pollution rate.

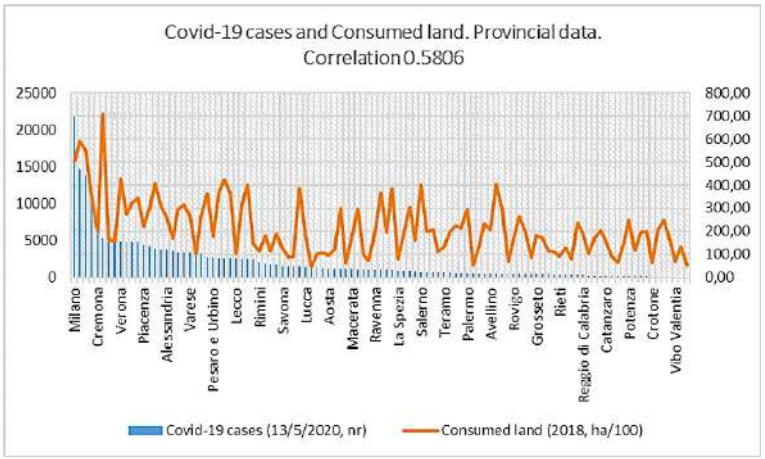

Fig.8 Covid-19 cases and consumed land. Source: Authors on data DPC (2020) and Munafò (2019)

Air pollution (Provincial data)

We base the analysis of atmospheric pollution on two measures which are considered to be among the most significant: the concentration of PM10 and of NO_2 (ISPRA, 2020).

Figure 8 shows the relation between the number of Covid-19 cases at the date of 13 May 2020 and the number of cases of deviation from the daily average of PM10 logged into 2017 and 2018. The limit value of the PM10 particle is 50 µg/m3. The two series of data have a correlation index of 0.5732.

Note that the data are recorded in the provincial capital and are reported in the ISTAT environmental data base (dati.istat.it), section "Environment and Energy", while the data about the number of cases of Covid-9 are related to the whole provincial territory.

Figure 9 shows an ISPRA source map with the distribution of the areas in which the allowed concentrations of PM10 are regularly exceeded. The fact that the whole Po Valley is classified as an excessively polluted area is highly significant.

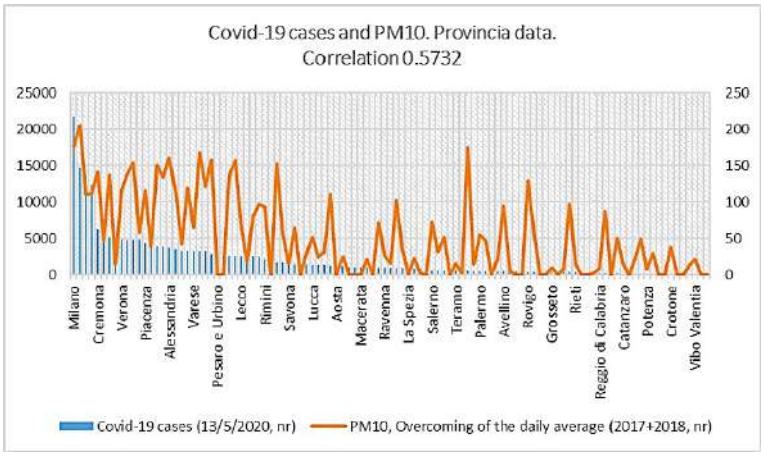

Fig.9 Covid-19 cases and PM10 concentration. Source: Authors on data DPC (2020) and ISPRA (2020)

Fig.10 Distribution of the area with overcoming of the limits of PM10. Source: ISPRA (2020)

Lastly, Figure 11 shows the relationships between the NO_2 concentration and the number of Covid-19 cases, with the epidemic data that date back to 13 May 2020. The correlation coefficient between the number of Covid-19 cases and the NO2 concentration is very high and it is equal to 0.5347. This evidence supports the idea that the virus "travels" on fine particles and that air pollution contributes to the spread of the disease (Martelletti & Martelletti, 2020; Setti et al., 2020).

It is important to emphasize that the Istituto Superiore di Sanità (ISS) has developed a specific page dedicated to the connection between air pollution and the spread of the SARS-CoV-2 virus

According to the ISS, "the hypotheses suggesting correlations between the areas with greater air pollution and the spread of the virus responsible for Covid-19 have prompted the request for opinions from the Istituto Superiore di Sanità and have stimulated many groups of scholars to cooperate to examine the issue and possible associations. However, the uncertainty that still affects many aspects of this epidemic requires some caution and a deepening of the understanding of any cause-effect relationships" (ISS, 2020).

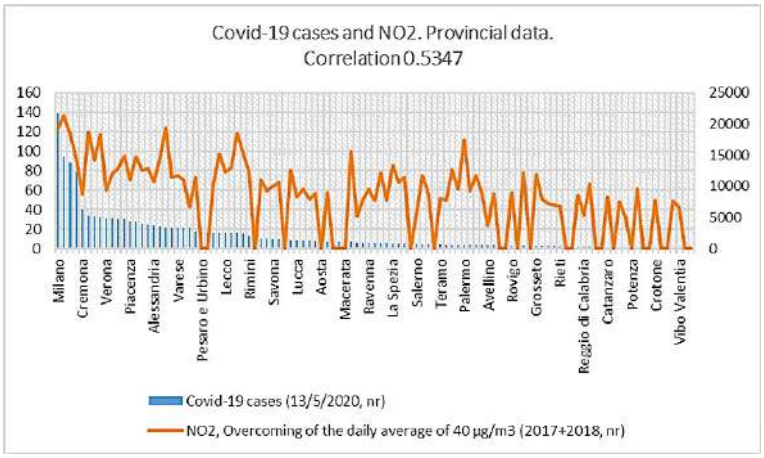

Fig.11 Covid-19 cases and NO2 concentration. Source: Authors on data DPC (2020) and ISPRA (2020)

2. Discussion

The data presented in the previous chapter testify of an Italian territorial system with varied and differentiated characteristics. They also show the possibility that some phenomena may have influenced and favoured the spread of the epidemic.

As already said, this does not mean that there is a direct connection between territorial phenomenon and event. It only means that there is the need to deepen the analyses to reach a better knowledge of the phenomena and to be able to apply results and models to the construction of forecast scenarios useful for the management of the phenomena that will occur in the future.

Table 1 summarizes the outcomes of the analyses carried out particularly in relation to the correlation coefficients and their meanings. Two of them are related to Regional data, five to Provincial data. The analysis shows for three cases a correlation with high significance, for three a correlation with medium-high significance, for one a correlation with very low significance.

From the previous analyses, a first difference emerges in relation to the type of data. In particular, even with the aforementioned attention, a greater degree of significance can be highlighted between epidemiological and environmental data, while a relation between socio-economic data and epidemiological data is present but can be shown to be less significant.

No association seems to be present between epidemiological data and structure of the population.

Data	Territorial level	Correlation coefficient	Significance
Covid-19 deaths / GDP per capita	Regional	0.4125	Medium-high
Covid-19 cases / GDP per capita	Regional	0.4425	Medium-high
Covid-19 cases / Population density	Provincial	0.4402	Medium-high
Covid-19 cases / Age of 65 and over	Provincial	-0.0849	Very low
Covid-19 cases / Land consumed	Provincial	0.5806	High
Covid-19 cases / PM10	Provincial	0.5732	High
Covid-19 cases / NO2	Provincial	0.5347	High

Tab.1 Summary of the correlation analyses. Source: Authors

The correlation between data, of course, does not imply causation but only a significant similarity in the trend of the two matrices of values. This, in accordance with the ISS as to the environmental data, does not translate into a specific cause and effect relationship between air pollution and spread of the pandemic. Having clarified this issue, the association between environmental quality aspects and the spread of the epidemic is one area in which the studies of scholars working in the social, economic and environmental field are being focused on.

The assumption is that there is some level of correlation between the two processes and that the diffusion enhanced both by the reduced quality of some environmental factors and by the concentration of some processes in restricted territories. For example, the concentration of toxic substances in the air reduces the body's defences, while higher income levels would have an impact on the amount of interpersonal relationships for work or other purposes and, therefore, on the probability of getting in touch with subject carrying of pathologies.

Obviously, the correlations built in this study are to be better investigated with time with the increasing availability of data.

Without going into the merits of the quality and completeness of the epidemiological data, it is necessary to underline the fact that, since the event is ongoing, the values change day by day. Since the rate of change tends to decrease, the latest data are much more stable than those collected, for example, in late March.

It appears to be untimely, then, to affirm that: "We observed similarities in the conditions of Wuhan area in Hubei Province, with those in the Po Valley metropolis, particularly related to the geographical and climatic conditions – presence of water bodies, flat lands, limited air circulation, similar climate zones –, socioeconomic ones – industrial production, transport infrastructure and mobility, population distribution and density –, as well as similarities in terms of presence, concentration and persistence of pollutants in the atmosphere" (Murgante et al., 2020, p.31).

The fact remains that the improvement of the qualitative factors of the territory represents a necessary target, independently from the need to face this immediate emergency. This is because man's use of space has become unsustainable due to a growing series of factors. Just think of agricultural production or climate change as examples of the environmental alterations that man continues to indiscriminately carry out.

3. Economic answers

The pandemic will leave behind a long wake of victims and an enormous cost in terms of human lives; yet, even the economic and social cost will be significant, and will have effects not only in the short term but also and above all in the long term (Capasso & Chiarini, 2020). Unlike other, the Covid-19 crisis has a characteristic that makes it more damaging: it is a truly global crisis.

The lockdown of production activities and of international trade has involved practically all over the world with disruptive effects in all sectors. The forecasts of the International Monetary Fund (2020) and the OECD (2020) indicate that the fall in production will be significant in all advanced countries, but emerging economies and poorer countries will suffer more.

The destruction of product and income is not so worrying for the direct consequence of the suspension of activities, but for the long-term effects on the alteration of the value chain and on the structural dynamics of the economy. Some sectors, such as tourism and air transport, have suffered considerable damages and will be profoundly transformed; similarly, many companies will leave the market, others will modify the production structure by relocating or shortening the production cycle to reduce the risks associated with the supply of raw materials and semi-finished products.

The impact in Italy will be particularly hard because the country's economy is structurally weak (Banca d'Italia, 2020). The growth rate of Italy's gross domestic product in the last 20 years is among the lowest in the world. Therefore, the crisis linked to the pandemic may have particularly negative effects on an already weak and uncompetitive economic system. The last decades have seen a notable technological transition, of which the last phase is the 5G technology, from which Italy has remained substantially out. This, along with other factors, has curbed productivity growth and undermined the country's growth rate.

The pandemic and the following crisis have accelerated a technological transition already underway that requires massive investments in at least three types of infrastructures: technological infrastructures, organizational and management infrastructures, legal and regulatory infrastructures.

Technological infrastructures include not only the connection network between databases, but the management of the data itself. These infrastructures are necessary for new production processes which return to be directed towards non-standardized but specific productions for individual needs. The platforms that manage the data are functional to this type of production. In this sense, production itself implies knowledge and know-how and increases the added value of the product.

Organizational infrastructures are necessary to manage new production processes that tend to be increasingly outsourced to the final product markets. Paradoxically, the new globalization will contribute to making production and marketing activities increasingly local. Territorial policies and the enhancement of local contexts are therefore necessary to guide the technological leap and the transformation of production and marketing systems.

Like any change, this too must be accompanied by a radical shift in the regulatory and legal system. It is known that the Italian legal system is cumbersome and does not help the development of new business initiatives by representing a high cost of "doing business". This cost will be even higher in a more articulated and complex economic system because it is enriched by a great territorial diversification.

4. Planning answers

Starting from the analysis carried out and from the interpretation associated with the data, it is necessary to take into consideration another non-secondary aspect, namely the effects in terms of innovation of the planning and its role.

The territorial strategies to be implemented can only be long-term strategies. The time investment necessary to modify consolidated actions and behaviours requires, in turn, a stable political and social scenario.

What happened between March and May 2020 will be difficult to replicate, because the quickness with which social and economic processes have slowed down and, in some cases, stopped is not sustainable, even in the event of an epidemic upsurge.

The general quarantine was the best tool to stop the epidemic but it had a strong impact on the social and economic situation. This meant that, as soon as the situation started to show signs of improvement, the health risks seemed to have been put in the background, overtaken by the attention to economic damage. We can say that the territorial system affected by the epidemic seems to have behaved in a less than resilient way since the universal response was the lockdown (Mazzeo, 2020).
A first line of territorial action, therefore, goes in the direction of increasing the system resilience level, so that it can respond flexibly without losing efficiency.
Given that resilience is the ability of an object to absorb aggressive phenomena while maintaining a reasonable level of functionality that does not lead to collapse (Holling, 1996), the response to disastrous events must be as effective as possible, so that the subsequent phase of recovery may start from a more solid base.
Also given that each disastrous event contains in itself the power to influence the future organization, on the basis of a better and more efficient growth model, it is possible to build different response scenarios after a shock. In some cases, the model may collapse into a non-resilient behaviour, or it may resume the path previously followed, in others it can improve by focusing on innovation and on the construction of a more advanced territorial structure (Figure 12).

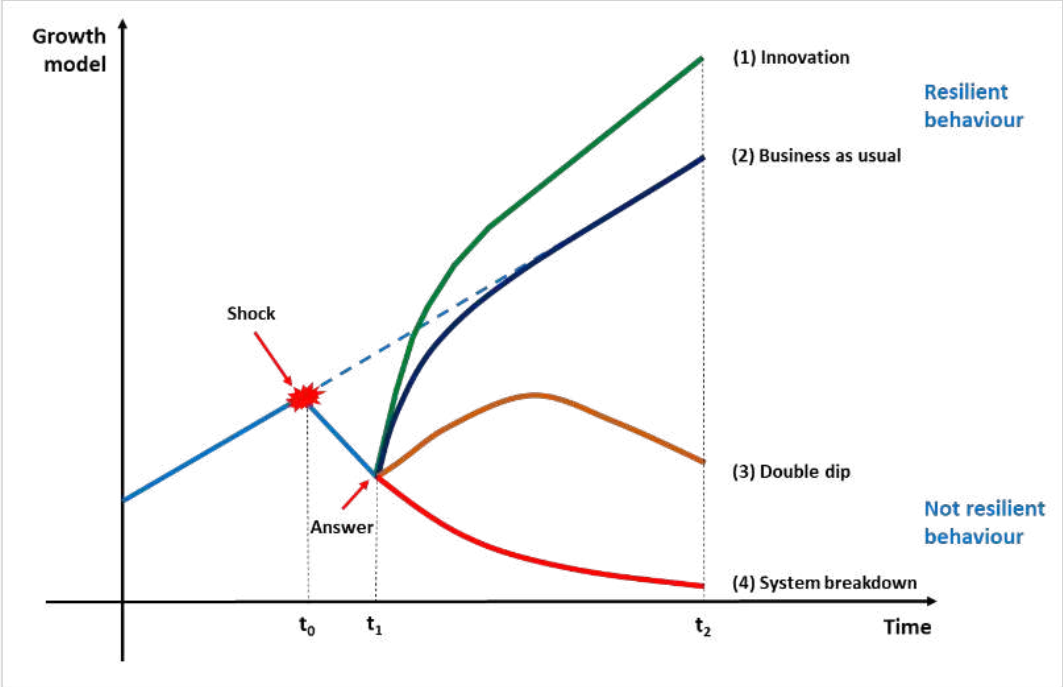

Fig.12 Potential evolutions of the growth model. Source: Mazzeo (2016)

Planning can help to re-enforce the strengths of urban and territorial systems, in connection with other research sectors.
For example, it appears to be possible that some land use manners, in particular those that led to a greater density of activities and functions, have represented a potential multiplier of the impacting power of the virus, which instead did not happen in the areas with lower density. Areas in which the epidemic is widespread, in fact, are also areas in which there has been a greater exploitation of the capacity of the territorial resources, in particular in regards to their use for production purposes.
The same system of services, showcased as strong point of some areas, has turned into a weak point and has made them vulnerable to the spread of the epidemic.

From this comes the need to investigate the difference between theoretical and effective response of the territorial systems. In some Regions this gap has been large enough to fuel more doubts about the capacity of local administrations in the construction of efficient structures and evolutionary scenarios.

In his current discussion, urban and regional planning has often highlighted the presence of a series of critical issues in the spatial processes developed in recent decades and which have been characterized by a tendency to limitlessly and indiscriminately extend of the possibilities of individual choice, both locally and globally. These processes have been widely analysed by national and international literature.

In particular:

- the constant increase in the world population and the percentage and absolute increase in the urbanized population;
- the uncontrolled expansion of urban systems, with the consequent assault to natural soil and the explosion of local and metropolitan mobility (Mazzeo & Russo, 2016);
- the growth of international mobility due to work and tourism;
- the increase in territorial risk factors and the impacts on climate change on the quality of air, soil and water;
- the processes of impoverishment of agricultural soils and homogenization of crops, affecting the quality of food products;
- the aging of the population, which varies from country to country, with repercussions on the public services system and on urban systems.

All the previous critical issues have to do with a scarcely sustainable use of the resources and are easily interrelated with parallel aspects belonging to other sectors, such as economics, sociology and public health (Matthew & McDonald, 2006; Sloane, 2020; Celata, 2020).

In particular, it is necessary to give back meaning to people's places of life, overcoming the assumption of "geographical neutrality" (Arribas et al., 2011) inherent in the current action of land use, in order to analyse and understand the innate diversity present in different territories and the impact they have on living conditions.

This action is also linked to the development of a coordinated and multidisciplinary approach to eliminate or, at the very least, reduce social disparities, which translate into other kinds of disparities, including the right to health. These inequalities tend to increase for reasons related to income, skin colour, level of education, as well as in relation to the physical position of the communities, and therefore to the conditions of housing, transport, social services. In summary, we could say that disparities are a function of the overall level of social capital. The higher the social capital, the more effective the access to services and the true availability of citizenship rights. Finally, it is appropriate to restore dignity to the quality of information and the effective implementation of participatory democracy.

The territory and the tools of its planning can address the critical points mentioned. The possible solutions can be applied to the physical space so that they can affect specific aspects such as the organization of the settlements and the places of life and work of the population, the environmental conditions of the settlements, the repercussions on the demographic structure, with the aim of growing the resistance of the overall characteristics of the population.

The Covid-19 epidemic has highlighted once again the critical issues associated with the processes of building of the local territorial space (the city as a place of opportunities and safeties) and the global one (economic expansion and access to all places by the use of communications). A possible answer passes, as mentioned, through the adaptation of practices and deepening of connections with other sectors. Territorial processes, in fact, are spatially and functionally through interrelationships that go beyond national and continental borders, and therefore need an answer that is no longer simply sectoral.

Notes

The paper is the result of the common reflections, research and work of the authors involved. However, Abstract, Section 1 and Section 2 are in common. Section 3 can be attributed to Salvatore Capasso. Section 4 can be attributed to Giuseppe Mazzeo.

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Image Sources

Figg. 1 to 9 and 11 to 12: Authors

Fig.10: ISPRA (2020).

Author's profile

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He was awarded PhD in Economics and Finance from the University of Manchester (UK) and PhD in Economics from the University of Naples Parthenope. Since 2013 he has been full professor of Economic Policy at the University of Naples Parthenope and from 1 June 2015 to 31 May 2019 he was Director of the ISSM which, following his project submitted to the CNR, became part of the present ISMed. His research interests are focused on the economics of Development and Economic Growth and on monetary and financial economics. In specific, he has in recent years dealt with the relationship between the black economy and financial development and the relationship between corruption and economic growth. He is the author of numerous publications and articles in national and international journals.

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About the effects of Covid-19 on solid waste management

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Abstract

Over the last months, spread of the SaRS Co-V 19 virus has been much more than a healthcare emergency. It overrun people's life styles, society's organizational models, welfare systems, the economy and business world, as well as solid waste management schemes.

The critical issues that have emerged require actions to overcome the crisis, while paving the way to achieve sustainable development goals: in this view, the Covid-19 emergency may represent an opportunity, as suggested by the International Institute for the Sustainable Development.

This work discusses the impact of the Covid-19 emergency on both the generation and the management of solid waste originating from both household and healthcare activities. Data about the amount of waste produced and associated ordinary handling procedures were gathered in order to highlight how both have been affected by the measures implemented to cope with the emergency. The vulnerabilities of the overall solid waste management system have been revealed, pointing out the need for a careful rethinking of possible avenues for future development.

Keywords

Environmental protection; Solid waste management; Sustainable development

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1. The management of solid waste

Solid waste refers to all those objects that have reached their end-of-life as well as those disposed by their keepers. Consequently, its composition is extremely heterogeneous and tightly linked to its origin, which allows a distinction to be made between municipal and special waste. The former includes the residues produced from households; the latter refers to all other types of waste. Solid waste is further classified into either hazardous or non-hazardous waste, regardless of its origin and in accordance with its hazardous properties.

In the last decades, management of solid waste has been under intense review, aiming towards an integrated approach, and thus at the maximization of material and energy recovery, as well as at the reduction of landfilling. To this end, solid waste streams are source-sorted by main components and hazardous properties and sent to adequate treatment processes.

The overall management develops through a series of activities that, although pursuing common objectives, are implemented differently, in accordance with the specifications of a complex legislative framework. At national level, the main reference is Legislative Decree no. 152/2006, but additional specific legislation has been enforced to regulate particular kinds of waste: this is the case of medical waste, whose handling is governed by Presidential Decree 254/2003.

In 2018, production of municipal solid waste (MSW) in Italy was reported to be greater than 30 million tons, corresponding to an annual per capita amount of approximately 500 kg, with a 2% increase compared to the quantity registered in 2017. About 58% of the waste produced was collected separately, but some differences in source selection levels can be recognized among Italian Regions (ISPRA, 2019a). In Campania, MSW production was greater than 2.6 million tons in 2018 and almost 53% of this waste was source-selected (ISPRA, 2019a).

Source-sorted waste streams are sent to recycling processes, whereas the remaining unsorted fraction, often mechanically pretreated, is destined to thermal processes in order to produce energy and dispose in landfill only the residues that cannot be valorized by other means.

The integrated MSW management system can be organized according to different schemes, in order to fulfill legislative requirements and recovery targets. The choice must take into account MSW composition, but it is obviously influenced by the availability of waste treatment plants. Despite the progress made in the last decade, several Italian regions have still difficulties in "closing the loop" of waste materials and handling their own MSW in accordance with the self-sufficiency principle.

In 2018 Campania Region exported more than 101.000 tons of waste, corresponding to the 21,8% of the overall waste exported at national level (ISPRA, 2019a). In the same year, the Region exporting the greatest amount of waste was Friuli Venezia Giulia, while some other region became prominent importers. This condition accounts for the existence of a particularly dynamic waste market, not only at national level, but also in Europe and in other areas worldwide.

Europe is tightly dependent on the waste trade with Asian countries to reach its recovery targets: for instance, the trade network for plastic waste involves Asia as the main importer and both Europe and North America as the greatest exporters. The import ban established in 2017 in China, which was the undisputed leader in the global plastic waste trade, had severe effects on the recycling system of several countries and significant streams were redirected towards other Asiatic countries (Wang et al., 2020).

A self-sufficient waste management should be pursued not only for MSW, but also for special waste, including the waste produced by hospitals and medical care services. Although the amount of medical waste is much lower than that generated from households, its features require handling procedures ensuring adequate protection of both human and environmental health, starting from its collection.

To this end, Presidential Decree 254/2003 sets out that medical waste must be source-sorted in accordance to its hazardous properties and destined to appropriate treatments: in the case of infectious waste, this is incineration.

Grosso et al. (2020) pointed out that in Campania more than 90% of the medical waste is classified as hazardous and 77% out of the hazardous waste consists of *Wastes whose collection and disposal is subject to special requirements in order to prevent infection* (European Waste Catalogue code 18 01 03). These data are consistent with those of other Italian Regions, highlighting a uniform approach at national level (Grosso et al., 2020). However, it is worth highlighting that in other States infectious waste represents only a minor portion of medical waste, ranging between 3 and 10%, likely because in Italian hospitals all the waste generated by patients is considered infectious (Cesaro & Belgiorno, 2017).

At regional level, the main treatment process for infectious medical waste is sterilization. Every year around 7300 tons of waste is sterilized and converted into a refuse-derived fuel that by necessity needs to be allocated to incineration plants located out of Campania Region. This amount of waste adds up to 39% of medical waste produced in Campania and exported elsewhere even under ordinary conditions (Grosso et al., 2020).

2. The effects of the Covid-19 emergency on the generation and management of solid waste

2.1 Municipal solid waste

The implementation of measures to contain the spread of contagion has forced an immediate modification of lifestyles as well as the lockdown of several industrial and commercial activities, along with bar and food services. This condition, in turns, has immediately driven significant changes in the field of MSW.

The data currently available about MSW amounts and qualitative characteristics are scarce and fragmented; they mostly refer to the sole month of March 2020, which has been only partially affected by the restrictive anti-Covid-19 measures, so that it is hard to provide a comprehensive overview of the change occurred.

Nevertheless, some considerations can be made on the basis of both the declarations provided by local administrators and the information released by companies working in the field of solid waste management, all highlighting the impact of Covid-19 on both the quantity and quality of the waste generated.

The study by Althesys (available at the link: http://www.althesys.com/) predicts that MSW Italian production in 2020 may drop to 2.5 million tons. The same study highlights that the amount of special waste may decrease as well: such reduction may account between 4.2 and 4.5 million tons for Lombardia, Veneto and Emilia Romagna alone, contributing to a lost revenue for the companies that handle this kind of waste close to 1 billion euro.

Further insights can be obtained from the information circulated about some major Italian cities.

During the meeting of the Committees *Ambiente e Controllo enti partecipati*, the Councilor for Mobility and Environmental Services of Milan, Marco Granelli, informed that a relevant reduction in the MSW collected had been observed already on 21st March 2020. The reduction percentages are given in Tab. 1.

MSW fraction	Reduction [%]
Organic	29
Glass	19
Paper and paperboard	22
Plastic	14
Unsorted waste	25

Tab. 1 Reduction in MSW collected in Milan, as reported by the Councillor for Mobility and Environmental Services of Milan

During the same meeting, the 70% decrease in the production of the organic fraction of non-household origin as well as the 43% reduction of the filling degree of street bins were also reported. Finally, the Councilor listed some provisions adopted to contain Covid-19 spread that impact on the solid waste management system. Among others, street sweeping was reduced; cleaning activities in markets and green areas were suspended and they were decreased by 40% in the city center as well as in nightlife areas. Conversely, the same cleaning activities were intensified in the areas close to hospitals, Civil Defense venues, accommodation centers, shopping malls and grocery stores.

A drastic reduction in MSW production was registered also for Turin, as published on the web page of the Metropolitan city of Turin (http://www.cittametropolitana.torino.it/cms/ambiente/rifiuti/osservatorio-rifiuti/ru-rd-mensili/). The operators handling the waste cycle for approximately 2.3 million inhabitants in the metropolitan area of Turin released the data dealing with generation and separate collection. It was shown that overall MSW production in March 2020 was 11.5% lower than the one registered in March 2019. The highest reduction, around 65%, was observed for the city of Turin, due to the reduction in commuter flows after implementation of the restrictions adopted to limit virus spread. As for MSW composition, the amount of packaging waste showed a relative increase against the organic fraction, due to the greater consumption of pre-packaged food as well as due to the wider spread of online shopping. Significant increases were registered for plastic (4.5%) and glass (6.5%) waste, whereas the reduction in paper and paperboard (-1.9%) was observed along with that in both organic (-5.5%) and unsorted (-10.7%) waste.

Different issues are raised by the analysis of data dealing with MSW generation in the municipality of Naples and provided by the company in charge of urban cleaning and waste collection services. Although overall MSW production in March 2020 was found to be 9.5% lower than the one registered in the same month in 2019, no significant change occurred between February and March 2020 (-1.6%). Nevertheless, in this period, waste composition was seen to have changed: the organic fraction significantly increased (26.4%), likely due to the greater consumption of fresh, bulk food, whereas paper (-11%), plastic (-6.4%) as well as unsorted waste (-2.4%) decreased.

It is also worth pointing out that additional types of waste were produced in this period, as a direct consequence of the large use of disposable individual protection items, such as gloves and masks. A daily use of 4 million masks was estimated during the emergency period and a further increase up to 20 million is expected when most working activities resume. Given these premises, a proper handling of the waste originating from the disposal of such items and the potential healthcare-environmental impact on conventional waste management practices need to be identified.

According to the European Centre for Disease Prevention and Control (ECDC), there is not clear evidence allowing to state that standard waste management procedures are not sufficient to ensure adequate levels of protection against the risk for Covid-19 infection or that MSW may play a role in transmission of the virus. Nevertheless, the same Centre recognized the need to adopt specific prevention and control measures for suspected or confirmed Covid-19 cases self-isolating at home.

Therefore, on 14th of April 2020, the European Commission provided *ad hoc* instructions concerning the management of household waste in these cases (European Commission, 2020).

In this regard, Italy anticipated the European measure, with the interim instructions provided by the National Health Institute (Istituto Superiore di Sanità - ISS) in March 2020 about the management of MSW during the emergency period.

According to the protocol drawn up by ISS (2020), when the waste originates from confirmed Covid-19 cases self-isolating at home or even suspected cases quarantined at home, it has to be considered similar to infectious medical waste as defined by Presidential Decree 254/2003 and treated in the same way. If the

management procedures that this Decree establishes for hospitals are not easy to implement, ISS recommended to suspend MSW separate collection and deliver all waste in - at least - two bags well-closed, as unsorted waste. In all other cases, only single-use individual protection items should be disposed with residual waste.

Finally, ISS recommended the companies involved in MSW collection to define specific routes to collect the bags from houses hosting quarantined people.

Following ISS indications, ISPRA produced a supporting document to clarify that when the waste is collected on a dedicated route, it should be primarily destined to incineration without any preliminary treatment; if not possible, the waste has to be delivered to mechanical biological treatment (MBT) plants, ensuring its sanitation (ISPRA, 2020).

The reason for preferring direct waste treatment via incineration lays in the higher level of protection against virus and pathogens provided by high temperature treatments. Conversely, when the waste is processed in MBT plants, handling of the waste itself may promote the release of pathogenic agents and consequent spread of the contagion. Nevertheless, in Italy the authorized thermal treatment capacity is often limited: since MBTs optimize the characteristics of unsorted waste for its thermal valorization, while reducing the amount to be incinerated, by-passing this kind of plants may not be a suitable solution.

The need to prioritize material recovery over energetic valorization, along with the traditional social opposition to the construction of thermal treatment plants has indeed directed waste management planning towards improvement of the recovery chain. However, recovery processes are not supported properly by highly separate collection levels, nor by policies effectively promoting the recycled products market.

The existing thermal treatment capacity, which is often inadequate even under ordinary conditions, could deal only partially with the overloading resulting from the Covid-19 emergency, also due to the diversion of some potentially recoverable materials to the unsorted stream.

In this regard, Lavagnolo and Pivato (2020), discussing the role of incineration plants within MSW management systems, suggest that regional planning should consider that waste-to-energy treatments may prove to be useful to deal with emergency situations like the one currently ongoing.

A further critical aspect of the MSW management system raised by the Covid-19 emergency refers to the recovery of source-selected MSW fractions. Several companies involved in the waste recycling chain have had trouble in either collecting the different materials (such as metals, glass, paper and plastic) or ensuring the delivery of recycling residues in cement plants.

In Campania, for instance, there are approximately fifty platforms for the storage of source-selected MSW that are experiencing severe difficulties due to the restrictive anti-Covid-19 measures. Suspension of the economic activities receiving glass, metals, paper and plastic have limited their possible recovery, and the same effect was obtained because of the scarce supply of waste materials.

This is the case of some paper mills, which cannot work at their full capacity because they do not receive waste paper. Particularly concerning is the situation of the plastic recycling chain, which is largely based on external trade: the transport paralysis that has followed the spread of the Covid-19 has, indeed, cause saturation of the platforms' storage capacity.

In order to deal with some of the above-mentioned issues, to ensure the regularity of collection and management services, ISPRA (2020) suggested the increase of the authorized capacity of storage areas in both productive and waste treatment plants. This proposal was formalized by the Italian Ministry of the Environment, with Circular no. 22276 dated 30 March 2020 and it was subsequently transposed in the Ordinance of the President of Campania Region no. 38 dated 23 April 2020.

2.2 Medical waste

The impact of the Covid-9 emergency on the waste management system is even more serious in the field of medical waste, which includes the residues originating from hospitals and healthcare facilities. As already pointed out for MSW, the large use of disposable individual protection items has contributed to the increase in waste production. The hospitals in Wuhan (China), epicenter of the Covid-19 pandemic, generated up to 240 tons per day of waste during the emergency, in the face of a daily production below 50 tons under ordinary conditions (Zambrano-Montserrante et al., 2020). Similar trends have also been registered in other regions worldwide as well as in Italy, where the companies supporting the most hit healthcare services during the emergency released some information. Although detailed data on the amounts of infectious medical waste are still not available, adoption of strict protocols to protect healthcare service personnel as well as the working conditions at saturated healthcare facilities resulted in the generation of higher amounts of waste, especially infectious.

Management of this kind of waste has been hard, especially due to the substantial lack - at local level - of dedicated plants for the treatment and disposal of medical waste.

Yu et al. (2020), considering the Chinese experience of Wuhan, suggested that installation of temporary incinerators would have represented a viable solution to deal with the dramatic increase in infectious medical waste during the emergency period, but the location selection of these plants would have raised another issue of great importance.

In Italy, where the difficulties in handling infectious medical waste are related not only to the installed treatment capacity but also to storage capacity, on-site sterilization plants would have been a useful option for several healthcare facilities. This solution, advocated by Presidential Decree 254/2003, may be considered for the wider optimization of the management system of infectious medical waste. On site sterilization would indeed entail a reduction in hazardous waste to be transferred from production facilities to dedicated plants as well as a possible increase of available storage volumes, with obvious sanitary, techno-economic and logistic advantages for the healthcare facilities themselves (Grosso et al., 2020).

3. Concluding remarks

The Covid-19 emergency has greatly affected our society's organizational models and people's daily life, with implications for the management of solid waste that reflect both lifestyle and welfare conditions of an area. The timely adoption of restrictive measure to protect human health has impacted both on the quantitative and the qualitative characteristics of the waste generated.

Facing the immediate consequences of the pandemic crisis, its wider impact seems definitely not relevant. Nevertheless, the steady improvement of the situation in many States worldwide poses the need to analyse the critical issues raised.

In the field of waste management, the strategies adopted to pursue the increasingly ambitious goals of a circular economy have proved to be ineffective. The relative increase in packaging waste originating from households indicates that the policies promoting virtuous behaviour among producers did not have any significant effect on daily life and consumption patterns. Paralysis of the management system for waste streams destined to recycling processes points out that recycling in Europe has been directed towards waste trade rather than the implementation of a self-sufficient system to "close the loop" of material cycles. Furthermore, in this way, the economic value of the materials produced in Europe is exported, but not the costs of the recovery policies. The deficiencies of this system were exacerbated to a greater extent in those regions, widespread in Italy, characterized by the lack of waste treatment and disposal facilities. Finally, the need to authorize additional storage capacities, by derogation from legislative provisions, highlights

shortcomings in waste management system planning, which is used to deal with ordinary conditions but does not consider the risks of the solutions adopted.

The Covid-19 emergency has highlighted the global limits of a system that, far from being sustainable, requires structural intervention to support actual implementation of circular economy principles. In this view, the emergency represents an opportunity to re-think waste management strategies, shaping them to allow greater flexibility as well as actual sustainability.

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The city and natural resources

Pandemic disaster can be a driving force for new perspective

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Abstract
The fragility of cities went into crisis with the outbreak of the recent Covid19 pandemic. This paper contains some reflections, born during the preparation of the next National Table for River Contracts. The city needs the territory and the pandemic can be a driving force for new perspectives, in which the urban condition can be revisited with a view to improving quality. Recent Climate Adaptation Plans, which some cities are drawing up, have to be reinforced by considerations involving natural elements. Cities crossed by rivers are fully included in the objectives of the Policy 2 "A greener Europe" of the Cohesion Policy will be financed by the Cohesion Fund, the European Regional Development Fund (ERDF) and the European Social Fund + (ESF +) in the period 2021-2027.

Keywords
Fragility; Pandemic; Climate adaptation plan; River; Landscape.

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1. Introduction

The crisis caused by the recent Covid 19 pandemic has shown the close relationship between its spread and the climatic conditions of cities. But not all cities are the same.

In Italy there are many Regions, especially in the south, where the classic city structure (physical and demographic) doesn't exist: it is instead possible to identify a continuum between a municipality and the adjoining one, in a territory whose settlement matrix is strongly rural.

In these cases the relationship between the urban element and the natural element is closer, especially when territories are crossed by waterways and the city and water live together and create special landscape features.

The network of natural, historical and infrastructural connections in general becomes the connector of environmental, landscape, historical and cultural resources.

Already in 2015 the Ministry of the Environment, in developing the SNAC "National Strategy for Adaptation to Climate Change" (Repubblica Italiana, 2015) raised the issue of differences between urban areas.

In devising a national vision on common paths to be taken to face climate change, in fact, urban settlements are identified as the main culprits and at the same time the main victims of climate change.

The document notes that in Italy the majority of urban structures are made up of small and medium-sized towns. The small to medium-sized urban centres (from 10,000 to 40,000 inhabitants) total 1,007 and host about 30% of the Italian population (18,206,000 people). The set of small centres (up to 10,000 inhabitants) host a similar overall population (18,714,000 people; 31.5% of the national total) but distributed in 6,888 municipalities.

This is a considerable number, especially when compared with the 46 large population centres (> 100,000 inhabitants), which host about a quarter of the population (13,700,000 people), and with the 151 medium-large population centres (from 40,000 to 100,000 inhabitants), with a total population of approximately 8,845,000 inhabitants, equal to approximately 15% of the national figure.

In small-medium sized urban centres suffer the same climate impacts as larger settlements, but climate adaptation initiatives could be hampered by aspects related to their small size (lack of information, of internal competences of administrations, of resources) and consequently a policy of greater attention by the local Authorities (State, Regions, Provinces, Associations of local bodies) is also necessary.

The main scope of this paper is to challenge the distinction made between interventions for the city and interventions for the territory: this distinction can be valid for large cities, where the transition of the city towards the countryside passes through the settlements of the vast suburban area.

This pandemic has taught us that there is a need for new parameters for density, distance, building height, health in the workplace, dwellings and also for leisure activities. Attention must be paid to all natural resources of the city and the territory which will have to converge strongly on the implementation of the SDGs "Sustainable Development Goals" of the 2030 Agenda (United Nations, 2015, 2019). The objectives that aim to favour the concept of sustainable development mainly concern the management of the territory and require the coherent monitoring of the metrics related to land cover (productivity, land cover, soil carbon, urban expansion). In particular, Goal No. 11 focuses on cities with the aim of making them safer, resilient and sustainable, and more inclusive always in close relationship with the protection of their natural and cultural heritage.

Undoubtedly, the pandemic has taught us that the city needs the territory.

2. Climate Adaptation and Pandemic

In the purposes of climate adaptation, then, cities begun to define their own programmatic guidelines, including the planning tools aspect. From the operative point of view, the numerous guides that many cities

in Italy have in recent years begun to prepare - for subsequently drawing up the Climate Adaptation Plan – express the necessity to act at different scale, both in terms of climate change forecasting (for a framework of risks), and in terms of potential impacts (for a framework of interventions). Because of its location and its own distinctive shape, Italy is particularly exposed to risks of climate changes. At present, therefore, the need to draw up strategic lines, aimed at making them proactive in a short span of time, is increasingly emerging.
This initial form of disadvantage must necessarily be transformed into a new opportunity to move quickly from great general targets - defined at global level - in real adaptation interventions, inevitably fell on specific territorial contexts. The document, drawn up during the Regions and Autonomous Provinces Conference, held at the end of last year, confirmed the Regions' commitment to share a common strategy for the whole Country: the common goal was to enhance synergies between adaptation, sustainable development and risk management, as encouraged by the European Commission.
The "Guidelines for regional strategies for adaptation to climate change" (Conferenza delle Regioni e delle Province Autonome, 2019) are dressed to Regional Authorities to intervene within their governance tools.
Obviously, they refer to the "European Strategy on adaptation to climate change" (European Commission, 2013), to the document drawn up by the European Environment Agency (EEA, 2013), and also to the aforementioned "National Strategy for Adaptation to Climate Change" (Repubblica Italiana, 2015).
From this last document the "National Plan for Adaptation to Climate Change" was born, broadly shared by all Italian Regions in 2018: its main aim is that national and regional strategies must get to bring themselves the goal of making routine the management of risk linked to changes in climate.
It is important to underline, for the purposes of this work, that there is already a clear reference to what Local Authorities (at Municipal level) must do for their planning tools.
Although it is clear that both the National Plan and related Regional Strategies should not be an additional over-level imposition, which all other plans must comply, the emphasis is stressed especially for local-level tools, certainly in line with Regional directives. The general structure, at a multilevel governance, pours on Municipalities the capacity of adaptation of its planning tools (also through possible unions between them, aimed at common and collaborative purposes for areas involving more than one Municipality).
Among these, also voluntary participation planning tools are mentioned, including River Contracts (RCs), which will be discussed in the next paragraph.
In addition, the above mentioned European Agency document, highlights how the underway climate changes is intended to continue, even with many questions to which there is no answer.
Effects are known: the temperature increasing, the rainfall trend changing, the ice and snow melting, the sea level raising. Quantifications of ecosystem changes are less known: moreover, there are a lot of negative influences on human health both in relation to intensity and frequency of heat waves and in relation to the spread of infectious diseases (a topic naturally involving these recent pandemic).
What is in question for interventions to be implemented is that, in addition to the so-called "technological" measures, it is necessary to address measures that promote "behavioural" changes. And it is precisely these last ones that force us to rethink cities.
The main issue is that this pandemic can hardly be traced back to the already known feared risks. For it, in fact, the biggest problem to face (in addition to verifying the fragility of health systems everywhere) was its speed of diffusion, which forced all States to apply strict behavioural rules in the hope that they would be useful to face the emergency. But nothing has yet been done in order to reorganize the life-style.
More recently, therefore, by virtue of the now full-blown emergency Covid-19, the European Union states on the need of some now inevitable practical measures (such as giving up fossil fuels or deforestation in order to maintain the increase of the temperature below the threshold of 1.5°C) with its economic measures (for example, the tax on emissions of CO2). For global level interventions a new document was enacted: the

"European Green Deal". The process starts as early as 2019 and, as stated in its intent, wants to "provide the roadmap to make the EU economy sustainable" (European Commission, 2019a).
The main aim is to provide financial support and technical assistance to help people, businesses and regions that are most affected by the move towards the green economy. This is called the "Just Transition Mechanism" and will help mobilise at least €100 billion over the period 2021-2027. To set into legislation the political ambition of being the world's first climate neutral continent by 2050, the Commission enacted the first 'European Climate Law' (European Commission, 2020a).
The Green Deal most recent act was the presentation of the "EU Biodiversity Strategy for 2030", which occurred on 20 May 2020, in order to protect fragile natural resources of our planet. It pays attention to the loss of biodiversity in view of its strong connection with the crisis climate.
In the time period provided for the attainment of prearranged levels of mitigation, ie within the 2030, interventions are planned for restoring forests, soils and wetlands. Moreover, creating green spaces in cities is essential to achieve the climate change mitigation needed by 2030.
It should be emphasized that the indispensable actions are addressed to degraded terrestrial and marine ecosystems across the whole of Europe with the aim of restoring at least 25,000 km of EU rivers to a free-flowing state. Even more interesting is that from this, the "Bringing nature back into our lives" document was derived. Although the restoration of nature is already partially required by the States members in the current legislation of the EU, the Commission presents a proposal for targets legally binding the recovery of nature in the EU in 2021 to restore the ecosystems degraded, especially for preventing and reducing the impact of natural disasters. "The evaluation of impact will consider also the possibility of a methodology to level the EU to map, assess and achieve good conditions of ecosystems in a way that can bring benefits in terms of regulating the climate, regulation of water, health of the soil, pollination and prevention and protection from disasters." (European Commission, 2020b).
Even in these case, a special attention was paid to the function of rivers and to the need of restoring freshwater ecosystems. The Commission undertakes to supply technical support to Member States by 2023 on their measures oriented to natural aspects (as improving water regulation, flood protection, nursery habitats for fish, and the removal of nutrient pollution) but also to economic enhancement. In fact, it can provide a major economic boost for the restoration sector and for local socioeconomic activities such as tourism and recreation.
These objectives must be in line with what cities are doing in the meantime for climate adaptation.
In particular, the already mentioned Municipal Climate Adaptation Plan must now inevitably include what declared in these new measures, including behavioral ones, that Covid-19 has made necessary.
"Italy is more exposed than other countries to the impacts of the changing climate and is in 2nd place in Europe for the losses economic generated by changes in climate with over 63 billion of euro"; the biggest financial loss in the last thirty years is caused by meteorological phenomena related to extreme events (European Commission, 2018).
In face of such impacts, only 26% of European cities has made a plan for climate adaptation, only 17% for impact mitigation, while 33% do not have any local plan related to climate.
In Italy, in 2019 many Italian cities signed a 10 points-statement for the adaptation to changes in climate, during the 2nd National Conference of Green City. It was organized by the Green City Network, a network promoted by the Sustainable Development Foundation in order to develop activities and measures to make the Italian city greener (Fondazione Sviluppo Sostenibile, 2019).
The Conference aimed at promoting a greater and more qualified commitment of Italian cities through these ten points: 1 defining and updating plans and measures for the cities climate adaptation; 2 integrating policies and adaptation measures with those of climate change mitigation; 3 updating risk assessment and measures both for emergency and for medium and long term; 4 valorising positive effects of the adaptation measures

and account the costs of the absence of such measures; 5 developing adaptive capabilities; 6 focusing more on nature-based solutions; 7 reducing the vulnerability and risks of very intense precipitations; 8 addressing heat waves and heat islands; 9 promoting investments in adaptation measures; 10 strengthening governance (Green City Network, 2019).

For the purposes of this paper, it is interesting to underline what is defined above all for developing adaptive capabilities, in order to incorporate the resilience to changing climate in urban plans.

In this process, it is vital that the existing legislation is applied appropriately, but also that Local Authorities take advantage of research and identification of best practices and techniques useful to increase their local adaptive skill, both in recovery settlements and in new designs.

Moreover, it is necessary to deep nature-based solutions. Tree-lined streets, public and private gardens, parks, green roofs and walls, every urban and peri-urban agricultural area provide ecosystem services, and widely contribute to climate adaptation, to heat waves reduction, and to water outflow surface improvement. The coronavirus pandemic requires rethinking urban planning standards in terms of physical public spaces and assets for access to public services and common goods. It also requires the revision of the urban parameters but, above all, demolishing and rebuilding public and private stocks which are inefficient from an ecological point of view but also poorly productive in terms of social exchanges and which today are not very responsive to the need for the "social distance" (Green City Network, 2020).

In most cases, however, innovative plans and policies that address the climate issue are still conceived as "experimental" and are not integrated into normal spatial planning regulations. Municipal Authorities are urgently called to ensure efficient planning for adaptation and to ensure coordination of actions to increase territorial and infrastructural resilience at all scales. Therefore, it is essential to identify "sensitive areas" in cities and to investigate solutions for them.

3. Water courses in the city: their role

Territories crossed by watercourses constitute a field of application of great interest, for the purposes of climate adaptation and are, today more than ever, a new chance in the post-pandemic panorama.

This is what has been focused for the preparation of the next National Table for River Contacts in the meeting held in April 2020. It had been preceded by numerous preparatory meetings and by a public summit held in the previous month of November (Cialdea, in press). In the Assembly of the Steering Committee of the National Contract Table, of which the writer is a member, a Discussion paper was prepared, aimed at the River Contracts inclusion in the new national and regional programmes. At present, River Contracts are given an important role in the implementation and improvement of local government policies. In a River Contract, the participation of all Authorities involved in the governance management of water bodies -in particular rivers - and well connected with people requirements, allows to face a multiplicity of aspects (hydraulics, agriculture, urban planning, economics) overcoming inconsistencies and conflicts more easily, reducing time and optimizing available resources (Bastiani, 2019).

River contracts contribute to the definition and implementation of district planning tools at the river basin level, as "voluntary strategic and negotiated planning tools that pursue the protection, the correct management of water resources and the enhancement of river territories, together with the protection from hydraulic risk, contributing to the local development of these areas". This is the definition given by Art. 68bis of the Italian Environmental Code, introduced in 2016 in the third part "rules on soil protection and fight against desertification, protection of water from pollution and management of water resources", in the Title II "The river basin districts, tools and interventions" (Repubblica Italiana, 2019). Legitimately, therefore, the River Contract is, in every respect, a planning tool for managing water resources (Martini,

2020). RCs now face the new cycle of European programming. In May 2018, the European Commission issued a Regulation proposal for the Community funds of the 2021-2027 Programme.
As multilevel governance and participation tools, they can contribute to the achievement of many of the Sustainable Development Goals of the 2030 Agenda. The experience, conducted in the above mentioned National Table for River Contacts within the Smart Rivers Network (for the European Innovation Partnership Water Action Group) has given us the opportunity to have an international comparison and to verify our approach with other European and non-European situations.
French, Belgian and Italian RCs can represent within the new EU programming a patrimony of partnerships (Public-Private Partnerships) and a model for the development of future agreements. This hypothesis was already advanced in past meetings, but now it could be the time to test new opportunities: the private sector and the civil society can cooperate for the implementation of local measures for improving territorial resilience through the introduction of new forms of agreement. In fact, private participation can be a useful tool to improve resilience and stimulate economic growth, income and well-being - traditionally considered issues of public policies. It will also be possible to promote the annual reuse of financial resources deriving from the State property water rent: in this way these resources can return to the territory from which they derive, and Regions could use them for environmental interventions envisaged by the RCs, especially oriented to Water Ecosystem Services.
About Italy, the "Water Resource Strategy" tries to cope with the challenging scenario of water quality and quantity depletion. Some strategic actions have been defined, as the climate adaptation in water management, especially regarding flood and drought controlling, and also in this the rivers' role is crucial (WHO & UN, 2019). Furthermore, the RC offers an interesting opportunity for reflection, also in relation to participatory policy processes (Cialdea & Pompei, 2019, 2020). The river is a privileged place for the recovery of the relationship with nature, when it crosses the city and along its course which can become a privileged path to get out of the city. It can also be home to green spaces for the biodiversity rebirth.
The research, set out in this paper, is evolving in this perspective and it refers to a case of the Molise Region. Molise is one of the regions that is still not particularly active as regards the RCs implementation: there are some initiatives that are still in the preliminary phase for various waterways, which in this region are often of an interregional character (such as the Trigno River, which for a big part of its course forms the border with the neighbouring region of Abruzzo, or the Fortore River, with the neighbouring region of Puglia). The only one that falls entirely in Molise is the Biferno River, which is being analysed in detail.
The Molise Region, addressing the New Regional Landscape Plan, through an Agreement with the "l.a.co.s.t.a." Laboratory of the University of Molise, directed by the writer, aims at analysing landscape features, and providing their valorisation (Regione Molise, 2019). In the landscape study approach, the need to experiment new intervention modalities emerges. The River Contract can be an opportunity to achieve the landscape quality objectives, set by the National Code of Cultural and Landscape Heritage (Repubblica Italiana, 2004). The River Contracts, in fact, match the Landscape Plan protection principles, both for naturalistic and environmental aspect and for artificial aspect, caused by human beings.
As shown in Fig. 1 part a and b, the river basin was divided into three sub-areas. The first area, including the river source, is a flat agricultural area with numerous environmental elements and characterized by several quality farms; the central part of the river course is characterized by a hilly territory with great geological and environmental fragility, and the last one consists of the coastal area, with intensive agricultural production, but also surrounded by large residential settlements and by the largest Industrial Centre of the region (Cialdea & Cacucci 2017, Cialdea & Quercio, 2017).
Analysing the third sub-area, which involve the Termoli city along the Adriatic Sea, the natural infrastructure, such the river is, actually connects different "almost urban" situations, very different from each other.

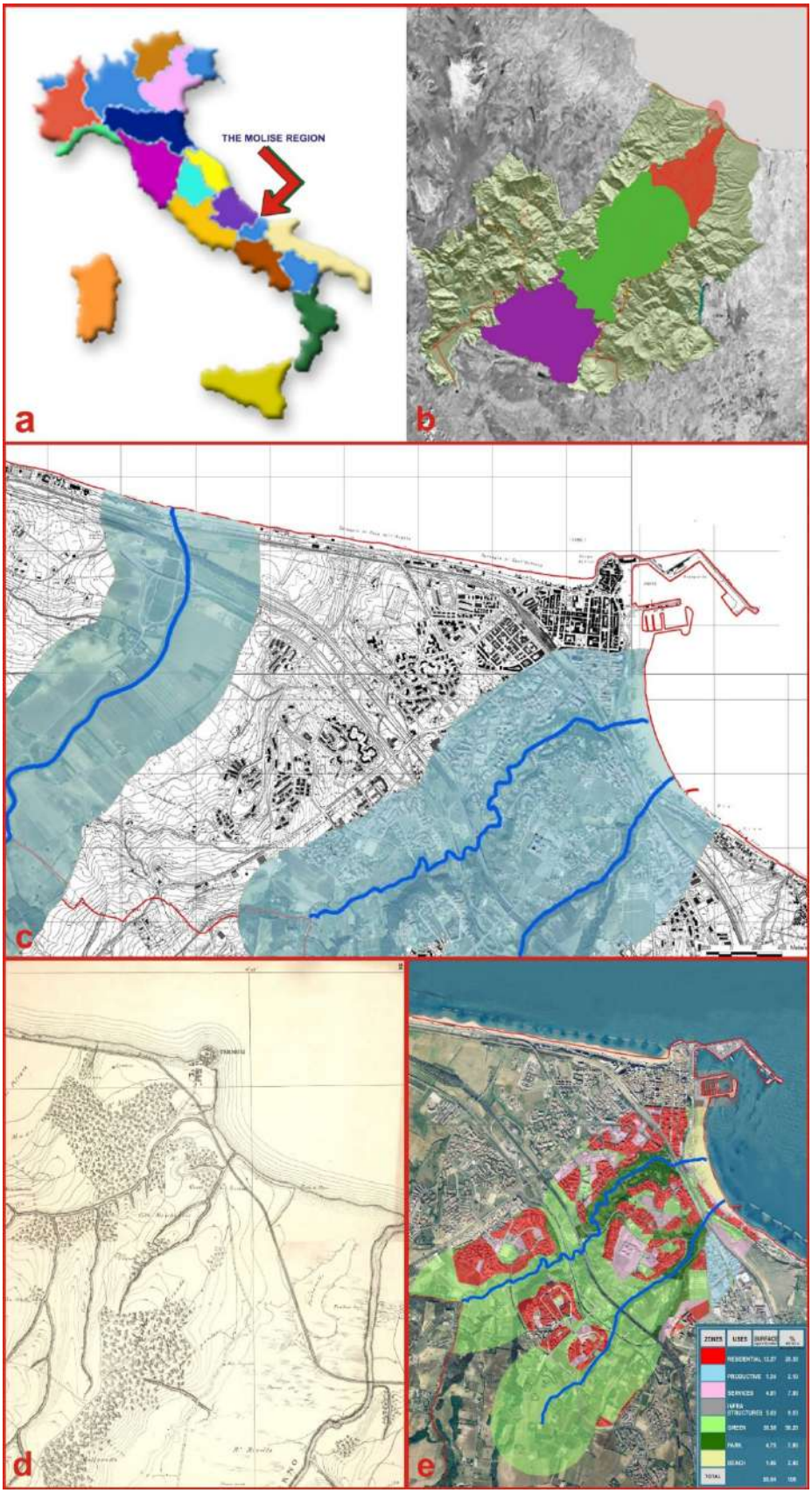

Fig. 1 The sample area: a Molise Region Localization in Italy; b Molise Region and the Biferno River basin divided in three sub-areas (Source: l.a.co.s.t.a. Laboratory 2016); c Water Flows in the Municipality of Termoli and their buffer areas (Source: l.a.co.s.t.a. Laboratory 2016); d Provincia di Molise (Source: Istituto Topografico Militare, Carta al 50.000 delle Province Meridionali in Sesto Antico 1:10,000, Foglio 17, 1863-1876, Torino – Napoli; e The Termoli Master Plan and its prescription (Source: Geographic Information System of the Termoli Municipality, processing by l.a.co.s.t.a. Laboratory 2020).

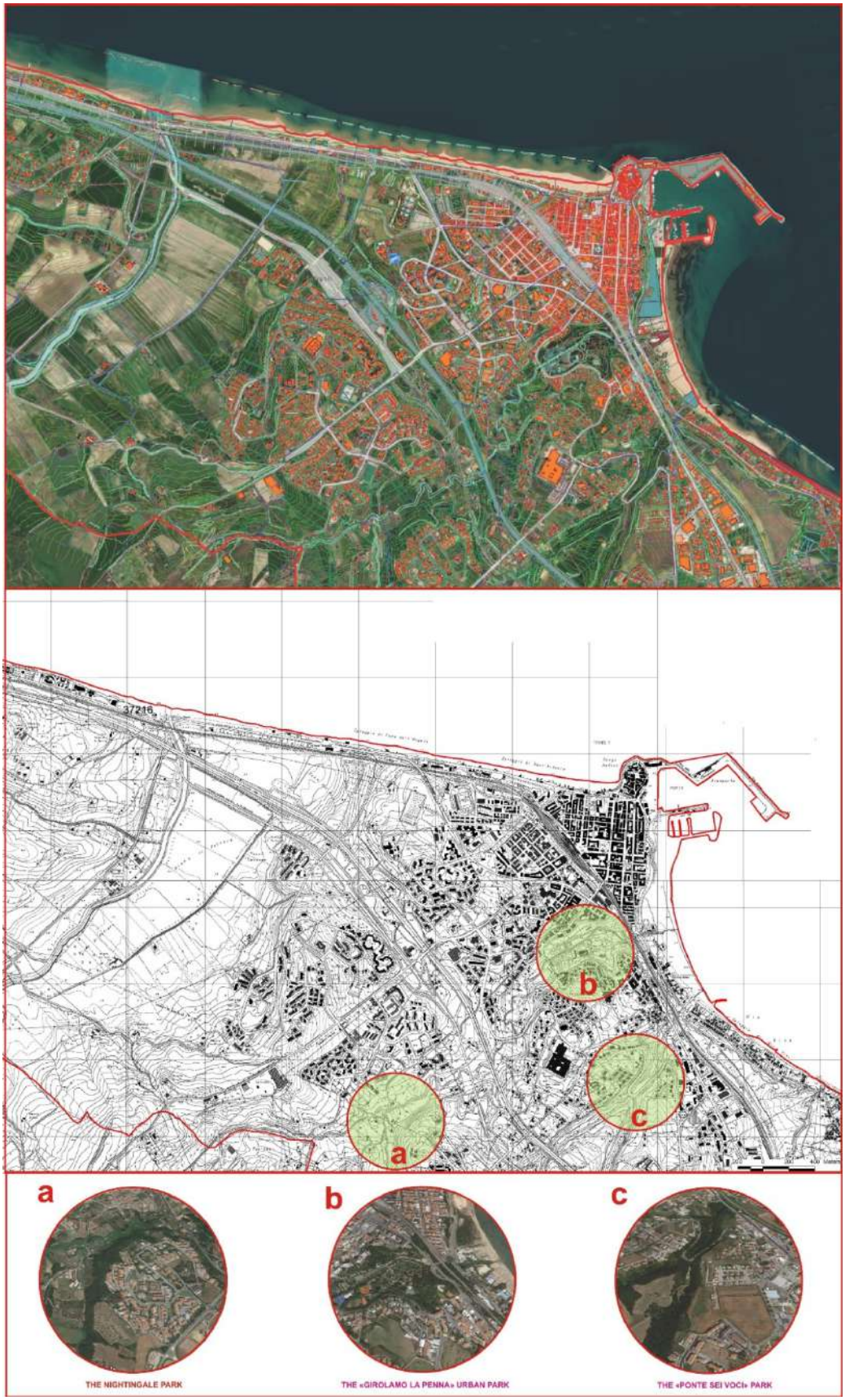

Fig. 2 The green areas system of the Termoli Municipality, located in the Satellite image and in the Regional Technical Map: a the proposed area named the "Nightingale Park; b the existing "Girolamo La Penna" Urban Park; c the proposed area named "Ponte Sei Voci" Park (Source: Geographic Information System of the Termoli Municipality and the Molise Region, processing by l.a.co.s.t.a. Laboratory 2020)

In some cases, regeneration and urban resilience projects could offer an integrated approach for the waterfront valorization. In other cases, the predominance of natural elements could improve the attractiveness of the region, enhancing the relationship with nature. Once more in other cases, the relationship between "water" (the mouth of the river) and "green area" has been deformed, erasing the natural spaces memory.

In Figure 1, part c, the urban centre of Termoli is visible, surrounded on the left side by the course of the Sinarca stream and on the right side by the two ditches, called Fosso Mucchietti and Fosso La Gatta (in the figure waterways are surrounded by a 500 meter buffer for each river bank).

Figure 1, part d, shows how, at the end of the 19th century, this area was strongly characterized by wooded areas.

A verification of the will of the urban planning tools was then performed (Figure 1, part e).

This area is approximately six square kilometres. The Termoli Master Plan recognises its strong naturalistic feature; in fact, more than half of it was defined as public and private use (sub-zones in agricultural use), to which 475 hectares for public parks and more than 144 hectares for beach strips were added. It is also deeply marked by the passage of infrastructures that develop parallel to the coastal line: the railway, the A14 motorway, the Adriatic State Road and the Termoli ring road are about 10% of the whole selected area. Residential uses are located close to the urban centre and their expansion is situated in the strip near the motorway track. In the southern part, facing the Adriatic State Road, there is a productive and commercial area, which characterizes the entrance to the town of Termoli. Other zones are useful for services, both for residence and for harbour and seaside activities.

Moreover, it looks like a sequence of dwelling areas for tourism (residences, camping and especially holiday homes or second homes) and there are no parking lots, service equipment (including commercial) and sports facilities, as visible in the Figure 2. Located outside the infrastructure barriers, the new city is made up of islands separated from each other by vast free and disconnected spaces.

There are spontaneous buildings, creating in recent years, as urban settlements without any service structure; their location is mainly concentrated precisely in the under study area, Rio Vivo - Marinelle.

Furthermore, the Termoli Municipality identified the green areas system, aimed at restoring degraded gardens, increasing arboreal surfaces, redeveloping existing parks and proposing new projects.

They are represented in Figure 2 with the letters a, b, and d.

In the Rio Vivo – Marinelle zone, there is the only already existing urban park in Termoli.

Its birth dates back to 1962, when the municipal administration decides to build on a large public garden, in the old private territory used for pasture and cultivation. The project, drawn up by the architect De Felice, was definitively approved in 1964. In the following years, some active sports facilities were added, including tennis and soccer fields, and finally a large swimming pool that is now in disuse. The connection between the two parts of this park, divided by the Rio Vivo stream, and therefore by the watercourse, is provided by graceful wooden bridges.

Reflecting on these issues, therefore, most delicate cases concern: a. The expansion of the residential settlements (see the Master Plan analysis in Figure 1); b. The recurrence of flood phenomena (remembering the damage of the two most recent floods in 2003 and 2015); c. The excessive proximity to the State road and other main infrastructures, as the Motorway and the railway.

Territorial analyses have highlighted, for this case-study, a highly critical area, which would require specific urban and territorial regeneration policies. The RC could be the driving force for redesigning this part of the city: it could become a useful "green lung", especially now that the post-pandemic condition requires a better use of the open spaces inside the city.

4. Conclusion: for a greener Europe

Based on foregoing territorial analyses, therefore, it is particularly important to engage in the implementation of interventions for this portion of the city. The rivers system, which invest so much the coastal territory, is closely related to natural and semi-natural spaces around it, almost seamlessly. In fact, it constitutes a primary "ecological corridor", which can play a strategic role for the territory of the whole area.

The expected result at the end of this analysing process, could be a River Contract, thought as a collaborative form between public and private actors, both involved in resource improvement. The realization of these intents could ultimately make use of the European programming 2021-2027 funds.

The link between alteration of natural ecosystems and pandemics increases the importance of the European Green Deal, after the Covid-19. Nowadays, priority is being given to the health emergency and it is difficult for the government to manage the climate crisis simultaneously. However, the protection of ecosystems is deeply linked to the fight against pandemics (Berg, 2000; Taylor & Laville, 2020; Acuto, 2020; van den Berg, 2020; Zevi, 2020; Daneshpour, 2020). So "the European Green Deal and other actions in favour of the environment are not a noble form to save future generations, but a measure to be taken urgently to safeguard mankind today and prevent pandemics" (Di Gennaro, 2020).

The proposal for next investment expenditure related to the European Cohesion Policy goes in this direction, with five aims (a Smarter Europe; a Greener Europe; a more connected Europe; a more Social Europe; a Europe closer to citizens). The majority of European Regional Development Fund and Cohesion Fund investments will be geared towards the first two objectives: a Smarter Europe and a Greener Europe.

In particular, a Greener Europe, Policy 2, will have to focus increasingly on the issue of biodiversity and pollution, in order to create green infrastructures aimed at restoring the ecosystem and climate adaptation in most vulnerable urban areas. In this context, the importance of enhancing ecological connectivity was also highlighted through green infrastructures. This last point is particularly emphasized, on the basis of the past programming experience.

The aim is to avoid the risk of the situation occurred with expenditures with 2014-2020 funds, which were too oriented to increase recreational and tourist use, without adequate attention to environmental conservation. That is what must be avoided in the 2021-2027 programming cycle (European Commission, 2019b; Repubblica Italiana, 2020).

The Commission is devoted to supporting locally-led development strategies and making citizens more and more involved. However, there must be an active action by Local Authorities. But precisely from this point of view, it is important to favour mechanisms related to participatory forms, such as the River Contract: because it involves different categories of actors and because it is a tool capable of promoting an increase in awareness of the environmental heritage value and their importance for the human life quality, also affecting those sectors where traditionally responsibility is given to Public Authorities.

River contracts constitute a tool still partially unexplored as regards an instrumental use for the implementation of adaptation plans to climate change. However, they have already been applied in different geographic contexts around the world.

In Italy specifically, some Regions often support the RCs paths with their own funds or work to intervene from the legislative point by issuing their own regional laws aimed at directing the interventions planning on water courses, based on the RCs activation. RCs not only guarantee the maintenance and protection of rivers, but they can also be a tool for finding implementations useful for local development solutions in the context of integrated management of water courses. These considerations are aimed at raising

awareness that it is necessary to develop concrete actions, knowing how to use the opportunities that the European Community offers.

RCs can become a tool for the recovery of identity values and at the same time be a flywheel for overcoming the lack of integration between environmental policies and urban planning issues. Landscape planning could allow the implementation of a contract activation path, with a concrete involvement and substantial sharing by all the actors, as part of a river requalification path, aimed at a public utility and at the same time at an environmental strategy.

Complexity in landscape can be read as the balance between the natural resources maintenance and settlement features of the site (Denier et. al., 2015; Cialdea, 2019), maximizing those which are aimed to satisfy basic needs and improve physical and social health. Coordinated action among Local Authorities and land users offers the potential to face the landscape at different scales. The river involves a multiplicity of factors and it is necessary to have a wide-ranging view for increasing the probability of successful outcomes.

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Image Sources

Fig.1: The sample area: a) Molise Region Localization in Italy; b) Molise Region and the Biferno River basin divided in three sub-areas (Source: l.a.co.s.t.a. Laboratory 2016); c) Water Flows in the Municipality of Termoli and their buffer areas (Source: l.a.co.s.t.a. Laboratory 2016); d) Provincia di Molise (Source: Istituto Topografico Militare, Carta al 50.000 delle Province Meridionali in Sesto Antico 1:10,000, Foglio 17, 1863-1876, Torino – Napoli; e) The Termoli Master Plan and its prescription (Source: Geographic Information System of the Termoli Municipality, processing by l.a.co.s.t.a. Laboratory 2020).

Fig.2: The green areas system of the Termoli Municipality, located in the Satellite image and in the Regional Technical Map: a) the proposed area named the "Nightingale Park; b) the existing "Girolamo La Penna" Urban Park; c) the proposed area named "Ponte Sei Voci" Park (Source: Geographic Information System of the Termoli Municipality and the Molise Region, processing by l.a.co.s.t.a. Laboratory 2020).

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Evolution of mobility sector during and beyond Covid-19: viewpoint of industries, consultancies and public transport companies

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Abstract

This paper presents the results of a survey carried out between April and May 2020, among a panel of chief executive officers (CEOs), consultancies in the mobility sector, and of Public Transport (PT) companies. We surveyed their expectation about the impacts of Covid-19 on urban mobility in the short-medium term and on their own business, and their opinions about the effectiveness and the sustainability of the measures proposed for coping with the emergency (e.g. incentives, public investment, regulatory measures, new supply of transport services and modes). Different views emerged between industry/consultancies, on the one hand, and PT companies, on the other. The formers show more optimism towards the future thanks to the opportunities foreseen to improve labor-efficiency and for developing new products after the crisis. On the other hand, Public Transport companies appear very much uncertain about the future and worried about the expected losses of demand and revenues, that, in the panel opinion, are far to recover the levels before the crisis (also in the long term). The measures proposed to deal with the interpersonal distances and with the reduced level of capacity are seen as effective, but some are perceived as not sustainable due to the induced increase in operating costs. Finally, poor trust in the administrative capacity is observed, to implement strong measures to manage demand peak (e.g. change in the times of the cities or of the factories) and to upgrade the PT service contracts.

Keywords

Short-medium term; Impacts assessment; Measure effectiveness and sustainability; Focus group; Survey.

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1. Introduction

The emergency from Covid-19 and the cities lockdown have had a strong impact on transport sector. Travel demand, in particular, registered an unprecedented overall contraction, with some relevant differences by sector and segment. In fact, on the one hand, freight transport, though declining, has maintained those levels close to the pre-crisis ones, due to an increase in urban deliveries, and in food and pharmaceutical freight distribution (see for example Borghetti, 2020). Passenger transport, on the other hand, has dramatically dropped down to less 90%-95% in the case of medium and long-haul (intercity) transport.

In the re-opening phase, travel demand is gradually resuming the levels before the crisis, but some structural changes in travel behavior are observed. In China, one of the first countries to re-open after several months of strict lockdown, the fear of contagion has moved travelers from public transport to using private vehicles. The outbreak of modal share shows an increase in the use of private cars from 34% to 66%, whereas the use of metro and buses drops down from 56% to 24% (Ipsos, 2020).

First evidences from the Italy show a similar pattern and confirm the perception of un-safety in using public transport, unlike traveling by car and on foot (Isfort, 2020): on a scale of 1 to 10, both journeys with private cars and on foot are perceived as very safe (8.7 and 7.3 as an average rating), the scores of all public transport do not exceed 3.5 on average (Tab.1).

Safety perception index	Average
car	8,7
on foot	7,3
bus/tram	3,5
metro	3,1
train (long distance)	3,3

Tab.1 Safety perception of traveling, by modes of transport (Likert scale: from 1=very unsafe to 10=very safe) - Source: Isfort, 2020 (adapted from)

An increase of passenger private mobility in the medium period is likely to happen also due to the reduced capacity of Public Transport, estimated between 50% and 20% of the level pre-crisis, in order to keep the (one-meter) interpersonal distance among travelers on board buses, trains and metro. The concern is particularly serious at the urban scale where, given the limited spare capacity of roads and parking spaces in the city center, the increase of travels by cars could lead to high level of congestion with severe consequences on the environment (landscape and air quality) and on people's quality of life.

It is of utmost importance to plan the re-opening based on the transport system's ability to offer safety conditions and adequate level of service according to travelers' needs. Technology could certainly give a contribution, but it will also be necessary to undertake actions to reorganize transport and to manage travel demand. To this aim, in view of a full re-opening of schools and other activities, Public Administrations and other Transport Associations are proposing a list of possible solutions including smart-working, modal integration, increasing PT services frequency, offering incentives for cycling and other innovative modes of transport ("micro-mobility"), providing PT companies with incentives to reduce fares and to compensate the losses of revenues. However, none of those seems to be effective on its own.

It is common belief that urban mobility should re-thought within a new system of rules of urban living encompassing new schedules for economic activities (e.g. offices, factories, …), differentiated times for school and education. The challenge is not trivial at all, as it involves many stakeholders and requires some radical changes in people's lifestyle and households' habits. In practice, implementing such policies would not be

possible without listening at people's needs, without engaging stakeholders and businesses, without sharing responsibilities among the institutional levels.

This paper aims at giving a contribution to the undergoing debate by presenting the results of a survey carried out between April and May 2020, among a panel of chief executives officers (CEOs), consultancies in the mobility sector, and Public Transport (PT) companies. With respect to two different time horizons, i.e. short-term (September 2020) and medium-term (April 2021), the questions were about:

- the expected impacts on transport sector businesses in terms of supply (products /services) and demand (customers /travelers) and, in general, on the overall transport system;
- the effectiveness and economic sustainability of some measures proposed for dealing with the emergency;
- the criticalities that can be envisaged.

The paper is organized as follows. In section 2 the survey is described as well as a list of measures proposed by Public Administrations and other Transport Associations to deal with the Covid-19 emergency. Section 3 presents the results of the survey. In Section 4 these are discussed and some conclusions are drawn, providing ideas for future research directions.

2. Research methodology

The research methodology included a focus group and an online survey carried out between April and May 2020 with the CEOs of a panel of industries, consultancies in the mobility sector, and of Public Transport (PT) companies operating in the Lombardy Region that was the first and one of most affected region in Europe by the Coronavirus (Tab. 2).

Sector	Firm	Core Business
Industry	Alstom	Railway vehicles and signalling systems production
	Hitachi Rail STS	Railway signalling and integrated transport systems production
	Hitachi	Design and manufacturing of railway and mass transit vehicles
	Lucchini	Production of high-tech steel products
	Mercedes Benz	Vehicle manufacturing
	Mermec	Professional services for the railway industry
	Metra	Production of aluminum products
	Microelettrica Scientifica	Systems and components manufacturing
	Scania	Commercial vehicles manufacturing
	Società di Progetto BreBeMi	Motorway A35 construction, operations and maintenance
Consultancy	NET Engineering	Feasibility study and design
	Systematica	Mobility and accessibility planning
Public Transport Companies	ATM - Azienda Trasporti Milanesi	Integrated Public Transport service in the city of Milan
	Autoguidovie	Public Transport service in the city of Pavia
	Brescia Mobilità	Integrated Public Transport service in the city of Brescia
	Ferrovie dello Stato Italiane	Italian National Railways
	Trenord	Regional railways service operations (Lombardy Region)

Tab.2 The firms and companies included in the panel

2.1 Focus group

The focus group is a qualitative technique to get preliminary insights around a specific topic (e.g. Mobility after Covid-19) from individuals of different population segments and from stakeholders. In practice, it consists of an open discussion moderated by an expert, among a limited number (e.g. 10-15) of selected individuals with different socio-economic characteristics, background knowledge and perspectives about the considered topic. The members of the focus group do not have to be representative of a population rather they should have some experience about what the moderator is intended to investigate.

In this study, the open discussion within the focus group was set up around basically the following questions:

- What are the critical issues of the Covid-19 emergency that have affected your own business, both on the supply side (i.e. products and services) and on the demand side (i.e. customers and travelers)?
- What changes can be foreseen on the overall transport system after the Covid-19 emergency?
- How your business could contribute to support the overall mobility system during and beyond the crisis?

The focus group is particularly useful, on the one hand, to preliminary explore attitudes and expectations to be further investigated analytically by means of a detailed questionnaire, and, on the other hand, to have general comments and feelings about the sustainability and the effectiveness of the measures to be eventually put in place.

The information obtained based on stated opinions, real experiences, and based also on the observation, during the discussion, of the reactions to the questions and the inputs given from the moderator, represents a basis of knowledge to identify the relevant variables to control in the subsequent phases of the analysis, and for designing the questionnaire for the survey.

2.2 Questionnaire

The questionnaire, carried out two weeks after the focus group, was structured in three sections.

The first section aimed at probing the perceptions of the respondents about the impacts on their own company both in the short and medium period. In particular, the focus was on the supply (of products and/or services), on the demand (of customers and/or users), on the provisional budget, on the organization of work and, more generally, on what impacts they would expect on the mobility and transport market, for example, whether they do expect a modal switch towards private cars or an increase of production of bikes, scooters mopeds. In addition, few questions were asked about whether any opportunities could be envisaged after the crisis, e.g. how likely the number of business travels could be reduced by smart-working and video-conferencing, both for managers and employees. For each item, a Likert scale from 1 to 5 has been adopted, where 1 corresponds to "very low" expected changes, 2 "low", 3 "neutral", 4 "high" and 5 "very high" expected changes.

Both the effectiveness and economic sustainability of individual measures for public transport were investigated in the second part of the questionnaire. This was addressed only to PT companies with respect to the list of measures emerged from the discussion during the focus group, such as:

- differentiated fares by time-of-day;
- seat reservation or reservation for travel-time slots in order to access stations/buses stops;
- use of protection mask and scan of the body temperature of passengers;
- interpersonal distance on-board the vehicles;
- sanitization of vehicles;
- introduction of demand-responsive PT services or dedicated home-to-work shuttle services;
- increasing PT service frequency to improve PT capacity.

In the third and final part of the questionnaire, interviewees were asked about their perceived effectiveness of two clusters of measures:

- public investments, in infrastructure and in rolling stock;
- incentives, for electric mobility, for active mobility and for public transport companies to compensate the losses in revenues.

Respondents were finally asked about their trust in the public administration and about any other critical issues related to the actual applicability of strong regulatory measures to reduce travel demand peaks, such as modification of times of the school, offices and factories, and adjustment of PT service contracts to cope with the new conditions.

3. Results

Different views emerged from the focus group between industry and consultancies, on the one hand, and Public Transport (PT) companies, on the other. As shown in Figure 1, a very negative common sentiment is observed in the short period characterized still by the strong negative impacts of two months of lockdown on the production levels. However, in the medium period, the Industries showed more optimism towards the future thanks to the opportunities for developing new products after the crisis. In particular, the new business of scooters and other means of transport under the umbrella term of "micro-mobility" looked the most promising one, followed by an expected increase of electric vehicles demand for both private and collective transport (i.e. cars and buses). On the other hand, PT companies appeared very much uncertain about the future and worried about the expected loss in demand and revenues, that, in the panel opinion, are far to recover the levels before the crisis (also in the long term). The expected loss in passenger demand on the long distance was estimated between 75% and 85%, and on the regional service between 40% and 50%. For Railways freight transport the figures were less negative, i.e. -50%, but still alarming not only for the losses of the operators, but also for the potential impacts of more trunks on the environment and on road safety.

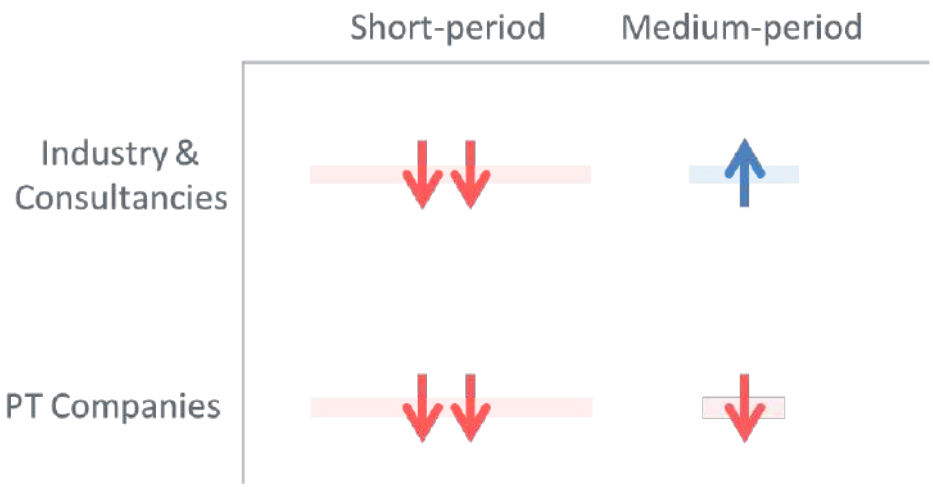


Fig.1 Overall sentiment of the respondents in the short and medium periods

The above figure is also reflected in the responses to the questionnaire about the new opportunities hidden behind the crisis. In particular, as shown in Fig. 2, about half of industries and consultancies in the panel see rooms for the development of new products and services, and about one third for a better organization of labor. PT companies show lower percentages, but some of these see the emergency as an opportunity to innovate selling processes, e.g. by the introduction of e-ticketing. In fact, digitalization is seen central to cope with the emergency and to develop integrated transport solutions (e.g. digital platform for Maas, Mobility-as-a-Service).

From a system perspective, sharing mobility and active modes, such as bikes and scooters are seen as effective to promote sustainable transport. These could contribute to enlarge the catchment area of stations and could help Public Transport to contain the loss of demand.

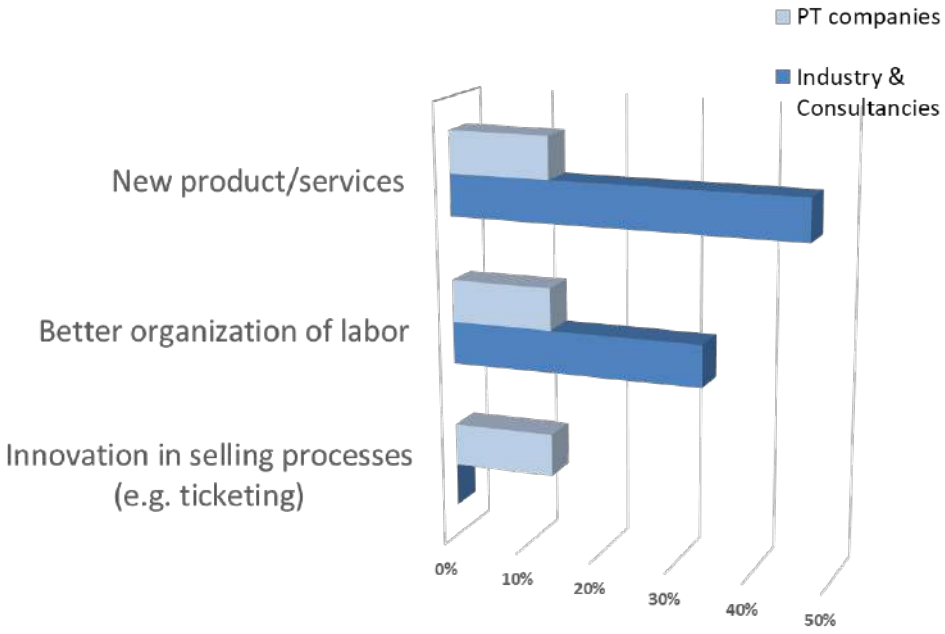


Fig.2 Areas for opportunities and business development after the crisis

Another chance to transform the emergency in an opportunity is seen in a better organization of labor. As shown in Fig. 3, the areas of possible improvement are the workplace safety, the use of smart working and videoconferencing to reduce working and business journeys, in particular for managers. As expected, Public Transport companies are less sensitive to the impact of smart working as many employees are drivers and obviously their presence at workplace is required.

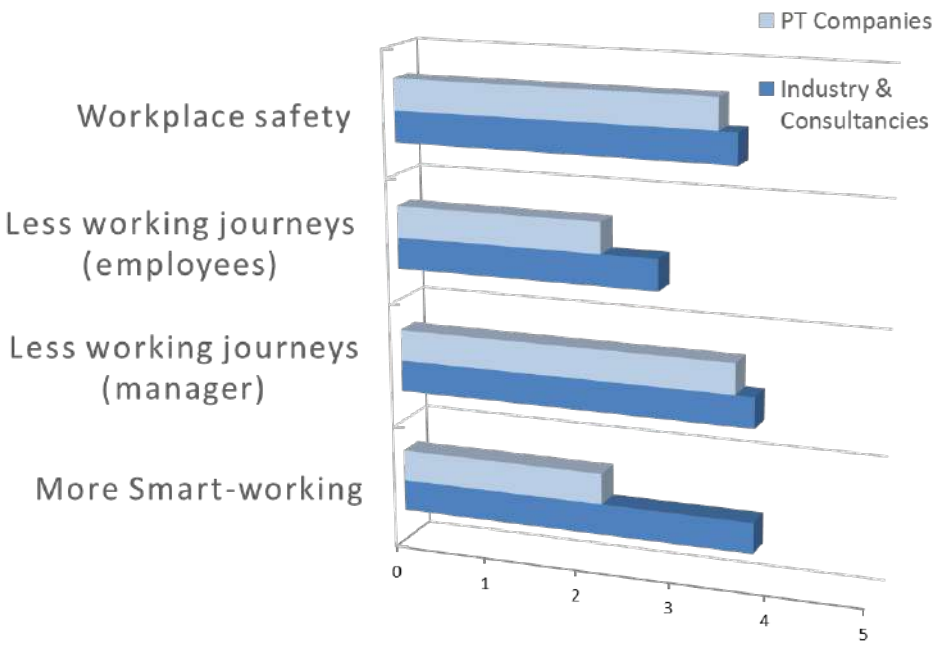


Fig.3 Areas of improvement in labor organization

The measures put in place or proposed to cope with the emergency can fall into four domains identified by their effectiveness and sustainability as evaluated by the panel (Fig. 4). We can distinguish between measures with:

- High effectiveness and High sustainability (HH);
- High effectiveness and Low sustainability (HL);
- Low effectiveness and High sustainability (LH);
- Low effectiveness and Low sustainability (LL).

The introduction of fares differentiated by time-of-day, the obligation of seat reservation and of the reservation for travel-time slot to access the stations/vehicles fall in the domain of high effectiveness and high sustainability, however some respondent has expressed concerns about the actual applicability of these measures, in particular for what concerns the enforcement outside the stations to regulate access (note that in Wuhan, China, these measures have been put in place with the support of the Police and the National Army).

The use of protection masks, the scan of the body temperature of passengers, keeping the interpersonal distancing measures on-board the vehicles, and the sanitization of vehicles are all seen as effective measures but not sustainable in particular for the additional operating costs to be borne by PT companies and by the lack of personnel to be allocated to these tasks.

The introduction of demand responsive PT services and home-to-work shuttle services for employees are considered as neither effective nor sustainable.

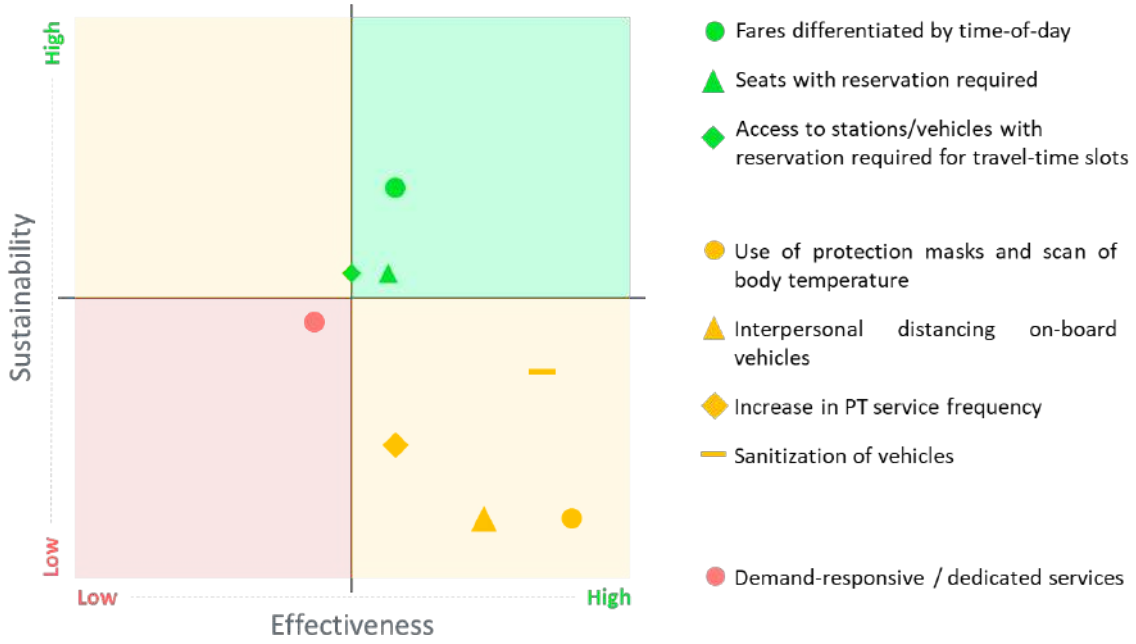
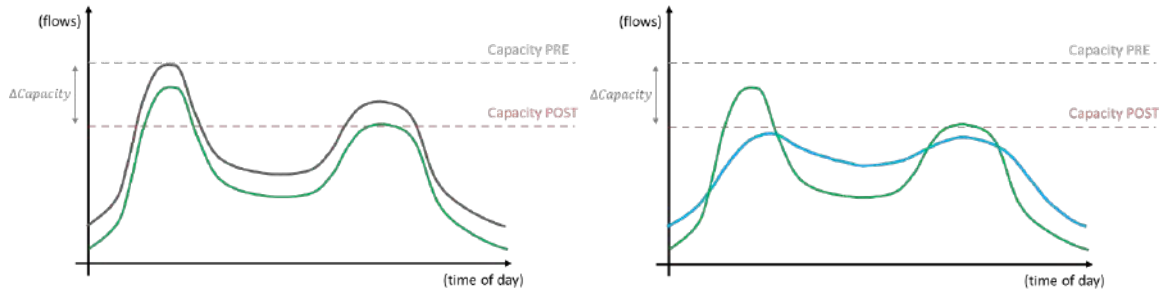


Fig. 4 Domains of effectiveness and sustainability of the proposed measures to cope with the emergency

Increasing PT service frequency is valuated as an effective measure to cope with the limited capacity of vehicles (buses, metro and trains) to keep the interpersonal distance. However due to limited numbers of drivers and vehicles this measure is perceived as unfeasible both in the short period and in the medium period. Note that the time to the market of new vehicles is about 18-20 months and hiring new drivers is even longer due to the administrative procedure. As a matter of fact, the only way to cope to the reduced capacity of PT vehicles is to reduce the volumes of demands (e.g. by promoting smart-working) and to smooth demand peaks

by spreading the flows along the entire daytime (e.g. by changing the times of the cities), as schematically depicted in Fig. 5.



(a) (b)

Fig.5 Schematic representation of the combined effects of reducing demand levels (a) and spreading flows along daytime (b) to cope with the reduced capacity of Public Transport

Measures to reduce demand peak such as changes in times of the schools, differentiated schedules in office and factories working hours, changes in the times of the cities (e.g. shopping, public services, medical cares,…) as well as measures to upgrade PT service contracts would require strong political action and great administrative capacity, since they may induce a radical changes in households' habits and daily routines. In this respect the panel has expressed very little confidence and trust in the ability of the public administration to implement such measure (see Fig. 6): the main criticalities pointed out are the lack of system vision, bureaucracy and time to market. In particular 75% of respondents see a barrier in the bureaucratic procedure to access the available funding, but also in the coordination of Public administrations at different levels (local/regional vs. national) as well as in their overall capacity to manage complex processes, especially in an emergency situation.

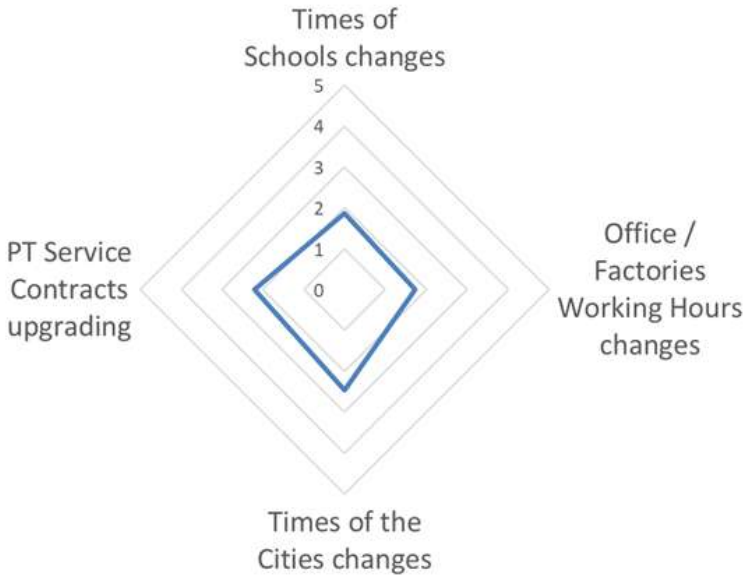


Fig. 6 Panel average evaluation of the capacity of Public administration to implement strong policies to spread demand peaks and to upgrade Public Transport service contracts (Likert scale: from 1=very low to 5= very high)

Finally, investments in new infrastructure and rolling stock as well as incentives for any form of sustainable mobility (i.e. active mobility, public transport and electric mobility) are considered effective (Fig. 7). The fact that incentives to electric mobility are less effective than the others can be explained, on the one hand, because

the diffusion of electric vehicle could increase private transport and congestion, and, on the other hand, because electric buses could have longer deployment and higher costs than traditional ones (with internal combustion engines).

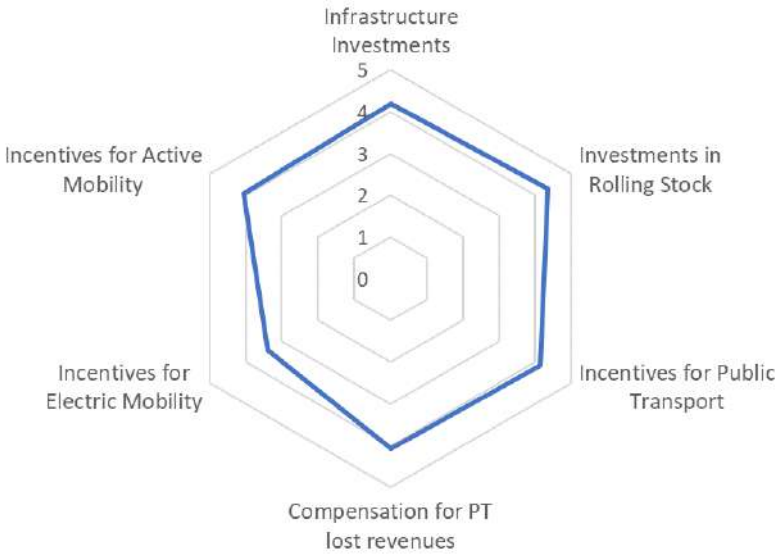


Fig. 7 Panel evaluation of public investments and incentives (Likert scale: from 1=very low to 5= very high)

4. Conclusion

Mobility sector has been severely affected by Covid-19 emergency and will be central for resuming a "new normality". Re-opening the cities after the "lockdown" period should be carefully designed and fine-tuned according to the capacity of the transport system and to the ability of supplying safety conditions and appropriate level of service to travelers'. Technology will certainly give a contribution, but it will also be necessary to re-think policies and undertake actions to reorganize services and manage the demand. Furthermore, it will be necessary to carefully assess the sustainability (in particular, economic and social) of the measures that will be implemented and to monitor their effectiveness.

The survey presented in this paper although limited in the sample size (i.e. 17 respondents), is significant since it presents the viewpoint of CEO of industries, consultancies in the mobility sector, and of major Public Transport (PT) companies operating in the Lombardy Region, i.e. one of the most severely affected Region in Europe by Covid-19 emergency. We surveyed the impacts on their own business as well as impressions, information and ideas on how to resume the overall mobility sector. On the other hand, we asked their opinion about the effectiveness and the sustainability of a list of the measures proposed for coping with the emergency (e.g. incentives/investments, regulatory measures, new supply of transport services and modes).

The results have shown that industry and consultancies see in the crisis some opportunities to improve their business (in particular to improve labor efficiency by exploiting smart-working and reducing unneeded business journeys), and also to develop new products, in particular for modal integration (e.g. scooter) and new innovative mobility services (e.g. MaaS platform). On the other hand, PT companies are very much worried about the losses in revenues due to the reduction of travel demand, which, in their opinion, is far to recover the level pre-crisis, even in the medium term.

A general consensus about the importance of sustaining local public transport has been observed not only to preserve a strategic sector for urban mobility but also because an unmanaged increase of journeys by cars could lead to high level of road congestion with severe consequences on the environment (landscape and air

quality) and on people's quality of life. In other words, the failure of urban public transport would mean a collapse of the overall urban transport system.

Incentives and public investments are only partly perceived as a solution, since they have long deployment times and, in some cases, delays due to the bureaucracy within the public administration. In the medium term, the solutions that gained more consensus within the panel have been the reduction of the demand levels by adopting, wherever possible smart-working solutions, and by smoothing the demand peaks by differentiating the times of the activities in the cities (e.g. schools, offices, shopping,…). However, such measures would induce radical changes in households' habits and in their daily routines, which in turn would require a strong political action and a great administrative capacity, which our panel does not seem to trust in.

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Tourism on demand. A new form of urban and social demand of use after the pandemic event

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Abstract

The Covid-19 pandemic is expected to lead to a critical reconsideration of the global volume growth model for tourism, for reasons related to the risks posed by global travel and the contribution of the tourism industry to global pollution, climate change and, more in general, the socio-cultural instability of certain geographical areas of the world. Nevertheless, it is possible to propose a different point of view by trying to accept this historical moment as an occasion to ponder over the need for a change in the unsustainability of the present lifestyles. Tourism in this can be a driver function to support this transition by giving to tourism flows a higher sense. Tourist destinations will have to change but how and how many tourist cities will be able to re-calibrate their supply system of services and facilities to host the "new tourists"? Could the on-demand model be a new way for tourists to enjoy their experience?

The paper, trying to give answers to these questions, proposes some reflections about the inevitable change imposed by the pandemic, aiming at outlining the possible scenarios that will characterize the tourism-city relationship in the next future and paying attention to the social aspects.

Keywords

Urban tourism; Climate change; Pandemic; Tourism on demand.

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1. Introduction

Recent decades have seen several large-scale outbreaks: severe acute respiratory syndromes such as "Middle East respiratory syndrome" or "Ebola virus disease" epidemic (Gostin & Lucey, 2015). Nevertheless the global event of the Coronavirus represents the major challenge that the world has had to face after the second world war so much to be defined a "pandemic". A term that has been used most commonly to describe diseases that are new, or at least associated with novel variants of existing organisms; for example, the emergence of HIV/AIDS when it was recognized in the early 1980s, and historical epidemics of diseases, such as plague. Actually, coronaviruses are not the only pandemic threat with much concern being given to influenza as well as other diseases that make scientists and governments worry about a repeat of the devastation of the Spanish flu of 1918 (Vasilakis & Weaver, 2008). Nowadays several of these pandemics have been "normalized" and they are part of the global health business as usual, or to be more precise developing country business as usual, even though their annual impact can be enormous. Beyond the debilitating, often fatal, consequences for those directly affected, pandemics have a range of negative social, economic and political consequences.
Sociologically, for the Covid-19 outbreak, the expansion of the contact between humans, wildlife, and livestock has been a major outcome of urbanization processes in different countries.
Urbanization and associated land-use changes, in conjunction with rising meat consumption, have brought reservoirs of wildlife diseases into closer contact with livestock and people (Wu et al., 2016) and the potential health impacts of zoonotic events and pandemic emergences are not limited to China only but represent the intersection of broader processes of urbanization, globalization, environmental change, agribusiness and contemporary capitalism. Through its capacity to produce and reproduce consumption spaces on a global scale, the expansion of tourism is one of these modes of urban change.
Tourism has been surely one of the sectors most affected by the pandemic. The growth of international tourism has been one of the most enduring and significant forces driving the world economy since the 1950s. From a mere 25 million international tourism arrivals in 1950, the numbers reached 450 million in 1990 and then quickly exploded to 1 billion arrivals by 2010. By 2018, the number of arrivals had increased to 1.4 billion and is estimated by the United Nations World Tourism Organization to account for $1.4 trillion and 7% of the value of world goods and services (RTE, 2020). According to the UNWTO forecast analysis (2020), the sector will now lose about 60% of the total tourists' flow and about 80 billion dollars.
The Covid-19 pandemic requests an afterthought about the connection between the demand of use by tourist flows and their spatial adaptation, both referring to the urban aspects and, mostly, to the relationship between the host community and the tourist one. This is all the more true in relation with the forecasting models of growth used till now for tourism in which the lack of the attention paid to unexpected risks such as infectiousness and contagiousness. Novelli et al. (2018) noted that much research has been devoted to crisis management and recovery, but few studies have addressed health-related crises in developing countries and even fewer have addressed the indirect threat of epidemics on their tourism industries. Their study on the impact of the Ebola crisis on tourism in The Gambia (where no outbreak was recorded) showed "devastating consequences" on the country's tourism industry and highlighted the importance of consumer perception and preparedness and proactively tackling the issue of crisis management failure.
The Covid-19 pandemic is expected to lead to a critical reconsideration of the global volume growth model for tourism, for reasons related to the risks posed by global travel and the contribution of the tourism industry to global pollution, climate change and, more in general, the socio-cultural instability of certain geographical areas of the world. Nevertheless, it is possible to propose a different point of view by trying to accept this historical moment as an occasion to ponder over the need for a change in the unsustainability of the present lifestyles.

Based on these premises, our study seeks to adds new knowledge to the existing body of literature on the relationship between global crises, such as disease outbreaks and pandemics, and the preparedness of global and regional tourism-related institutions to coordinate crisis management and recovery actions. The challenges are not simply economic. In the framework of these considerations, the paper is articulated in two main parts. The first part refers to the situation before the pandemic considering tourism in its main aspects as a global phenomenon. In the second part, some considerations about the impact of the pandemic are pointed out and alternative forms of enjoying the tourist destinations are proposed. Next, in section "Conclusions" we argue that hopes for a return to pre-Covid-19 patterns of tourism must be questioned to rethink a more sustainable and resilient tourism system and to respond united to any future shocks.

2. Before the Covid

2.1 Tourist flows and spatial distribution: a balance issue

The connection between tourism and the city is complex. Cities are physical places where the needs of tourists and inhabitants intersect. This means that cities must face different demands by offering adequate structures and facilities. This condition characterizes the tourist cities and may represent a factor of their vulnerability. The tourist demand can be considered as an additional urban load that can compromise the balance of the global organization of the city affecting the urban quality of life. Nevertheless, tourism has been seldom studied as an intrusive activity mainly due to its indisputable positive economic effects. Tourism is a double-edged phenomenon being at the same time an economic resource and a generator of negative impacts (overcrowding, pollution, noise, soil and energy consumption, social conflicts) on urban systems. This second aspect concerns town planning more directly if we consider that the efficiency and the quality of life in a city also depend on the quality of services and infrastructures, that in summing up compose the urban supply (Esopi, 2018).

This can be better understood if we think of tourism as a system comprised of two main components: the demand-side and the supply-side. Tourism demand concerns the needs expressed by a non-residential population. On the other side, tourism supply refers to the presence in the city of facilities and structures to satisfy this demand. Town planning can influence the demand-side by intervening on the supply-side in terms of quantity, distribution, and qualities of facilities and structures to assure the efficiency of the city.

In this regard, it is possible to bring out that the urban planners' challenge consists in defining the conditions (policies and strategies) and the technical tools able to provide a qualified urban supply (of services, spaces, and facilities) that has to be compatible with urban characteristics and resources. Tourism planning and land-use, thus, are closely connected, and, if properly planned, tourism can be a "driving function" able to lead the city towards a more sustainable dimension.

Thinking in a systemic framework makes it possible to envisage that all the components (physical, functional, and social) engaged are connected and interact simultaneously. The change of status of one of the components determines a change of the entire city-system. Stressing this consideration, it is possible to connect the structural crisis of present cities to an entropic state in which the city loses energy and force to face internal as well as external risks that can occur unexpectedly. On the contrary, in normal conditions, the urban system evolves inside a sustainable range of development, where the production of entropy is under control. Tourism is probably the most representative urban activity of this phenomenon.

When tourism becomes too invasive, it generates entropic processes that progressively lead the city towards a gradual modification. This process can be identified as an effect of "urban ousting", which occurs when the tourist flows exceed and invade the urban space transforming the tourist in "entropic city users".

The urban ousting could be referred to two different types: a) "restricted" for instance during some big events (Olympic games, international fairs, Expo, etc.) that require specific management plans but it normally affects specific urban zones; b) "all-embracing" that is when tourism assumes more importance than consolidate urban activities causing the banishment of residents and the phenomenon of gentrification. Urban tourism tends to overlap with gentrified areas, especially because gentrification provides consumption facilities and a middle-class sense of place that attracts further consumers. The attraction of visitors accelerates the pressure of gentrification as the intensification of land use pushes up the value of commercial and residential properties. New spaces of consumption can increase land values and this process explains why property owners are particularly interested in promoting local tourism growth (Logan & Molotch, 2007).

Although urban tourism management and its flows are a discussion focus within the scientific literature (Urry & Larsen, 2011; Evans, 2000; Pearce, 1998; van den Berg, van der Borg, & van der Meer, 1995; Law, 1992), there is still a lack of interest in considering it as an integrative element of the city planning, of the transport design, or the urban regeneration policies (Pearce, 2015). Being a diffusive and an inter-sectorial activity, tourism can be the means to promote sustainable models of enjoying resources, and in this sense, it can promote a real change in visitors' behaviors paying more attention to energy transition, water consumption, waste production, the use of soft mobility, respect of the host population and so on. The search for an equilibrium also refers to the basic concept of carrying capacity and to the spatial distribution of tourist flows within the urban places.

Before the present pandemic crisis, the distribution of tourist flows inside the host system acted according to some known trend. Within the destination, tourism demand concentrates in time (normally corresponding with a holiday, big events, cultural exhibition, religious celebration, etc.) and in space normally corresponding with the areas in which attractions are localized (monuments, museums, shopping, historical center, cathedrals, etc.). When tourism loads exceed the threshold of the compatibility (with social, economic, and environmental resources), the host system collapses, and its levels of livability rapidly decrease. If this situation occurs, the "carrying capacity" of the system has been overcome.

In this sense, and strongly referring to tourism, the carrying capacity can be defined as the ability of the urban system to perform tourist functions without threatening those that are essential for residents (Thurot, 1980; Mathesion & Wall, 1982; Grasselli, 1989)[1]. This concept indeed is much more complex and takes into account at least three main components: a) the physical component that refers to the maximum number of persons that a place can bear before its breakdown; b) the functional component that refers to the system of services and facilities whose quality deeply affects the visitors' experience; c) the social component that refers to the well balanced relationship between tourists and host community. The threshold of the carrying capacity for a destination is determined by the balance among these three components. As both tourism, as well as the destination, are complex and dynamic systems it is not possible to individuate a certainly defined value corresponding to a specific point in which the perfect and stable equilibrium can be achieved (Fistola & La Rocca, 2014). Nevertheless, it is possible to refer to a "state of compatibility" in which the tourists' needs and the resources (social, economic, territorial) of the host community are well balanced, and a condition of no conflicts and no loss of energy is achieved. Tourism sustainability could thus coincide with this compatible

[1] There is a wide literature about definitions of tourism carrying capacity. Some scholars (Maggi et al. 2010) agree on the complexity of the concept and refer to different components based on three main relationships: a) environmental: refers to the capacity of natural resources that are in the tourist destination and their fruition by tourists; b)cultural: refers to the tourists' satisfaction based on their expectation; c)socio-economic: concerns to the social and economic satisfaction of the residents referred to the presence of tourists in their city. These relationships can be found in the definition by the UNWTO (1981) "the maximum number of people that may visit a tourist destination at the same time, without destroying the physical, economic and socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction".

state of balance (even if dynamic) in which a widespread quality of life can be assured for all the urban typologies of users (citizens, residents, city-users, and visitors).
The individuation of new forms of tourism aimed at reducing energy consumption and primary resources (water and soil), safeguarding the cultural heritage, respecting the identity values of a place can lead the whole system (the host community and the tourists) towards these states of equilibrium. The focus of the change will affect the supply-side dedicated to tourists particularly referred to transports, accommodations, and entertainment. The ability to reformulate the supply-side system according to a sustainable perspective (as has been before meant) is most likely a possibility to switch towards a "smart" dimension in which public and private sectors work in synergy for a common goal (La Rocca, 2013; Canfora & Corbisiero, 2014; Papa & Fistola, 2016).
The responsible tourism, in this sense, rather than a further typology can be intended as a new approach to tourism issues, aimed at mitigating (through sustainable behaviors) the impacts deriving from unplanned development, in this, improving also the competitiveness of the destinations. In this way, the word tourism is understood in a positive sense, where the journey and the holiday are intended both as an opportunity for quality of life and an opportunity for cultural exchange as well. Taken together, they become a tool to foster the growth of more sustainable touristic flows.
In this regard, recent studies have underlined a growing sensitivity towards environmental issues by users who prefer certified structures and products even in the face of higher spending (UNEP & UNTWO, 2012). This trend allows us to make a consideration regarding the possibilities of a radical change in the lifestyles and cultures that tourism could generate.
In fact, as a pervasive activity[2] for which the social component has a fundamental role, tourism can influence behaviors and play a driving role in promoting more sustainable uses of cities and resources (decrease of waste production, reducing use of the water and energy consumption, etc.). Tourism, thus, being characterized by "transversality" and "pervasivity"[3] , can be a driving function able to shift the system towards sustainable conditions. In this sense, the tourism sustainability can coincide with a condition of possible equilibrium (between tourist demand and supply) where the city achieves widespread urban quality levels for all categories of users: residents, city users, and tourists.

3. After the Covid

3.1 Tourism's uncertain future

The bewilderment caused by Covid-19 has crushed every desire for escape and travel, temporarily closing the tourism golden age. This pandemic has grounded our hyper-mobility to a halt forcing us to stay rooted, and maybe it's the right moment to reflect on why we constantly feel compelled to be always "on-the-go" in contemporary society. The situation is unprecedented. Within the space of 3 months, the framing of the global tourism system moved from overtourism to "non-tourism" (Corbisiero & Ruspini, 2018).
There are already several future tourism studies that draw possible scenarios of the impact of Covid-19 on the tourism sector, once again emphasizing the role of economic driver that the tourism industry undoubtedly plays in the world. According to this perspective, the tourism industry is counting on a, probably reduced, revival of its activities in 2021. This optimism is based on four expectations: a vaccine, the relaxation of travel

[2] Despite the global crisis, before the Covid-19, tourism has had an uninterrupted growth over the past six decades more and more involving all different social levels and becoming a transversal activity, that involves several sectors (mobility, hospitality, leisure, etc.).

[3] *Transversality* refers to the multiplicity of sectors (public and private) involved in tourist development. *Pervasiv*e refers both to the constant growth of tourism in the late sixty years and to the trend that characterizes actual demand, at all social levels, impatient of sharing its own experiences rapidly and in real-time.

restrictions, implementation of additional health measures for travelers and passengers to access the transports and the presence of a loyal clientele.

Though, these studies pay little attention to the unbalance that tourism can generate on the general organization of the destination, as previously underlined. This lack of attention determines a space in the scientific research trajectories that, on the contrary, could represent an innovative research path to propose strategies and resolutive actions able to support the decision-makers in the fulfillment of objectives of wellness and quality of life for the whole communities involved in tourism activities.

Targeting the tourist of the future will involve an array of response-driven approaches across a range of socio-economic levels, markets and destinations. Many of these post-pandemic changes will be driven by new technologies that may herald an era of cyber-tourism. Therefore, there is a need for the tourism industry to position itself as a strategic early mover, in terms of planning, trialing and incorporating emerging ideas and technologies, and applying multiple strategies to deliver new options such as @-tourism. Such ideas will generate new tourism streams, thereby further strengthening the industry's global competitiveness into the future.

Countries and destinations will need to assess the impacts of the Covid-19 and any further future pandemics using both monetary and non-monetary metrics. These values should also be evaluated concerning other structurally ingrained, institutional conditions and global factors such as climate change, that are increasing the vulnerability of less affluent regions already struggling to build resilience after disease outbreaks and related social backlash (e.g., from Ebola, Zika virus and HIV/AIDS) (Milano, Novelli & Cheer, 2019).

In such a situation, this pandemic represents a transformative moment or opportunity that will change the tourism, whose re-birthing will require new sets of values, new paradigms, and a dramatic shift from the over-tourism, overconsumption, and excessive greed that defined much pre-Covid-19 tourism. These discussions are fledgling, and they are not so obvious.

To assess the impacts of Coronavirus is a real complicate task because of several aspects concerning particularly the uncertainty due to the little information about the virus's behavior and evolution. If the economic impacts need to be supported by in-depth analyses, all the same they are the most evident; the social impacts, on the contrary, are more intricate to individuate as they concern the tourists' behaviors and much more their perception of the danger that will affect their choices. The recent trends elaborated by UNWTO (2020) highlight the decrease of the global tourist movement and, although still in uncertain conditions, it is possible to individuate at least three types of factors that will carry weight on the inevitable change that the pandemic has imposed. These factors can be described as:

- direct factors related to the perception of the risk which is therefore dependent on the trend of the spread of the epidemic (and, therefore, the end of the health emergency);
- indirect factors referred to the spending capacity in activities that at the moment are considered not a primary asset, such as tourism;
  indirect factors referred to the organization and the quality of the supply chain that will have to be able to ensure the safety conditions required.

In the first case, it can be reasonably assumed that the most direct impacts will concern the long-haul travel model, generating a contraction of the distances that the tourist flows will be willing to travel by predicting an increase in domestic flows and rebound tourism within their regions of residence.

In the second case, the aspects mostly connected with the job crisis generated by the pandemic, and the consequent closedown of medium-size activities must be considered. It should also be considered that this aspect affects both the supply-side and the demand-side (expenditure capacity).

In the third case, reference is made to the contraction in the supply-chain, like transports and accommodation, as well as several other ancillary services related to tourism (catering, culture and entertainment, events…).

The report by Cerved Industry Forecast "The impact of Covid-19 on the tourism and transport sector" (March 2020) compares three typologies of scenarios: a) absence of shock; b) basic scenario; c) pessimistic scenario. The first one evaluates the trend of tourism and transport if the Covid had not occurred. The second puts the deadline of the emergency phase at the end of May and presumes that the economic upturn will occur two months after the deadline.

The pessimistic scenario puts the deadline at the end of 2020 envisaging an economic upturn ~~in the~~ six months later, and global isolation of several countries. For Italy, which was the first country in Europe to have managed to isolate the coronavirus, the future analysis that are taking shape before the end of Covid-19 allude to the risk that the country will be isolated and in difficulty concerning the historical issues of fiscal stability and political stability that mark its weakness. The impact is also hurting areas of Italy barely touched by the virus. Italy's tourism federation announced that damage to the tourism sector is estimated at 200 million for the first quarter of the year.

Even though the three scenarios consider the support of public funding, the total loss in revenue is expected in the range from 29 to 64 billion ~~of~~ euros in the period 2020-2021 with a large regional variability. The basic scenario particularly evaluates the loss in revenue for the tourism and transport sectors to be about -20% in 2020, with about 22 % of expected rebound that is much higher than the overall trend expected for Italy (respectively -7,4% in 2020 and + 9,6% in 2021). At the end of the forecast period, the turnover of the companies in the travel & tourism sector would not regain the levels of 2019, with overall losses of 29 billion euros (22 billion in 2020 and 7 billion in 2021) compared to a scenario without shock (in absence of Coronavirus). In the pessimistic scenario, the sector's turnover would suffer 41.5% losses in 2020 (against 17.8% of the Italian economy as a whole) with a rebound of 42.2% in 2021. This would result in overall revenue losses of approximately 64 billion euros (43 billion in 2020 and 21 billion in 2021). The forecasts also identify the sectors of the supply chain most involved: hotels and travel agencies, catering, car rental, air transport with airport management, conferences, and the organization of fairs and events.

The territorial distribution (fig. 1), despite its inhomogeneity, highlights a condition of constant suffering for some regions such as Liguria, Calabria, or Val d'Aosta. The regions most exposed as to the number of employees in the tourism and transport sector would be Sardinia and Lazio.

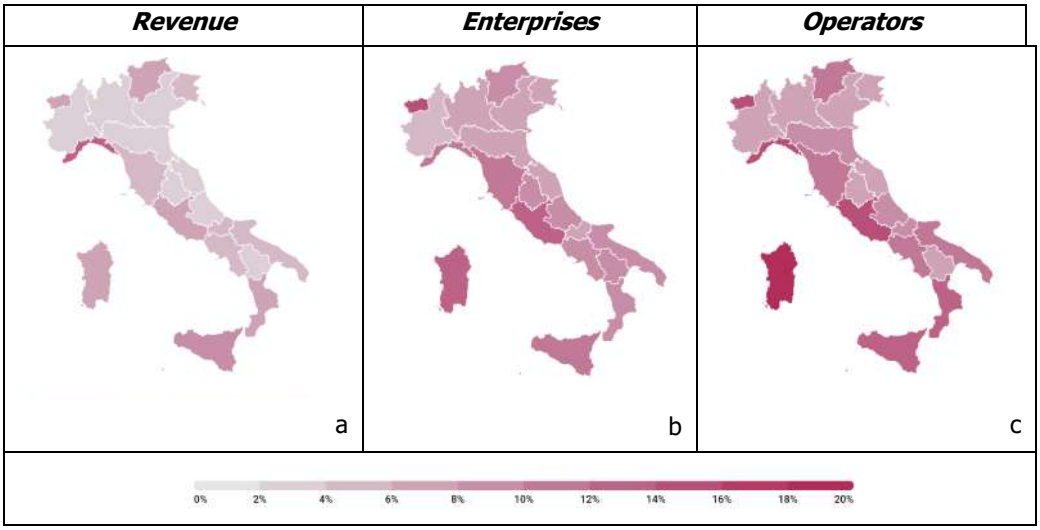

Fig. 1 Territorial distribution of the crisis post coronavirus in Italy referred to revenue (a), enterprises(b) and operators(c) (elaboration on CERVED data)

The Interim Economic Outlook of the OECD (2020), on the other hand, showed a severe slowdown in the production of GDP for the period 2020-2021 underlining the economic crisis that will affect the tourism sector especially as concerns to the reduction of the visitors from China and Asian countries to Europe.
The World Travel and Tourism Council (2020) has ranked countries that will be most exposed to the reduction of tourism mobility (fig. 2). The ranking refers to the percentage generated by the tourism industry on GDP, highlighting (again using economic indicators) the position of Italy as one of the countries with a strong tourist vocation. Even though in a loss condition, Italy stays in a favorable condition compared with the other European countries in the ranking, such as Greece, Portugal, and Spain (fig. 2).

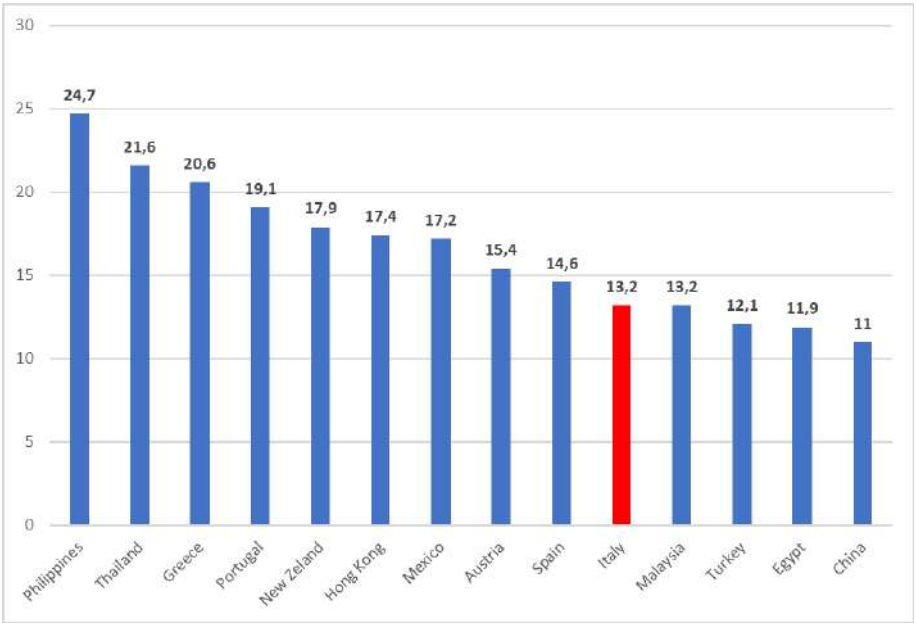

Fig. 2 Percentage generated by the tourism industry on national GDP (elaboration according to WTTC data)

The IPSOS surveys (2020) investigated the aspects relating to the age of possible travelers who suffered the most from the uncertainty related to the spread of the pandemic (fig. 3). The "grey-tourists" (over 45 years) express a bigger difficulty than young generations in planning their holidays even for a short period. This, theoretically, could be correlated to the segment of age that in Italy was most affected by the virus, and, on the other side, it could also be related to a greater reluctance of grey tourists for the habits changing required to contain the contagion.

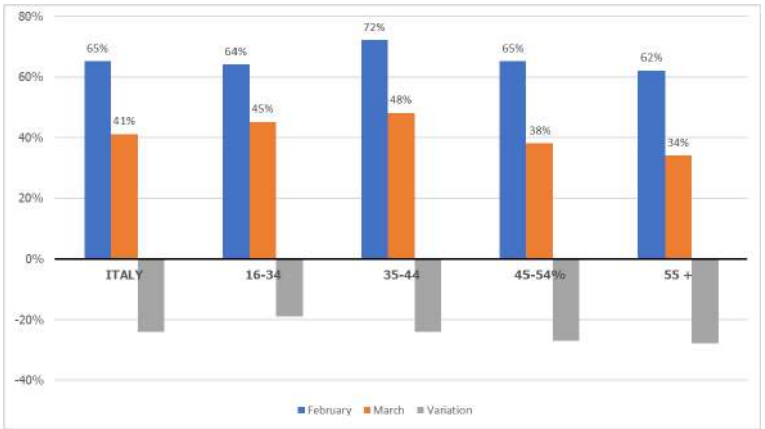

Fig. 3 The results of the IPSOS survey on the holiday forecasts of Italians by age after the ordinance "I stay at home" (11 March 2020)

Referring to the production of policies and measures envisaged for the worldwide containment of Covid-19, the Organization for Economic Co-operation and Development (OECD) elaborated an interactive map (updated to 11 May 2020) that allows for the comparison among states concerning: a) containment measures; b) fiscal measures; c) monetary policy and prudential regulations; d) measures to promote burden-sharing within the private sector; e) other measures including structural policy measures.
In this respect, figure 4 represents the Italian situation per region referred to the production of policies during the two phases of the pandemic.

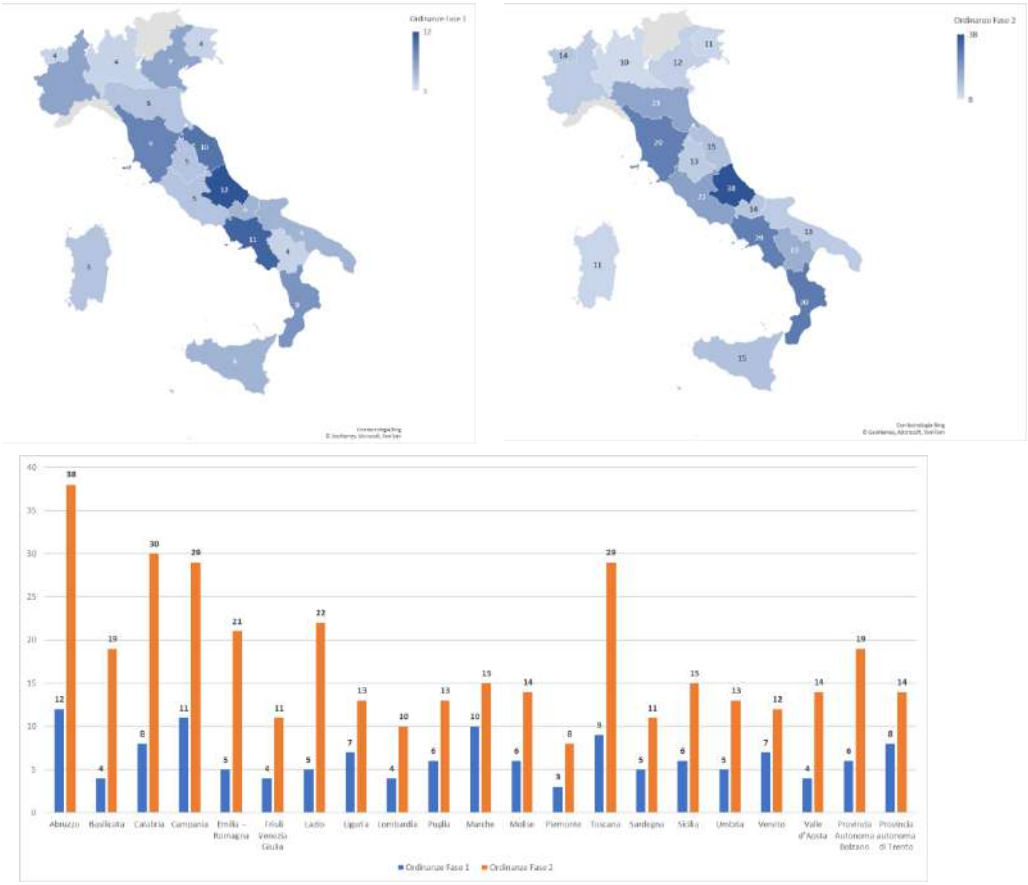

Fig. 4 Territorial distribution of the production of regulatory measures in Italy during phase 1 and phase 2.

The main measures refer to the OECD categories a) especially during phase 1 of the lockdown and b) during phase 2 mostly aimed at recovering economical fall. As concerns the tourist sector, measures mainly are targeted to give rules for interpersonal distances and for sanitizing the common spaces in accommodation and food facilities.
Nevertheless, a lack of general and integrated perspectives must be underlined in the management of the territorial emergence at a political level. Given the rapid pace of developments, the overview of regional responses is not comprehensive and in some cases regional policy responses have been working in progress, or simply remained at the stage of public announcements.

3.2 A new model of urban competitiveness and tourist attractiveness: tourism on demand

The Covid-19 pandemic should lead to a critical reconsideration of the global volume growth model for tourism, for interrelated reasons of risks incurred in global travel. Tourism increase has been historically defined by

virtually all tourism organizations - UNWTO, ICAO, CLIA, or WTTC - as growth in tourism numbers. This perspective has already been questioned in the context of the global financial crisis (Hall, 2011) and as the challenges of over-tourism, climate change (Zucaro & Morosini, 2018), and Covid-19 pandemic further illustrate, this perspective is outdated. These changes are also expected to generate new social migration (climate refugees) and new conflicts for the conquest of primary resources (e.g. water). This forecast framework necessarily requires a rethinking of the forms of spatial adaptation of tourist flows which concern both mobility and the relationship between the tourist population and the host community. In this sense, the pandemic can be seen as an opportunity as well as a challenge.

The Covid-19 crisis represents in fact an opportunity to critically reconsider tourism's growth paths, and to question the logic of more arrivals implying greater benefits. For example, as a result of the significant decline in demand, airlines have begun to phase out old and inefficient aircrafts. Video-conferencing has become widely adopted by smart-workers, including students forced into distance learning, and business travelers avoiding non-essential air travel. Many business travelers will welcome opportunities to fly less. In Italian cities, the full lockdown responses appear to have seen a significant rise in cycling and outdoor activities. Adding to this, Italians seem to regain confidence, and interestingly, a greater involvement in environment-friendly activities, desiring rural areas as a refuge from urban life.

It is a shared opinion that tourism is an important factor in the economies of all countries, and in a nutshell, it has so far been one of the main agents capable of improving the level of regional as well as urban competitiveness; it is probably because of its central role that cities and regions have become real "tourist products".

The challenge, of course, consists of the ability to defeat the virus, by knowing it and thus predisposing the pharmacological and medical remedies as rapidly as possible. The opportunity refers to the ability to share knowledge and defining alternative patterns of using cities and resources in coherence with the peculiarities of all the involved components (social, physical, and functional), thus promoting a sustainable perspective.

Tourism on demand (TOD) is one of the possible patterns that can be implemented in the short term to test forms of use that, on one side, allow for the monitoring of tourist flows which are also required by emergency and non-invasive; on the other side, it allows for a distribution of the tourists load that should be compatible with the carrying capacity of the system involved. The flow management have to become a priority theme on the agenda of all the local governments that have decided to intervene effectively on the consequences induced by overtourism. Particularly, the knowledge of how many tourists a place, town, or larger destination can tolerate is turning out to be among the major challenges seized by an ever-increasing number of policymakers and scholars.

In considering the future development of international tourism, both the travel industry and tourist-receiving countries should be concerned to identify those factors which are likely to influence the direction of future demand. In this sense, digital transformation can unlock innovation and ensure the competitiveness of security protocols of European touristic systems.

This condition requires a coordination and cooperation effort at various levels: political-administrative, socio-economic, territorial. Integration within the tourism sector is a difficult task, as different levels of responsibilities and purposes of the public sector as well as of the private sector are involved (La Rocca, 2014) Nevertheless, some hypotheses of policies to be adopted can be formulated to achieve a balanced status, even though dynamic and not stable. In particular, we refer to the definition of interventions that have to be framed into the objectives of:

- restraint policies;
- policies for the management of tourist flows;
- participation planning policies.

As to the first point, interventions must consider the need not to exceed the maximum capacity that an urban system can sustain. At present, it must be considered that the pandemic has defeated the risk of "overtourism" as we used to define it. This aspect has to be considered in the definition of a local urban master plan where the distribution of the urban charges has to be decided by the planning of the supply-side elements (urban services and facilities). As for the second issue, policies should also concern visitors management techniques to distribute tourist flows inside the destinations diverting them from the most congested attraction areas to alternative paths for visiting the city.

Sensible areas of the urban system should be considered as "protected areas" where some restrictions may be applied to reduce tourist impacts. In particular, these measures should aim at:

- reducing the use of sensible areas (demand-side);
- varying timing and distribution of use (supply-side);
- improving action that can modify visitor behaviors (supply-side).

As for the third point, measures must concern the participation of all the actors (public and privates) involved in the process of tourist development according to a sharing approach to the decision-making policies. Such an approach permits to reduce the conflicts that inevitably occur between tourists and residents and to promote more sustainable forms of tourism. The balance among the whole of the interests that tourism development involves is necessarily based on the realization of an efficient system of governance. Governance in tourism is largely discussed in the scientific literature and it mainly refers to the cooperation and partnership between public administrations and private stakeholders as the fundamental condition for the success of a tourist destination. The proposed policies can be considered as the first guidelines for reducing the risk of generating dangerous entropic phenomena within the functional system (such as urban ousting) which could produce an entropic decay of the urban system as a whole.

4. Conclusions

Pandemics are an important issue for society and tourism, even if many of their potential threats and the actions needed to manage them have either been ignored or forgotten by the State, industry, and politicians at large. This paper tried to underline how pandemics and viruses may provide an impetus for individuals to transform their travel behaviors, even though transformation in the tourism system is extremely difficult. On one hand, research in tourism highlights the need to consider biodiversity conservation and climate change imperatives in combination with destination models that seek to reduce leakage, enhance wellbeing, and better capture and distribute tourism value (Gössling et al., 2016). In contrast, there are strong business and political voices claiming that the economy, including tourism itself, should be opened up as soon as possible so that it can return to "normal", and that affected businesses should receive substantial government financial support without necessarily having to meet any sustainability or climate change mitigation requirements. For example, the International Air Transport Association (IATA) has called on the International Civil Aviation Organisation (ICAO) to amend the carbon offsetting and reduction scheme for international aviation (CORSIA), or risk airlines pulling out of the scheme (Topham & Harvey, 2020). Clearly, without appropriate regulatory and governance settings to ensure that government bailouts of the tourism industry, including the transport sector, come with environmental caveats, the prospects for an immediate major paradigm or third-order change for more sustainable forms of tourism becomes all the more unlikely.

At the time of writing, there is no evidence that sustainability is a consideration within massive economic stimulus package in Italy, although several European environment ministers have called for plans prepared for the European Green Deal to be central in rebuilding European economies. The absence of the voice of the Italian environment minister in this "new blue-green deal" is puzzling. Nevertheless, the ongoing existential

threats posed by climate change, biodiversity loss, and exposure to zoonotic diseases means that the demands for more sustainable forms of tourism are essential for rethinking our cities.

Changes to tourism as a result of Covid-19 will be uneven in space and time over the world. While some destinations will undoubtedly reconsider the nature of their tourism industry and focus more on local and more sustainable forms of tourism, without substantial institutional and governmental interventions, which are currently overwhelmed with saving lives and creating conditions to restart domestic economies, the juggernaut that is international tourism will roll on.

For many destinations and governments, the question about the sustainability of tourism has to be measured with the "business as usual" model. Maybe the world of tourism should disconnect this slogan to figure out the future of tourism. Further, tourism scholars also need to consider if their research should be "community-responsive" to have a meaningful impact on the society, as research for its own sake drives to nowhere.

These reflections will necessarily have to start from a deep understanding of how to revamp domestic tourism, which even if it will not compensate for the decline of international tourism flows, will be crucial to revive the tourism. Coordinated approaches with other connected sectors heavily hit by the crisis, like the creative and cultural ones, will be of the essence to make the recovery successful.

Finally, it is paramount especially for Italian stakeholders to use the Covid-19 outbreak to improve crisis management strategies and strengthen international and domestic co-ordination mechanisms and mutual learning across Regions and tourism sub-sectors to rethink a more sustainable and resilient tourism system and to respond united to any future shocks. A critical rethinking of the neoliberal approach to space, of the touristification and commodification of our spaces should urge a radical discussion for a novel conceptualization of space - both inside and outside - tourism and hospitality. This would mean setting the ground for a novel spatial imagination for destination dynamics welcoming the unintended, unexpected, indeterminate multiplicity of untidy guests. This historical moment is also prompting us to enact a deeper connection between urban space (Alkan Meshur, 2016) and rural dimension and leads us to remember the enormous importance of exploring possible paths considering all the involved variables, in order to be ready and try to anticipate responses.

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Questioning urbanisation models in the face of Covid-19

The crisis as a window of opportunity for inner areas

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Abstract

The Covid-19 pandemic raises questions about the ever-growing urban concentration that characterizes our society, and various experts are pointing out the need to rethink our cities. At the same time, a number of voices advocate for a rediscovery of rurality. However naive they may sound, these claims have the merit of calling for a thorough reflection on the challenges and potentials that alternative modes of urbanisation could bring along. In order to provide a contribution in this direction, the article introduces the challenges that the present sanitary emergency raises for contemporary urban environments, to then reflect on the reasons behind the progressive abandonment of remote rural areas, and especially on the increasingly scarce accessibility to services offered to their inhabitants. The authors argue that policies dedicated to counteracting these trends are needed in order to enhance the overall resilience of our societies. To address this concern, the National Strategy for Inner Areas, promoted by the Italian Government to trigger place-based territorial development in remote areas of Italy, is a promising way forward, and the present crisis constitutes a window of opportunity to further strengthen and refine the Strategy's approach in view of the next EU programme development period.

Keywords

Urbanization; Rural development; National Strategy for Inner Areas; EU cohesion policy; Covid-19

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1. Introduction

The relentless march of urbanization has a long history. According to the European Environment Agency, since the mid-1950s the total surface area of cities in the European Union (EU) has increased by 78%. Over 4 billion people live in cities today, six times as many as did in 1950, and in 2009 the proportion of urban population became larger than the one living in the countryside for the first time in human history. When it comes to the EU, in 2019 this share accounted for almost 75 percent of the total, and scenarios for the year 2050 forecast an additional 10 points increase.

Until a few months ago, these trends were considered irreversible and even desirable. The downsides of increasing concentration and urbanization were often considered as minor drawbacks, when compared to the advantages the latter brings along in terms of economies of scale, access to diverse skills and services, interconnectivity and leisure. Since the Covid-19 emergency crisis struck, however, a number of experts from various disciplinary fields started to reflect on the fragility and vulnerability of our consolidated way of living, raising overarching questions on the ever-growing urban concentration that characterizes our society. A number of ways forward have been suggested, ranging from a reconceptualization of urban mobility towards more sustainable means of transport to alternative approaches to public and working spaces in the city. Other claims went as far as pointing out the need for a more drastic paradigm shift, advocating in favour of the resettlement of underpopulated or abandoned rural areas. Whereas these arguments appear sound or, on the contrary, rather naive and insufficiently grounded in scientific evidence, they at least have the merit of bringing attention to the need to explore more thoroughly the implications of the current emergency situation for mainstream urbanization trends, and to start considering the challenges and opportunities that alternative models could bring about.

In order to provide a preliminary contribution in this direction, this article reflects upon the actual viability of more dispersed urbanization alternatives from an accessibility studies perspective, to then highlight the potential role that the Italian National Strategy for Inner Areas could play in this regard. After this brief introduction, the challenges that the present sanitary emergency raises for contemporary urban environments are briefly presented, also in the light of the arguments recently brought forward by a number of experts. The argument advocating a return to more dispersed models of urbanization are explored more critically in section three, with particular reference to their actual viability *vis-à-vis* the reasons that have led to the progressive depopulation and marginalization of rural areas, their scarce accessibility to services of general interest and the increasing dependence on urban nodes. The authors argue that, if more dispersed modes of urbanization are to be pursued, policies specifically dedicated to counteract these trends and to enhance the actual liveability of remote areas should be undertaken. In this regard, section four presents the National Strategy for Inner Areas (Strategia Nazionale per le Aree Interne – SNAI), promoted by the Italian Government to exploit multilevel synergies between European, national and local actions and resources, as a promising, innovative way forward. A final section rounds off the contribution, by reflecting on how the present crisis represents a window of opportunity to further consolidate and strengthen the role of SNAI in the national policy environment, in particular in view of the next EU cohesion policy programming period.

2. The end of urbanisation as we know it?

There are undoubted advantages to urban life. Concentrating large numbers of people in small areas means larger workforce with more diverse skills, easier access to mass transit, and economies of scale in everything from public services to cultural institutions to private business. Similarly, concentration of people is a good ecological principle in dealing with climate change, by saving on infrastructure resources. It is also a good thing socially, as people are exposed to others unlike themselves in a densely diverse city. Whereas those

dynamics explain much of why incremental urbanization trends are a longstanding global phenomenon that hasn't been challenged by any credible alternative, now that the Covid-19 emergency has gone on for some time, a growing number of arguments started to emerge, questioning ever-growing urban concentration and dependence on density (Stier et al., 2020). More in particular, the pandemic is challenging us to think about city issues from a different perspective and, by questioning physical and relational density, it calls into question the agglomeration effects constituting the very rationale behind the existence of cities. To prevent or inhibit future pandemics, we may need to find different physical forms for to address the density issue, permitting people to live, work and communicate even as they temporarily isolate. The way people move in cities also presents a number of challenges, with the benefits of public transport consisting in efficiently massing numbers of commuters together, which however isn't a healthy form of densification (Serafimova, 2020). Moreover, and perhaps most importantly, the pandemic is at the same time unfolding as a natural experiment in class inequality, with the possibility of smart-working largely concerning upper and middle-class professions, whereas the low-skilled and unregistered labour force finds itself in precarious economic positions and is more likely to be exposed to potentially unhealthy conditions, both physically and mentally (Sennet, 2020). Finally, additional concerns arise in relation to those tourism-based and sharing economies that, after having changed the soul of our cities in the last decade or so, are now challenged with an unprecedented crisis that will be hard to overcome (Gössling et al., 2020).

This flags up the need for a radical rethinking of urbanization dynamics, that reconcile and integrate multiple dimensions, such as environmental needs and health, economy and social justice (Batty, 2020; Sennett, 2020). Numerous experts already started to provide tentative inputs in this direction, reflecting on what alternative models of urbanisation could look like. In his letter to the President of Italy Sergio Mattarella, the Italian architect Massimiliano Fuksas underlines the need for a habitat that is better prepared to face global pandemic, in which housing and health functions are further integrated and connected, so that inhabitants would feel safer and less isolated (La Stampa, 2020). On a similar line, Ware et al. (2020) propose their concept of "elastic city", an urban system that could be easily fragmented in independent blocks in case of epidemic crisis or other emergencies. In so doing they argue at the same time that the way we conceive and use spaces is also becoming a subject of debate, whereby increased attention should be dedicated to ensure all citizens have access to collective, semi-public spaces such as balconies, staircases, green roofs, courtyards etc. Additional considerations are put forward on the possibility to temporarily change the use of spaces that, during the crisis, have lost their function. Hotels and cruise ships could be turned into hospitals and shelters, restaurants into food charities, office buildings into housing. In particular, a number of authors are reflecting on how the economic crisis that will follow the pandemic may be an occasion to structurally intervene in the housing sector, by ensuring more equal housing conditions through the reuse of those urban proprieties that will lose their short term rental function due to contraction of the tourist sector and those office spaces that may become redundant in the perspective of more flexible smart and home-working arrangements (Coppola, 2020)[1]. Strong public intervention is invoked to make it again convenient to reside and work in the city centres, and in so doing inverting the touristification trends that have expelled residents from the most attractive areas of our cities (Leon, interviewed in Erbani, 2020).

In parallel to the reflections on what future is awaiting our cities, a number of authors started to focus their attention on how the present crisis could change the existing relations between cities and what lies outside them. In two interviews recently released to the Italian Journal *La Repubblica*, Rem Koolhas and Stefano Boeri argue in favour of an abandonment of present urbanization models, in favour of the valorisation of rural spaces and villages (Giovara, 2020; Piccoli, 2020). In particular, as argued by Boeri in relation to the Italian context,

[1] For an overview of the impact of the Covid-19 emergency on the housing debate see: Rogers & Power, 2020.

the almost 6.000 municipalities of the country that count less than 5.000 inhabitants and the 2.300 abandoned villages represent an opportunity for facilitating a contraction of present urbanization trends in favour of further social and physical dispersion. This rediscovery of the rural has been already criticised from various sides, and depicted as a bucolic, naïve argument that willingly forgets to engage with the actual conditions and challenges that have progressively led to the abandonment of the country's rural areas since the end of World War II (for a critique see: Chiodelli, 2020). Be that as it may, the centrifugal perspective that underpins them has at least the merit of opening up an alternative standpoint from which to observe the implications that the current emergency situation may have for mainstream urbanization trends, one that is not exclusively centred around urban cores but that shifts the focus of attention towards urban-rural relations and the challenges and opportunities that a rediscovery of rurality would bring about.

3. Rural beyond rhetoric. Process and challenges undermining rural liveability

In the face of the emerging claims towards a return to (a renewed) rurality, it is worth reflecting why rural areas have undergone marginalization processes, and how such processes affected the liveability of those areas. Rural areas, and rurality in general, can take on various meanings. Since the second half of last century, rural studies tried to define and conceptualise the rural, from functional positivists attempts of delimitation to a post-rural social construction of space (Gallent & Gkartzios, 2019; Gray, 2000; Woods, 2009). Some, Hoggart first, even questioned the conceptual inappropriateness of the notion of rural itself (Hoggart, 1990), while others suggested more nuanced consideration of rural spaces, beyond public imagination of rural archetypes, introducing notions and labels, such as the rural-urban continuum (Pahl, 1966), rurban, non-urban, shadow landscapes (Bryant et al., 2011) and so on. In its overview of regional and rural planning, the OECD identifies three key steps in the definition of the rural: the old paradigm, in which the rural was the non-urban, the new rural paradigm, from 2006 onwards, in which the rural comprised a variety of distinct types of places, and the "rural policy 3.0", that distinguishes three types of rural areas depending on their being within, close or far from a functional urban area (OECD, 2016, cited in Tomaney et al., 2019). For the sake of simplicity, and agreeing with scholars who challenge the delegitimization of the distinction of the urban from the rural and acknowledge the relevance of the latter as an ontological category rather than a residual backdrop of the former (Gallent & Gkartzios, 2019; Scott et al., 2019a; Urso, 2020), this article refers to the "rural" in its widest meaning, from near-urban hinterlands to remote wilderness (Gallent & Gkartzios, 2019), insofar as it applies to processes and phenomena mentioned below.

Since the second half of the last century, many European rural areas have undergone intense processes of marginalisation (Camarero & Oliva, 2019; Johnson & Lichter, 2019; Montalvo et al., 2019; Vasta et al., 2019; Viñas, 2019). The attraction exerted by urban nodes, in particular towards active population groups, has progressively emptied these areas, where, as a consequence, the ageing index has increased. Depopulation is the main phenomenon that is usually reported when considering the marginalisation of rural areas. In this light, the ESPON ESCAPE project distinguishes two types of shrinkage: active shrinkage, driven by migration, and legacy shrinkage, driven by distorted age structures resulting from former migration processes (ESPON, 2019). As the project points out, active shrinkage is more typical in Central and Eastern European countries as well as in Southern Europe, while legacy shrinkage is recurrent phenomenon in Western European fringes. Together with depopulation, a number of other factors contribute to reinforcing the marginalisation of rural areas, and the consideration of social, economic and cultural aspects can allow for a better conceptualisation

– hence understanding – of the issue[2]. Processes of de-anthropisation of natural and open spaces, weakening of social ties and loss of cultural values and identity are key aspects of the impoverishment of rural areas.

In addition to the attraction exerted by urban nodes on rural dwellers, urban-rural relations have evolved over the last century into a complex system of interactions, and a large body of literature has addressed urban-rural linkages from various points of view (e.g. the recent H2020 ROBUST, and among others Funnell, 1988; Healey, 2002; Woods, 2009). Despite the variety of perspectives and insights, the majority of contributions acknowledges a predominant role of the "urban" side of this relation. As a matter of fact, also as a consequence of increasing globalization, urban society has somehow expanded into rural society. Materially, with a proliferation of second homes and accommodation facilities for the exploitation of rural assets for tourism and leisure (Gallent, 2020); but also importing economic, political and cultural models, hence influencing local values, identities and ambitions from an urban perspective. Through the decades, the value of rural areas as places of production has given way to their attractiveness as places for consumption for tourism and leisure (Gallent & Gkartzios, 2019). All these processes induced a progressive rarefaction of the rural *civitas*, i.e. "the set of social ties, functions, services and institutions capable of offering citizens the advantages of a civilized life" (Dematteis, 2009). Services and amenities – basic services such as schools and health services, but also small stores, banking services, libraries, bars, etc… – have progressively decreased since the second half of the last century, as the number of potential users needed to ensure their provision was no longer met (Camarero & Oliva, 2019; Küpper et al., 2018). The dismantling of services and activities became part of an overall spiral of decline, in which the dependence of rural dwellers on urban nodes is both a cause and a consequence.

Accessibility and mobility are undoubtedly key aspects to understand the marginalisation of rural areas. Due to their geographical connotation and settlement pattern, rural areas are characterised by low accessibility in comparison to urban contexts. A pattern of small towns and villages with low density and a scattered social fabric make traditional public transport services inadequate and inefficient, due to low and dispersed demand (Bacci et al., 2020; Daniels & Mulley, 2012; Davison et al., 2012; Farrington & Farrington, 2005; Li & Quadrifoglio, 2010). Not surprisingly, most of the people who live, work or come to these areas for leisure, travel by car. High car-dependence and scarcely efficient public transport services are two sides of the same coin, and the users most affected by this situation are those who do not own or cannot drive a car (Binder & Matern, 2019; D. Gray et al., 2001; Mattioli, 2014; Shergold et al., 2012; Verma & Taegen, 2019; Vitale Brovarone & Cotella, 2020). This gap concerns both mobility within rural areas as well as to/from the nearest urban centres, where basic services are located (Black et al., 2019; Ferreira et al., 2007; Shergold & Parkhurst, 2010). Moreover, in spite of the widespread stereotype of rural areas as places of slowness and low mobility, the lack of essential services and distance between activities implies the need for high mobility (Camarero & Oliva, 2019). While digitalisation could be a way of improving rural accessibility to de-materialised services, these areas very often suffer from lack of adequate infrastructure and expertise, adding further complexity to the issue (Philip et al., 2017).

Whereas said challenges are largely agreed upon, they continue to remain marginal in the scientific debate and only a minority of contributions focuses on exploring solutions to face them. In the last decade, planning theory and practice have been increasingly dominated by urban issues, while rural concerns – with few exceptions, the British academia having historically been at the forefront (Gallent & Gkartzios, 2019) – have been largely overlooked. As a consequence, spatial development policies have progressively left rural development issues behind, while most of the attention and efforts were concentrated on urban cores as engines of growth, this leading to the consolidation of a feeling of abandonment in rural actors and communities, belonging to places that "do not matter" (Rodríguez-Pose, 2018). Despite the emergence of the

[2] For instance, a rural area gaining population may also undergo marginalization, when an increasing number of its residents daily gravitate on urban nodes and just populate the area without inhabiting it.

city-regionalism paradigm, that in principle should identify and exploit synergies between urban and rural objectives, a city-centric approach continues to prevail, that further marginalises rural areas and reinforces existing centralities and hierarchies (Jonas & Moisio, 2016; Urso, 2020). Due to the limited resources and low level of institutional capacity, local policy-makers most of the times dedicate their efforts to micro-scale, short-term goals or conflicts (Scott et al., 2019b) and, with few exceptions, remain distant from the decision-making arenas responsible for developing wide-ranging, long-term development policies. As a consequence, rural development remains largely grounded on a limited knowledge and understanding of the needs of rural areas (Cotella & Vitale Brovarone, 2020; Harrison & Heley, 2015; Urso, 2020).

All the issues brought forward in this paragraph contribute to weaken what Gallent defines as the "rural infrastructure", a multi-scale and cross-domain concept comprising the range of public and private, community and social infrastructures conveying health, education, transport, as well as enabling social ties through community groups and local networks (Gallent, 2019). The weaknesses of these rural infrastructures affect wellbeing and social equity, undermining the liveability and potential for development of rural areas.

4. Towards place-based rural development. The Italian National Strategy for Inner Areas

The elements and processes described in the previous paragraph give an idea of how hard living in rural areas can be, especially in remote ones. Let alone equipping these areas to sustain incoming flows of counter-urbanisation, also addressing the problems that hamper the liveability for people who already live there poses various challenges. To make rural areas more liveable, and to counter the marginalisation processes they are undergoing, dedicated policies should be put in place. While there have been a number of good practices, in most cases they remain anecdotal success stories, whose positive outcome largely relies on extemporary opportunities and conditions, hence preventing upscaling or replication elsewhere.

National and supranational policy approaches aiming at instituting a structural framework to address the marginalisation of disadvantaged rural areas could produce a more widespread impact, assuming that they are flexible enough to accommodate local conditions and logics. An attempt to reformulate the EU cohesion policy in this direction, in turn providing an input to national and regional policy-making in the various EU member states[3], dates back to more than a decade ago. More in detail, publication of the so-called Barca Report (Barca, 2009), commissioned by DG Regio Head Danuta Hübner in 2007, argued for a place-based reformulation of the EU cohesion policy, that would allow for further local experimentalism, actor mobilisation and overall valorisation of local territorial capital. Deeming the long-standing dichotomy between cohesion and competitiveness as misconceived, the proposed approach foresees mutual reinforcement between efficiency and equity objectives. The innovation of the EU cohesion policy is envisaged through an integrated architecture involving inter-institutional agreement on a common EU strategy for the sectoral policies with place-based relevance, the creation of inter-DGs task forces and, most importantly, the strategic and operational integration of the regional, cohesion, social and rural funds. The place-based approach works from the assumption that places suffering from marginality and underdevelopment have, to a large extent, the necessary knowledge to get out of this condition. At the same time, it argues that the choice – therefore not necessarily the inability – not to put this knowledge into play, stems to a large extent from local hierarchies of power, and the will of ruling classes to maintain their privileged positions (Barca et al., 2012). For this reason, the approach proposes a strong central action, destabilizing and questioning the power dynamics and balance rooted in local systems,

[3] For an overview of the mutual influences linking EU and national policy-making in the field of territorial governance and development polices see: Cotella & Janin Rivolin, 2015; Cotella et al., 2015).

to then oversee a process of rebalancing and territorial growth. Policies for territorial development should therefore consist in promoting in each place integrated investment projects and even more institutional growth, through a process of breaking the economic and social balance, to then re-orient and recompose it through multi-level governance (Barca, 2009; Celata & Coletti, 2014).

Despite its potential, the impact of the Barca Report on cohesion policy has been rather limited; the Commission's proposals for the 2014-2020 period have not been able to fully implement the rationale of the document and fell short on a coherent place-based approach (Becker, 2019; Mendez, 2013). Nevertheless, thanks to the considerable leeway granted to Member States in the actual implementation of the EU cohesion policy and, in particular, to the appointment of Fabrizio Barca as Minister for Territorial Cohesion in 2011, the place-based approach breached into the Italian policy-making arena. One year later, the launch of the National Strategy for Inner Areas (SNAI) initiated a fertile season of experimentation for the country's regional development policy (Cotella & Vitale Brovarone, 2020).

4.1 Objectives, approach and operational features

The SNAI places itself as a one-of-a-kind experience in Europe, thanks to the way it consolidates the EU place-based approach into a national regional policy.[4] It targets those territories that are located at a significant distance from centres providing essential services, that are typically remote and sparsely populated, affected by severe ageing, depopulation and impoverishment (Barca *et al.*, 2014). At the same time, it acknowledges that these inner areas often feature important environmental and cultural resources that the local population struggle to preserve. Targeting areas located in all regions of the country, the proposed approach to regional policy constitute an important paradigm shift in the country's policy environment, as it abandons traditional interventions aimed at bridging the development gap between the northern and southern part of the peninsula, while acknowledging access to services as an essential precondition for development throughout the whole country (Cotella & Vitale Brovarone, 2020)[5].

The overall aim of the Strategy is to invert the marginalization processes that characterises the concerned areas, by acting towards a reinforcement of their economic and structural conditions. To reach this goal, it sets three interrelated objectives: (i) to preserve and secure the territory; (ii) to valorise its natural and cultural diversity and (iii) to enhance the potential of under-utilised territories and resources.

More in detail, SNAI is characterised by a twofold action, that aims at exploiting synergies between top-down and bottom-up development initiatives (Barca *et al.*, 2014). On the one hand, it focuses on the improvement of essential services, by putting in place top-down actions to provide inner areas with the necessary 'prerequisites' for territorial development in the fields of health, education and mobility. On the other hand, it triggers local development processes, by supporting projects focused on environmental sustainability, promotion of local cultural and natural capital, agro-food systems, renewable energies, craftsmanship and traditional know-how. Following the principle of concentration inspired by the EU cohesion policy (Barca, 2009), SNAI does not act on all the municipalities classified as internal, but concentrates on a limited number of project areas, appropriately selected by region on the basis of a preliminary classification that follows national criteria. More in detail, the selection of the areas is grounded on a thorough methodology defined by the Technical Committee for Inner Areas (CTAI), that first mapped the 'service centres' of the country on the

[4] To the authors' knowledge, to date there are very few examples of nation-wide place-based policies in European countries (for instance, the recently launched National Strategy Against the Demographic Challenge, in Spain. Ministerio de Política Territorial y Función Pública, 2019; Camarero & Oliva, 2019). To this respect, Italy is a prominent case, since the logics of the report trickled-down from the European to the domestic arena, turning the country into a test-bed for the place-based approach.

[5] For the first time in the history of Italian regional policy, the potentials of the national polycentric settlements structure for fostering development are valorised also in rural and mountain remote areas (Urso, 2016).

basis of the presence of education, health and transport infrastructures, and then classified the remaining municipalities in the light of their distance from such service centres. According to this methodology, over 50 percent of Italian municipalities is classified as either intermediate, peripheral or ultra-peripheral[6], accounting for over 60 percent of the country's territory and hosting almost 25 percent of its population. A further investigation by CTAI on the presence of specific institutional and cooperation preconditions, a list of eligible areas was compiled and proposed to the regions, with each of them required to formally select the project areas to be involved in SNAI. Each region selected from two to five areas to implement the strategy, on the basis of its own development priorities, leading to a pool of 72 project areas (Figure 1) that include more than 1,000 municipalities and over 2 million inhabitants.

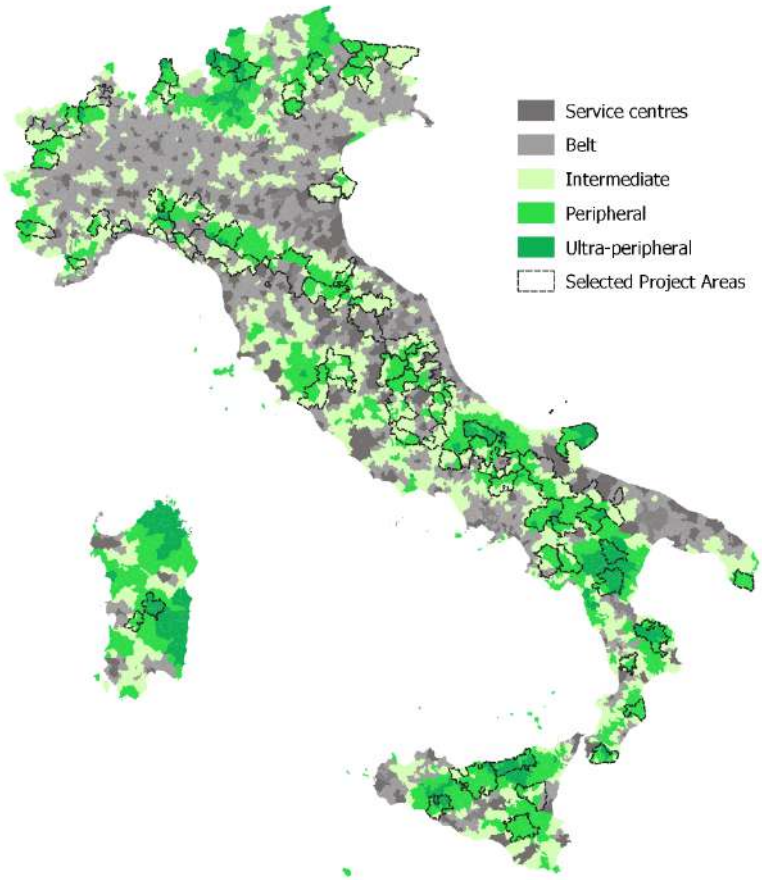

Fig. 1. The 72 areas targeted by SNAI over the total of inner areas. Source: authors' own elaboration on data provided by the Comitato Tecnico Aree Interne (the SNAI technical committee).

All regions were then required to start implementing the strategy. Following a learning-oriented approach, they had to identify a pilot area to test the methodology, to then activate the other project areas in sequence, in order to capitalize on the methodological and operational lessons of those activated earlier. The making of each strategy foresees the organization of a number of focus groups and meetings to involve all relevant stakeholders at the various territorial levels, and especially on the ground. The process begins with definition of a draft strategy by all involved actors, which identifies the guiding principles for development. Then, the strategy is fine-tuned, translating ideas into targets, actions and procedural frameworks. The CTAI supervises each phase and, once it has approved the final version, a framework programme agreement is signed between

[6] That is to say located respectively at 20 to 40 minutes, 40 to 75 minutes or more than 75 minutes from one service centres.

the national bodies involved in the CTAI, the region and the local territorial actors, setting a binding commitment to implementing the identified actions (Lucatelli, 2016).

When it comes to its governance structure, the strategy brings together local actors at the core of the process, requiring at the same time that the organise in formal supralocal associated entities (e.g. Union of Municipalities). Moreover, it awards regional and national actors a coordination and steering role. This makes the SNAI a multilevel, multi-actor and multi-fund process (Cotella & Vitale Brovarone, 2020), acting as a coordination platform between domestic (mostly national and regional) and European resources[7] . More in detail, the Strategy acknowledges the national level as the most suitable for the provision of prerequisites for development, and the local level as the best standpoint to identify the potentials for local development. In this light, interventions in the field of education, health and mobility are funded nationally[8], whereas local development projects are defined by local actors and funded with European funds. The regions act as key nodes, since they manage both the Regional Operational Programmes (ROP) and the Rural Development Programmes (RDP) and they decide on the amount of ESIF to be devoted to SNAI through such programmes. Furthermore, they flag up the strategic objectives of the strategy, define its timeframes and set aside the financial resources.

4.2 Improving essential services: health, education and mobility

Access to adequate citizen rights such as health, education and mobility is a necessary precondition for the development and liveability of inner areas. This is particularly true in the face of the sanitary emergency we are challenged with, that has been clearly showing how the lack of health infrastructure in specific areas may lead to a rapid escalation. SNAI appears aware of this need, and its very essence is based on the argument that, unless adequate provision of services is granted to inner area inhabitants, it would be pointless to invest in development strategies valorising local resources (Barca et al., 2014).

In particular, the distribution of health services across the territory is very relevant to considerations on urbanisation patterns and trends in the face of Covid-19. For some time now the economic and medical literature suggested economies of scale in the production of such services, with increased volumes and higher quality of services, arguing in favour of a centralization of care services in larger and more efficient structures (Barca et al., 2014). Ageing and depopulation are not the best ingredients to keep small hospitals alive in remote areas and, needless to say, unless highly subsidized, larger and more efficient structures have no interest in settling in inner areas where demand is low and accessibility is scarce. This situation led to a general trend of centralization of health services that has been affecting a number of Italian regions as well as other countries in Europe, in turn leading to a situation in which more or less remote rural areas are rich in second homes and potentially of people willing to use them, but deprived of the possibility to safeguard their health in case of explosion of a disease (Gallent, 2020).

To cope with this situation, SNAI envisages a reorganisation of the health system, exploring and pursuing alternatives to hospitalisation, so as to provide practical solutions to support inhabitants on-site, from postoperative monitoring to emergency medicine. The envisaged actions include: assessment of the

[7] The incentives programme defined by the Italian Stability Law is combined with a number of funding programmes from the European Union, dedicated respectively to regional development, rural development, fisheries and social cohesion, for a total of over €1 billion. To date, the total budget devoted to the 37 areas that reached the implementation phase accounts for about €600 million. On average, the EU funds cover the highest share (64.7 percent), followed by national funds (22.3 percent), complementary public funds (6.8 per cent) and private funding (6.2 per cent) (Agenzia per la Coesione Territoriale, 2019).

[8] These interventions could concern, for instance, the reorganisation of educational facilities with the creation of new facilities in barycentric positions within each area, replacing inefficient facilities spread over the territory; the reorganisation of health provision to provide better access to diagnostic and emergency services; or the adjustment and improvement of transport services, including flexible solutions and better access to rail networks (Barca *et al.*, 2014).

consequences of scarce access to services on specific target groups (e.g.: elderly, women in need of pre-natal care, disabled, …); a distinction between managing emergencies and diagnostic services; identifying and testing targeted services and innovative policy solutions, also by involving local pharmacies and introducing community services (community nursing and obstetrics) and e-services such as telemedicine and telecare.
As far as education is concerned, SNAI starts by acknowledging that schools play a crucial, threefold role: as providers of "decent education that guarantees the substantial freedom, as Amartya Sen states, to decide whether to stay or to go" (Barca et al., 2014, p. 34); as providers of the necessary knowledge, know-how and tools for students to be able to keep living in their territories, also contributing to their local development; as civic centres. Even more than in urban contexts, this threefold role is crucial in inner areas, where education can give a substantial contribution to strengthening the relation between students and their territories. Nevertheless, also in this case, depopulation and marginalisation affected the local education system, with abandonment and precariousness, that often lead to lower scholastic achievement and higher dropout rates. To address these challenges, SNAI envisages a multilevel governance model able to set up and valorise mutual relationships between schools and territories.
Finally, as regards mobility, SNAI foresees two lines of action: improve the provision of services (so as to reduce the need to travel), and improve mobility from and within these areas, so as to reduce the time and effort taken to reach services located in the main hubs. The two sorts of action are not mutually exclusive; on the contrary, an integrated approach should be implemented, calibrating the two alternatives based on careful cost-benefit analyses. To help inner areas develop their mobility strategies, SNAI defines four guiding principles: environmental sustainability and flexibility of interventions; coordination of territorial programming and transport planning; careful analysis of demand; consolidation of pilot projects already implemented that produced good results in terms of a qualitative shift toward collective means of transport, reduction of public contribution and technological innovation.

5. A window of opportunity for future urban-rural synergies?

The proposed contribution is placed within the timely debate that is emerging in relation to the impacts that Covid-19 pandemic may have on our societies, and in particular on the way they settle and function in space. In this light, it takes inspiration from a number of arguments in favour of a revision of existing urbanization models, towards alternatives that shift the focus from the urban dimension to the interactions and potential synergies that the latter may establish with the rest of the territory.
This is particularly relevant in a context like the one of Italy, were the so-called inner areas host almost one quarter of the total population and cover more than the 60 percent of the national territory. In this light, the process of socioeconomic marginalization that since the 1950s had progressively undermined the liveability of these areas is certainly a phenomenon that deserves further attention, especially in relation to the role that they could play in a sanitary emergency like the one we are living in, thanks to their lower physical and relational density and their higher environmental quality. More in particular, whereas a number of arguments towards a return to the rural have been put forward in response to the pandemic, they clearly call for a further investigation of the reasons why rural areas have been undergoing intense and tough marginalisation processes for some time. Depopulation, shrinkage and ageing came alongside with loss of active population, de-anthropization and lack of land and landscape protection, as well as weakening of social and cultural identities and ties. Scarce accessibility is a cause and a consequence of abandonment; access to services and amenities is increasingly difficult, opportunities moving away and ability to access them becoming more and more challenging, especially for those who do not own or cannot drive a car. If living in these conditions is hard for those who resisted and keep struggling to live there, the general idea of a migration of urban dwellers

in rural areas as of today sounds at the very least naïve, if not for those few who are really fed up with hustle and bustle of urban life and eager for to turn to a rural lifestyle, with the customary plaid jacket.

Whilst the urban has dominated policy discourse and, even when addressed, rural areas have been subject to urban-centred interpretations and ambitions, the rural cannot be considered as an extension of it, and rural-urban dependences and interdependences deserve specific focus and policies (Scott et al., 2019b). Academics and policymakers are called to a joint effort for an in-depth understanding of and action on rurality, with place-sensitive, multilevel approaches and strategies. In this light, SNAI stands as an innovative experience in a European policy landscape that appears increasingly focusing on urban areas as economic development engines (Cotella, 2019), and could constitute an interesting source of inspiration for national and supranational policymaking in the light of the upcoming program development period (Cotella & Vitale Brovarone, forthcoming). At the same time, its potential contribution to the territorial cohesion of countries is undeniable, as it represents the first attempt put in place to equip rural remote areas throughout the country with the necessary preconditions for livability and to reverse marginalization trends.

Together with its impact and innovation potential, however, one should also highlight the limits that the strategy had revealed when undergoing implementation. Besides its limitations in terms of territorial coverage – the strategy acts on just one third on the eligible areas – some other pitfalls are undermining its potential. In particular, as more thoroughly discussed elsewhere (Cotella & Vitale Brovarone, 2020), its subsidiarity allows for political discretion and discrimination of winners and losers, as well as patronage and discontinuities related to the loss of ownership when political settings are renewed. Moreover, regions being a key player and a connection node between the local and the national level, the various ways in which regional actors are involved in the process can lead to differential results.

On a more general note, and perhaps more importantly, SNAI seems to have lost part of its national prominence, mostly as a consequence of the shifts in government occurred in 2013 and 2014 and the substitution of Fabrizio Barca as Minister for Territorial Cohesion. The subsequent relabelling of the Ministry as "Territorial Cohesion and Southern Italy" could be considered as a litmus test of the loss of political ownership of the strategy at the national level, with a number of policy proposals that seem once again based on the traditional north-south dichotomy. As a matter of fact, the national situation is somehow coupled with the progressive loss of momentum of the place-based approach in the EU political debate. Still, the current situation, even if forced and temporary, may well represent a "window of opportunity" for SNAI and its advocates, a specific moment in time where contextual conditions allow to push forward solutions that would not take root in normal times, as for instance those insisting on a valorisation of inner areas and the potential synergies they could establish with denser urban regions. In this light, the coincidence of the present emergency with the negotiation with the European Commission in relation to the programming period 2021-2027 could lead national and regional policy-makers to turn their attention once again towards the valorisation of urban-rural relations, to be pursued through the progressive improvement of the liveability of rural areas, bearing in mind the enhancement of the resilience of the system as a whole.

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Fig. 1: authors' own elaboration on data provided by Comitato Tecnico Aree Interne (the SNAI technical committee).

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The Covid-19 pandemic effects in rural areas

Turning challenges into opportunities for rural regeneration

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Abstract

Rural communities tell us the story of a thousand of years of collaboration between nature, culture and humans. The current Covid-19 pandemic is considerably threating rural areas, posing challenges exacerbated by low available financial resources, not easily accessible health services and greater isolation. Rural areas are also considered safe shelters characterized by better daily living conditions thanks to easy to maintain social distancing and access to nature, to cultural and nature-based recreation activities. The Covid-19 crisis is revealing the crucial role of natural and cultural heritage for social cohesion, local development and mental wellbeing. The paper presents some responses to the Covid-19 crisis collected through an open call for action within the RURITAGE project. It aims at show how rural areas can cope with emergencies and it builds the basis to rethink the current crisis as a crucial tipping point for a resilient development of rural territories. It is key to overcome the idea of rural areas as mere food production system, calling for a broader vision of rural communities as poles of development based on local heritage, natural resources, creativity and social inclusion as essential elements to regenerate rural areas and to rapidly support their transition towards sustainable future.

Keywords

Rural regeneration; Covid-19; Social resilience

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1. Introduction

Looking across the world, rural communities tell us the story of a thousand of years of collaboration between nature, culture and humans. Rural areas embed unique traditions, culture, gastronomy, landscapes, and communities. Nevertheless, they are facing continuous demographic and socio-economic challenges that bring to depopulation, ageing, disengagement, reduced service provision and inhibited accessibility. Even though urban areas have been hit hard by the crisis, the current Covid-19 pandemic threats rural areas even more, posing challenges exacerbated by low available financial resources, not easily accessible health services and greater isolation issues.

Most available scientific publication on the current Covid-19 pandemic focus on health and medical research (Fu et al., 2020; Wilson & Jack, 2020). A big share of the public debate is focusing on urban densely populated settlements, their mobility issues and the future of urban public space. Not many scholars focus on the effects, challenges and potential opportunities for rural areas caused by the crisis.

According to previous studies (Setti *et al.*, 2020; Xiao et al, 2020), the Covid-19 pandemic has a faster spread and harder impact in terms of death rate in densely populated areas with higher concentration of PM10 and PM2.5. Yet, density is most likely just one of several key factors that determine how vulnerable places are to the virus. Across the world, Covid-19 has taken root and strongly affected areas with diverse geographic, climatic and demographic conditions. Megacities like New York and London experience a strong impact due to large flows of visitors and tourists, diverse global populations, and dense residential areas. Also, the pandemic has been particularly serious in predominantly industrial areas like Wuhan, Detroit, and Northern Italy, that are strictly connected through supply chains and trade exchange (Florida, 2020). Rural areas have been less impacted so far, but controversies were raised in several countries (i.e Asquith, 2020) because of people that wanted to move to second houses to escape from most hit cities and regions and to enjoy calmer and more natural areas (i.e Hart, 2020) Indeed, partial social restrictions or total lockdown experienced in some countries could have reverted citizens' priorities. Landscape enjoyment, local safe food production and delivery, possibility of social distancing, and spread accessible open public areas, that were not much valued before, have been increasingly acknowledged by people living in small apartments in densely populated cities (Venter et al., 2020). At the same time, several experts around the world are calling for a 'rural renaissance', where rural areas would assume a central role in developing sustainable and resilient communities.

As acknowledged in the recently published Communication from the Commission on the EU budget powering the recovery plan for Europe '*rural areas will have a vital role to play in delivering the green transition and meeting Europe's ambitious climate and environmental targets'* (European Commission, 2020). To reach this objective, the Commission is proposing to reinforce the budget for the European Agricultural Fund for Rural Development by 15 billion euros. The overlying idea is to support farmers and rural areas in making the structural changes necessary to implement the European Green Deal (European Commission, 2019), and in particular to support the achievement of the ambitious targets in the new biodiversity (European Commission, 2020b) and "Farm to Fork" strategies (European Commission, 2019) . Nevertheless, still recognizing the core role of agriculture and farmers into rural society, we believe that rural territories and communities embed resources and local heritage that go much beyond this. Deconstructing the images of rural areas as mere crops for food production to build a narrative of rural communities and territories to build a new one, to be conceived as vibrant poles of development based on local heritage, natural resources, creativity and social inclusion, could be crucial to truly regenerate rural areas and rapidly support their transition towards a sustainable future.

Indeed, RURITAGE perceive heritage in its wider sense including natural and cultural heritage, beyond tangible monuments and artefacts, recognising intangible forms of traditions, social practices, and knowledge as the values that tie communities together and as a resource for sustainable local development. The whole paradigm

for regenerating rural communities lies on the identification of six powerful drivers that boos regeneration in rural communities all around the world. These six drivers identified in the project are the so-called RURITAGE Systemic Innovation Areas (SIAs), namely Pilgrimage, Local Food Production, Art and festival, Landscape Management, Migration and Resilience.

Fig. 1 RURITAGE paradigm for heritage-led rural regeneration: the six Systemic Innovation Areas

With the aim of gathering and exchanging rural experiences to support each other during the Covid-19 pandemic, RURITAGE has launched a call for actions of knowledge, skills, ideas, and resources of social resilience across the world (RURITAGE, 2020b). So far 62 initiatives of rural responses during Covid-19 have been submitted from all over the globe, although mainly cantered around Europe. The call has received initiatives within each RURITAGE SIA, creating a collection to aid and inspire other rural communities. The collection is found as an open resource on the RURITAGE website, where the actions are published gradually under the section Rural Resilience Actions (RURITAGE, 2020a).

Starting from the analysis of those practices, this paper attempts at giving some examples of how rural areas can cope with emergencies through the enhancement of their local, natural and cultural heritage, and it also aims at building the basis to rethink the current crisis as a crucial tipping point for a lasting resilient development of rural territories. In this moment, when an overall coordination at EU level on how to respond to the crisis in rural areas is missing, RURITAGE would like to propose a new strategic agenda, valuing local cultural and natural heritage to transform rural areas into long-lasting sustainable laboratories. This does not refer to rural areas as potential safe place for short period holidays or safe shelters in times of crisis but rather include a strategic and long-term vision for regenerating rural territories through community-built strategies for sustainable development and inclusive repopulation. To this aim, the second section builds upon the 6 RURITAGE SIAs, underlying current challenges and potential opportunities within the Covid-19 scenario, including the role of relevant stakeholders and targets. The third section briefly discusses the results and presents the main conclusions of the paper, developing the basis to set a strategic agenda for rural sustainable development in the future.

2. Covid-19 effects in RURITAGE Systemic Innovation Areas: challenges and opportunities

2.1 Pilgrimage

The tourism sector directly contributes to 4.4% of GDP, 6.9% of employment and 21.5% of service exports in OECD countries, on average, and continued growth provides real prospects for sustainable and inclusive development (OECD, 2020b). Prior to the Covid-19 outbreak, the travel and tourism sectors were expected to make up 10% of global Gross Domestic Product (GDP) in Europe (European Commission, 2020d). Pilgrimage,

holy and hiking routes are currently valuable options of sustainable and slow tourism in Europe and all over the world (Balestrieri & Congiu, 2017; Nolan & Nolan, 1992). Within RURITAGE, the cases of Camino de Santiago (Spain) and Via Mariae (Romania) demonstrate how rediscovering local cultural and natural heritage along pilgrimage and hiking routes poses great opportunities for less explored areas to gain recognition and boost local economy.

As easily understood, the tourism and travel sectors have been particularly hit hard by the crisis. The European Union's tourism industry is estimated to lose around one billion euros in revenue per month because of the outbreak (European Commission, 2020d). The Travel & Tourism sector faces a staggering 100 million jobs losses due to the coronavirus pandemic, according to the World Travel & Tourism Council. The impact on the travel and tourism ecosystem particularly hit the small and medium enterprises sectors.

This crisis is creating huge challenges also to the pilgrimage and hiking routes because of travel restrictions on the one side, and also due to the intrinsic cross-border nature of some religious pilgrimage route and events, such as the Hajj in Islam and Santiago de Compostela in Catholicism that draw millions of pilgrims every year. Ensuring health and safety of local populations and of pilgrims in such emergencies could be quite challenging (Escher, 2020) while small hotels, business working in the food and beverage sectors could struggle in adapting to the current safety measures imposed by local governments. On the other hand, most of the less known pilgrimage and hiking routes – that could better face the issue of managing lower numbers of tourists - dispose of limited financial resources, that could be further reduced because of the current crisis. At the same time, if properly planned and managed, pilgrimage and hiking routes can be considered amongst the safest tourism destinations in the current Covid-19 crisis, thanks to the intrinsic nature of such activities that can easily adapt to the current imposed social distancing rules and that naturally take place in open-air natural environment, thus facilitating their adaptation to the current challenge.

It is therefore crucial to raise a great coordination among all involved and interested stakeholders, from regional to local authorities to local businesses involved in the activities – mainly hotels, restaurants and other accommodations structures – to guarantee the adoption of appropriate measures for safe destination, keeping small local and family-run businesses alive. Big opportunities are raising both for internationally recognized pilgrimage and hiking routes, that could redirect their targets towards family and domestic tourists, and also for smaller and less known places that can claim for the re-discovering of local cultural and natural heritage, involving rural communities into long-lasting regeneration process. Also, pilgrimage and hiking could take this chance to connect to other nature-related activities – i.e. open-air sports, fishing, etc. – that will support market diversification increasing the potential number of visitors of the area. In some cases, i.e. KATLA Geopark in Iceland, they are taking the chance of this moment, when there is no visitors entering the country - to improve and re-develop part of the pilgrimage related infrastructures also temporarily employing people that lost their jobs due to the crisis. Finally, current limitations to big mass events and crowded hotspots, are calling for a spread tourist offer during the upcoming seasons that could be boosted and sustainably maintained through time by involving and engaging with the creative sectors' local stakeholders and organizing small events along the pilgrimage and hiking routes, such as small concert, open air movies, theatre representations. All this will be possible only thanks to a strong and coordinated responses by the whole pilgrimage and hiking routes, able to involve the whole stakeholder chain. In this sense interesting results could also shortly come from the survey designed by the Cultural Routes Programme of the council of Europe (Council of Europe, 2020).

2.2 Local Food

Sustainable food and drinks production and local gastronomy embody agricultural practices, rural landscape, local history and traditions, and symbolizes the cultural heritage of a territory. Food serves as a strong

connection between nature and human society bringing together land, heritage and the people. As in the case of RURITAGE Role Models, the Coffee Landscape of Colombia and the local Agro-food production in Puglia, local food production is a diverse and dynamic channel for sharing stories, forming relationships, create development and building communities. While food production is mostly located in rural areas, population is increasingly living in densely populated urban areas (Seto et al., 2017) far away from places where the food is actually produced. In the last decades, the global food trade changed the eating habits of consumers which moved from local and retail markets to supermarkets and discount stores. Moreover, the significant change in lifestyle, the increase in working hours, and the decreasing availability of time to cook, led to triumph of supermarkets, fast food services and discount store (Cappelli & Cini, 2020). On the other side, a huge movement in slow food production and consumption, healthy lifestyle and zero kilometres philosophy is rising. The current Covid-19 emergency re-opened the discussion on food security in Europe which seemed to be distant memories due to shortage in agricultural workers (Hobbs, 2020; News European Parliament, 2020) and issues in food transportation and global logistic (Gray, 2020). There is a well-known issue concerning the lack of agricultural workers that has resulted in unharvested and unsold stock. Food producers and farmers are currently greatly challenged to find temporary workers due to travel restrictions. However, there are recognised ethical challenges of temporary labour for agriculture where workers are often treated differently than inhabitants (Chung, 2019). Instead of temporary labour, there are opportunities to enable formal engagement for workers.

On the top of this, a report coming from the UK (Loopstra, 2020) described how the Covid-19 lockdown not only exacerbated food insecurity among those who regularly struggle, but also created new economic vulnerabilities due to loss of work and income, or even because people are self-isolating and unable to get the food they need. This situation created several private solidarity actions, where businesses, public sectors and the civil society have teamed up together to provide services to the local communities. In Izmir, Turkey, the municipality has stepped into support at the same time local food producers and vulnerable people and families. They developed food-aid packages containing locally produced food that are funded by private donations either online or directly in stores. The municipality delivers packages directly to vulnerable groups and economically disadvantaged families. In this way, less benefited members of society are supported as well as the local entrepreneurs and farmers. Also, in areas where initiatives have not been directly coordinated by authorities, local food producers and farmers are forced to rethink and adapt their businesses. Across rural Europe, many initiatives for distributing food directly from the producers to the customers' homes are taking place. The initial aim has often been to maintain an active production in order to adapt to current challenges. But at the same time, by receiving deliveries to the door, inhabitants are less exposed to risk. This is both a way to ensure the health of vulnerable inhabitants but also an action to strengthen local production and entrepreneurs. For elderly and vulnerable groups this action can be a potential lifesaver. The action of food delivery has taken different shapes depending on where it has been initiated and the kind of local entrepreneurs, producers, and farmers. Most businesses have made their usual products possible to order via their homepages or directly by phone. In other areas, initiatives have arisen from networks of local farmers, through the support of social networks, where customers can place an order via Facebook pages, while in others there was a top-down approach achieved in cooperation with regional authorities. Another model has been to list local producers on the municipality website where the inhabitants can easily reach and buy local food/products directly from the manufacturer.

Both in urban and rural areas the crisis sped up and supported the development of new business models based on sustainable door-to-door food delivery. It is now crucial to work on the sustainability of these new business models as these logistic innovations towards online commerce of food can arguably be an excellent opportunity to reach and maintain new customers for local food producers. In rural areas, there is a need of further

developing local capacity and skills towards digital tools for advertisement, logistic and e-products. Local authorities and relevant stakeholders – small farmers and local producer associations - could build upon this new trend to boost the capacity of local farmers through on online training and educational tools as well as interactive webinars to spread knowledge.

In the medium-long term, this change of perspective could increase awareness of food independence in communities and it can also contribute to develop a greater trust-building between local farmers and inhabitants. Also, through the crisis, there is a high potential of reinforcing the role of local producers and farmers and to boost the recognition of local communities' bond with their territories. The reinforcement of such relations could enhance the local microeconomy also in non-crisis situations, since it allows to increase local employment and improve people's quality of life (Cappelli & Cini, 2020), contributing to the regeneration of rural territories. The crisis has highlighted the importance of the rural world as the food producer for the sustainability of life and the deep relations between the urban and rural worlds. Rural areas should not lose this opportunity but start to work on this further in relation with the closest peri-urban and urban areas, building and reinforcing existing Short and Slow Food Ecosystems of relevant producers, consumers and other stakeholders.

2.3 Migration

Beyond the challenges presented by the migration crisis, migrant arrivals in rural contexts serves as a great opportunity for rural regeneration (Green et al., 2009; Greve Harbo, Lisbeth; Ström Hildestrand, Åsa; Heleniak, Timothy; Sigurjónsdóttir, 2017). Indeed, despite the challenges posed, rural areas can take advantage of the opportunities provided by an influx of migrants as a source of new vitality to restore declining villages. In areas suffering from population decline and closing services, the arrival of migrants can create new opportunities for growth.

This is the case of Lesvos UNESCO Global Geopark (GR), that has developed integration and information programs for newly arrived as well as citizens on local cultural and natural heritage and of PIAM Onlus (IT), that works on migrant's hospitality and inclusion in Asti province, also rediscovering the autochthonous varieties of ancient wheat as local food and heritage as a way for boosting migrants' integration (Conticelli et al., 2019) through the connection with local food, territory and traditions. They have demonstrated that it is possible to boost and accelerate the process of integration and regeneration by means of (i) integrating migrants within the local agro-food chain and the creative industries, (ii) restoring old and unused buildings to give hospitality to the migrants, (iii) offering training to migrants and residents related with organic farming, arts, built heritage restoration, traditional crafts and trades, etc. (iv) facilitating the connection with residents with defined food- (ethnic cuisine) and art-related activities (traditional dance, music performance), (v) offering internships for migrants in local businesses, farms, tourism related activities, (vi) developing integration and information programmes for migrants and citizens, (vii) offering educational programmes and guided tours, specifically tailored for migrants to make them aware of the cultural and natural heritage of the territory.

The Covid-19 pandemic has posed new challenges to the areas hosting migrants and refugees, because of the need to stop many integration activities (i.e. language courses, work on the field) due to total or partial lockdown measures, thus in some cases exacerbating already existing problems. Many government services have been suspended because of the ongoing coronavirus pandemic. To help approximately 220,000 migrants in Germany resume their lessons, the Federal Office for Migration and Refugees has invested about 40 millions of euros to continue the courses in a digital format and currently, nearly 83,000 immigrants are participating in digital integration and language courses (Bathke, 2020). As social distancing rules and guidelines have been implemented across Europe, authorities and migrant associations have expressed concerns about the living

conditions of some of the most vulnerable members of society. In Italy, migrants living in reception centres have written an open letter to authorities expressing their concerns about living in close, confined spaces and officials have voiced concerns about the conditions of asylum seeker camps on the Greek islands (European Commission, 2020c). On the other hand, the imposed sanitation measures forced all reception centres to adopt adequate sanitation, including the ones that did not have acceptable quality levels before the emergency. In this sense, the pandemic could boost the finding of a permanent solution to overcrowded asylum camps and low living conditions.

One crucial part of the response to the Covid-19 pandemic is to make sure that all members of society have the information they need to stay healthy and follow quarantine guideline (World Health Organisation (WHO), 2020b). To ensure that migrants are not overlooked in the response, civil society organisations have been busy translating and communicating vital information to their communities. Authorities have also made an effort to communicate critical information in multiple languages (European Commission, 2020c). Moreover, support measures to improve communication and counter xenophobia have been activated in many areas in order to provide accurate and timely evidence-based information, aiming at dispelling fears and misperceptions among host populations regarding refugees or migrants and the Covid-19 outbreak (World Health Organisation (WHO), 2020a).

Because of the pandemic, countries have tightened their borders and restricted the entry of most foreign nationalities. This has strongly affected some economic sectors, and mainly the agricultural one that strongly relies on seasonal migrant farm workers. Covid-19 has also posed controversial challenges to migrant domestic workers. For some, workload has increased, and free Sundays have been denied as the whole family is staying at home and is demanding more constant assistance. Others have been let go by employers confined at home, refusing contact with outsiders (Jordan and Dickerson, 2020; IOM-CREST, 2020).

In some countries, like for instance in Canada, temporary migrant workers were among those permitted entry; they have been deemed essential workers due to the central role they play in supporting Canadian farmers and the food supply (Hastie, 2020). In Italy, to find a solution to the urgent need for farm workers, PIAM Onlus has promoted and agreement with farmers organizations, through which refugees are employed in the agriculture sector under the supervision of the managers of reception centres. These procedures involve regular working agreements, therefore counteracting illegal exploitative activities (a phenomenon that is known as "caporalato" in Italy).

The pandemic has thus emphasized that migrant workers (farm workers, but also workers in health sector and migrant caregivers, etc.), are essential to the local economy due to their expertise and skills. As highlighted by the Communication from the Commission "Guidelines concerning the exercise of the free movement of workers during Covid-19 outbreak" (European Commission, 2020a) it is necessary that those workers are treated in the same manner as the workers that exercise critical occupations referred to above. Beyond allowing such workers to continue crossing the borders, it also needed to guarantee that the employers provide them for adequate health and safety protection. Identifying and disseminating good practices, strengthening dialogue and coordination between recruiters and employers, and stimulating business action in global supply chains to effectively protect migrant worker health, well-being and rights, could definitely enhance the commitment and capacity of employers and labour recruiters to protect migrant workers, including seasonal workers, not only during the pandemic but also after the end of the emergency, and thus could help in addressing improving the future integration of migrants in local communities.

2.4 Art&Festival

Cultural and creative sectors tend to be considered less accessible for rural communities. By enabling participants of all ages and abilities to take part in artistic activities, RURITAGE intends to use culture, art and

festival as a mean to further increase territories' attractivity, creativity and to eventually revitalize local communities. Accordingly, RURITAGE clearly aspires to make the arts more accessible to rural communities to experience, participate, and work in.

The cultural and creative industries is one of the sectors most heavily affected by the Covid-19, with performances and concerts cancelled, and theatres, museums, and cinemas that have been closed. As in urban areas, cultural life and social exchange in rural areas is halted. SMEs are largely affected by the Covid-19; in Italy, for example, approximately a third of SMEs in the creative sector will suffer from a 15% decline (OECD, 2020a). According to a preliminary estimation by Eurostat, the Covid-19 crisis might affect about 7.3 million cultural jobs across the EU. Over 30% of the affected workers are self-employed and lack adequate social protection (EU Science Hub, 2020). On the 27 March 2020 the Culture and Education Committee Chair, Sabine Verheyen, stated that the cultural and creative sectors across Europe have been disrupted by the impact of stringent public health measures. Verheyen claimed that cultural and creative businesses are among those struggling the most and in most need of financial support. Under the Coronavirus Response Investment Initiative, European Member States will be able to use Structural Funds money to support small businesses and employment schemes. Verheyen asserted that businesses and individuals in the cultural and creative sector should receive access to this financial support (European Parliament, 2020). As there is no common strategy on EU level yet, most EU countries have developed own approaches. For instance, Italy has set an emergency fund addressed to performing arts, cinema and audio-visual media and has removed taxes for cultural sites. At the same time, in Denmark, there is a funding coverage of 75% of cultural work salaries (EUNIC Global, 2020). Rural access to creativity and culture has not been explicitly mentioned in any of such initiatives.

Although culture has already been accessible online for many years, the globally occurring lockdown made virtual access the only way to approach culture. Many significant cultural institutes have moved partly online as a way to boost and enrich reality. The biggest European museums designed online tours allowing visitors to see parts of the collections, while smaller venues are following. Culture in rural areas has not been at the centre of this debate. Nevertheless, in rural areas, libraries have made their collections available online where some have even provided videos of librarians reading out loud directly to children. The same applies for rural-based festivals, where some will instead manifest themselves virtually (Rowen, 2020). However, digital tools are not only used by grander organizations but also by smaller art groups, study circles or networks which continue meeting virtually while performing and executing their art. An example of this is a smaller study circle on the island Gotland, Sweden, where seniors paint together virtually on a weekly basis. By encouraging societal groups to sustain their usual practices but in a new format can help to maintain a sense of community in rural areas.

The effect of abandoning tangible experiences for the benefits of online participation should also be noted. Although digitalization is generally conceived as an opportunity, increasing accessibility and connectivity, it has its limitations. By bringing culture online there is a risk of creating something excluding, in particular in rural areas where there is a lower access to internet connection. There is also a lower usability among an older population, who often constitute a noticeable part of rural inhabitants. In this case, accessibility may turn into unapproachability, depending on technological access and skills. In regard of this, it is suggested that the online activities are mainly complimentary means (Kużelewska & Tomaszuk, 2020)The urge for tangible art experiences and social exchange can be stressed as a result of post-isolation and social distancing. The fear of disease transmission can also pose for more vulnerable groups both physical and psychological problems that go beyond government regulations and that could lead to exacerbate vulnerability and exclusion.

At the same time, there may be an emergence of other type of events and gatherings. The easiest solutions approached by several local authorities is to create a spread offer of open- air events with smaller audiences

and closer contact. However, the questions on how limited audiences would affect the ticket prices and the affordability for locals should be raised. The demand for arts will perhaps increase and offer more frequent opportunities for artists to perform and for locals to take part in performances. For example, interactive transformational festivals can be sustainable opportunity for people of all ages explore, participate and work within (Rowen, 2020). By developing more flexible "menus" of art and festivals for communities, adapting to local needs, conditions and practices, a more sustainable rural cultural exploration may emerge.
The state of emergency at local level has forced to redirect resources towards the health care systems, in order to respond to the most urgent needs, leaving little room to the cultural sector, in lack of an EU strategy. The crisis can arguably have caused a fear of widening social inequality while revealed the crucial role of culture for cohesion and mental wellbeing. However, the current restrictions can be viewed as an opportunity to strengthen the rural arts and festival scene from within. Reinforcement of the local scene can possibly enhance the local sense of recognition and further on interest in heritage and history. The restrictions may even allow local artists to gain greater appreciation and therethrough, lead to a regeneration of the local art scene and provide a catalyst for creative grassroots projects where the outcome might be a social meeting place for locals which creates a sense of belonging and pride within the rural communities.

2.5 Resilience

RURITAGE explores the concept of resilience as driver of regeneration, turning challenges in learning and development opportunities, by enhancing the role of cultural and natural heritage for building resilience against the threats of climate change, natural disasters and social and economic crisis, simultaneously boosting economic growth, creating jobs and livelihoods, strengthening access to health and education, and contributing to foster the responsible ownership of cultural and natural heritage in rural areas. Within RURITAGE, Psiloritis UNESCO Global Geopark (GR) and KATLA UNESCO Global Geopark (IS) are good examples of how responsible ownership of cultural and natural heritage in rural areas can turn a challenge as a natural disaster into an opportunity for revitalizing the rural territory basing on participative projects, on resilience training for the community and on traditional storytelling as a mean to understand the environment, foster awareness on the relation among landscape, hazards and man's interventions. The Covid-19 crisis has highlighted that new crises of unforeseeable nature are likely to emerge, as the combination of environmental degradation, societies with increasing inequalities and deep economic interconnections have made the world more vulnerable, thus underlining the need to approach societal resilience from a 360-degrees system approach (Giovannini et al., 2020).The Covid-19 shock is so extreme in its duration and intensity that it is simply impossible to address it through absorptive capacities or a simple adaptation of the system. Therefore, it should become an opportunity to progress and "bounce forward" through adaptation and transformation (Giovannini et al., 2020).
The lack of fast internet connection, already considered a crucial hamper in the development of rural territories, could be one of the main barriers to allow smooth and fast communication, creating trouble in distance learning for pupils and smart-working for adults and contribute to make rural inhabitants even more isolated during the lock-down measures. Also, people in rural areas are suffering of more severe mobility issues, due to social distances and private cars' use restrictions. Reaching rural areas in the time of crisis was and still is much more difficult than it was before. At the same time, social distancing, the lack of adequate open public green areas and the possibility of smart-working or working from home could drive people living in densely populated settlements to look for moving to more natural environments. In most cases, rural areas have proved to be safe shelters compared to urban agglomerations: a lower rate of infection and better daily living conditions during confinement. This perception could lead to big opportunities for repopulating ageing rural areas, and to make rural areas attractive poles of development. Some rural areas are already thinking about developing co-working space with fast internet connection to host digital and nomad workers in their territories. This

process represents a huge opportunity but could also lead to an unplanned gentrification issue. Indeed, urban smart workers tend to have much higher income than rural inhabitants and could speed up a rural gentrification process. To avoid such unwanted consequences, this process should be carefully planned and managed by local administration. Improve services and infrastructures – both for mobility and internet connections - for rural inhabitants is crucial to create long-lasting communities of people that decide to stay, live and work in rural territories.

Moreover, the need to face a completely new scenario lead to invent new ways to contribute to health, training and education of the population, thus empowering the human capital, i.e. through improved the skills and abilities of people to develop and enhance their resources. Covid-19 emergency showed, even more clearly than before, that to boost digital skills in the local community is a real priority.

The main challenges that both urban and rural areas are currently facing is the need to recover activities after the pandemic in safe conditions and to give children the possibility to attend educational and social activities while schools are closed. With reference to the former, business and local activities had to face both a great loss of revenue, for which financial support by the governments is needed, and the adoption of measures to guarantee safety conditions and the respect of social distancing among workers and users that are not always clear and that make it difficult to understand what needs to be done. Moreover, to implement the safety measures, costs are needed that small businesses are not able to sustain and for this reason they prefer to remain closed. On the other hand, new economic activities linked to the crisis have born and could become permanent. In Ireland, for instance, a collect-and-deliver service offer services from pharmacies and local shops for passengers, delivering critical medical supplies for the elderly, the vulnerable, and the sick within rural areas. Finally, after a long period of "home-schooling" and social distancing, new measures are needed to give children the chance to safely attend educational and social activities.

To turn the COVI-19 crisis into a new opportunity or revitalization for total areas, opening up new possibilities of counterbalancing depopulation and ageing characterizing many rural areas, policy measures are needed able to provide better infrastructures (physical and technological) for guaranteeing the physical and technological accessibility to the areas. Strengthening digitalization, training, sustainability combined with a stronger local financial capital, represents strategic measures to support people and local community.

2.6 Landscape management

RURITAGE not only intends landscape as cultural or protected landscape, but more as rural territories with multi-level governance, and heritage-based planning and management strategies. The cases of the Wild Atlantic Way (IE), the Duero-Douro cultural landscape (ES,PT) and the Austrått and Ørland, manorial landscape (NO) well represent example of diverse integrated landscape management and governance models that boosted regional development through their natural and cultural heritage. Even though rural areas may have been less hardly hit by the pandemic, the current Covid-19 crisis is presenting huge challenges to regions that are trying to boost rural regeneration through dedicated networks, funds and agreed strategies and visions. At the same time there is a shared fear that funds dedicated to rural development and environmental protection may be reduced in the following years and reallocated to more urgent public sectors (i.e health, education, etc.), even though European Union is working on increasing the European Agricultural Fund for rural development. This would of course further exacerbate existing unemployment and issues, forcing even more rural inhabitant to move to urban areas.

Also, the values of the natural and cultural capitals of rural territory have not been altered, and this offers good opportunity to offer safe and beautiful tourist and work destination. The reduction of tourists has given a respite to those areas that received more visitors, favouring their ecological recovery.

In this sense, regional and local authorities a have a great occasion to increase the value of their natural capital integrating ecosystem and their services into decision making process and local policies. In line with the EU Green New Deal (European Commission, 2019), local authorities and stakeholders could use this moment to focus on shaping a more sustainable future rethinking how '*to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts'.* Also, as mentioned in the recently released EU Biodiversity Strategy for 2030 (European Commission, 2020b) '*the recent Covid- 19 pandemic makes the need to protect and restore nature all the more urgent. The pandemic is raising awareness of the links between our own health and the health of ecosystems'*. Investing in green infrastructure, wellness corridor, and slow mobility infrastructure can on the one side improve and restore natural ecosystem, but at the same time creating options for sustainable tourism.

Regional governments, tourism agencies, cluster of innovators in heritage and landscape management have a great opportunity to rethink tourism in a more sustainable way and to work on the peculiar characteristics on their areas. Indeed, rural territories have now the possibility to develop their distinctive characteristics, building on their natural and cultural heritage resources and enhancing human capitals.

Cultural and nature-based tourism is increasingly growing in the last decade and it is very likely that it will keep growing after the Covid-19 pandemic. Working on an integrated management of the landscape and heritage could support regions and rural territories to find their local distinctiveness and identity, building their own local brand for regeneration. There is arguably a great opportunity to create or reinforced existing networks to build a community response around a common purpose.

3. Discussion and Conclusion

At the moment, not much scholars have focus on the effects, challenges and potential opportunities for rural areas caused by Covid-19 crisis. Fragmented responses in rural areas are starting to raise around EU and beyond through reinforced networks, better collaboration, cooperation and solidarity for strengthened resilience.

Partial social restrictions or total lockdown experienced in some countries could have reverted citizens' priorities leaving space for 'rural renaissance', where rural areas would assume a central role in developing sustainable and resilient communities. Social distancing, the lack of adequate open public green areas and the possibility of smart working could persuade urban inhabitants to move to more natural environment. This cannot be seen as a spontaneous process, since it requires local authorities to improve basic infrastructures and services, but also properly plan future development of the areas, to repopulate ageing and uninhabited rural areas avoiding unplanned gentrification issues. Also, the tremendously fast digital transition we are living should not leave anybody behind and should be carefully planned in rural areas, allowing people to get the basic digital literacy to access information and activities available online. At the same time, sustainable nature-based recreation, landscape enjoyment and pilgrimage and hiking activities, could boost the development of a new form of slow, sustainable and proximity tourism enhancing the value of local cultural and natural heritage and human capital.

The pandemic has emphasized that migrants and refugees are essential resources for the local communities due to their expertise and skills, and that their social inclusion would be a great achievement for rural communities. Actions for enhancing the commitment and capacity of employers and labour recruiters to protect migrant workers, could help in addressing improving the future integration of migrants in local communities.

Last, rediscovering local food production and demanding a short and slow food chain could not just improve the quality and the health of the food we eat, but also contribute to reduce greenhouse gas emissions related with the food industry, nurturing at the same time local farmers and rural microeconomy and.

The Covid-19 crisis has caused a fear of widening social inequalities while revealing the crucial role of natural and cultural heritage for social cohesion, rural regeneration, and mental wellbeing. Competent authorities on

rural territories should build on this momentum to develop comprehensive heritage-led regeneration plans based on local heritage and resources. Building equitable, sustainable and inclusive rural communities will require to work on reinforcing human capital, through capacity building and awareness-raising activities, and social and cultural capitals, taking back arts to rural and working on the recognition of local heritage by local communities. Also, local authorities should urgently act to maintain and enhance natural capital, through a better integration of ecosystem and their services into decision making process, and to further develop built capitals, working on essential infrastructure for mobility and fast internet connection. It is urgent to give shape to a network that will improve not only the response to crises but also the competitiveness of rural territory.
In line with this, the EU Commission is proposing to reinforce the budget for the European Agricultural Fund for Rural Development. These investments could sustain and enhance local food production and the recognition of natural capital as a crucial characterizing element of rural areas. Nevertheless, there is a strong need for further integrated framework of policies and investments able to sustain such a complex environment of natural, cultural, human, social and built capitals, as intrinsic and inalienable resources of rural communities. Such a coordinated response could support the renaissance of rural areas as vibrant poles of development based on local heritage, natural resources, creativity and social inclusion as essential baseline to regenerate rural areas and rapidly support their transition towards sustainable future.

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Shaping space for ever-changing mobility. Covid-19 lesson learned from Milan and its region

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Abstract

In the Milan experience, Covid-19 emergency crucial issues were already hidden weaknesses of the city and its region: the limited capacity of transit transport, roads and public spaces, with crowding problems for both work and leisure. The challenge is to regenerate the competitive "human measure" of Milan, based on its unique relationship between public spaces and mobility, overcoming its health risk. The report raises a question on the established transit-oriented development approach, focusing on spaces "in between" and not only on nodes and networks. The traditional "invariants" welcome changes: the spatial structure of the public realm becomes a platform for ever-changing mobility and services, providing quality of life for communities, users and tourists. With this respect, streets represent by far the most strategic asset of the urban public realm. They can be reshaped in resilient infrastructure capable to respond to new forms of mobility based on a renewed Mobility-as-A-Service paradigm, as final result of different travel behaviors of the post pandemic scenario, among which an expected reduction of the overall "mobility consumption" (space) and new temporal urban rhythms (time). To this end, short-term and responsive planning becomes a crucial opportunity to enable rapidly deployed responses, through an extensive use of new analytical tools based on Open and Big data analytics and computer-based simulations.

Keywords

Mobility; Resilient infrastructure; Public space; Data analytics.

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1. A Perspective Shift: From Nodes to Textures

1.1 Milan identity at risk

Milan and its region have been deeply touched by Coronavirus, not only for the number of hospitalizations and deaths; its competing identity feature itself has been put in crisis: a world class hub for high quality meetings, providing exchanges of inspiring ideas, experiencing a vibrant social and cultural life, mixing business and leisure. The lockdown killed this priority asset. Its icon, the Milano Design Week, was cancelled. The world famous out of venue ("Fuori Salone"), regenerating historical nucleus as well as trendy peripheral neighborhoods[1], in synergy with regional manufacture districts[2], is waiting for better times to come, investing in maintaining its competitiveness in the wood/home/textile/fashion chains and the whole system.

In recent years, Milan became an ever more appealing city to live and work and an imposing global touristic destination, booming after the Milan Expo 2015 and looking forward to the 2026 Winter Olympics[3].

A polycentric settlement structure, with dense historic cores and open landscapes, in a fine-grained multicenter urban region of great variety and biodiversity, a comprehensive functional system with human-scale dimensions (city diameter: 15 km; urban region diameter: 40 km). The success of its "human dimension" is based on its relationship between collective spaces and mobility, both at city and regional level; collective spaces deep on culture and vibrant for social life, connected by accessible public transport facilities.

This vibrant density now implies unsustainable health risks. In addition to this indisputable issue related to a lifestyle based on physical proximity, the Milan system was well performing up till now but at the limit of its capacity; transit transport, roads and public spaces show crowding problems (Fig. 1), both at city and regional scale, for work as well as for leisure/sport mobility[4]. Not only trains and subways but also urban parks (such as Parco Sempione) as well as regional outdoor destinations (e.g. the lakes) were congested and still are, despite the social distancing regulations, as one could see from the Navigli waterfronts as soon as they were re-opened. The hidden weakness of the city and its region is now crystal clear in the midst of the emergency, and of course limited capacity of mobility infrastructures are also combined with environmental issues: traffic pollution, risks of floods related to land consumption and climate change, as the Seveso river flooding of May '15 made clear, invading important roads and neighborhoods[5].

The challenge is to regenerate this unique competitive "human dimension", the physical proximity of Milan and its region, overcoming the health risk. Milan is very "little" indeed[6]; the city is well served by subways and public transport, connecting peripheral neighborhoods with the historic center, which was already conceived as pedestrian/bikeway oriented (Area C, 30 km zones); 55% of city mobility is by subway[7]. Within the region, mobility is mostly by car but 50% of commuters are coming to the city by train[8], after reaching the closest local train station or a major subway interchange parking by car. These two crucial percentages are now downsized to 1/3 due to restriction on transit capacity, in order to overcome health risks, by ensuring physical distance between users[9]. How can this system not crash? What could the short term and "new normal" scenarios be?

1 Such as Lambrate and North of Loreto (NoLo), emerging urban creative districts.
2 See for example "Brianza Experience" in the wood manufacture district as well as the initiatives by the Museum of Modern Art of Gallarate, in the Simplon textile district.
3 Milan welcomed almost 11 million of visitors in 2019 (source: City of Milan Statistics).
4 Works are in progress for subway extensions; also, a renewal of the Regional Railway Service is programmed; the "Milano 2030" City Plan foresees the transformation of the railway ring into a Circle Line to support peripheral regeneration areas.
5 The land consumption (urbanized land) is 14,3% of the Lombardy territory (source: Regione Lombardia, 2018).
6 The City of Milan is only 182 km2 wide.
7 Source: City of Milan Statistics 2019.
8 Source: City of Milan Statistics 2019.
9 Estimate shared by media on the base of governmental restrictions for the re-open phase, May 2020.

Fig.1 People invading roads during last edition of the Design Week (via Tortona).

1.2 Scenario Inputs

The unsustainable scenario is that the 2/3 of mobility no longer supported by subway/trains will shift to private cars. Fortunately other variables could come into play to cut down the mobility demand and avoid its peaks, as indicated by scenarios under discussion right now in the political agenda at all levels: smart working[10]; differentiation of times and calendars for public offices, facilities and also for the private sector; e-commerce, home delivery and remote service-provision. Moreover, alternative mobility ways could be promoted, allowing individual mobility with less pollution and infrastructure space occupancy (e-bike/e-motorbike, personal or shared, e-car sharing, soft/eco last mile logistics); already urban trends, their extension to the whole urban region could be supported. New regulations could allow a hybrid ever-changing use of the infrastructure space. The tactical urbanism proposed by the resiliency plan "Milano 2020"[11] is going into this perspective, where flexibility in time and uses is leading the experiments. Commuters mobility will increase the percentage of individual vehicles, but smart working and individual vehicle sharing could be promoted also at regional scale; most of all, the major interchanges could be focused not only on the shift vehicle/subway but also on vehicle/soft mobility: new temporary bike lanes are "colored" on roads above the subway lines, in order to welcome alternative mobility on the same axes connecting peripheral interchange gateways with the metropolitan core center in about less than 20 minutes. Temporary solutions could prepare the transition towards a new normal settlement model.

1.3 A resiliency regeneration model

The fundamental question is which is the vision beyond these scenario inputs. The current crisis could offer the opportunity to learn from the Milano lesson and lean towards a new resiliency model integrating

10 See ULI Urban Land Institute Italy, Young Leader webinar May 21st, 2020.
11 City of Milan, May 2020.

development and mobility, a new vision of the connection between settlement and infrastructures and more specifically between mobility and collective open spaces.

A question is now open on Transit Oriented Development, so far undisputed model of sustainability, which promotes concentration in transportation nodes in parallel with land saving. At the moment, concentration is perceived as a high-risk health factor: at least it requires a new smart management in real time (as suggested for example by the Singapore case). As a consequence of a deeper critical look demanded by unexpected changes, the focus has been shifted from "networks & nodes" towards "spaces in between" which came out as resiliency resource.

A broader concept of regeneration as re-interpretation of the figure-ground approach: regeneration not only of dismissed sites and yards around major nodes of infrastructure networks (the figure) but also of their background (the ground), id est the meshes of infrastructure networks, the spaces in between the infrastructure grid: a rediscovery of the complementarities between filled and empty spaces which shape the texture of the territory. The focus on the resiliency approach will no longer be on abandoned areas around railway stations, potentially high density new poles (both urban and regional) but on the textures themselves, low-medium density textures, urban and regional consolidated textures: intelligent landscapes[12].

1.4 The rediscovery of low/medium density districts

The experience of health risks related to dense, concentrated settlements is leading to a rediscovery of the low-medium density contexts: territories bypassed by High Speed railway corridors, "slow" territories, often with great historic and natural landscapes, could offer alternative healthy lifestyles, supported by broadband connections, smart working opportunities, home care and e-commerce services, enjoying outdoor private spaces and larger indoor spaces, thanks to a low-budget real estate market. Back to the "provinces", contexts with entrepreneurial culture and availability of spaces to be reused for new start-ups, hopefully encouraged by de-bureaucracy policies. Back to the countryside, sometimes already family home places, integrating proximity and care of elderly parents, otherwise a new choice of inspiring landscapes for creative people or open-air living opportunities for young couples with children. Regeneration of historic villages is on stage in the public debate just after the Covid-19 emergency, especially for Central Italy or for mountains contexts[13].

For the Milano urban region[14], this shift of perspective leads to realize the resilience potential of its historic production districts (Fig. 2).

In the Northern dry plains, manufacture districts of small medium enterprises have shown resilience facing digital and globalization challenges since the 70s; today they are ready to re-convert their production process for emergency needs, almost in real time. As an example, in the Simplon manufacture district (N/W of the metropolitan core) textile industries are now producing health masks, and mechanical industries are manufacturing machineries for hospitals. Dangerous effects of delocalizing strategic production abroad are now clear; these districts are ready to promote and welcome a reshoring of essential manufacture chains. Their mixed-use feature, integrating home and factory, living and working spaces, their fine-grained flexible texture with multitask outdoor courtyards, offer a resiliency settlement model for contemporary emergency times. In the Southern wet plains, agricultural districts have shaped the territorial pattern for centuries, the rural landscapes; historical nucleus ("cascine") regeneration potential could be boosted by new smart working trends, offering a healthy lifestyle integrated with agricultural environment.

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12 References could be rooted in the Colin Rowe school (the conference *ROWE ROME 2015: The Best of Both Worlds - Regenerating the Light City*) as well as in a contemporary visionary landscape planning (Vegara, 2016)

13 See Stefano Boeri's call for regeneration of ancient Italian villages ("borghi"), interview on *La Repubblica*, April 21st, 2020.

14 Population density: Milano City 7.588 inhabitants/km2; Lombardy average 422; more density in the Northern urban region than in the South: e.g. Provincia di Varese 743, Como 468 but Mantova 176, Cremona 202 (source Istat 2019).

Fig. 2 The resilient hybrid texture of manufacture districts (Brianza).

The food production, with its organic and "zero-km" added value and new HT cold chain techniques and logistics, is also re-organizing these territories as food districts.

The Lombardy health chain (manufacture HT production and research hospitals) will soon launch its new Human Technopole, currently under construction in the former Expo site (Milano Innovation District MIND). It is spread across in the whole urban region and it demonstrated its vitality with the first experimentation and protocol on plasma at San Matteo hospital in Pavia, and the innovation of the saliva test for coronavirus at the Insubria University of Varese and Busto Arsizio labs. The "provincia" is evidently vibrant.

The Milano region districts are resilient because they have always been hybrid: they perform flexibility (time, space layout, change of uses), plan evolving variety (uses, typologies, morphologies) and their ecosystem has evolving biodiversity; and now they are becoming more and more "smart", not only thanks to the HT integration with the clustering program supported by Regione Lombardia, but also by becoming the preferred location for intermediate hot-spots for smart working, in between wide-spread remote working and the company headquarters. Experiments are already ongoing, for instance by banks such as Intesasanpaolo, which located company co-working spaces in the major district poles of Lombardy, such as Gallarate or Saronno, intermediate cities of the polycentric Milano region structure.

More specifically, Milano manufacture districts, once described as land-consuming "infinite city"[15], now reveal resiliency resources which could be developed also in a contemporary regeneration approach, seizing the opportunity of the new dedicated regional law (L.R. 18/2019). This law, launched last November as completion of the previous regional law on land consumption (LR 31/14)[16], promoting the synergy "regeneration & land saving", could now be re-interpreted to reboot manufacture districts, providing incentives for reuse of dismissed industries and reconversion of the existing ones, promoting their competitiveness by making treasure of the proximity to logistic hubs and developing new opportunities related to the opening of the Gothard/Ceneri tunnel (foreseen by end 2020). Regeneration & health through resiliency, a more complex and site-specific planning paradigm than just land-saving, according to new priorities in the public goals arena.

[15] This term to indicate the Milan urban region was introduced by the sociologist Aldo Bonomi in his book *La città infinita*, published in 2004 by Bruno Mondadori, Milan, Italy.

[16] L.R .31/14 and 2018 Variant of the Lombardia Regional Plan.

There is also a change of perspective at city level, from the CityPlan "Milan 2030" approved last fall to the recent "Milan 2020" Resiliency Plan: strategies such as tactic urbanism or temporary uses proposed for tackling climate change and flooding risks, aging population and social inclusion, are now refocusing on the health emergency and post-Covid-19 economic restart, for quick temporary interventions during the current re-opening phase and for management of the upcoming year of coexistence with the virus (2020-2021).

1.5 Transit & roads: towards a resilient balance

The district model teaches us the resiliency of open systems, flexible and self-organizing, not only for their hybrid mix but also for their mobility model, which is individual, as in all low-medium density settlements: individual mobility has to be re-conceived as a resiliency resource and not just as an obsolete unsustainable mobility way to shift as much as possible towards the transit mode. The mobility pervasiveness of regional textures, low-medium density contexts, provide a sanitary presidium. Alternative itineraries have a safety potential. Under the perspective of the Coronavirus emergency, individual mobility is sustainable indeed. The challenge is how to design this pervasive individual mobility in eco-friendly and energy-savings terms[17]. It is an open research field, and a very urgent one.

A multiple scale approach is crucial, holding in a comprehensive vision the pervasivity of regional/urban textures together with mobility options for commuters and for inhabitants/users inside the urban cores. Not just from a sectorial point of view (transportation and mobility plans, all levels, including bike regional plans) but from a comprehensive master planning point of view: the overall perspective of the settlement system, integrating its morphology with the mobility model. A sight which recognizes equal dignity both to roads and railways, at all scales. An integrated vision of roads and transit systems with a goal of modal mix more than a modal shift strategy: mix vs shift for a resiliency performance of the whole settlement. It is a matter both of structure and management of the model.

Trans-European infrastructure corridors crossing at Milan, especially the Gothard one which will be upgraded by December 2020 with the opening of the new transalpine base tunnel, are calling for urgent decisions about their management and their integration into regional infrastructure networks. An orientation towards a High Capacity instead of a High Speed model will promote the hybrid use of the lines, both for passengers and goods, allowing more flexibility in management and resiliency of the system, in order to be able to face emergency and short-term commuter issues (both towards Lugano and Milano). Priority will be given to the integration of the corridor with the regional railway system (regional and suburban lines) and not to the fastest connection between metropolitan cores (Milano-Zurich) as alternative to the air lines at continental scale.

In order to promote the open structure of the system, alternative hybrid corridors (both railway and roads) should be promoted, even secondary ones, as well as missing links: feasible small scale interventions but strategic for increasing the flexibility and so the resiliency of the whole network, providing alternatives, emergency by-passages, temporary passages.

Milan transalpine infrastructures are already offering a multi-branch structure, with the Simplon axis, not only the Gothard one; a third one, a minor corridor could be promoted, the Bernina one, connecting Milan to Zurich through touristic landscapes of lakes and mountains: it was recently proposed as Sport Corridor for the Winter Olympics of Milan 2026[18]. All these three corridors, with their complementarities and synergies, could support the regeneration of low-medium density landscapes, resilience landscapes. Strategic will be the completion of the Pedemontana transversal axis, linking Malpensa and Orio al Serio airports and serving as a spine of the manufacture districts.

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17 See for example the integration strategy of train stations and bike paths in the Franciacorta Regional Plan, 2017.

18 Fossa, G. & Guenther, F. (2020, in press). The Sport Corridor, *Urbanistica*.

The issue of resiliency corridors is internationally shared: similar infrastructure hybrid corridors, integrating a settlement system of intermediate cities, are now under discussion in competitive macro-areas abroad, such as New York-Boston[19].

Therefore, under the pressure of the virus crisis, a revision of the Transit Oriented Development approach in a resiliency perspective is emerging, given that a certain level of concentration in selected locations could not be avoided for environmental reasons.

Research for innovation is already concerning not only railway and smart logistics but also driverless vehicles and electrical highways, smart roads. All these research streams will be convened towards individual eco-mobility, both regional and urban, safety commuting and last mile logistics, facing the e-commerce boom.

1.6 Infrastructure spaces as living smart landscapes

The virus teaches us that space is a resiliency resource. Resiliency requires resource spaces available on textures inside infrastructure patterns but also on the infrastructure space itself: resiliency spaces are those in between settlements, blocks, buildings: open spaces as flexible landscapes, whichever function is currently hosted there. From an urban design method, we discover materials for resiliency plans (figure-ground[20]) (Fig. 3).

A new concept of infrastructures as space resource, resilient, open to hybrid and temporary uses, to smart flexible changes: infrastructures as living landscapes, a spatial shape which has changeable structures and sections, ready to assume different space configurations and to welcome different uses and users, from mobility to restaurants, active and passive uses: a place with a hybrid identity (Fig. 4).

Infrastructures pervade tissues; the metaphor is no longer the backbone but the respiratory and circulatory system: roads and railways are conceived as space occupancy, lanes and tracks together with their safeguard bands, rivers with flooding strips, power lines, gas pipelines, cables, are all considered as land strips; climate change risks are integrated in this space resilient to health risks.

From connections between network nodes to axes of a spatial structure which will be source of the regeneration of the living landscape. The mesh innerves the territory making it resilient, able to absorb and redistribute flow changes in typology and consistency, shading capacities, integrating services, redesigning the mobility space also as an identity place.

Innovative projects already experimented the use of safeguard land strips along infrastructures, a reserve in case of need of extra lanes/tracks, for hosting greenways in the meantime. Famous best practices redesign still active infrastructures as spines of the open space system (Madrid M30 eco-boulevard, Hudson River Park, Boston waterfront): railway and highway corridors, waterfront axes (canals, rivers, lakes, seashores). Historic references are Robert Moses (integration of green and infrastructure system) and Frederick Law Olmstead who conceived greenways and parks as a regional system integrating health goals.

Fertile is the proposal of the green river[21] on the Milan circle line which opens up the yard regeneration to the urban/regional system of greenways and parks, linking nodes to textures.

Today's priority indeed is not only the regeneration of urban portions, abandoned areas around transit nodes (brownfields, yards, urban voids, etc.), but the regeneration of the whole mesh of public open spaces/public realm (streets, squares, parks, greenways, bike and pedestrian paths, infrastructure strips and rings), exploring specifically a new resilient role for streets for both mobility and urban space (a place to stay).

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19 See Yaro, R. Reboot New England, project proposal in progress, PennDesign, Philadelphia, 2020 and RPA Regional Plan Association NY Annual Assembly May 27th, 2020.

20 See Graves, 2009 and Hurtt et al., 2019.

21 Stefano Boeri Architects, Milano, 2017.

Fig. 3 A "figure-ground" interpretation of the Milan historic texture ("Milano 1840" by Charles P. Graves).

So far, the pedestrianization has been a must for major urban projects transforming strategic dismissed areas, as well as for city centers and historic nucleus. But now a new walkability demand is emerging, in order to integrate in a shared space a slow mobility mix: a hybrid and resilient walkability. As a quick answer to the virus pressure on mobility, this new walkability paradigm should be extended to the whole consolidated city in the metropolitan core and to the urban textures of the district cores. Today a resilient approach with temporary solutions focused on space textures is mandatory, considering the health situation, which is now leading the regeneration demand, with emergency and new-normal phasing. The traditional invariant becomes resilient: the spatial structure of the public realm becomes a platform for ever-changing mobility, services, and quality of life. A new vision integrating mobility and services and outdoor living for communities, users and tourists. A new challenge integrating place making, street design and transportation programming, towards a comprehensive resilient design approach, for intelligent living landscapes.

2. Resilient Infrastructure for Pedestrian Mobility and Walkability

The rising demand for transport services and infrastructure linked to urbanization (United Nations, 2014) requires institutional setups to effectively design and plan future cities to achieve environment-related goals at local and national levels, and ultimately to improve quality of life (Vandecasteele et al., 2019). Encouraging the shift towards sustainable mobility strategies based on public transport and active modes of travel (i.e. Sustainable Urban Mobility Plan) is one of the main challenges of European cities (Buhrmann et al., 2019), since they are increasingly facing problems of traffic congestion, road safety, energy dependency and air pollution.

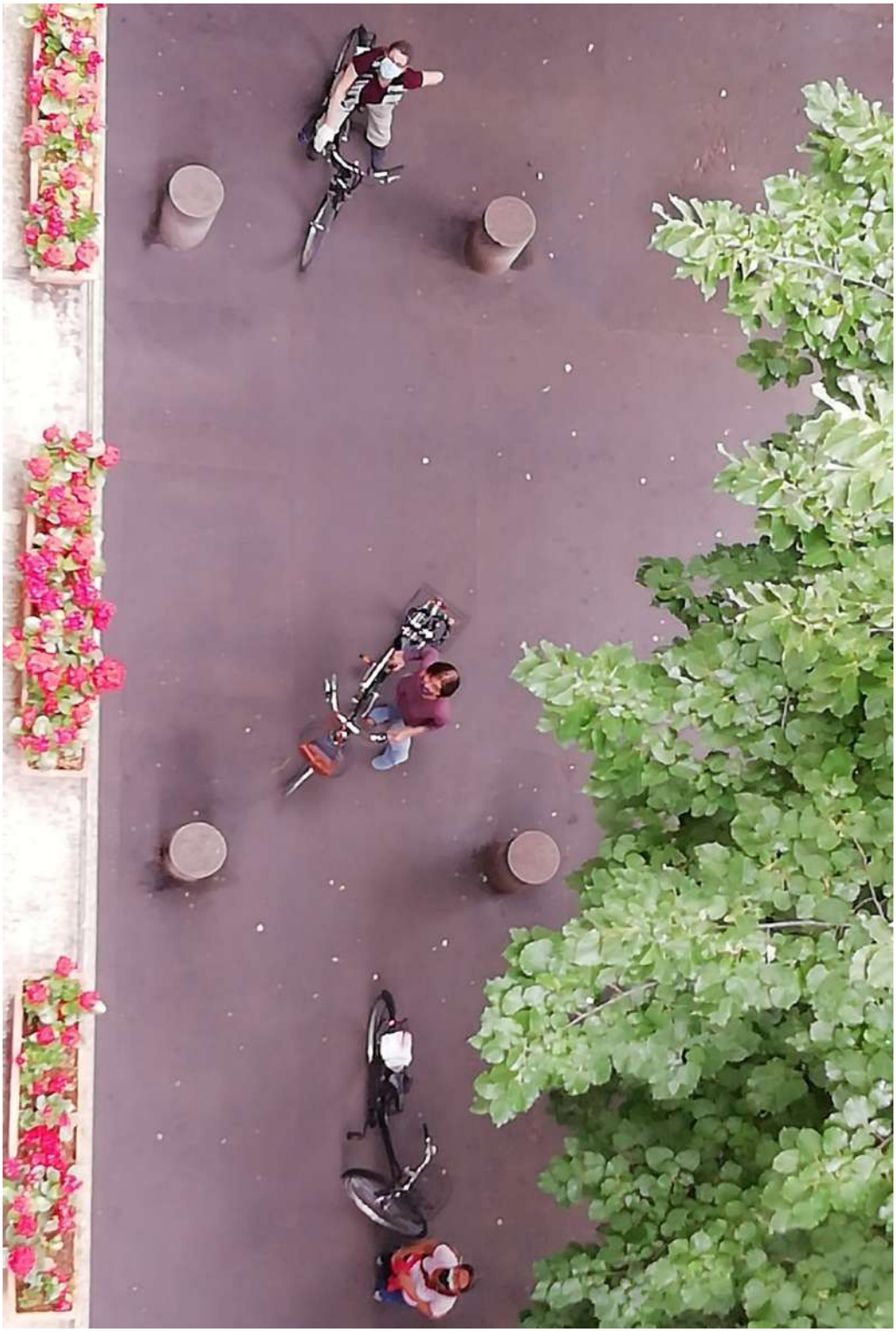

Fig. 4 Bikers in Foro Bonaparte at the first day of the re-open phase.

Facing this trend, advanced urban planning activities are shifting towards a focus on walkability, with regard to the development of strategies and design elements which enhance the accessibility, comfort and safety of the urban setting for walking, considering also the needs of vulnerable road users (e.g. pedestrianization of urban areas, barrier-free streets, public spaces for outdoor activities). According to the General Theory of Walkability (Speck, 2013), the essential elements for evaluating the level of walkability of urban environments (Gorrini & Bertini, 2018) comprise the following: (i) presence of services within a walkable distance; (ii) level

of comfort and safety experienced by pedestrians; (iii) attractiveness of the urban areas in terms of architectural design and social context.

As highlighted by the 2030 Agenda for Sustainable Development Goals (SDGs) adopted by the United Nations in 2016, there are several targets directly linked with making walking a primary travel mode, beyond a first - and-last-mile solution to connect to public transport, most notably SDG 11.2-Sustainable Transport for All, SDG 3.6-Reduced road deaths and SDG 3.9-Reduced exposure to air pollution. Nevertheless, walkability has a recognized social impact considering that more accessible, inclusive and livable public spaces (including streets) attract more people in the community (e.g. elderly, people with reduced mobility, women, children), allowing them to maintain social and civic contribution to community life.

Walking is in fact recognized today as a catalyst, a fundamental driver of sustainable urban development as part of a wider planning approach which entrusts the role of leading actor to active mobility, as an intrinsic dimension to the quality of life experienced in cities. Walking is by far the oldest, most accessible, democratic, reliable and sustainable form of mobility and its pivotal role is given by definition being the mode of transport which links all other types of movements: any journey in fact begins or ends by walking.

Walking ensures direct access to any urban opportunity and accessibility constitutes, in fact, the basic principle, the qualifying and transversal element with respect to all other urban disciplines: if in the past distance represented the element capable to shape the physical structure of cities, today is time, the fourth dimension, by its intangible nature, which transforms their functional form and guarantees the correct use of urban functions beyond efficiency and speed.

And such use, which in turn ensures social participation, is possible thanks to the system of public spaces, - primarily streets, squares and parks - which represents the most strategic asset of the urban built environment, the most long standing elements of the urban fabric, that remains over time and shapes the city.

This articulated multi-functional system, that constitutes the matrix of relationships and the vital frame of urban development, may include a large array of diversified assets: ecological corridors, shared and walkable streets, pedestrian areas, green infrastructure, etc. In particular, the public space shaped by streets is the essential infrastructure of equality, creating spontaneous interaction, diversity and vibrancy.

It is this in-between space that brings people together and acts as a human catalyst by putting social interaction at the heart of urban life.

Furthermore, streets are called to deal with patterns and variables that are not all predictable to date and, in this sense, they must act as flexible and resilient infrastructural elements, capable of accommodating new forms of transport and adapt to future mobility trends.

As a result of digitalization and based on the Mobility-as-a-Service paradigm, the flexible space provided by streets is fundamental to ensure the correct use of new transport opportunities and innovative mobility solutions, to include micro-mobility devices, on-demand transit services, e-healing and ride sharing schemes and driverless technology.

For instance, new ways of managing and designing the curb space are emerging as response to a growing competition in cities for curb access due to the rise of ride services and the renewed models of city logistics as far as urban goods delivery is concerned. Once again, time can be considered the key variable to allow for a wider use of the same space, by envisaging a dynamic curb able to ensure flexibility and an effective coexistence of movements and uses.

Despite the possibility to accommodate new forms of mobility, the resilience and flexible use of the public space has become a more urgent necessity as a result of the Covid-19 pandemic, which will definitely generate a new mobility morphology due to different travel behaviors of the post pandemic scenario, among which an expected reduction of the overall "mobility consumption" (space) as well as new temporal urban rhythms (time). This crisis opens opportunities for decades to come, to reshape and redesign our cities.

The idea that safe, generous and accessible common space is fundamental to public life. We need a greater amount of public space, more capacious, more articulated, more polysemic and multifunctional; a hybrid space, made up of several components, flexible for different uses.

Experiments and concrete interventions are being launched all over the world. Actions that redefine the relationship among different mobility systems, coming to imagine new ways to distribute the space on the road and also to radically rethink the uses of urban spaces.

From the point of view of urban planning, this is a topic that is both critical and exciting at the same time: a decisive redefinition of limits and spaces is not always possible and not everywhere, although certainly this moment of rethinking represents a great opportunity to give new priorities and imagine more virtuous initiatives and new balances.

Given the critical situation due to the Covid-19 pandemic, the European Commission (2020) has recently provided guidelines for short-term urban mobility and transport planning interventions. Among the principles included in the document, the section 'Active Mobility' has a specific focus on walkability: "*Many European cities are taking steps to make active mobility (e.g. walking and cycling) a safe and more attractive mobility option during the Covid-19 outbreak. Urban areas could consider temporary enlargements of pavements and increased space on the road for active mobility options to facilitate the needs of the population to move in a safe and efficient way, while reducing speed limits of vehicles in increased active mobility areas*" (European Commission, 2020, p.15).

In this regard, the activities of urban transport planners and decision makers are projected ahead towards investigating sustainable future mobility solutions taking into account the need to effectively plan the city in order to ensure public health, but also to enhance social, environmental and economic resilience.

Taking into account the urgency of the current situation, the Open Streets plan of the Municipality of Milan[22] (2020) provides an initial framework for promoting pedestrian mobility in order to reduce risk of contagion associated with high contact and crowding in mass transit facilities, but also to reduce the use of private transport modes.

This includes short-term interventions on road network and public transport infrastructures (i.e. temporary enlargement of sidewalk infrastructures, social distances and queue management in transit infrastructure), to guarantee the possibility to access public transport, services, retails and goods within a comfortable walkable distance from home.

In just a few short months nation-wide lockdown and post-lockdown phases have drastically changed citizens' behaviors and mobility patterns related to the cities, neighborhoods and streets in which they live. Moreover, it is nonetheless necessary to investigate the unprecedented changes and long-term effects of disruption on urban mobility. In this framework, Urban Informatics (Foth et al., 2011) provides innovative walkability assessment tools and metrics for supporting the activity of mobility and transport planners in an efficient and effective manner, within an evidenced-based approach. Thanks to the recent development of advanced Information and Communication Technologies (ICTs) and the increasing availability of digitally widespread data sources, Big and Open Data is becoming a valuable support to the activity of decision makers by unveiling hidden mobility patterns in the cities and specific target users' needs (Batty, 2013).

The proposed multi-disciplinary methodology is based on the integration of the different knowledge and skills ranging from computer science, urban planning, traffic engineering and environmental psychology (Fig. 5).

This is aimed at investigating innovative tools and metrics for assessing the level of walkability in urban areas (with a focus on the City of Milan as a case study), considering the impact on Covid-19 pandemic on pedestrians' safety (i.e. risk of being exposed to contagion due to social density).

[22] Available at: https://bit.ly/3bD1AAH

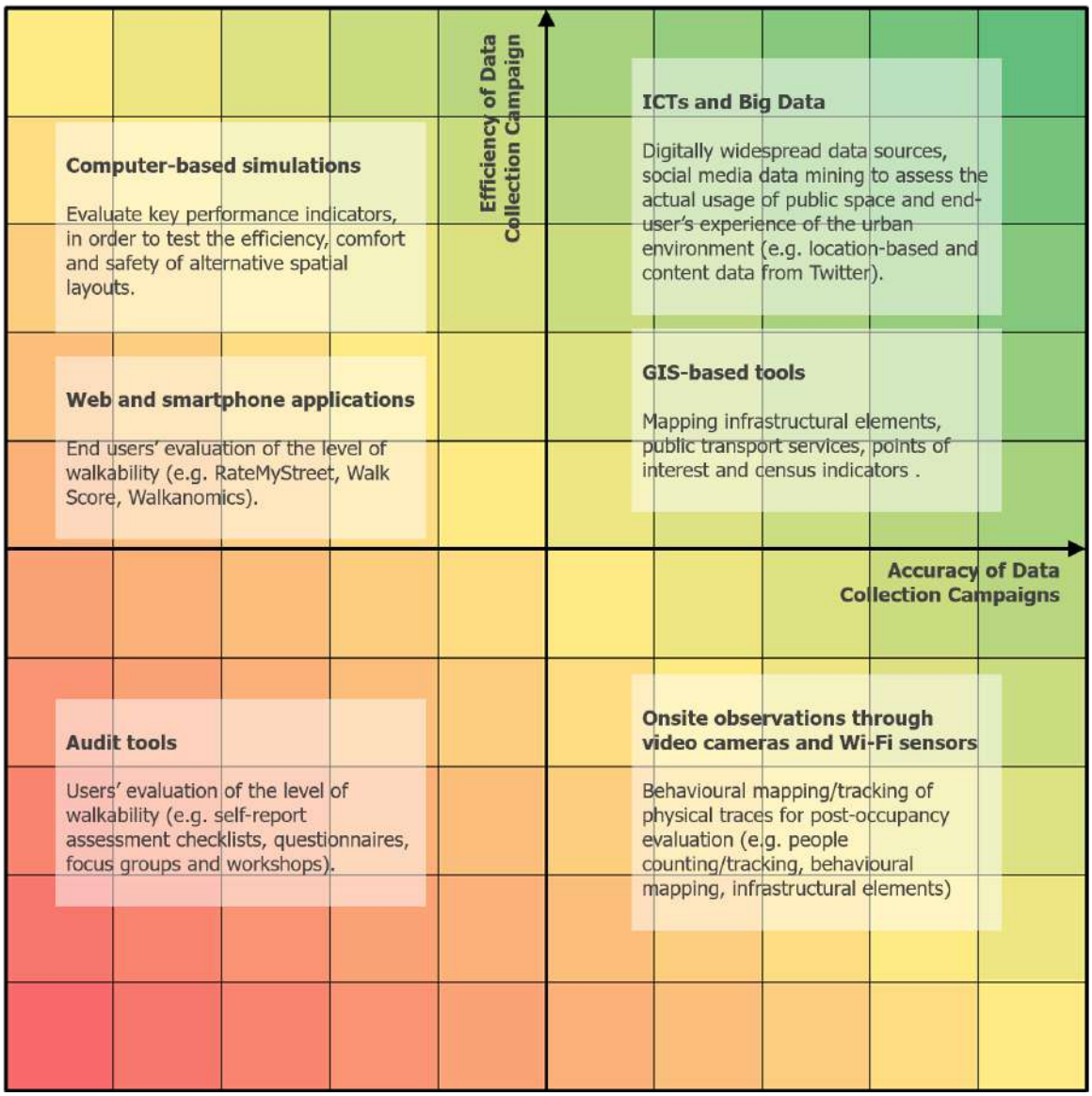

Fig. 5 The proposed multi-disciplinary approach for assessing the level of walkability in urban areas.

This is based on: (i) cartographic analysis of the Milan sidewalks network, to identify the areas which foremost need the implementation of short-term solutions to accommodate pedestrian flows in compliance with the recommended social distancing of one meter (Section 2.1); (ii) computer-based simulations of pedestrian dynamics to test the effectiveness of alternative conditions and courses of action in a predictive and explanatory scheme (Section 2.2).

2.1 GIS-based Interactive Sidewalks Map of the City of Milan

Geographic Information Systems (GIS) allow to analyze large samples of geo-referred structured datasets for assessing the level of walkability of cities, neighborhoods and streets, focusing for example on public service density, land use mix, road infrastructure connectivity, point of interests and census data about the socio-demographic characteristics of the inhabitants (Blecic et al., 2015; Oliveri et al., 2015).

The proposed work took up this challenge by applying GIS-based technology to produce an interactive cartographic analysis of the City of Milan (Fig. 6), based on geo-referenced open datasets regarding the

infrastructural characteristics of the sidewalks network[23]. Starting from the recommended interpersonal distance of 1 meter for contagion containment, the analysis considered the space occupied by each person (0.6 m + 0.2 m of comfort zone) and applied 1 meter spacing assuming different sidewalk sections. In this way, it was possible to define intervals to evaluate the level of suitability of sidewalks based on their width.

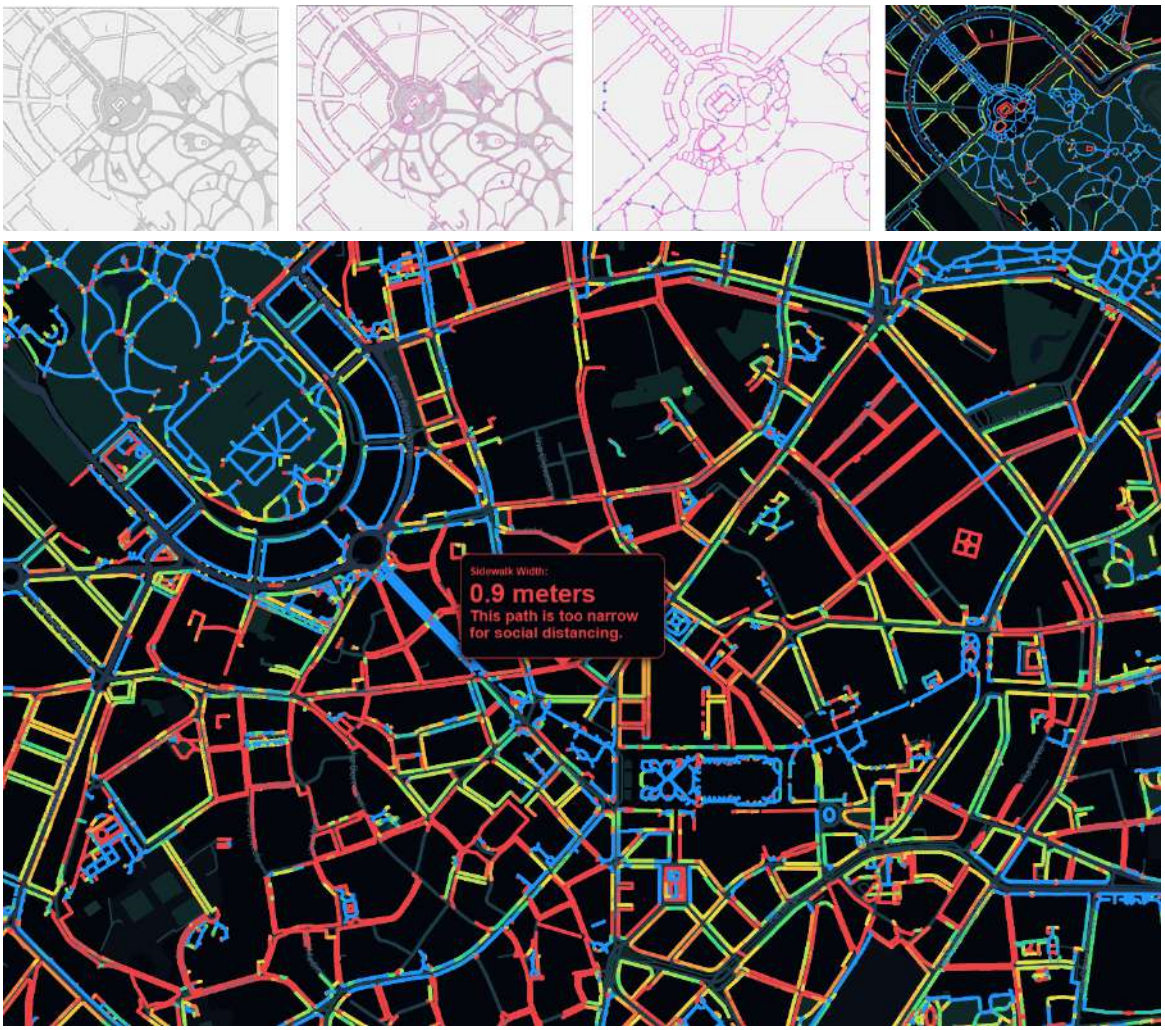

Fig. 6 A screenshot from the interactive map showing sidewalks widths in Milan and highlighting the critical areas where physical distancing cannot be respected: very difficult (less than 2.4 m), highlighted in red; somehow doable (between 2.4 and 3.3m), in yellow; doable (between 3.3 and 4.2 m), in green; easy (more than 4.2 m), in blue.

The map was built starting from the polygons of the pavements available as open source on the Geoportal of the Municipality of Milan[24]. Starting from these polygons, the center line of each single sidewalk was obtained and the distance from the edge of the roadway and the buildings was calculated. The results obtained therefore showed the width of each sidewalks, before deducing street furniture elements (e.g. streetlamps, benches, etc.). Data have then simplified and cleaned up to make them usable more comfortably by removing all segments shorter than 20 cm, considered not essential for visualization or analytical purposes. Once the new database was created, an interactive map was developed and published[25].

The preliminary results showed that more than 40% of Milan sidewalk area is not adequate to allow the necessary social distancing measures against Covid-19 pandemic crisis. Is therefore required, in line with the

23 Available at: https://issuu.com/systematica/docs/milan-sidewalks-map
24 Available at: https://geoportale.comune.milano.it/open-data/
25 Available at: https://research.systematica.net/prj/milan/sidewalks.html

principles and objectives of the Open Streets plan of the Municipality of Milan[26] (2020), a capillary series of interventions to retrofit our sidewalks and grant adequate comfort and safety levels for pedestrians.
Future works will be aimed at further analyzing this sidewalks' database alongside other information regarding road hierarchy, vehicular traffic, public transport accessibility levels, socio-demographic information. This will allow the mapping tool to be essential for cities in decision-making process as a means to facilitate the identification of intervention clusters, define priority areas and design adaptation measures most effectively.

2.2 Calibration of Computer-based Models for Pedestrian Dynamics Simulation

Computer-based systems for the simulation of pedestrian dynamics provide optimized solutions for supporting the activity of transport planners and decision makers in the design of transport infrastructures. This is based on the possibility to evaluate key performance indicators (e.g. travel time, density condition, waiting time), to test the efficiency, comfort and safety of alternative spatial layouts and traffic management conditions (i.e. *what-if scenarios*) in a predictive and explanatory scheme.
In this framework, the current work aimed at applying simulation models to investigate the effects of disruption related to Covid-19 pandemic crisis on pedestrian mobility. In particular, we applied a descriptive set of metrics and parameters for representing the impact of social distancing into the Social Force Model of the pedestrian simulation platform PTV Viswalk (Kretz et al., 2018).
We focused on calibrating the dynamic regulation of interpersonal distances among pedestrians (i.e. *social isotropic parameters related to repulsive force*), to avoid conditions of inappropriate proximity and spatial restriction due to high density situations.
The proposed calibration phase allowed to compare simulation results between the Social Force Model and the proposed Social Distancing Model (Fig. 7). This was based on the execution of a simulation campaign focused on pedestrian counter flow situation in a corridor-like scenario (3-meter width, representing the average width of sidewalks in urban areas), characterized by Level of Service B (corresponding to irregular flow in condition low-medium density).

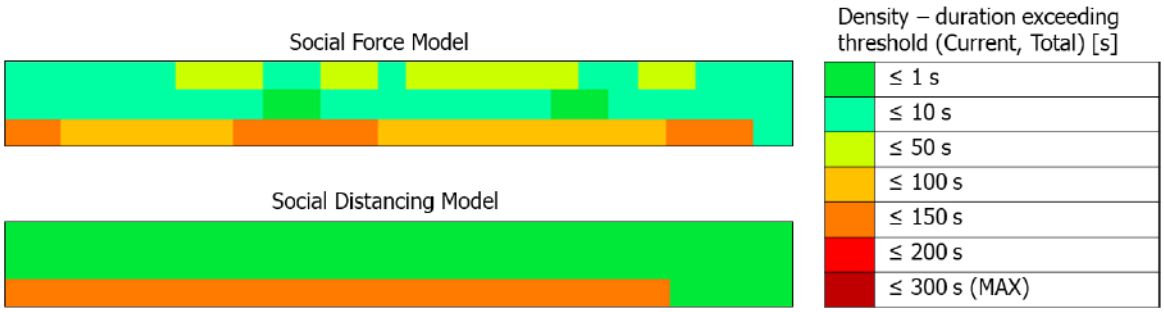

Fig. 7 Simulation results achieved through the Social Force Model and the proposed Social Distancing Model.

The proposed discretization of the simulated environment (each cell is of 1×1 meter, that is the recommended space for guaranteeing social distancing in dynamic situations) allowed to calculate the level of density in the simulated scenario, identifying those cell occupied by more than one agent for each second of the simulation (300 seconds in total). Results showed that pedestrian circulation dynamics driven by social distancing are more often characterized by continuous detouring maneuvers and speed adjustments, causing temporary/local situations of high density and queueing due to the limited capability of the infrastructure to accommodate pedestrian flows. The proposed approach represents an innovative contribution for the estimation of the impact of social distancing on pedestrian dynamics, comparing the traditional approaches devoted to the mere

[26] Available at: https://bit.ly/3bD1AAH

estimation of flow rate (Highway Capacity Manual, 2010) and Level of Service (Fruin, 1971). This is linked to the possibility to evaluate the need to provide short-term urban mobility and transport planning interventions (e.g. temporary enlargement of sidewalk infrastructures, queue management in transit infrastructure), within an-evidence based approach.

Future works will be focused on: (i) variable density conditions and complex spatial layouts; (ii) introducing the notion of shared space among group members (e.g. family, friends); (iii) video-recorded observations of behavioral patterns related to social distancing; (iv) evaluating the plausibility of the model against the so called fundamental diagram (Seyfried et al., 2005), in which the relationship between the variation on the pedestrian flow with respect to the increasing of the level of density is represented.

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Author Contributions

Although this paper should be considered a result of the common work of the authors, G. Fossa took primary responsibility for the Section 1; D. Deponte and A. Gorrini for the Section 2.

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From social distancing to virtual connections

How the surge of remote working could remold shared spaces

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Abstract

Covid-19 will have significant impacts on the world, changing many aspects of our lives, including urban life and work routines. Challenges arising from the spread of the coronavirus are likely to push the digital infrastructure of cities, accelerating the transition towards the smart city. Additionally, we may see a permanent shift towards remote work arrangements, notably telecommuting and smart working. In the aftermath of the pandemic, the affirmation of such a scenario requires us to reflect on the challenges of an interconnected society produced by Information and Communication Technologies (ICTs). Taking remote working as an illustrative example, the paper offers a critical reflection on how ICTs can influence our perceptions of places and argues that places play a key role in influencing the patterns of remote workers' identity construction. The authors caution about the dark side of digital connectivity, pointing at the risks that a prolonged detachment from reality and the loss of places can put on remote workers' identity. In order to overcome potential tensions, remote workers should avoid too much connectivity continuously balancing identity performance in both physical and virtual workplaces. Implications for both organizational and urban design are provided.

Keywords

Coronavirus; Remote working; Smart city, Workplaces, Identity.

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1. Introduction

The diffusion of SARS-CoV-2, better known as coronavirus, is bringing forth a global emergency whose implications escape general understanding. What can be assumed based on reasonable evidence is that it will disrupt social conventions by the increasing distance between individuals and by revolutionizing our approach to the city. On March 11th, 2020, due to the growing spread of the infection, the World Health Organization (WHO) declared the outbreak a global pandemic.

In order to protect the safety of their population, the governments of the countries affected by the coronavirus put into place several restrictive rules that enforced, first and foremost, "social distancing." On an urban level, such restrictions had the effect of a "neutron bomb," whose explosion left the buildings intact and damaged only life forms. The city squares became "desert," human mobility was forbidden and opportunities for relationships between individuals dramatically dropped down.

During this quasi-suspension of time, technology has come to aid by enabling us to take advantage of "tele-proximity" (Virilio, 1998) and apply it to all traditional relational routines such as attending classes or working in offices. Therefore, the emergency has put on the foreground the need to supply our metropolises with increasingly efficient telematic networks for them to be equipped to face the challenges of an era marked by unpredictable risks[1]. There is no denying that, currently, some of the major sources of planetary apprehension are population growth and the increase of migration to the cities.

In a global context of overcrowding – as the population is nearly seven billion people (McNeill & Engelke, 2017) - more than half the world's population lives in urban environments, where a more intense existence is ensured and yet the price to pay is that of high energy consumption. Considering that the urban population increases by the size of "London per month," one can understand how our metropolises are becoming the real catalysts of the globe (Ratti & Claudel, 2017). Nevertheless, these cities are affected by an "eco-catastrophe," generated by the laws of an economic growth that is incapable to set self-imposed rules. According to Alberto Magnaghi (2010), this growth disrupts the specific structure of the "territory;" territory intended as the imperturbable work of intertwining between nature and human culture. Perhaps, it is no coincidence that the coronavirus (a perfect catastrophe for global civilization) originated in China, a country where, in the last thirty years, the phenomenon of urbanization has brought to the cities five hundred million new citizens (Ratti & Claudel, 2017). Urbanization and related consequences (including a substantial dissipation of resources and the growing emissions of carbon dioxide) are likely to produce on the planetary ecosystem effects comparable to those of a meteor collision. This is the prediction of two Anglo-Saxon scholars, Simon Lewis and Mark Maslin (2019), and, according to them, this scenario is not entirely unavoidable.

Following the theory of adaptive systems, within a broader analysis of the *Anthropocene*, the two academics came to this conclusion: the surge of digital connectivity, technological progress, and the availability of renewable energy could lead our species to establish new forms of coexistence. In a hypothetical society of the future, artificial intelligence could save the planet. Suffice it to say that the computing power and the statistical know-how of some computer giants could help us in preventing the surge and the spread of new pandemics. This already happened back in 2009, when the services provided by Google's algorithm proved essential in supporting the American government in the fight against the H1N1 virus (Mayer-Schonberger & Cukier, 2013).

However, the idea that digitization is only in its infancy is widespread among many scholars. In this respect, the Covid-19 diffusion has worked as an accelerator of pre-existing dynamics, by pushing an IT development

[1] "Cities after coronavirus: how Covid-19 could radically alter urban life". Retrieved on 15th April 2020 from https://www.theguardian.com/world/2020/mar/26/life-after-coronavirus-pandemic-change-world

process and the interconnection of the global society. When the emergency will be over, this push is likely to affect our choices for many decades to come[2].

In regard to urban dimension, one could see, as it is already happening in different parts of the world, the exponential development of the so-called "smart city"[3] (e.g. Hollands, 2008).

A city where, thanks to the intensive development and application of advanced technologies, it is possible to optimize the services and the infrastructures available to the citizens by making them more customized, more efficient, and ramified. A smart city, thanks to the support of computer networks as well as artificial intelligence solutions*, big data* and the *internet of things*, will be able to guarantee citizen's security and healthcare more and more efficiently, thus becoming increasingly resilient and ready to face a new crisis[4].

It is also likely that urban innovations favored by future investments in technologies will encourage the surge of remote working worldwide, notably telecommuting and smart working (e.g. Bailey & Kurland, 2002; McEwan, 2016). These two types of remote work arrangements have been on the scene during the pandemic and their adoption proved to be crucial in preventing the interruption of many professional activities and in limiting economic damages.

In the aftermath of the pandemic, the affirmation of the above scenario requires us to reflect on digital innovation and the challenges of an interconnected society produced by Information and Communication Technologies (ICTs). Taking remote working as an illustrative example, the paper offers a critical reflection on how ICTs can influence our experience of space and contribute to creating new urban identities. Our experience (and perception) of space is affected by the symbolic-evocative value of places (Demarco, 2019), not least those workplaces in which individuals spend most of their time. A system of collective relationships can be defined in relation to these routine places. And personal and social identities can be built in relation to a similar system as well.

The authors caution about the "dark side" of a state of hyper-connectivity in the cyberspace, shedding light on the serious risks that a prolonged detachment from reality and the loss of "places" can put on identity construction. They stress that, in order to overcome potential tensions and preserve individual (and place) identity, remote workers should constantly search for "requisite connectivity" (Kolb et al., 2012) aimed at balancing identity performance in both physical and virtual workplaces. The comprehension of the relationship between the perception of spaces and identity construction can provide an important cognitive element to steer the choices of the companies in the direction of remote working design and management. It can also affect the choices made by the policymakers, engineers, architects, and city planners engaged in urban transformation projects and the smart redesign of cities.

The paper is structured as follows. Section 2 analyzes how the use of ICTs altered our perceptions of physical proximity and increasingly contributed to creating connected and interconnected individuals, organizations, cities, and societies, as exemplified by the intertwined paradigms of smart city and smart working and the increasing diffusion of new workspaces for remote workers (i.e. Smart Work Centers) in urban and metropolitan areas. These spaces, however, risk becoming "non-places" (Augé, 1992) with negative effects on remote workers' identity and identity construction.

Mainly drawing on organizational research, section 3 examines how remote workers' use of connective technologies is strictly influenced by their needs for identity construction.

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2 "Five ways coronavirus could shape our digital future". Retrieved on 15th April 2020 from https://www.odi.org/blogs/16747-five-ways-coronavirus-could-shape-our-digital-future

3 "Coronavirus will permanently change how city work". Retrieved on 20th April 2020 from https://www.forbes.com/sites/miriamtuerk/2020/04/08/coronavirus-will-permanently-affect-how-cities-work/#4f8193961da9

4 "How Life in Our Cities Will Look After the Coronavirus Pandemic". Retrieved on 20th April 2020 from https://foreignpolicy.com/2020/05/01/future-of-cities-urban-life-after-coronavirus-pandemic/

Starting from the contested concept of "non-places" as framed by Marc Augé and drawing on "practice theory" (Orlikowski, 1992; 2000) and the theoretical "duality" of connectivity (Kolb, 2008), Section 4 critically discusses how physical and virtual workspaces can be constituted as places in relation to remote workers' connectivity behaviors. Section 5 reports some implications of our analysis for the design of new urban workplaces (i.e. Smart Work Centers) and the broader smart city.

2. The impact of ICTs on urban planning and work design

The massive use of media technologies since the introduction of the *world wide web* has shaped a new type of social environment. An environment in which space we share no longer coincides with its location (Beck, 1996; Marramao, 2009). In this environment, proximity relationships are no longer linked to coexistence in places because it is possible to connect to each other in ubiquitous and synchronic modes.

Referring to this new kind of dimension, when the *world wide web* first appeared, Manuel Castells (1996) posed the famous distinction between "space of places" and "space of flows," respectively hegemonized by physical relationships and virtual connections.

The potential inherent in virtual connections allowed using the *web* goes far beyond the opportunities of information and communication exchange enabled by traditional media. While the latter are "one-way" and move from a broadcaster to a passive receiver, the *web* is, in fact, a bidirectional platform that acts both *top-down* and *bottom-up* (Ratti & Claudel, 2017).

The *web* involves an audience of users by urging them to share all sorts of data and thus activating a multitude of flows from every place and towards all directions. In recent years, the invention of flexible and portable devices (e.g. smartphones, tablets) has contributed to multiplying information and communication flows on a global scale. Free from the static personal computer interface, people started to access the network in a more agile and versatile manner.

This has encouraged mobility patterns and outsourcing processes (Elliott & Urry, 2010); however, in some cases, it has also discouraged sociality within material spaces (Twenge, 2017). The configuration of physical spaces has not substantially changed. Actually, it is their geography that has been significantly altered, turning into a "connectography" (Khanna, 2016).

During recent years the massive advancements in ICTs have fostered the development of the *smart city* as a holistic approach to urban planning and governance (e.g. Komnikos et al., 2013; Nam & Pardo, 2011).

The concept has increasingly attracted the attention of a variety of stakeholders, including scholars and public institutions. Indeed, many cities worldwide have started to rely on this approach to develop strategies and initiatives aimed at providing solutions to rapid urbanization and pursuing social, economic, and environmental sustainability (European Parliament, 2014).

Although the term smart city is controversial and actually a shared definition is still lacking (see Mosannenzadeh & Vettorato, 2014, for a review), there is quite a consensus among scholars and practitioners that smart city is based on the utilization of ICTs, investments in human and social capital and collaborative innovation among people, businesses and institutions aimed at developing more inclusive and higher quality services for citizens (Errichiello & Marasco, 2014; Komninos et al., 2013; Paskaleva, 2011).

It is worth highlighting that rather than a description of current reality, the smart city mostly reflects a strategic vision that is advocated to achieve sustainability goals (e.g. Angelidou, 2015; Komninos et al., 2013). Despite the growing interest in the smart city approach, there are conflicting views and no consensus even about the benefits of the real smart city. Supporters of the smart city frame it in a positive manner and agree that it would improve citizens' life and contribute to ecological integrity, social equity, and economic growth. In this respect, two different approaches are used in evaluating smart cities, i.e. the "technology-driven" and the "human-driven" (Kummitha & Crutzen, 2017).

The former emphasizes the values of ICTs in making smart cities interconnected places where citizens can access better and new services and are engaged in the decision-making processes.
The latter sustains that the expected benefits can also be achieved through leveraging human capital and sustaining the development of people's capabilities. However, opponents (e.g. Grossi & Pianezzi, 2017) are seriously critical of the actual contribution that the smart city can provide in creating a more democratic and sustainable society, as well as more inclusive and creative urban spaces (Kummitha & Crutzen, 2017). Beyond shaping urban planning, the diffusion of ICTs has affected every aspect of life, including work practices and routines.
Available communication and collaboration technologies pushed companies and public organizations to increasingly adopt different typologies of remote work arrangements (RWAs). These can be distinguished according to an individual (e.g., home-based telework, mobile work, smart working) or group perspective (e.g. virtual teams). Notwithstanding their specific features, all RWAs involve employees temporarily or permanently spending some working hours at a distance from traditional offices, colleagues and/or managers (Cascio, 2000); workers are geographically dispersed and rely on electronically mediated communication (e.g., emails and videoconferencing) to interact with others (Raguram et al., 2019).
Smart working emerged in recent years as a highly flexible type of RWA (e.g. Clapperton & Vanhoutte, 2014; McEwan, 2016). Indeed, the adoption of smart working implies that employees can choose when and where to work, selecting among various workspaces, both outdoors (e.g. home, coffee shop, co-working spaces) and indoors (e.g. open spaces, concentration areas).
Coherently, it reflects a holistic approach in managing flexibility that includes three levers, i.e. the re-design of physical workspaces ("bricks"), investments in information and communication technologies (ICTs) ("bytes"), and a substantial change in employees' and managerial attitudes and practices ("behaviors"), (Clapperton & Vanhoutte, 2014; De Kok, 2016), notably those related to autonomy and control (e.g. Cunha et al., 2020; Errichiello & Pianese, 2016; Errichiello & Pianese, 2018).
In Italy, at the end of 2019, there were no more than 570,000 smart workers (Smart Working Observatory, The Polytechnic University of Milan), but the need to ensure "social distancing", after the spread of the coronavirus, led to an exponential increase in these flexible forms of employment. Just a few weeks after the beginning of the pandemic, the total number of smart workers has increased by 555.000 (The Ministry of Labour and Social Policies, Italy) and long-term forecasts predict a rise to 8 million (Smart Working Observatory, The Polytechnic University of Milan). In some ways, the uncertainty about the possibilities to return to "normality" makes it likely that the ecosystem of the companies will react to the pandemic by permanently shifting to more flexible and flat organizational models. Therefore, we can picture a future scenario where the extension of remote work will accelerate a global trend that is already underway.
Workspaces, rather than disappearing, will have to be rethought according to a "smart" logic and be equipped with technologies suitable to the needs of the workers of the future. In this regard, we can hypothesize the diffusion of collaborative spaces, designed primarily for remote workers, including employees of private companies and public institutions.
Spaces whose design and features reflect the model of "Smart Work Centers" (SWCs), innovative workspaces already spread in some countries such as the United States, Australia, the Netherlands, Japan, Korea, and more recently, also realized in France and Italy (Adamsone et al., 2013; Errichiello & Pianese, 2019; Micropol, 2014). SWCs are co-working spaces where employees can flexibly work individually or in teams, accessing a variety of office equipment as well as communication and collaboration technologies (e.g. printers, internet, teleconference systems, etc.). Moreover, within these spaces, workers can access corporate resources, data, and applications through cloud systems and rely on social computing tools to interact and collaborate with distant colleagues.

Beyond the "byte" lever, SWCs are also aligned with the "bricks" lever of smart working, as offices are organized with open spaces and shared desks as well as different areas designed for different purposes, i.e. collaboration (e.g. meeting rooms), concentration (e.g. small offices), communication (e.g. skype/call booths), contemplation or relaxation (e.g. coffee shops). Moreover, SWCs also offer additional services, including educational courses, technical support, nurseries, and recreational facilities. These workspaces are already attracting interest among private companies, such as Samsung Electronics[5] that built them for their employees (corporate SWCs). SWCs have also been created by public institutions, like those funded by the Korean Government (Eom, 2016).

In this case, they give access not only to employees but to a variety of users, including professionals and entrepreneurs (multi-user SWCs). It is important to report that SWCs are sometimes part of a broader smart city development plan. In this case, they can be funded through public-private partnerships like in the project developed by the municipalities of Amsterdam and the IT service provider Cisco[6].

Beyond offering advantages to both employees (e.g. increased productivity) and organizations (e.g. cost savings), these innovative workspaces also contribute, at a societal level, to reaching some key goals of smart city programs, i.e. increased citizens' engagement, reduced air pollution and unemployment (e.g. Adamsone et al., 2013; Eom, 2016).

In view of the spread of SWCs, it is important, however, that these new flexible work environments are not only designed as "access gates" to the *worldwide web*. They should also set the conditions for more human forms of connection primarily made of social relations. In this regard, it is worth highlighting, as it will be shown in the next sections, that the identity of an individual is shaped, in fact, by sociality. This sociality stratifies over time through the practices of living together in "places," areas circumscribed by boundary lines, but also exposed to external contamination.

However, as the anthropologist Marc Augé claims, the typical dynamics of the contemporary world have de-legitimized the function of "places" producing a series of "anthropological non-places," spaces designed not to be inhabited but to enable the mere circulation of flows. Non-places are anonymous environments made of stealthy relationships, as well as mere supports of technological functions, economic and financial transactions. Here people make contact without ever really contaminating themselves and nobody can read anything about themselves or others.

The main consequence of the proliferation of non-places is a widespread sense of disorientation followed by a search for points of reference and a so-called "identity obsession" (Marramao, 2009). Such phenomenon creeps into every aspect and every dimension of our lives.

The loss of places and the establishment of remote working have exasperated the spasmodic search for a defined professional identity even in the workplace.

In this respect, organizational research on virtual work has hitherto shown that individuals' and groups' choices about "if", "when" and "how" to use connective technologies are influenced by personal and context-specific factors, such as communication practices, interpersonal trust and organizational culture (Collins & Kolb, 2012; Wajcman & Rose, 2011). Indeed, these factors affect connectivity behavior through "human agency" (Cousins & Robey, 2005; Emirbayer & Mische, 1998) that refers to "the level of choice, control or free will that contemporary workers have over their connectivity states" (Kolb et al., 2012: 269). However, remote workers'

5 Samsung Electronics (2012), "How to work smart: Samsung smart work center". Retrieved on 15th April 2020 from: https://kslee7.tistory.com/entry/How-to-Work-Smart-Samsung-Smart-Work-Center.

6 Cisco (2011), "Cisco Smart Work Centers: Foster Urban Regeneration, Social Inclusion, and Reduced Carbon Footprint", Retrieved on 10 th April 2020 from https://www.cisco.com/c/dam/en_us/solutions/industries/docs/scc/smart_work_center_solution_overview_us_0725.pdf

decisions on how to realize the connective potential of modern devices and applications are also strictly related to their needs of identity (re-)construction.

3. Understanding identity in the context of remote working

In any social domain identity is a self-referential description that explains who an individual is and how he fits into his surroundings (Ashforth & Schinoff, 2016). In the domain of organizations, identity also explicates "why a person joins certain organizations and why he voluntarily leaves, why he approaches his work the way he does and why he interacts with the others the way he does during that work" (Ashforth et al., 2008:334). Identity is a multi-level construct since it exists at the individual (i.e. personal identity), interpersonal (i.e. relational identity), and collective level (i.e. social identity) (Brewer & Gardner, 1996). According to an interpretive perspective, identity construction (including reconstruction) refers to the process through which actors come to define who they are (both as individuals and as members of groups), how they communicate that definition to others, and how they use that definition to shape their professional and private lives (Ashforth & Schinoff, 2016; Ashforth et al., 2008). Identification, the extent to which individuals internalize a given identity of an entity as a definition of self, is a key outcome of identity construction (Ashforth & Schinoff, 2016). When the entity is the organization (i.e. organizational identification) the individual simply feels a sense of belonging to that organization; otherwise, he includes the organization in his self-concept. In the first case, identification is "situated" i.e. it arises in specific situations and tends to be weak, temporary and unstable; in the latter case, the individual is strictly connected to the organization and identification is a stronger, more durable and stable entity (Ashforth et al., 2008).

In order to understand how the construct of identity has been used in organizational research, it is appropriate to take into consideration the contributions of authors from various disciplines (e.g. philosophy, psychology, and sociology). In this respect, it is important to highlight that between the 19th and 20th centuries both European and American cultures refused to attribute to the self a static meaning. Inspired by Nietzsche's concept of perspectivism and Freud's psychoanalysis, identity has become something indefinite and associated with an array of representations; it has been considered increasingly influenced by the processes that regulate social exchanges. In 1959, in *The Presentation of Self in Everyday Life*, Erving Goffman described identity as the mere result of a theatrical performance. Goffman claimed that the subject represents himself in front of an audience of actors who, in return, use the same technique to showcase their own personality. Beyond these "dramaturgical strategies" identity becomes only an abstract entity. Later on, Berger and Luckmann (1966) conceptualized identity as the mere result of a "social construction" enacted through negotiation and compromise. In 1976, the Norwegian sociologist Jon Elster, in contrast to the perspective of methodological individualism, claimed that each individual is composed of many selves. In this direction, Remo Bodei (2016) stated that individuals have become "multiple" subjects since they perform different roles depending on the different social contexts in which they find themselves. Within this debate, a relevant position is adopted by the French philosopher Michel Foucault (2019). He claimed that the cognition of our body is achieved through a complex process that requires, first and all, a relationship with others. In fact, by ourselves, we cannot perceive some parts of our body (the back, the nape of the neck, and not even our face). The only way we can perceive these parts is to see them reflected in a mirror or to see them through the eyes of the others who outline and describe them to us. In a certain sense, the others work, for us, like a mirror. They tell us who we are, how we are made, and what we represent.

Their narrative implicitly assigns us a role and shapes our perception of ourselves. However, beyond their narrative, physical contact is highly effective in producing similar effects. Handshakes and physical interactions sharpen the perception of ourselves. Our body becomes more sensitive "under the fingers of the other." The social nature of identity, its interpretation through the dramaturgical lens along with the acknowledgment of

the key role or physical interactions for identity construction provide a valuable frame of reference to understand the effects produced by remote working on identity and identity construction. In office-based work, individuals' identity is more likely to be clearly defined and socially recognized through "identity cues" that enable identity enactment by a) "priming or rendering salient an identity"; b) "providing descriptive and normative information about the identity (what the prototypical member thinks, feels, and does)" (Ashforth et al., 2018: 332). The first type of identity cues (e.g. punching a time clock, formal dressing, and working at a personal desk), is highly relevant for both situated and deep identification.

As workers start to carry on activities remotely, they lose these cues and need to re-construct their identity. At the same time, from the worker's perspective, regular face-to-face interactions in the office provide workers with the opportunity to communicate their identity to others through descriptive and normative information about their thoughts, emotions, and behaviors.

The transition to remote working can be considered as a novel and disruptive event that "threats" existing identity and triggers identity construction (Bean & Eisenberg, 2006; Brocklehurst, 2001). Indeed, in the new work arrangements employees feel the pressure to re-define and communicate externally their role and position mainly to other organizational members (peers and managers). Empirical research showed that electronic connections enabled by different technologies (e.g. e-mail, smartphone, social media, and cloud-based technologies) are used by remote workers to "perform" their identity online with the aim of maintaining informal bonds with colleagues and be recognized as a member of the organization (Dery & Hafermalz, 2016). As the intensity of remote work increases, individuals rely more on impression management (or self-presentation) practices (Barness et. al 2005) in the attempt to convey impressions that are biased in the direction of their desired identity image (Leary & Kowalski, 1990).

By examining how smartphones are used by a group of mobile workers, Symon and Pritchard (2015), for example, showed how connections are used to perform different work identities that can also coexist: connection as being contactable and responsive, connection as being involved and committed, and connection as being in-demand and authoritative.

In general, studies converged that remote workers tend to exacerbate their level of connectivity in order to reaffirm their role (e.g. authority, status, sense of self) and communicate to others their professional commitment (e.g. in terms of responsiveness, trustworthiness and constant support) and that tensions and paradoxes can arise from too much connectivity (Leonardi et al., 2010; Mazmanian et al., 2013; Sewell & Taskin, 2015). Leonardi et al. (2010) consider connectivity as a paradox since perpetual connectivity threatens the expected benefits of remote working (e.g. flexibility and autonomy) producing increased stress, burnout, and feelings to be controlled and not trusted by colleagues and supervisors. Barber and Santuzzi (2015) showed how benefits in staying connected and increased flexibility afforded by ICTs are counterbalanced by negative physical and psychological outcomes (e.g. physical fatigue, poor sleep quality) deriving from workplace telepressure, a preoccupation with and an urge to respond quickly to work-related electronic messages. Mazmanian et al. (2013) found that knowledge professionals use mobile email devices to work anywhere/anytime to perform both autonomy and responsiveness, but basically their autonomy is reduced because they end up being constantly connected. Similarly, Sewell & Taskin (2015) showed that after telework adoption both professional and nonprofessional workers paradoxically accept restrictions on their autonomy to convey the image identity of the ideal worker constantly available to colleagues and connected to the organization.

4. Work identity (re-)construction between real and virtual workplaces

In light of the analysis carried out so far, we can come to some general conclusions: when the individuals, in order to perform their identity, augment their virtual connections, they risk to obtain an effect opposed to that

that they intended to achieve. They can fall back into a kind of loneliness that implies the loss of freedom and a consequent sense of alienation and increasing stress conditions. In fact, as we have discussed in the previous section, the social construct of identity is conditioned, first and foremost, by physical contacts (Foucault, 2019). The priority that such contacts gain in the assertion of self-identity also leads us, however, to recognize the crucial importance of the "anthropological places." These are those territories of space in which people interpenetrate: where they meet and collide, where they intersect multiple relationships. In examining the properties of these places, Augé listed three essential characteristics of a place: a historical one, a relational one, and a more specifically identity-related one.

A place is historical, according to Augé, when it does not deny past housing traditions when it incorporates itself into pre-existing architectures without distorting their conformation. It is relational when it opens to the outside through streets and road ducts (but also corridors or passageways that allow, at the same time, access and exit). It is, lastly, a place of identity thanks to the combination of the two previous characteristics: only in so far as it allows historical residents to relate to allochthonous elements, only in so far as it allows the interpenetration between a sedentary and a nomadic component. Even for Augé, indeed, identity is a continuous mixing of social representations, something that is defined only at the price of being manipulated by many actors. When young people go away and foreigners replace them, the references of an already given identity tend to disperse and fade away. Then, however, the combination of tradition and innovation leads to new representations of identity. The problem is that the processes of industrialization, of mechanization and, then, of computerization (i.e. the spread of the Internet, of the ICTs, the proliferation of mobile connections) have created spaces that do not strictly place because they do not accommodate these three characteristics. To define these spaces Marc Augé coined the concept of "non-place." Non-places are one-way spaces as they allow only uninterrupted transit. They are the spaces of circulation, communication, and consumption, where people can sometimes meet without ever really contaminating themselves. Spaces in which loneliness coexists without creating material and emotional bonds (Augé, 1992; 1996). Next to physical spaces such as motorways, airports, motels, and shopping centers, archetypal non-places described by Augé also include the virtual spaces of communication and media technologies, such as chat rooms, multi-user games, and virtual reality environments (Coyne, 2007; Merriman, 2004).

However, non-place is an ambiguous and contested category (Coyne, 2007). As Merriman (2004) noted, Augé failed to recognize that "individuals such as maintenance workers, security guards, shoppers or business travelers often do see spaces such as supermarkets, motorways, and airports as places" (p. 149). He overlooks 'the ways in which virtual or highly mediated social relations … [can] construct a familiar sociality and the sense in which places such as supermarkets, Internet chat rooms, airports and motorway service areas do act as 'meeting places' where all manner of social relations are performed" (p. 151).

Later, Augé himself recognized that it is impossible to classify space as a place or non-place[7] and agreed with Merriman (2004) who claimed that "place and non-place are relational, contingent and continually folded into one another" and that the non-absoluteness of the concept derives from "the multiple and relational "placings" which arise through the diverse performances and movements associated with travel, consumption, and exchange" (p. 147). According to this argument, any space - whether physical or virtual - can be a place or non-place in relation to the meanings that individuals attach to that space and the nature of social relations that they perform in it.

On the basis of the previous analysis, we can argue that, when the focus is on remote working, individuals "create" and "re-create" a workspace as a place or non-place contingently to their decisions (and actions) about if, when and how to connect through ICTs. As an illustrative example, consider mobile workers that

[7] "Nonluoghi e "surmodernità"-Incontro con Marc Augé. Retrieved on 14th April from: https://maurogarofalo.nova100.ilsole24ore.com/2008/07/17/i-nonluoghi-e-i/

increasingly find themselves in archetypal non-places like motorways and airport lounges. In such circumstances, performing their identity online through electronic connections enabled by the phone or the tablet allows them to maintain social bonds with their colleagues and nurture a sense of belonging to the organization, i.e. organizational identification.

The same happens for remote workers when they decide to work far from office buildings, e.g. at home or coffee shops. This means that the "virtual space" that workers access through choosing to stay connected is contingently created by them as "place" and this secures their identity construction. However, if remote workers find themselves in traditional physical workspaces, such as corporate offices or co-working spaces, too much connectivity (i.e. hyper-connectivity) can turn both the virtual space and physical workspace to non-places. In fact, if workers consider physical workspaces only as "gateways" to cyberspace they contribute to creating them as non-places, showing no interest in social relationships with other people working in those spaces. However, this kind of behavior compromises their identity construction since self-recognition – based on talks and visual interactions - cannot be sustained.

To understand how physical and virtual workspaces can be constituted as places in relation to remote workers' connectivity behaviors, we rely on the theoretical perspective of connectivity as "duality", assuming "connects" and "disconnects" as complementary states, intertwined in interdependent relationships (Kolb, 2008). This perspective draws on "practice theory" (Orlikowski, 1992; 2000): human action is both "enabled" and "constrained" by technology, and individuals can always exert human agency to adapt technology's features and attributes to their preferences and needs. Accordingly, remote workers should balance their states of connection or disconnection to achieve and maintain "requisite connectivity," i.e. a middle ground between extreme and counterproductive states of "hypo-connectivity" and "hyper-connectivity" (Kolb et al., 2012). Indeed, states of too little or too much connectivity are both detrimental to work performance. This argument also applies when expectations and needs are referred to as identity construction. Indeed, connectivity as duality helps to understand how being in the cyberspace can offer relational intimacy and satisfy the remote worker's unresolved needs of identity construction (i.e. "connects") but it also produces detachment from reality and antisocial behaviors that are detrimental for identity (i.e. "disconnect"). In the first case, a virtual workspace is a place, and connections are "enabling." In the latter case, both the virtual space and physical space are non-place, and connections are "constraining" (i.e. they disconnect in practice). To address this tension and avoid what can be considered as an "identity paradox" remote workers should at first look for a "requisite connectivity" aimed at balancing identity performance (next to work performance) in both physical and virtual workplaces.

4. Conclusions

Future cities will be increasingly designed worldwide as smart cities. In urban and metropolitan contexts, the re-design of traditional workspaces will be a tangible statement of the new paradigm. In the aftermath of the pandemic, the high potential of connectivity offered by advanced ICTs will contribute to increased workers' flexibility enabling them to choose where and when to carry on their activities. However, our analysis clearly cautions about the "dark side" of a state of hyper-connectivity in the cyberspace, shedding light on the serious risks that a prolonged detachment from reality and the loss of places can put on the identity of individuals.

In this paper, we focused on remote working to show the contradictions inherent to too much digital connectivity as well as the tensions of remote workers' identity construction between virtual to physical workspaces.

In this respect, in section 2 we underlined that our expectation for the future is that many private companies and public institutions will re-think their traditional offices embracing a smart logic and that new investments will be realized to build innovative workspaces, notably Smart Work Centers, specifically designed for flexible

workers. However, if corporate offices will likely be designed as SWCs and contribute to transforming the future city, the analysis provided in previous sections offers us some valuable insights that should inform their physical design and guide work practices enacted by remote workers within their physical boundaries. In this respect, it is worth highlighting that SWCs are mainly designed for employees often belonging to different companies. This means that these workspaces tend to lack the physical and cognitive proximity among peers that characterizes traditional co-working spaces mainly designed for self-employed professionals usually belonging to the creative class (e.g. architecture, design, and communication), as well as entrepreneurs and/or teams working on innovative projects (e.g. startups) (Gandini, 2015; Merkel, 2015).

In coworking spaces, a shared work identity is likely to exist among professionals. Moreover, in these workspaces, informal networking contributes to workers' identity construction e.g. in terms of social reputation and professional status. On the contrary, SWCs can easily turn into non-places where remote workers only "transit" to connect themselves to the virtual workspaces being disconnected from the physical surroundings. We discussed how to realize SWCs as the emblem of an "interconnected way of working" (Boorsma & Mitchell, 2011) and exploiting their potential in boosting remote workers' creativity (Errichiello & Pianese, 2018), the potentialities of technologies available within SWCs should be aimed at enabling a "requisite" state of connectivity resulting from a balanced and synergic combination of connections among physically close workers (sharing the same workspace) and connections between situated and distant individuals. With these premises, SWCs actually are likely to work as places.

Indeed, in these circumstances, they would preserve workers' identity construction and even contribute to creating a shared work identity among SWCs' users.

Our analysis has broader implications for the design of future cities beyond workplaces. Indeed, the dominant image of the smart city is that of an innovation ecosystem contributing to new and improved services mainly developed through public-private partnerships (Errichiello & Micera, 2018; Marasco & Errichiello, 2016; Paskaleva, 2011). However, the rise of the smart city and the related surge of telematic connections risk distorting the concept of cohabitation that is the very foundation of the living city.

The danger is to transform our urban environments into what Paul Virilio (2004) called "metacity:" a ghost city, without limits and without laws, the capital of a world without consistency that has its center nowhere. Although we caution about this risk and thus refuse an "integrative perspective" centered on ICTs (Kummitha & Crutzenb, 2017), we are not totally critical of the concept of smart city and its practice. Rather, we embrace a "pragmatic school of thought," focused on enabling citizens to enhance human interaction and use a social agency to "invent and promote the usage of technology while addressing their own problems" (p. 47). Indeed, this perspective resonates with practice theory (Orlikowski, 1992, 2000) and the theoretical "duality" of connectivity (Kolb, 2008) we have drawn on to build our argument.

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The paradigms of urban planning to emergency-proof

Rethinking the organisation of settlements at the time of a pandemic

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Abstract

Urban planning is one of the sectors that is able to provide a contribution to the definition of a desirable scenario for the future of the city and the territory as it deals with the physical and functional organisation of human settlements, more than others, also for reasons related to its historical origin.

The paradigms now acquired from a disciplinary point of view, such as densification, sustainable mobility, mixitè, urban green, etc., raise the issue of compatibility with the needs of social distancing imposed by the health emergency. One wonders if and how the principles and criteria for the physical and functional organisation of settlements, which inform and substantiate the technical-scientific documents and the spatial and urban planning instruments themselves, will change.

The response confirms the overall goodness of the organisational model shared by the community of urban planners. This can only be a stimulus to continue the research and application activities in the field with even greater commitment and determination. The crisis must in any case build an opportunity to rethink the functioning of the city, its spaces, its times and its forms of social and economic interaction, as we imagine will happen in all other fields

Keywords

Covid-19; Urban planning; Paradigms; Settlements; Social distancing

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1. Foreword

The global lockdown imposed by the health emergency has highlighted the extreme fragility of contemporary social and economic systems. The crisis we are experiencing demonstrates the unequivocal interrelation between human health and the ecosystem conditions of the planet. The global scale and the rapid spread of the epidemic have shown this reality in all its drama, but also its potential. The health of everybody depends on the health of everyone else. We are all connected in a relationship of interdependence.

According to scientists, this pandemic is unlikely to be the last. In fact, global warming could lead to the multiplication of tropical pandemics in the future, as the World Bank and the *Intergovernmental Panel on Climate Change* (IPCC, 2019) have been saying for years. This could make public health interventions more problematic and, therefore, our ability to control the spread of epidemics less effective.

Some have also put forward the hypothesis that there may be a direct or indirect correlation between pollution and ease of contagion (Coccia, 2020; Conticini et al., 2020; Fattorini & Regoli, 2020; Zhu et al., 2020). There are those who think that once the vaccine has been found, it will return to a sort of previous normality, in 24 months or less. Others are convinced that we are facing an epochal change. However, if the predictions of scientists and virologists who announce a long period marked by new possible pandemics are reliable, one wonders how many of these extraordinary habits will become ordinary.

In these circumstances, it is necessary to exploit the *crisis*[1] as an *opportunity*, that is, as a great unrepeatable opportunity for a radical change in our existence, based on the protection of the environment and health, considered as inalienable common goods.

This crisis, as we imagine will happen in all other fields, should be an opportunity to rethink the way the city works, its spaces, its times and its forms of social and economic interaction.

The emergency has revealed the fragility of the settlement structure and the strong criticality in the system of infrastructures for tangible and intangible communications. These problems, which could be not transitory but structural, force the urban planning discipline to review the criteria through which it has operated until today in great depth.

Have speeches and hypotheses on paradigms, principles and criteria aimed at a correct urban and territorial planning been swept away?

2. Urban planning and hygiene

If one recognises hygienism as being at the origin of modern town planning, then it is possible to say that this discipline was founded by doctors. Air, space, and hygiene are the figures in its most recent history (Mumford, 1961).

In the second half of the 19th century, the drawbacks created by industrial development became intolerable due to the cholera epidemics spread after 1930. The first measures to eliminate them were studied and health legislation became the direct precedent of modern urban planning legislation (Benevolo, 1963).

The origins of general town planning are, therefore, identifiable through the growing awareness of the *city evil* and in its connection to a hygienic-sanitary problem. Thus, the first forms of technical manuals on the desirable characteristics of housing, hygiene regulations and building regulations were born. Finally, the need to coordinate the various interventions through a master plan emerged (Ernesti, 1990).

There is a need to resume a common path between scientific sectors, in particular between public health and space planning. Attempts to reconnect between the two fields of sanitary engineering and urban planning

[1] It is linked to the word which in Chinese means crisis and which has two opposing interpretations: threat and opportunity.

were already present before the outbreak of the Covid-19 epidemic (Fasolino et al., 2016a; Fasolino et al., 2016b). Only recently, however, medicine has become interested in the impact of planning decisions on people's health. Think, for example, of decisions relating to land use and how to build the anthropic environment.

Health is considered to be the link between ecology, the physical - natural and built - environment, society, politics and economics (Institute of Medicine, 2001). Consequently, the rise of health problems is an alarm bell when there are elements of inconsistency between these environments.

Therefore, the emphasis is placed on the importance of developing healthy urban planning in order to ensure the health of all within a world that becomes increasingly urban and where the poor population is growing (Duhl & Sanchez, 1999). Epidemics recur periodically and thus urban planning must offer its own contribution and give answers on how the city will face the crises to come.

3. Uncertainty, vulnerability and resilience

For a long time this world has undergone a process of radical and inexorable increase in *uncertainty* and consequent *fear* (and in all likelihood this suffering will continue for a long time to come) (Bauman, 1999; 2006). Floods, drought, forest fires, sea level rising, desertification are all phenomena that will be hit hard[2].

In advanced modernity, a *risk society* has been created (Beck, 1986) in which technology can even contribute to intensifying natural disasters and amplifying their consequences (Giddens, 1990). This is the case with aircrafts that can comfortably transport the virus from one end of the planet to the other in a few hours.

Dynamic interaction and physical, social, cognitive and organisational proximity (Boschma, 2005) are the very essence of contemporaneity, where interchange is vital for the functioning of modern communities of workers. Epidemiologists warn that, after the present, we will have to organise ourselves for new potential pandemics which will be even more dangerous. Therefore, it is necessary to reflect on the characteristics of the areas in which the convergence of risk factors is occurring with greater intensity (Connolly et al., 2020) and on the probable propagating conditions of the contagion.

From this point of view, it is necessary to examine the characteristics of the land use mainly affected in our country. The geography of Covid-19 in Italy shows, in fact, the most important infection clusters located in the most innovative and densely populated provinces of northern Italy, covering a much larger territory than that of Wuhan, in China.

The latter, in fact, despite counting a population of 12 million inhabitants, insists on a very concentrated area. This means that the outbreak of an epidemic in a context that takes the form of a settlement continuum, determines a very rapid and difficult to counteract geographical spread of the virus.

Among the characteristics to be taken into account are the thousand trajectories of commuting home-work[3], consumption, school, leisure and youth entertainment, even at night, which affect a very large urbanised area, seamlessly and enclosed in very short travel times. A further confirmation of the fact that the vulnerability is primarily that of settlement on the territorial scale, caused by the ways in which the well-known *widespread city* has been configured.

In order to aim for quality growth, through the use of a circular, sustainable and highly competitive economy, it is also necessary to replace the old polluting infrastructure with a more modern, clean and efficient one, in all sectors.

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2 One of the most suggestive historical syntheses on the immanent cyclicity of pandemics is told in The Squirrels of the Plague (Davis, 1998).

3 In particular, local work systems, photographing commuting flows, should be considered as a tool for analysis and intervention. Instead, an a-spatial reading of a production system known for its great territorial variance and specialization has been preferred.

The risk society will have to focus on the *resilience*[4] of human settlements, to be considered as the main objective of the economic revitalisation policy and the creation of new jobs. This implies the need for physical and social infrastructures for the safety and protection of the lives of people and communities, starting from healthcare, in line with a green strategy.

4. Spaces and health

The great historical epidemics have always been followed by changes in the use of spaces. For example, with the Modern Movement we oriented ourselves to the rarefaction of the built, to the design of airy houses, full of windows and light, where the air could circulate freely. It is a design model that has remained, more or less, the same until the 70s of the last century. Afterwards, we returned to the pursuit of urban density for the advantages in saving resources that this paradigm brings.

The new way to deal with sociability will be the figure that will distinguish the next few months, until the arrival of the coronavirus vaccine. However, the fear of contagion could remain for a long time leading to changes (perhaps forever) in the ways of living, working, recreating, moving.

What will change therefore in the creation of new spaces and in the transformation of existing ones?

There is no doubt that two positive phenomena encouraged by the current crisis situation will remain: teleworking and tele-commerce. Telework will reduce, for the same production, individual and environmental costs, and inconvenience for the time lost in commuting. *Tele-commerce*, for the same volumes of goods, will require fewer trips (a van in a round of deliveries travels many kilometres less than when dealing with individual purchases) and, moreover, will increase competition by reducing the producers' space monopolies.

The *lockdown* highlighted the need for housing with adequate space for those living inside. This is a need that contrasts with the current Italian situation. In fact, in Italy, more than a third of households with 2-3 members live in less than 80 square meters and 13.4% of houses do not reach 60 square meters (ISTAT, 2011).

In this circumstance, one should begin to reflect on the possibility of having per-capita spaces that respond to future needs, dictated by health crises, rather than reconsidering the hypotheses of favouring the division of housing to meet the contraction of the size of the family unit.

Digitisation will affect the way we produce and work much more than before. Telework will extend and stabilize, requiring larger houses, where it is also possible to practice indoor sports, have a terrace and perhaps a condominium garden. Workplaces will also have to be reconsidered on the basis of two opposing needs: the distance between workers and the management of the spaces freed from telework. As a result, some spaces in the offices will gradually become redundant but, at the same time, more space per person will be needed. They will probably have to be designed in a new way, with meeting spaces for collaborations, rather than working individually on an ongoing basis. There will also be more attention paid to both hygiene measures and services (gyms, laundries, shops) that will be placed inside the buildings to minimise the exits. Looking ahead, in general, the space needed to live and work will increase, and therefore the demand for new spaces or for complete renovation. This demand must be directed towards the recovery of unused and underused land in urban regeneration processes and in no way to the consumption of new land.

5. Wired cities

In the next *ordinary* life, a new IT revolution will give an immediate acceleration in the use of still underutilised technological tools, the digitisation and delocalisation of work. Remote meetings have finally been discovered along with their efficiency: saving time, energy, travel costs and pollution.

[4] *Resilience* considered as the capacity to «resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner» (UNISDR, 2009, p. 24).

We are beginning to think about the role that work and distance learning will play in the future and, therefore, about the importance of the proper functioning of the infrastructures for basic intangible communications for functions that affect ordinary life, and not necessarily emergency situations. The emergency has also highlighted (ISTAT, 2020) the need for adequate IT equipment. However, above all, the digital infrastructure of the country is priority in order to give high technological capacity to all private and public entities operating in the fields of economic and training activities. The *internal areas*, also by virtue of the almost natural isolation that its orographic conformation implies, seem to be less affected by the diffusion of Covid-19. As of today, an indicator for the identification of internal areas must necessarily be of a telematics nature (band, fibre, jig). In fact, these are immense territories often endowed with vast unused real estate assets. If properly infrastructured, they lend themselves well to absorbing urban housing densities without being affected by the effects of periphery while still favouring the monitoring of health, training and soil protection. The potential benefits of owning the workplace in a peripheral and / or rural area are already known: higher levels of well-being and lower perceived stress levels, absence of urban congestion, traffic and pollution, etc.

6. Adaptability and flexibility

Adaptability and flexibility of houses and offices are necessary in order to respond to different needs that may arise over time and have always been themes that have remained in the background of disciplines such as architecture and urban planning but which today are of particular importance.

We need to design urban and domestic spaces capable of hosting different functions and roles over time. The city and the houses have a great *inertia*. Cities or buildings, designed on rigid functional schemes, are unable to adapt to changes. Even the private space will have to adapt[5]. New types of spaces become necessary which include personal environments adaptable to forced cohabitation or remote working. It will go from rethinking the traditional studio in a digital key, to forms of common service, such as *co-working* condominium spaces.

It is also necessary to think about the periodicity with which these types of phenomena are manifested, and will increasingly manifest themselves in the future. A solution is represented by *multifunctionality*, in analogy with spaces for the management of emergencies in the field of civil protection.

Take for instance the concept of *Urban Special Structures* (for example the *vertical gym* built in Caracas by Alfredo Brillembourg) for which in ordinary conditions such structures are places of worship, recreation or sport spaces; but in times of crisis the roof turns into a landing strip for rescue helicopters and the entire building becomes an emergency centre or a distribution point for basic necessities. It is about positioning these multifunctional structures in strategic points of the settlements, at an appropriate radius of distance from each other. Telework, which certainly does not eliminate the need for close contacts, would call for creative activities, hubs for innovative jobs, places for exchange and information. And all this could favour the return of residence. However, small non-impacting productions, research activities and laboratories could find space in the city. The different possible solutions apply to physical space so that they can affect specific aspects such as the organisation of settlements and people's living and working places, but also the urban environmental conditions.

7. If and how urban planning paradigms change

The health risk, which could be the key to the Third Millennium, seems to call into question, imposing its revision (Fig. 1, Tab. 1), the main disciplinary paradigms on which the desirable scenarios for the city and the territory are based (Fasolino, 2015).

[5] Italians' dissatisfaction with their homes is a widespread phenomenon (RUR, 2012).

In addition to zeroing out or minimising land use (EC, 2012), the key word for urban planning of our time is *green*. Particularly, *Green and blue infrastructures* (EC, 2007; Naumann et al., 2011; Meerow & Newell, 2017) represent a cross-cutting paradigm capable of providing multiple benefits (environmental, social and even economic) to the communities living there. In this sense, green infrastructure contributes to maintaining and increasing ecosystem services (EC, 2007). Green materials, plantations, green roofs, parks and forestations can only increase the environmental conditions of well-being and health. It is well documented how vegetation can consistently reduce pollution levels, through the absorption of carbon dioxide or fine particulate emissions (Jobbagy & Jackson, 2000; MEA, 2003; Lal, 2004; EC, 2012).

Social distancing could lead to reviewing the meaning of an urban indicator in which *building density* and population density substantially coincide, so much so that they are used almost indifferently. The building density must therefore be accompanied by an indicator of the *intensity of the presence of bodies*, a sort of degree of filling of urban containers.

Urban density remains an important paradigm for all the other aspects it brings with it. *Transit oriented development* (TOD) (Dittmar & Ohland, 2004; Knowles, 2012), with reference to the nodes of public transport, is also associated with density, among other things, as well as with the mixitè and the shortening of distances, to be used preferably on foot or by bicycle, thus promoting individual and sustainable movements.

In the reconstruction of social relations (Gehl, 1980; 2010), urban planning is required to rethink urban planning standards in terms of public physical spaces and intangible assets for access to public services and common goods and for carrying out collective experiences fostering community solidarity and training courses. It is necessary to study the repercussions produced by the changes that occurred in the main dimensions of daily life, with significant effects for residential and work environments (diffusion of collaborative consumption, *co-housing* practices and the use of spaces and networks for sharing).

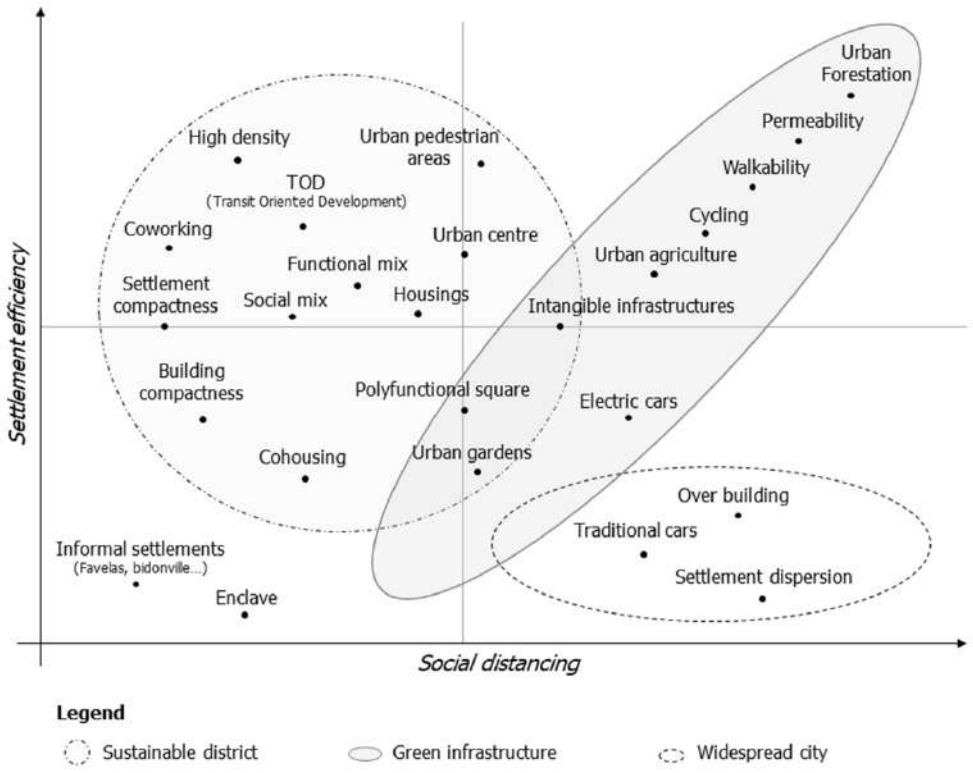

Fig.1 Social distancing and settlement efficiency

The behaviour protocols, to be applied more or less forcefully in certain periods, may distort functions and use value. Roads, gardens, parks, schools, stadiums, theatres, all public or public spaces, in addition to all other safety requirements (Fasolino et al., 2018), must guarantee the distance between individuals. A different public space will need to be envisioned, one which is more flexible, more introvert and completely rethought considering its more moderate density use.

Perhaps the *third places* (theorised by the sociologist Ray Oldenburg) namely private spaces with some public characters will increase. *Third spaces* are located in an intermediate area between home and work: bars, meeting places, pubs, social centres and these would bring together small self-selected communities.

In the time of Covid-19, cities are deserted ghost towns. Cities, on the contrary, are beautiful if you live them filled with life, if you hear the sound of words and the noise of encounters. One wonders then, what happens to the *city effect*?

The density of connections is the most precious value of the city, but public space is the first to succumb to the virus, which propagates precisely in the multiplication of encounters. Classrooms, places of entertainment and squares are symbols of life that are transformed into places of contamination. Furthermore, since in an emergency some activities (bars, restaurants, etc.) need more spaces outside the buildings, it is clear that in the future there will be a need for more public spaces.

Element	Paradigm	Principles / Criteria	Actions / Tools / Techniques	Healthcare emergency
Soil	• no to soil consumption	• Ecosystem services (ESs) • soil protection (danger/risks) • territorial security (hydrogeological/ seismic)	• avoid soil consumption • control of soil consumption (shape, fragmentation, jagging, barrier effect, etc.).	The soil saved provides ecosystem services including those related to people's well-being and health.
Density	• high building density	• Transit oriented development (TOD) • reduction of routes O-D • compactness ratio (S/V)	• densification at public transport hubs • targeted urban regeneration • building replacement with premium • management and transfer of building credits	Building densification is balanced by an increase in per capita surface area allocation. Disconnect the concept of building density from the intensity of presence of people in the built spaces.
Mixitè	• functional mix • social mix	• reducing the risks of single-functionality of neighbourhoods and settlements • reduction of risks related to lack of social cohesion	• involve multiple functions • avoid the concentration of people of the same social class • social housing	Mixitè is not synonymous of high population density and can be pursued even at a low intensity for activities present in any given place.
Green	• Green infrastructure • Eco-system services (ESs) • Nature based solutions (NBS)	• Establishment/extension of protected areas • territorial and urban biodiversity • implementation/extension of ecological networks • social / urban gardens • multifunctionality in agriculture	• plantings / forestation • multifunctional urban greenery (arboreal, shrubby, hedges) • permeabilization • eco-compensation • renaturation of compromised sites	Vegetable and forest open spaces favour air quality and environmental conditions of well-being and health. Large parks and green areas encourage physical activities with adequate possibilities for social distancing.
Mobility	• accessibility	• slow mobility	• urban pedestrian areas	The slow individual movement modes of

	• sustainable mobility	• local public transport • rail transport	• restricted traffic areas • 30 km/h zones • cycle paths • bike sharing • electric cars • car sharing	transport (pedestrian and bicycle) are consistent with the need for social distancing and the improvement of people's health and wellbeing.
Urban endowments	• Innovative urban planning standards	• standard for new needs • performance standards • infrastructure for intangible communications	• social housing • equipped green spaces • broadband / fibre optics • waste collection facilities / ecological islands • spaces for emergency management	The strengthening of the infrastructure for intangible communications allows remote activities especially in the most critical phases of the emergency.
Energy	• energy saving • renewable resources	• energy efficiency • renewable energy production • heat island effect reduction	• orientation / S / V ratio • reflective urban materials • stretches of water • green roofs / green walls • micro energy generation (photovoltaic, solar thermal, geothermal, composting, micro-wind, etc.). • rainwater recovery • district heating	Some devices are irrelevant with respect to critical health issues (panels, green roofs, etc.). Some devices are favourable to create conditions of well-being (heat island reduction).
Resilience	• social resilience • institutional resilience • urban resilience	• empowerment • tangible and intangible infrastructure	• participation / training • functional mixitè • social mix • mitigation measures • adaptive measures	Making the settled community more aware of natural and man-made risks and equipping it with the infrastructure to cope with them, in recovery and ordinary circumstances.

Tab.1 Urban planning paradigm, emergency proof principles and actions

The functional and social *mixitè* remains a value to pursue, even at low intensity. A principle that remains current is that of avoiding strictly homogeneous social islands, which can easily lead to marginalisation because they are unable to gather mixed composition nuclei which is the only way to favour a culturally complex system. The primary functions of a neighbourhood must ensure the presence of people who populate the streets at different times and who, while frequenting the area for different reasons, have the opportunity to use many of its shared facilities (Jacobs, 1961). In a health emergency the public transport service will have a reduced capacity allowed for each vehicle. It is difficult to increase the number of vehicles, given the chronic economic deficit of municipal transport companies leading to the risk of a more widespread use of *private cars*. *Car sharing* or *car-pooling* could further develop, but the strategic line of public transport would still be downsized in favour of a private solution.

The recommendations of the World Health Organization (WHO) call for an increase in the use of bicycles in cities, both because it allows social distancing to be maintained, and because exercise improves health and makes people less vulnerable to the virus. In addition, bicycle use can make a major contribution to limiting air pollution and, particularly for journeys of less than 5 km, which account for two thirds of urban journeys, therefore the bicycle is much more efficient than the car.

However, there is no doubt that the incentive for pedestrian and bicycle mobility must be accompanied by an extraordinary bolstering, of the infrastructures connected to these two basic modes of transport and must be supported by suitable policies. We are already studying the models of Budapest, Bogota, Philadelphia, Minneapolis, Oakland, Vancouver, Calgary, Vienna, Mexico City, Berlin and London which, in this emergency phase, have decided to intervene in public mobility, enhancing cycling.
Cycle-pedestrian networks will have to connect the traffic generators and attractors: railway stations, interchange car parks, production, management and training centres, universities and hospitals.
Finally, it is necessary to verify how the requalification of open spaces can affect not only the supply of specialised places for social activities and the demand behaviour, but also the improvement of the capacity of reception, inclusion, coexistence and creativity of spaces in common as well as their propensity to reactivate community values.

8. Times and spaces of the city

In certain phases, the need to modulate the intensity of people leaving their homes leads to the need to find greater integration between the urban plan and the city time plan (Bonfiglioli, 1994). It is clear how the timetables of services of public interest condition the functioning of the city and the territory. It is something that concerns both individual and collective behaviour at the same time (Mareggi, 2000). In fact, public times are those of work, shops, schools, cinemas, transport. They make the collective life of the inhabitants as well as businesses possible. They have the role of regulating the appointments between people and affect the lifetimes of each of them.
Therefore, timetables are an intangible social construction. They are not physical, yet they exist to the extent that they project themselves into the urban space. In fact, they become effective only when the service opens in the urban place where it is located, in the building which is dedicated to it. In this sense, the times of the services are localised, organised around the service itself, which is necessary for its operation.
The timetable system of working, transport and schools is located in the city and, on a large scale, in the urban system of which the city is a node of material and immaterial flows. On a small scale, the urban planning of times aims to design a new architecture for the equipping of public spaces such as, for example, the safety of pedestrian paths for children and the elderly, but also the trade and revitalisation of peripheral neighbourhoods. The possibility of using the spaces of certain services of public interest for different functions throughout the day is often not considered useful or necessary or is not allowed. The mono-functionality of the spaces facilitates management but represents a waste of resources and satisfies only a part of the possible users. The temporal continuity in the use of public spaces and equipment, in addition to meeting criteria of efficiency, makes it possible to modulate the presence of people during the day or the days of the week.
For the future, we imagine a scenario of mobility, regulated by shifts, no rush hours, no concentrated holidays and weekends, with more spread out working and rest hours. We are heading towards a city that never sleeps and towards a use of time to extend space. The dilution in time of people on the move, and of their presence in the spaces, in light of the emergency, assumes an even more important role than it already has in the organisation of the life of a city in ordinary conditions.

9. Resources

For the organisational revitalisation of the country, it will be necessary to finance structures and infrastructures in the health, education and social cohesion sectors, such as health and socio-health equipment, parks, schools, sports facilities, public offices and social housing.

The European context will need to include investment in unprecedented public policies. The new EU 2021-2027 programming will help to plan the relaunch through green interventions capable of providing immediate responses, but also to pave the way for a more resilient and supportive economy and society.
Economic resources will have to be diversified in forms and sources: EU funds and funds for the implementation of the Agenda 2030 SDGs, can be channelled into urban regeneration, favouring innovative public urban allocations, traditional channels related to construction activities (urbanisation charges, conventions, equalisation, compensation), charges applicable to new economies or deriving from the resulting benefits (green economy) and public-private partnerships. In addition to pedestrian and bicycle paths, urbanisation charges will have to be used to bring fibre optic, or at least broadband, to the areas which still have no coverage. The calamities of recent years have been answered almost always by resorting to emergency solutions. Also in this case, it will be necessary to seize this great opportunity offered by the crisis and to plan prevention on an urban scale.

10. Utopia

In urban planning, the value of utopia (Choay, 1965) is based on the experiments of industrial communities, who are bearers of development promises in an original social and settlement context. There is no shortage of references to hygienist utopias also in literature. In *Les 500 millions de la Bégum* (Verne, 1879), the two cities of France-Ville and Stahlstadt represent, respectively, an example of utopia and dystopia in urban planning and architecture (Sica, 1981).
What has happened, with hundreds of thousands of deaths and billions of people segregated at home, in ghost towns, will not pass by without leaving a mark on history. There is now a need for lucid thinking and a forward thinking, primarily in terms of politics, adequately supported by scientists, who can imagine and design the cities of tomorrow (Hall, 1996).
Will the world be globalised as before or will travel and exchange difficulties generate the need to rediscover a local dimension? The local is the dimension in which the network of social and human experiences has always taken root and opens up to the outside. Life will tend to be structured in neighbourhoods that must have all the functions, including those which have been expelled by local communities for years.
The *post-pandemic city* will be green and digital. New parks and gardens will be created in dozens of uncultivated public areas with no designated use. Small areas of therapeutic forests will be created in urban parks. Green will no longer be used only as urban furniture but as a real infrastructure.
According to the latest UN estimates, 1.8 billion people today have no home or manage inadequate housing, with very small spaces, without water and without electricity. By ensuring these people adequate housing with sufficient hygiene conditions, states not only protect their lives, but those of the entire global population, contributing to the containment of infection. It is unthinkable, in fact, to ask such people to stay at home without adequate interventions. This crisis is only exacerbating a condition that is already unworthy.

11. Knowledge and participation

History is full of events that see thousands of people occupying public spaces for various reasons, of celebration or protest. «Accustomed, as we are, to thinking that changes take place online or on a globalised scale, we do not realise that they are made of human bodies in urban spaces and that the mere presence in the square of people claiming their right to the city is a political fact of an explosive nature» (La Cecla, 2014), as happened to date for springs and struggle against regimes.
Looking to the future, the issues of aggregation, but also of social control, must be reconsidered. One wonders, for example, about the consequences of the *data urbanism*, which wants to regulate the development of urban

life with the control of private data. It will involve developing models and applications based on the *Urban Intelligence* project, which makes it possible to work on knowledge, scenario building and resilience management in the post-event. *Urban Intelligence* in turn makes use of the *Digital Twin Model*, capable of virtually reproducing the cities and parts of cities that are being studied.

In general, there is reasoning of novelties and changes in all sectors and in all the activities they have lived up to now based on the pillar of meetings and live interaction. The change that will affect citizens' participation practices and processes is destined to be profound, also with respect to the places of participation and sociability.

On the other hand, a transition from traditional tools, entrusted to social listening and direct involvement, to innovative tools entrusted to digital platforms, *smart communities* and *open data systems* was already underway. This applies, therefore, also to the practices of the local government participation.

Hence, an increase in the experimentation of forms of networking and remote public consultation on plans and projects can be expected. This reflection will focus on how to combine the advantages of direct dialogue with communities with the limits of digital techniques for involvement and dissemination of knowledge. This must be done in the awareness of having to proceed with progressive adjustments and the need for an assessment of the statistical risks present in the expansion of online procedures.

Participation, *governance* and *e-democracy* are even more, if possible, keywords to designate the possibility of citizens co-building public actions relevant for the future of their city and their associated life. These complements and deepen the classic tools of public debate and the political choices that give rise to political representations.

Scientific research and planning as well as public health decision-making are often criticised for relying almost exclusively on scientific and professional competence. However, it is necessary to reaffirm that this condition represents a strength and that skills must be strengthened and recognised. At the same time, new ways to extend the audience of those involved in the decision-making processes must always be hypothesised and tested. Finally, digital infrastructures and tools may also be entrusted with the task of compensating for the effects on democracy that could occur, in certain circumstances, due to the forced thinning of public spaces.

12. Final considerations and perspectives

The path towards a return to normality can represent an important moment in which to reflect on the relationships between scientific sectors and on the effects that these interrelationships can have on the social structure.

Urban planning is faced with a twofold challenge which, while on the one hand requires the mobilisation of intellectual resources in order to carry out an in depth analysis of the radical changes that will take place in the near future, on the other hand, it needs the creation of a finally comprehensive disciplinary framework, which is consistent and long-term.

The pandemic itself is a complex phenomenon, which requires the integration of medical and environmental sciences, urban sociology, psychology, urban planning and architecture, in order to gain systemic operational skills which are capable of dealing with complexity through a multidisciplinary approach.

It is also essential to adopt a resilient approach by addressing the crisis as an opportunity to improve global and urban governance, leveraging a new awareness. «COVID-19 has magnified the deficiencies of how we manage our cities but has also given us a unique chance to rethink, replan, and redesign. However, the question remains: will we heed these lessons? When the alternative is empty streets, quarantined urban dwellers, locked-down cities, a stalled economy, and most devastatingly of all, the loss of life, I argue we can no longer afford not to» (Acuto, 2020).

Predicting disasters is certainly difficult, if not impossible, but planning the development of the city with the margins necessary to contain the damage from recurring emergencies must be part of ordinary tasks. Urban planning is the discipline on which the responsibility for developing interpretative models capable of measuring the complexity and uncertainty of changes and proposing solutions for human settlement systems falls. It can perform this task as the cardinal principles on which it is based also respond to the needs of managing traumatic health emergencies.

Urban planning can unexpectedly claim a decisive role, contributing to the definition of the right distance between the threats of promiscuity and the opportunities that are hidden behind physical and relational proximity. To fully carry out this mediation task, the planning culture needs a renewed ability to propose long-term scenarios and visions. What we think today and, above all, what we do can change the cities of tomorrow, making them safer, more inclusive and more resilient in facing future crises.

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Image Sources

Fig.1: Elaboration by authors.

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Virucity. Rethinking the urban system

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Abstract

The paper focuses attention on three fundamental points. The first one concerns an analysis of the urban condition perceived and detected directly by the observation of the city suddenly deprived of the fruition component and characterized by the functional reset of urban activities with the exception of health functions. The second element is attributable to a systemic interpretation of the phenomenon through the analysis of the effects on urban subsystems produced by the pandemic, recalling the holistic approach to the study of urban phenomena. The third element concerns the envisaging of possible post-virus urban scenarios for which a significant bifurcation is foreseen: on the one hand, if the virus produced a rethinking of life models and the need for new ways of acting and interacting in the city we could imagine an urban future characterized by a general rebalancing of anthropic contexts; on the other hand, if the desire to return to entropic and energy-consuming models will prevail, we will continue to witness the slow degradation of human and natural habitats that will lead to the "right" extinction of human beings. These alternatives underlie a series of dilemmas that the paper emphasizes as structuring elements of possible future urban scenarios, highlighting the fundamental role of urban scientists and planners.

Keywords

Covid-19; Urban system; Post-pandemic scenarios; City risk.

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1. Introduction

We were hit in the heart of our anthropic settlement that we thought was unassailable; within which our artificial time was spent safely, marked by unwavering commitments and personal anxieties.

A sneaky, transparent, deadly enemy is now inside the megacities and man has turned out to be weak, vulnerable and perhaps defenseless.

The deafening silence of the empty city at peak times underlines the change; if "the city is listened to as a piece of music" (Lefebvre, 2009) then today there is no more music because the musicians are missing.

The only possibility of fighting is a new form of domestic resistance, in an urban context in which the functions are radically and suddenly transformed, consequently changing the image of the city and the perception of anthropic space. Suddenly citizens were denied the use of urban space, the right to "dwell" in the city: "Mortals live when they lead their lives in conservation and use" (Heidegger, 1976).

This is an urban pandemic that plagues metropolitan concentrations and constantly spares rural settlements and villages. The urban space is suddenly "contracted" in the *domestic space*, close distances, paths and places of daily use of the city. The metropolitan block has triggered a sudden and unexpected need to manifest the levels of urban resilience. Deserted cities are reconquered by spontaneous flora and pseudo-wild fauna, which becomes a new urban population.

The inner and old districts of the great historical and art cities, such as Rome, Florence and Venice, are regaining their dignity and their decorum, now that they have freed themselves from the hordes of mass tourism that expelled their legitimate inhabitants. Attending this change, as well as those that determine the clean-up of air, water and the new clarity of the sea in coastal cities, amazes us pleasantly, but only at first. Subsequently, we forced urban respirators of smog, we feel a feeling of invasion and usurpation of our own space, built by us and which is being "invaded" by species that we had banished from our places and suffocated with a consumption of senseless soil.

The virus is carrying out, as always in history, a cleaning operation of overcrowded urban systems by eliminating entropic agents. The transformation and adaptation of the natural space for the creation of anthropic habitats has long passed the natural thresholds. Megacities today appear as human concentrations where the life of those who produced it is often difficult, articulated in times of high concentration, in high density spaces, in mobility channels with paralyzing congestion, in anthropized contexts where often the main resources like air and water which are polluted and often unusable.

The growing anthropic entropy leads to an increase, often uncontrolled and unnoticed, in the vulnerability of urban systems and its component subsystems. The holistic specificity of the urban settlement, understood as part of a territorial system, which is part of a global environmental system, also leads to considerations relating to the extreme vulnerability; this is generated in these conditions due to the increase in entropy, but with a difficult effective perception. One of the highest risks is attributable to the composition, integration and synergistic effect of environmental risks with those generated by the pandemic.

Climate change is probably the greatest and most widespread cause of risk to which anthropic systems are currently exposed and their synergistic composition with conditions of high general entropy could produce irreparable damage in the socio-anthropic system.

In the event of a natural disaster (think of the extreme events affecting Indonesia), one should choose whether to remain outside exposed to the risks of atmospheric agents or to take shelter in overcrowded interiors risking a spread of the infection. Unfortunately, as it continues to happen for scientists' warnings about the irreversible effects of climate change that remain guilty, unheeded or stupidly underestimated, even the warnings launched over the years relating to the risk of a world pandemic have been ignored.

From one side, powerfully challenging the rhetoric of modernity, it has shown that city strengths (social and production resilience and resistance) and weaknesses (high exposure to natural and social attacks) have

structural and ancient origins independent from industrialism and modern technology. While from another side it has shown that city forces powerfully incorporate and depend on human technology, that they are eminent examples of both opportunistic and sophisticated abilities that humans have in orienting natural and artificial processes toward the reproduction of their own species.

2. The systemic view

In the urban system, the virus primarily attacks the socio-anthropic subsystem and in particular its structure of interactions. The ways of acting and interacting in the city are suddenly eliminated. The interaction between individuals, transactions, and exchanges become prohibited activities. Much of the *raison d'etre* of urban existence is abolished. Sharing spaces, interacting in places, meeting, recognizing, rendezvous and tightening become actions that are not allowed. Residential activity is mandatory and exclusive.

The disease has entered the cities upsetting the systemic balance. The sudden crisis of the socio-anthropic subsystem, pervaded by the invisible assassin, has quickly "infected" the other systems in an unprepared, uncertain national context, often on the verge of structural crises, this is characterized by funding for vital functions (such as health) frequently "affected" by illegal agreements, intrigues and robberies. The socio-anthropic system has reacted in general by understanding the uniqueness of the moment and the seriousness of the threat. We have returned to consider the primary elements, but sometimes confuse the basic need, as in America where the queues to get in the arms shops are longer than those in the supermarkets. The socio-anthropic sub-system is one of the generative systems of human settlement and its destabilization generates entropic interactions on the other sub-systems (Fig. 1), but also a definable phenomenon of "self-impact" readable, for example, in the lockdown which requires residential stay.

In many megacities and spontaneous cities (from South Africa, to India, to Latin America) the invitation to return and / or return home is simply inapplicable because the home is not there.

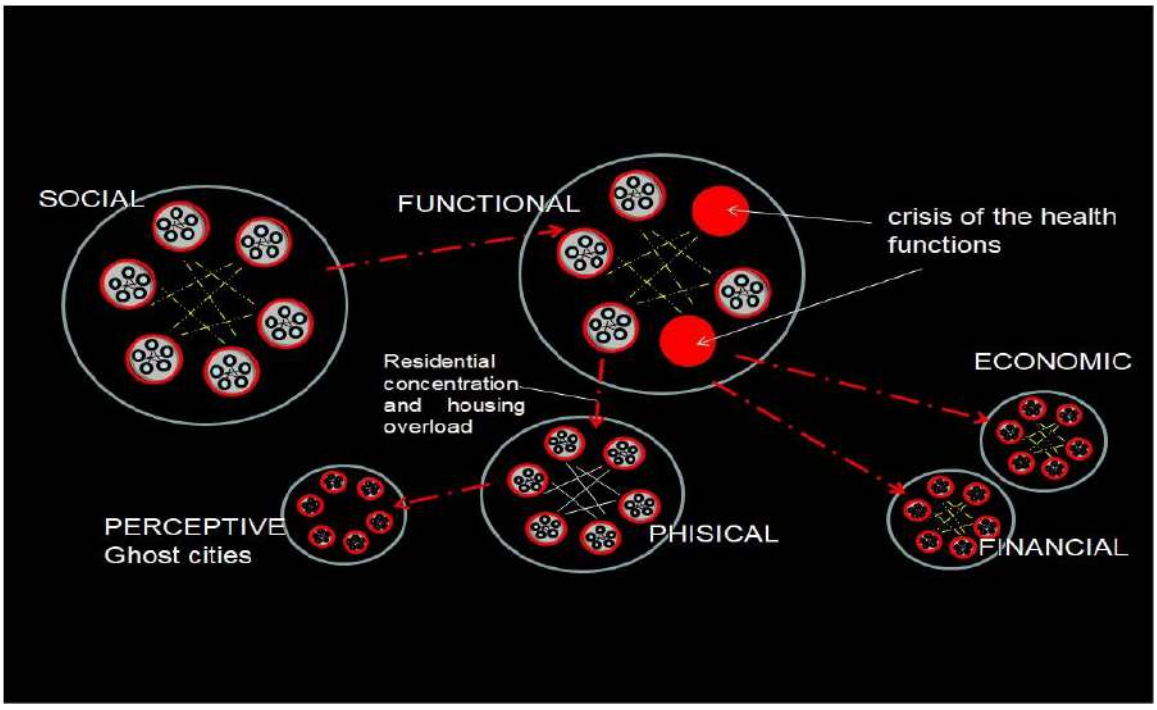

Fig.1 The Covid-19 impact on the urban sub-systems

The polarizing power of the big city has been suddenly canceled by the viral load and many inhabitants abandon the big cities to return to their villages of origin (Lèvy, 2020). The complexity is drastically reduced to a functional dualism which mainly sees residential and healthcare activities becoming characteristic of urban systems. The city is still, deserted, but tries to transfer much of its relational system to the new digital interactive space.

3. The role of the technology

ICTs gave good means and potentials of remote working to many social activities (see the intentional disarticulation of social production, particularly evident in the case of service activities, from education to administration) while basic social organization under risk (return to individual and/or small group agencies, family and community resilience) functioned as an optimizing agent in a multiscale space of possibilities.

Technological innovation intervenes to maintain relationships, save ties, to rebuild interactions and to connect. It is as if in urban contexts the city has been synchronously, brought back to the years in which the activity and the domestic economy of self-production, recovery and attention to the use of fundamental goods (in particular food) characterized the life of family groups and at the same time projected forward in a time in which almost all human activities (information, relationship, learning, transaction, etc.) are virtualized in the network of networks and mediated by the displays of personal devices.

The complexity is reduced, the flexibility stiffens, the vulnerability increases and with it the risk of being hit in the meta-system: the physical one of the residence and the digital one of the network. The new urban, unnatural, coercive, forced condition will reveal the difficulties of the most fragile individuals, as in an "unnatural" selection. Those who fail to resist isolation will trigger the social conflict that, due to the systemic structure of the city, will quickly impact and "infect" the other subsystems.

The recovery of the clarity of the skies and waters in the cities, which see the inhabitants confined in the home, corresponds to a drastic drop in the costs of fossil energy, but also a sudden process of economic recession and global impoverishment. Reflection on the correlation of these phenomena can lead to several conclusions: the first leads to predicting and putting in place as soon as possible actions that allow different nations to restart their production engines to resume the process of "growth".

A second could lead to a rethinking on the economic models of exploitation of the resources adopted by humanity, given that when these models are inactivated, the planet quickly recovers and regenerates, even within highly concentrated urban settlements, the resources necessary for man to survive.

In other words, the anomalous condition could generate a positive effect of collective rethinking on the models of existence so far adopted in the Anthropocene. Human behavior which have produced the destruction of much of our natural environment (which welcomes us) and the degradation of our living habitats.

From the Fordist city onwards, a progressive process of poisoning of anthropic settlements was triggered, substantially attributable to industrial functions, residential activities and emissions of mobility. In the American counties with the highest pollution from emissions due to vehicular mobility, there has been a greater spread and mortality of Covid-19 which, being a virus with effects on the respiratory system, finds fertile ground for its diffusion and pathological manifestation (research by Harvard TH Chan School of Public Health).

Many observers have also noted the "positive" effects of the pandemic attributable to the so-called "psychic results" and to the perception of loss that everyone has experienced in domestic confinement.

Loss is a strong feeling, which individuals perceive as crucial for the development of their biological existence: the loss of loved ones for those affected by mourning, the loss of freedom for inmates, but also small losses such as the inability to pick up a glass because of a banal thumb dislocation.

4. Some dilemmas of analysis on futures of cities under risks from social extreme events

The 2020 pandemic from Covid-19 has confirmed many interesting things for urban studies and urban scholars. Rovelli remainded us that numerous events of infectious diseases run in parallel with social and urban evolution: this from the ancient social and urban realities narrated by writers or historians (Homer for Mycenae or Thucydides for Athens), where rational and divine reasons alternate each other, to the empirical science of the last millennium (Newton for London). Millions of deaths (in 1920, one hundred years ago, roughly fifty in the Spanish flu pandemic) which makes the 2020 Covid-19 pandemic with its half a million of deaths a ridiculous competitor. Developments in health care organization have strongly pruned social disasters from pandemics (Rovelli, 2020).

The continuous general growth of human population, which makes irrelevant some local cases of demographic containment, and with it the spread throughout the planet of urban regions and megacities and of human interaction and movements, coupled with pollution and contamination of the natural environment, makes highly probable a situation of recurrent local and global infection diseases and of containment efforts similar to what we are registering in the current days. This while substantial changes in the modes of human living and in particular of human settlements production will probably be highly inertial and unsuccessful.

Manoeuvres to increase densities of population in cities in order to reduce soil consumption, preserve agricultural spaces and potentials, and preserve natural common goods as deserts, forests, polar glaciers, and oceans will increasingly compete throughout the planet with global warming and climate change, biodiversity loss, physical-chemical contamination, artificiality and artificial life, social and environmental extreme events, and entropy disorder. Thinking to the current infection disease, to make the urban and regional planning situation even more complex, an increase of urban densities attained by big and tall buildings could make social distancing and quarantine impossible and create spatial hotspots of infection. In some sense we should look at the 2020 Covid-19 pandemic as a marker and precursor of a near future of urban population trends.

Forecasting futures, in particular far futures is hard. But staying close to the current situation of cities under the Covid-19 pandemic, a superficial analysis has shown that urban population can also in some sense passively and voluntarily accept powerful political restrictions of freedom imposed by different macro and micro levels of the government system (see home confinement), despite the urban studies rhetoric of cities from Marx to Weber as human multiagentive spaces and systems (Borgo, 2019) that are powerful magnets of population attraction because of their virtuous diversity from the political intolerance of the small community of countryside villages or of corporate social aggregation of peers (Marx, 1993; Weber, 1986).

Even in the completely artificial spaces of small apartments (in the most case with no dedicated space for homework) in the low-middle classes of the welfare societies of European countries, in home working and in living at home people has shown interesting and in some sense also environmentally distorted attitudes to tentative re-creation of human resilient behaviors, accepting substantial separation from more natural external spaces with movements confined in the totally artificial proximity corridors of urban canyons to breathe and/or to buy something to eat or drink. At the same time the lack of care for individuals or groups external to the home niche has confirmed the egoistic spatial and ontological organization which is typical of cities.

Nature in the surroundings of cities have anyway reappeared in cities in many ways, for instance in the collapse of mechanical sounds in the city, cleaner air, reduction of the urban heat island phenomenon, reduction of urban waste, and so on: what is obviously the bright side of the coin while the dark side has been represented by the collapse of industrial production of goods, of the merchandising of goods other

from food products, the collapse of the small and ill-structured activities diffused in the territory that develop at the margins of the city and of its articulated societal body, in many cases with the more or less sincere emergence of people lamenting loss of their habitual works, poverty, impossibility of buying food etc., etc..
In some cases with sieges of the local town hall: while reminding of old stories of rural-urban insurgence and radical poverty, this has created intra- and inter-scale conflicts involving urban and regional and national and supranational (see conflicts among European countries) governments for local and non local distribution of financial resources.
Despite the inadequacy of most city settlements to a rapid conversion from concentrated workplaces (office buildings, schools, etc.) to distributed workplaces (networking operated from sending and receiving agents and/or interacting multiagents confined in places each from the other remotely located with insufficient availability of ICT tools and connections to the web), people in cities have showed good abilities of networking: the gradual shift in the last few years to remote services has evidently been a relevant factor of success of the new socio-productive organization.
When the barriers to people circulation were relaxed with the declining rates of the infection disease, roughly three months after the starting of the rigid home confinement, people have shown tendencies to return to normal behaviors even in an intriguing framework of fears and uncertainties in coming back to the old order, according to consolidated psychological models of human resilience after strong stresses.
In some countries ICT intelligent devices highly distributed throughout individuals and groups of city population have generated powerful abilities to analyze and control the infection disease propagation through the mapping of multiagentive movements and interaction and the profiling of individual and groups and places, challenging the fears of loss of privacy that are typical of the alleged spirit of freedom of cities.
Countryside rural contexts in Europe where people still live and produce (intriguingly by making large use of chemicals) according to the old tradition of the local community and family organization were substantially untouched by the disease and seen with a deep sense of desire, not really different from what happened for the surroundings of Florence in the Middle Age in the Boccaccio's Decameron tales of Black Pestilence, when they were observed and imagined by people infected or under risk of infection. When the regional governor of Puglia, Italy, stated one month and half after home confinement that regional residents no matter if they had or not a status of workers in agriculture could travel daily to and from their own small piece of land for horticulture, the media reported a peak of political consensus to the reelection of the governor while the regional polls were approaching.

5. Conclusions: envisaging the urban future

The city has always been the place of exchange.
How will it change with forced exchange at a distance? How will the places of being together, of social gathering and public spaces be transformed? An urban system for which, after the season of urban sprawl, which multiplied the waste of soil, the costs of transport, pollution, etc., did we recommend densification and functional mix forecasts? If public transport has to drastically reduce the number of transportable individuals, how will we move to the large metropolises where (even) new professions of employees were born to compress passengers in subway cars to allow the doors of convoys to be closed? How can urban tourism be transformed in particular in Italian cities of art or in world cities such as New York which count 40 million visitors a year? Will we have to completely rethink the functioning of the human settlement?
The question which summarizes the previous is: how will we live together?
In the end, the Covid-19 pandemic has shown everywhere a lot of contradictory phenomena which deserve analytical attention from research and/or decision making agents involved in urban studies in the domains of

both spatial organization and socio-political organization. It would be worthwhile to pursue an in-depth analysis of some dilemmas.

Countries which decided to follow the laissez faire way of the herd immunity in fighting against the flu pandemic (see Sweden) got performances not substantially worse than those of countries which enforced draconian measures of social distancing and home confinement (see Italy)

Countries which were characterized by a convergence on a certain typology of political decisions in some cases got good (China) and in other cases bad (Italy) results.

Rich regions (Lombardy, Italy) were hit much worse by the infection disease when compared to poor regions (Calabria, Italy). In Italy, again, cities that according to some conventional socio-technical view are well reputed at least in an Italian context for their organization (Milan, Turin) performed very poorly in fighting against Covid-19 pandemic while other Italian cities with comparable numbers of residents that are usually considered as victims of creative disorganization (Naples, Palermo) were completely safe.

Urban regions having plenty of public transport (again Milan metropolitan area) performed very bad when compared to urban regions lacking of public transport, this in an evident dualism of intraregional behavior in the pandemic season between northern regions and southern regions in Italy, which seems to deal with some peculiar mix of system components of urban objects, events, processes, and ontological agents, some complex frame of traditional/non-traditional urban and socio-technical systems organization.

In this moment of uncertainty the role of urban scientists and town planners is fundamental. To say it with Forester it is necessary today to "serve people in need" (Forester, 1998). It is difficult to think that a series of single measures will never provide for the control of all the variables that make up the innumerable urban complexity. Probably in the early stages of the "return to the city" some precautions will be observed which will dilute with time, allowing the virus to spread, perhaps with less deadly effects and perhaps already in the presence of therapies and vaccines.

Maybe something will change for those who already had a different idea of urban life. Some areas of intervention for new town planning seem to emerge naturally. Probably it will be necessary to reduce the intensity of use of overcrowded urban areas and rethink new suburban models.

The times of the city will have to be completely redefined to avoid functional concentration and that of travel during peak hours. Perhaps some variation of time or functional cycle could be implemented (Lynch, 1977). The shift from home to work, which can no longer be fully supported by local public transport, must necessarily include personal micro-mobility systems, such as the bicycle (in particular electric) or the electric scooter, hitherto ill-seen in the major urban areas of our country, which must even be tangibly incentivized. The provision of neighborhood co-working areas and containers, where you can go keeping distances and separations between the users, equipped with all the info-telematic technologies to carry out any type of activity, will be necessary.

The building must be thinned out trying to recover green spaces capable of oxygenating the urban system (Esopi, 2018). The large urban functions will also have to accelerate their virtualization processes, allowing telematic use which must also apply to the healthcare function which will implement domestic telemedicine in a drastic and fast way.

For commercial locations they must necessarily be considered controlled uses. Urban supermarkets will be able to provide online reservations for entry that eliminate queues and minimize the simultaneous presence of customers. For megamalls, big retail centers and hypermarkets, the use and protected thinning will be fundamental for their survival, which already showed signs of decadence.

On the other hand, a possible action to re-launch the transaction economy may materialize in the forecast, and rapid preparation, of "free zones" distributed throughout the territory.

The wide sport arenas will have to rethink the ways of use by reducing the influxes and distancing the spectators. Maybe a new wave of "tactical urbanism" will drive to a social rethink of urban spaces and to a real bottom-up redesign of the cities: "A city can only be called such when its streets belong to people" (Friedman, 1998).

Now's the time to rethink time and the spaces of the city.

Design a new time of use of the urban functions and recover and reuse the abandoned buildings, deprived areas and deserted industrial buildings for a new idea of public space. But actually, we will have a different city where, at least in the early days of the "recovery", people will change side of sidewalk when meeting fellow citizens who come in the opposite direction, where it will not be possible to recognize each other because of the protective devices that each must wear to move, where everyone will be classified "digitally" as belonging to a group and its movements will be controlled remotely.

Borrowing a term representative of the climate crisis, it is possible to say that perhaps we will see a new dimension of the greenhouse effect, considering the mini habitats and plexiglass barriers that many urban functions are preparing for use in the post-emergency phase.

Are we going to a *plexiglass sociality* or will we accept the risks of contagion by returning, prudently, to repopulate urban contexts?

If we stop for a moment to think about the urban quarantine prisoners who yearn for simple actions: retrace the spaces of the city, cross the historical places, read the monuments and architecture, meet acquaintances or simple peers, enjoy the green spaces again, view the sea again. Maybe, the invisibility of the enemy and the fatalism of many populations could also lead to the recovery of life and pre-pandemic habits, the passage of which would be denoted only by the face mask, worn in various "ways" and of doubtful efficacy.

Considering the relatively short history of man on this planet, the wonderful transformations but also the catastrophes, the destruction, the wars, which not even the viral threat seems to be able to stop It is difficult to have confidence in the ability of the so-called "sapiens" to face the big changes; the fear of what is invisible will gradually dilute over time, such as information coverage and daily bulletins on the number of victims and victims.

The fatalism dictated by personal finitude, will end up prevailing, especially in those parts of the world and in those cities used to living with natural and anthropic risk.

In the end, cities show their well known art of "muddling through" (just to remember the sociological agentive figure by Lindblom), with unexpected traits of socio-technical resilience and of rapid adaptation to sudden dismantling of some highly reputed urban machinery (transport and mobility by private and/or public transport) for instance through opportunistic re-tuning of the social life at individual and group level on some innate human-spatial measures and distances (see the neighborhood contexts) that allow easier movements to local people.

Arguments and dilemmas which give room to technical hopes in a possible pause of the continuous growth of the artificial and pollutant side of cities of today and of the near future, if it is true that in the very short time of two or three months a sudden change in technological organization has generated enormous outcomes in terms of stopping well rooted trends to the growth of artificiality of cities.

However, this first period of "loss" could lead many of us to rethink their "urban existence" and to reactivate processes of raising social capital also by rediscovering neighbourhood relationships hitherto ignored. Loss can lead us to reflect on the reasons for life, which can be reduced to two elements: knowledge and relationships. The fear of the disease could perhaps lead to new dimensions of reflection on the purpose of the time granted to each, in which the presence on the planet is factualized. Now's the time to rethink the urban system and remould the Anthropocene. Many of the described issues have been developed and proposed by urban scientists for a long time but have been unheard; on the other end, it is needless to say:

"we had already said it", maybe the scholars and town planners have to take the occasion to promote a new urbanism. This is probably the best hope we can make to ourselves in this time; but if we consider, as a return to normality, the re-adoption of the dominant and connotative models and behaviours of our pre-Covid society, then there is a strong risk that fear and the feeling of loss passes in vain, without leaving a change behind (Giordano, 2020).

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Image Sources

Fig.1: The scheme has been created by R. Fistola

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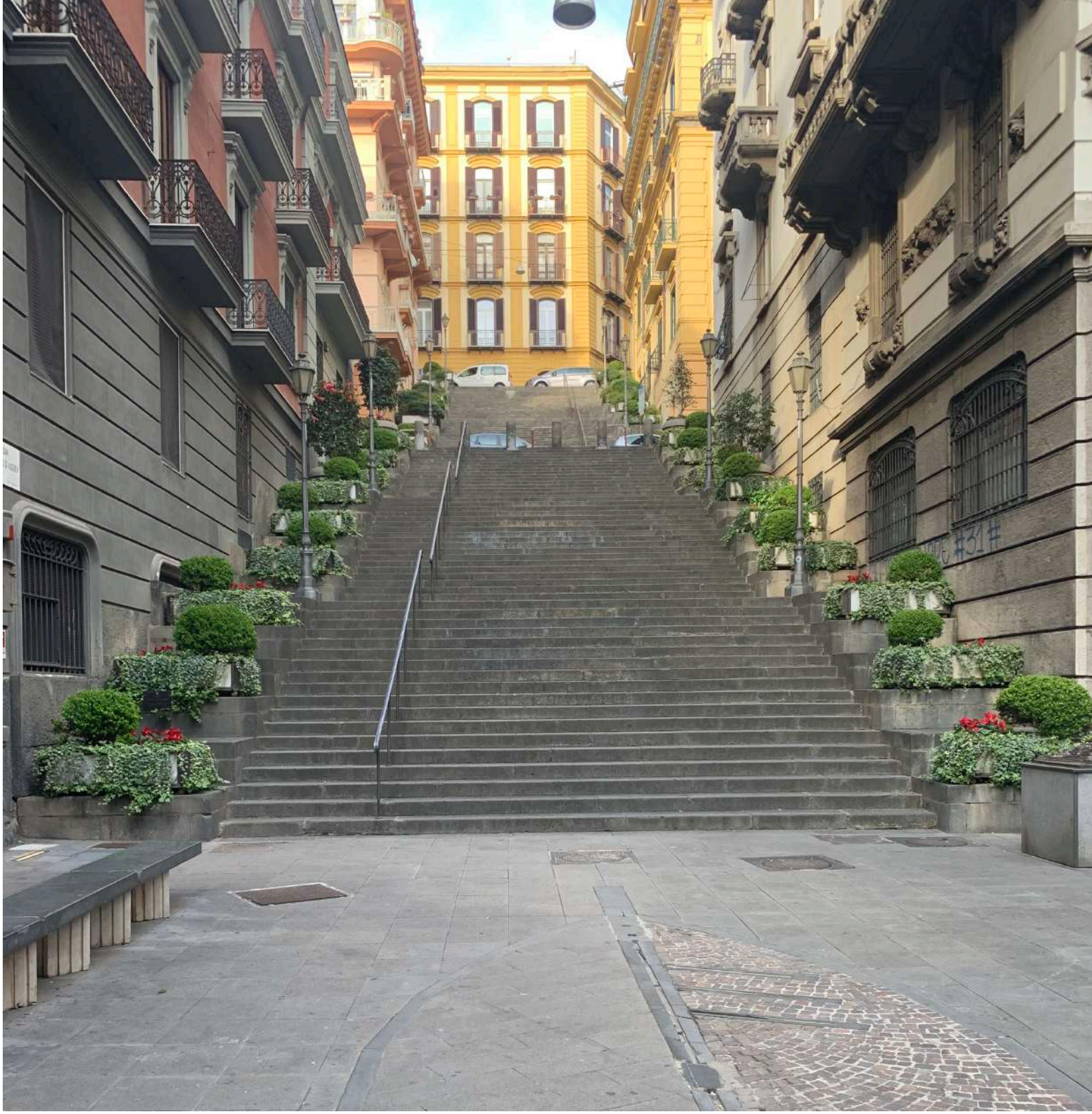

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The role of the urban settlement system in the spread of Covid-19 pandemic. The Italian case

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Abstract

The paper proposes a focus on three main aspects related to the spread of the new coronavirus in our country: the correlations that have been established between the spread of the Covid-19 virus and the settlement system of our country; the urban and territorial phenomena that can be associated, positively or negatively, with the diffusion of the virus; and, finally, the correspondence between homogeneous clusters of Italian provinces (due to the current most significant urban phenomena) and the intensity and spread of the infection. The research is divided in four steps: the identification of the scientific and disciplinary approach, the definition of territorial areas and their descriptive variables, the choice of computational models, and the evaluation of the results. The main findings of the study highlight that significant correlations are not always identifiable between settlement characteristics and the spread of the infection. The diffusion of the new coronavirus is closely related to some of the main features of the demographic (e.g. people aged 65 years and above) and socio-economic (e.g. GDP for inhabitant) structure of the urban population.

Keywords

Holistic approach, Settlement system, Spread of Covid-19 virus, Statistic analysis.

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1. Introduction

"La matematica è lo strumento indispensabile per capire quanto sta accadendo e scrollarsi di dosso le suggestioni. Le epidemie prima di emergenze mediche sono emergenze matematiche perché la matematica non è la scienza dei numeri, è la scienza delle relazioni, descrive i legami e le relazioni tra enti diversi cercando di dimenticare di cosa sono fatti quegli enti astraendoli in lettere, funzioni, vettori, punti e superfici. Il contagio è una infezione della nostra rete di relazioni" (Giordano, 2020).

There are essentially three scientific questions that this work intends to answer. The first concerns the possible correlations that can be established between the intensity and spread (as at 31 May 2020) of Covid-19 infection and the settlement system of our country with reference to the provincial areas and, limited to the available variables, also to the capital cities. The second question relates to the identification of urban and territorial phenomena that may be associated, be it positively or negatively, with the spread of infection. The third question concerns the update (2020) of the main phenomena of settlement nature (*inter alia*) that can be recognised within the system of Italian provinces in order to identify, with reference to the intensity and spread of infection, possible and different correspondences with homogeneous clusters of provinces. This work is divided into six phases: the identification of the scientific-disciplinary paradigm in which the research is developed, the definition of the territorial areas, the phenomena examined and the set of descriptive variables, the identification and implementation of calculation tools, the definition of the analysis models used, the results of the elaborations carried out, the conclusions.

2. The scientific paradigm

The prominent feature of a chaotic system is its high sensitivity to even the smallest actions that can occur at any point of its being and becoming. Therefore, the degree of indeterminacy that can reach a chaotic system is extremely high and, in addition, any phenomenon, even a small phenomenon, can very quickly reach macroscopic proportions. In other words, in the presence of chaos, any prediction can reach relevant inaccuracies (Gargiulo & Papa, 1992).

The theory of dynamic systems can be considered as the essential support in the development of the conceptual framework of reference for the study of "chaos". The definition of a dynamic system is given by the elements and relations between the elements of the system, as well as the laws and criteria of (state) evolution over time (Gargiulo, 2009).

The space of existence of the evolution of the system is known as the space of states or space of phases; this space is a purely conceptual abstraction, the coordinates of which are the components of the state. Of course, the spatial coordinates of the phases change with the context. Although it is recognised that the behaviour of chaotic dynamic systems is unpredictable, the space of states can be useful to represent this behaviour in geometric form.

In order to refer back to our cognitive/interpretative capacity the complex systems and, with them, the city and the territory, these can be broken down into subsystems that, with less difficulty, enable us to find the structure of the system and, therefore, the set of relations that are established between the elements of each subsystem and between these and other subsystems: the organisation (Morin, 1993).

The organisation represents the constituent property of a system and the types of relationships/interactions that are established between the elements of the system determine its functioning.

In order to understand the functioning of a system, it is necessary to adopt a holistic approach and to know it as a whole, in its entirety. Knowledge, as the result of the sum of the behaviours of the individual parts, does not restore the overall behaviour of the system. As Morin states "the organisation connects, in an inter-

relational way, different elements, or events, or individuals that consequently become components of a whole" (Morin, 1983).

It is a widely shared opinion that the holistic approach, together with the General Systems Theory and the complexity paradigm, offers a valid theoretical support useful to the knowledge and interpretation of the territory and the city, especially during historical times of "bifurcation" such as that we are currently experiencing (Bottero et al., 2017).

In fact, in addition to the speed of transformation processes, the coexistence of apparently contradictory phenomena, the growing spread of the products of technology over the city and throughout the territory, unpredictable catastrophic events occur, such as the Covid-19 (Fang & Wahba, 2020), a pandemic that has exploded in Italy in all its virulence since February 2020, forcing to change our social behaviour and, with it, many relationships that structure the urban and territorial system.

The work presented in this article, which aims to understand if and which characteristics of the territory have contributed to the spread of the Coronavirus, uses the holistic-systemic approach, summarised so far, seeking the relationships/interactions between the numerous elements that come into play in a complex system such as the territorial and urban system.

To this end, the reading and interpretation of the data could only refer to statistical multivariate techniques that allow, through the use of a significant amount of data, a "synthetic" reading, i.e., the reading of the mutual influences of a complex system.

Specifically, in the first part of the work, the objective is specified in the study of the relationships between the descriptive characteristics of the various subsystems (anthropic, functional, economic, geo-environmental and mobility) through multivariate linear regression techniques. The choice of scale, for this reason, was the provincial scale, with some specifications to the urban scale of the provincial capital, to also allow for the reading of the influence of the hegemonic city in the provincial territory.

In the second part of the work, through the method of the principal components, the primary attributes that define and condition the national settlement system on the provincial scale are studied.

In a nutshell, the objective of this analysis is to understand whether the territorial characteristics significantly correlated with the spread of the pandemic play a relevant role in the provincial spatial planning, as appears from the application of factorial analysis and cluster analysis.

3. The definition of variables

3.1 The dependent variable: the extent of infection

In order to identify the dependent variable representative of the distribution and spread of the pandemic in the individual provinces of the national territory, the data provided by the government agencies involved in the management and monitoring of the Covid-19 crisis were used.

Amongst' the data available in open access format, those relating to the number of total infections and deaths due to Covid-19, declared by the individual regional agencies, during the first four months of 2020 have been selected. The numerical values related to infections were obtained from the data repository associated with the WebGIS platform developed by the Italian Civil Protection Department for the Covid-19 crisis on 31 May. The values of deaths due to Covid-19 were taken from the report *Impact of the Covid-19 epidemic on the total mortality of the resident population in the first four months of 2020* prepared by ISTAT (Italian National Institute of Statistics) and ISS (Italian National Institute of Health) and updated on 30 April.

At this stage, a hypothesis was made to develop a synthetic measure of infection that would jointly take into account the number of positive cases and the number of swabs carried out, excluding the number of swabs carried out on individuals already declared positive for the virus to check their recovery. However, the different

reliability of the variables involved suggested choosing only one descriptive variable of the infection, whilst being aware of its poor reliability.

3.2 The independent variables: the settlement system

In order to investigate whether and to what extent the characteristics of urban planning have influenced the distribution and spread of infection in Italy, a set of 28 continuous quantitative variables has been defined to describe the "structure" of the system of the Italian provinces, i.e., the main elements and relationships (which can be interpreted through the subsequent use of multivariate statistics techniques) that comprise and determine the organisation and functioning of this territorial level of reference (Masoumi & Shaygan, 2016).
The variables chosen are representative of the main 5 sub-systems that characterise the settlement system and reflect the holistic approach adopted:

- anthropogenic sub-system, consisting of 7 variables related to the demographic structure of the settled population, such as number of inhabitants and settlement density of both provinces and capitals, population rate over the age of 65, average age and natural balance (Gargiulo et al., 2018);
- socio-economic sub-system, consisting of 8 variables related to the economic-productive structure of the settled population, such as elderly dependency ratio, active population, number of unemployed, ratio between the employed and active population, income and GDP per capita, average income per provincial capital;
- functional sub-system, consisting of 2 variables related to the supply of some of the main health and training services in the provincial territories, such as universities and hospital beds;
- mobility sub-system, consisting of 6 variables relating both to mobility supply, in terms of vehicle fleet, public transport fleet (buses and trolley buses) and motorcycle fleet, as well as transport demand, taking into account the number of total daily movements and the number of movements for study and work purposes;
- geo-environmental sub-system, consisting of 5 variables related to the territory over which all the activities, spaces and channels of the provinces are distributed, such as territorial surface area, portion of mountain territorial surface area, average temperature value for the months of March, April and May of the thirty-year period 1981-2010 , distance of the provincial capital of each province from the provincial capital of the area infection by region, distance from the provincial capital of the area of infection (Bergamo) to the capital of each province (Zucaro & Morosini, 2018).

Given that part of the data provided by ISTAT refers to 2011 (the year of the population census), the provinces of Verbano, Forlì-Cesena and Southern Sardinia were excluded from the study, as they were established after that year.
Specifically, as regards the functional sub-system, the variable describing the capacity of the health system has been found from a dataset relating to hospital facilities throughout Europe, the source of which is the European Union Institute of Statistics (EUROSTAT). Being a geo-spatial dataset, the independent variable related to the capacity of health services throughout Europe was obtained from a spatial join operation, performed in terms of GIS, with the shapefile related to the administrative borders of the Italian provinces.
From the reading of the settlement, geographical and territorial information collected, it is possible to record the gap - and not only the economic gap - between the northern provinces and the southern provinces of Italy: Milan, Bolzano, Bologna are at the top of the ranking by GDP per capita, with values even above the European average; at the bottom of the ranking are the provinces of Agrigento, Bari and Cosenza. Provinces such as Biella, Savona and Trieste are "amongst the oldest", unlike Naples, Caserta, where the old age index has the lowest values.

With reference to the functional and mobility sub-systems, the reading of the collected data shows a state of affairs that is not influenced by geographical location, but rather by the metropolitan dimension. Specifically, a greater number of daily movements characterises the Metropolitan Areas (Milan, Naples, Turin, Bari, etc.) compared with the other provincial territories, associated with the greater size of the vehicle fleet (private and local public transport network).

ID	Variable	Source	Year
P01	Covid-19 infections	Civil Protection	2020 (31th May)
P02	Deaths due to Covid-19	ISTAT & ISS	2020 (30th April)
V01	Territorial surface	ISTAT	2020
V02	Territorial surface of the capital	ISTAT	2019
V03	Mountain areas	ISTAT	2011
V04	Resident Population	ISTAT	2019
V05	Resident Population of the capital	ISTAT	2019
V06	Housing density	ISTAT	2019
V07	provincial capital housing density	ISTAT	2019
V08	Average age	ISTAT	2020
V09	Over-65 population	ISTAT	2019
V10	Natural balance	ISTAT	2018
V11	Elderly dependency ratio	ISTAT	2019
V12	Active population per 1,000 inhabitants	ISTAT	2011
V13	Unemployed per 1,000 inhabitants	ISTAT	2011
V14	Average income per capita	ISTAT	2014
V15	Average income per provincial capital	Il Sole 24 Ore	2016
V16	GDP per inhabitant	ISTAT	2016
V17	University locations per 100,000 inhabitants	CRUI	2017
V20	Average temperature value March 1981-2010	ISPRA	2014
V21	Average temperature value April 1981-2010	ISPRA	2014
V22	Average temperature value May 1981-2010	ISPRA	2014
V24	Distance of the provincial capital from the province of first infection	Google Maps	2020
V25	car fleet	MIT	2018
V26	bus and trolley bus fleet	MIT	2018
V27	motorcycle fleet	MIT	2018
V28	Total daily movements	ISTAT	2011
V29	Daily movements for study reasons	ISTAT	2011
V30	Daily movements for work reasons	ISTAT	2011
V31	Hospital beds	Eurostat	2019

Tab.1 The selected dependent and independent variables

3.3 The correlation analysis between variables

After collecting the set of 28 variables, a correlation analysis was carried out to exclude the highly correlated variables and to therefore ensure the significance of the results of the subsequent multivariate statistics analysis. The collinear variables, in fact, do not provide additional information and it is difficult to identify the effect that each of them has on the dependent variable

Table 2 shows the high linear correlation between the variables highlighted in red such as: the resident population, the over-65 population, the vehicle fleet, the total daily movements and the hospital beds. These variables are mainly related to the sub-systems of both functional and anthropic mobility, given that, as it was easy to guess, the resident population is highly correlated with the demand for mobility and the supply of health services. The number of inhabitants is also positively correlated with some of the demographic variables considered, such as the over-65 population and population density.

However, it was decided to keep some variables even if they are highly correlated with others, such as beds and the over-65 population in order to allow for a more immediate interpretation of the final outputs.

Ultimately, 7 variables have been excluded from the initial dataset, which, in terms of significance, do not provide additional elements to the interpretation of the phenomenon under study.

	Resident Population	car fleet	bus and trolley bus fleet	motorcycle fleet	Total daily movements	Daily movements for study purposes	Daily movements for work reasons	Hospital beds
Resident Population	1	0.991	0.930	0.961	0.993	0.993	0.973	0.984
car fleet	0.991	1	0.929	0.954	0.987	0.983	0.970	0.978
bus and trolley bus fleet	0.930	0.929	1	0.890	0.903	0.934	0.869	0.914
motorcycle fleet	0.961	0.954	0.89	1	0.954	0.948	0.938	0.955
Total daily movements	0.993	0.987	0.903	0.954	1	0.976	0.993	0.987
Daily movements for study reasons	0.993	0.983	0.934	0.948	0.976	1	0.944	0.963
Daily movements for work reasons	0.973	0.97	0.869	0.938	0.993	0.944	1	0.981
Hospital beds	0.984	0.978	0.914	0.955	0.987	0.963	0.981	1

Tab.2 Pearson's correlation matrix only with the excluded variables correlation values

3.4 GIS techniques for data verification and control

The tool used for the control and spatial representation of the data and results obtained from this work was the ArcGis computer software. The first part of the research work was dedicated to the collection and management of spatially referenced data, in order to have a cognitive overview of the urban phenomenon (Stillwell & Clarke, 2004). More specifically, a geodatabase divided into five sub-systems (anthropic; socio-economic; functional; mobility and geo-environmental) has been developed on a the provincial scale in relation to the Covid-19 infection index, with the aim of examining the spatial relationships between the characteristics of the urban system and the spread of Covid-19 infection throughout Italy during the cognitive process.
In the second part of the research work, the ArcGIS software has been a tool to support the use of statistical techniques used in order to represent and verify the statistical results obtained, above all, to identify the homogeneous characteristics of the provinces (cluster analysis). Although the use of statistical techniques and the development of GIS tools represent two distinct areas of research, they can both benefit from their joint use (Fotheringham & Rogerson 1993). Their real and functional integration currently represents a frontier of research (Mandal & Mondal,2019) for the definition and analysis of the complexity of urban phenomena, in this case, for the relations between the components of the urban system and the measurement of infection (Hou et al., 2017).

4. Analysis models

4.1 Multiple linear regression

Multiple linear regression is a statistical analysis technique used to make a prediction of the evolution of a dependent variable by taking into account several independent variables (Johnson & Wichern, 1998). The objective is to identify the equation underlying the multiple regression model that can numerically define the linear relationships between the dependent variable and the independent variables considered.

$$Y_i = \beta_o + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_n X_{ni} \quad (1)$$

In the event of n independent variables, the multiple regression model assumes the expression reported in equation 1, where β_o is the intercept with the Y_i axis , β_n is the inclination of Y_i with respect to the X_{ni} variable keeping the other independent variables constant.

The IBM SPSS Statistic Version 20 software was used to perform the multiple linear regression analysis. Specifically, the Best-Subsets approach has been used for this application, which enables all possible regression models to be assessed given a number n of independent variables. It has been chosen, as the literature suggests, to select, as the criterion for selecting the best sub-models, the R^2 determination index, the value of which is corrected taking into account the number of independent variables inserted in the model and also considers the width of the data sample (Maxwell, 1981; Muirhead, 1982).

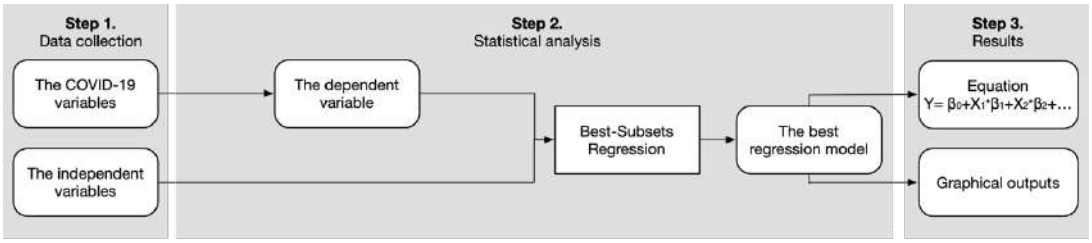

Fig.1 The conceptual procedure for the regression analysis

The use of this specific approach enables the calculation limits of the stepwise approach to be overcome which, in order to identify the best model, makes a limited number of attempts without considering all possible combinations of models. Before proceeding with the regression, the 22 variables used (1 dependent and 21 independent) were normalised using the maximum and minimum values of each variable in order to prevent the different dimensional quantities of the variables influencing the result of the analysis.

Results of Multiple linear regression

The selection of the independent variables to be included in the elaboration aimed at identifying any significant relationships between independent variables (predictors) and dependent variables in one with the choice of the regression model to be applied are the most important elements in the approach to the elaboration of multiple linear regression. In this case, the selection of the independent variables to be included in the model was made on the basis of the initial set, consisting of 28 variables, subsequently reduced to 21, in order to take into account the strong correlation between some of the most significant variables, a correlation that could have presented problems of multicollinearity, therefore reducing the significance of the model used and especially the results of statistical processing.

The dataset used for the analysis of the multiple linear regression comprises a dependent variable (Covid-19 counts) and the 21 independent variables measured for the 104 provinces under analysis (the provinces of Forlì-Cesena, Verbano-Cusio-Ossola and South Sardinia were excluded due to lack of data).

The application of the Best-Subsets approach to this dataset enabled value of R^2 to be obtained, adapted equal to 0.562. Therefore, the best model identified is able to explain more than 56% of the analysed phenomenon.

ID		β	Significance	Importance
	Intercept	0.632	0.020	
V31	Hospital beds	0.707	0.003	0.268
V08	Average age	-0.186	0.023	0.159
V24	Distance of the provincial capital from the province of first infection	-0.164	0.039	0.129
V10	Natural balance	-0.444	0.042	0.126
V22	Average temperature value May 1981-2010	-0.189	0.065	0.104
V01	Territorial surface	-0.093	0.086	0.089
V16	GDP per inhabitant	0.188	0.086	0.089
V13	Unemployed per 1,000 inhabitants	0.082	0.273	0.036

Tab.3 Statistical significance of predictors

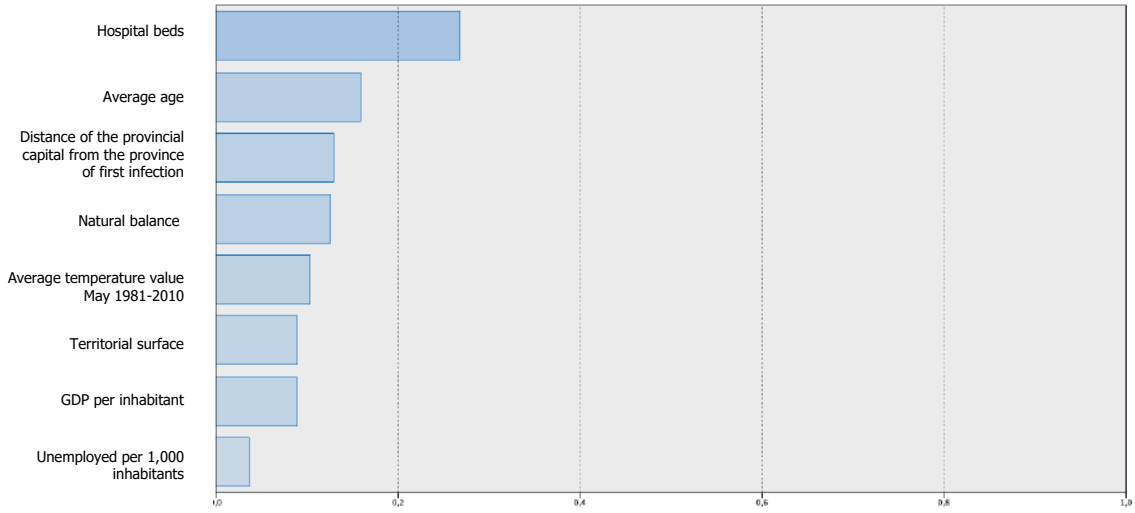

Fig.2 Importance/significance of each predictor

Table 1 shows the list of the eight independent variables selected from the Best-Subsets approach and their values of β_ which are the angular coefficients of the regression model equation. Looking at the values of significance, the eighth variable (Unemployed per 1,000 inhabitants) must be excluded given that the value of significance is greater than 0.1.
The linear model equation estimated from the multiBest-Subsets regression analysis is as follows:

$$\text{Infections}=0.632+0.707*V31-0.186*V08-0.164*V24-0.404*V10-0.189*V22-0.093*V01+0.188*V16 \quad (2)$$

It should be noted that the coefficients in a multiple regression model must be considered as net regression coefficients: they measure the variation of the response variable Y in correspondence to the variation of one of the explanatory variables when keeping the others constant.

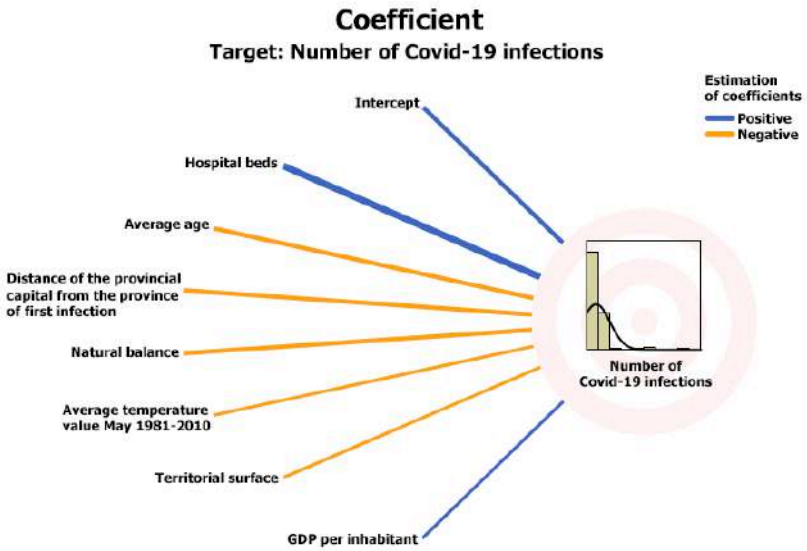

Fig.3 Relationships between the dependent variable and the selected independent variables.

There are numerous outputs of the calculation model used in this study (Best-Subsets) and not all of them are easy to interpret. However, for the objectives of this work, it may be useful to start commenting, in addition to the equation of the estimated linear model shown above, on the synthetic representation below in which

the estimation of the coefficients is highlighted with respect to the level of decreasing significance of each one, the sign that assumes the coefficient in the estimation equation and the normalised value of each coefficient.

There are 7 independent variables, selected directly by the model's algorithm, which have certain characteristics - in terms of number, distribution and variability - that can relate to the data related to the dependent variable (measurement of infection) in the Italian provinces as at 31 May 2020, of which two are positively related and 5 are negatively related, with a decreasing level of significance and consequent increasing importance. Unfortunately, none of the variables identified are representative of the characteristics of urban and territorial planning - which is the specific discipline of urban planning in the strict sense. However, other predictors can contribute - in conjunction with the identification of the latent system of the Italian provinces obtained through the analysis of the Main Components and especially with the Cluster Analysis that complete this study - to identify phenomena of coexistence and collinearity between the consistency and distribution of infection on a provincial scale and the settlement system of our country. The variable number of hospital beds is the most important predictor of the entire panel of variables given that its normalised coefficient (0.770) takes the highest value and its significance (0.003) the lowest value and consequently the highest importance. As expressly mentioned in the section of the study relating to the definition of the correlation between the variables used, this data is strongly correlated with other very significant indicators of the settlement structure of our country - resident population, over-65 population, vehicle fleet, daily movements, etc. - and, therefore, the considerations on this predictor must take into account, so to speak, the baggage of information underlying the beds variable. In other words, the number of beds can be identified as a multiplier of the infection, not only because the hospital facilities have become real multipliers of the infection, in conjunction with the RSA (*Residenza Sanitaria Assistenziale* – Extended Care), but also because they are a measure related to the number of elderly people over the age of 65 (age group particularly exposed to the infection and with fatal consequences), the number of residents and the dynamism of the exchanges of each province. The coefficient of the second and final predictor with a positive sign, but with a decidedly marginal importance, is 0.082 and refers to the GDP per settled inhabitant. In a nutshell, it can be said that as the number of beds increased and, with it, as the number of people aged over 65 and the GDP per inhabitant increased, the infection also increased, naturally due to the different coefficients. All the other predictors have instead operated in the sense of a reduction in the number of infections, obviously with different weightings. The most significant was the natural balance with a normalised (negative) coefficient of 0.444, so it can be said that a higher natural balance helped to reduce the total number of infections. The other predictors, again with a negative sign, have remarkably close normalised coefficients values and, therefore, their role in reducing the infection can be considered to have a similar effect. This specifically concerns the distance of the provincial capital from the area of first infection, the average temperature over the last twenty years, the average age and the surface area of each province. In a nutshell and by way of example, it can be said that the value of the geographical distance from the area of first contamination has contributed to reducing the infection. Therefore, an average value of the highest temperature detected in recent years has reduced the spread of

the epidemic and the territorial extension of each province has played a role in mitigating the infectiousness of the virus.

The results of this analysis have suggested increasing the knowledge of the latent structure of our settlement system in order to complete the analysis underlying our study and allowing a comparison, with equal effectiveness, of the intensity and spread of infection and the anthropic, socio-economic, functional, spatial and geo-environmental characteristics of the metropolitan areas and provinces of our country.

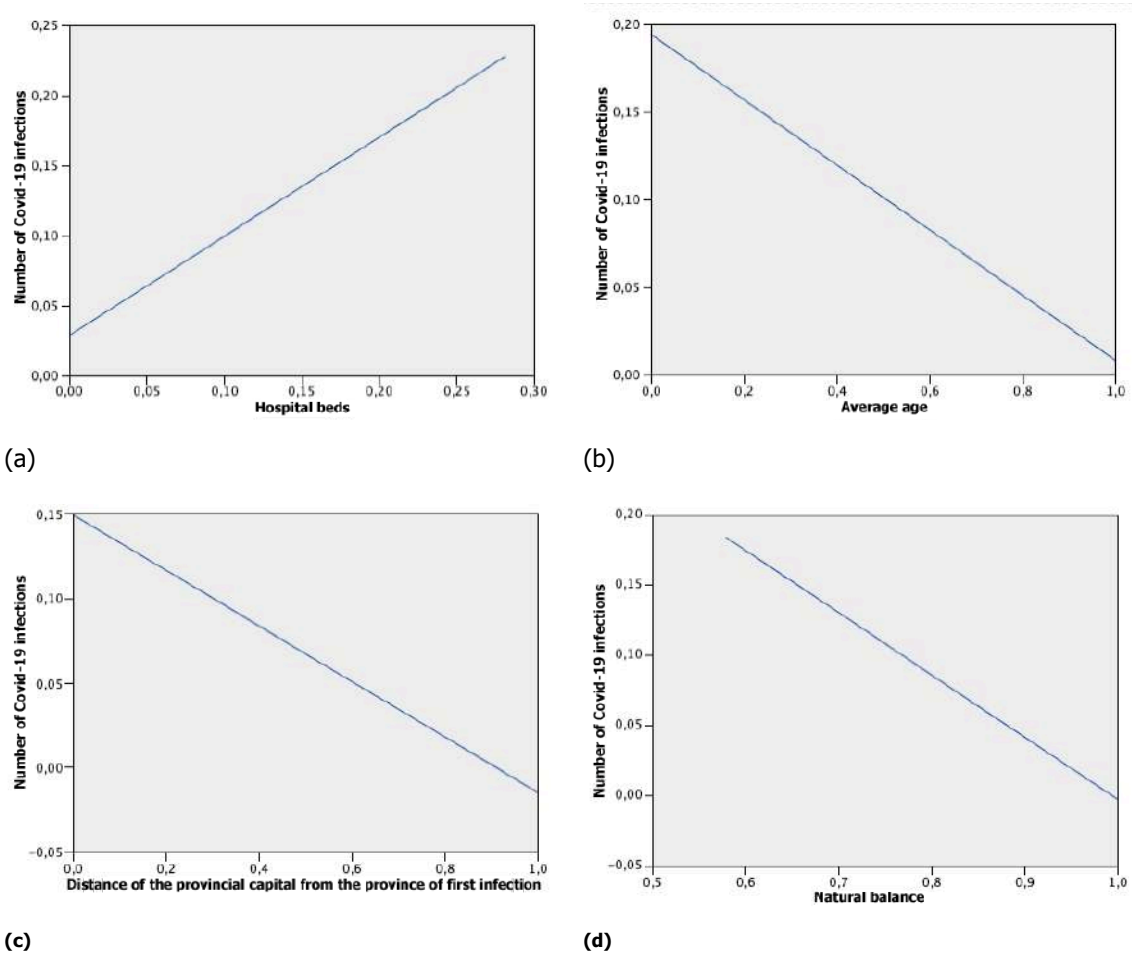

Fig.4 Performance of the significant variables with respect to the dependent variable

4.2 Principal components analysis

The principal components analysis (PCA) provides a description of the variability of a set of variables by means of a subset of new variables, known as main components, which are independent of each other, obtained as linear combinations of the original variables and ordered according to the maximum share of variability (Sadocchi, 1981).

The PCA with reference to p variables, $X_1, X_2, \dots, X_i, \dots, X_n$ with $i = 1, 2, \dots, p$ (random multivariate vector), enables as many p variables (other than the first ones) to be identified, $Y_1, Y_2, \dots, Y_i, \dots, Y_n$ with $i = 1, 2, \dots, p$ (multivariate vector), each linear combination of the p starting variables. The objective of the PCA is to identify appropriate linear transformations Y_i of the observed variables that can be easily interpreted and capable of highlighting and summarising the information inherent in the initial data (Härdle & Simar, 2003; Chakraborty & Reader, 2010).

The application of the PCA to the set of 21 variables selected for this study enables new variables to be obtained that can provide a concise explanation of the variability observed in each of the 21 initial variables. In other words, this method provides a description of the phenomenon under study by means of a small number of unrelated dimensions, ordered according to their importance, the coefficient of which represents the weighting that each variable has in the determination of the component, enabling an easier interpretation (Papa & Piscopo, 1988).

The IBM SPSS Statistic Version 20 software was used to perform the factorial analysis of the main components. The statistical analysis was carried out through the method of factor extraction, setting the threshold value of the eigenvalue, for the choice of the factors, equal to 1. The method chosen for factor rotation (Varimax) maximised the variance of the factor weightings. The outputs, numerical values, matrices and graphs that the software provides have been used in the interpretation phases of the results.

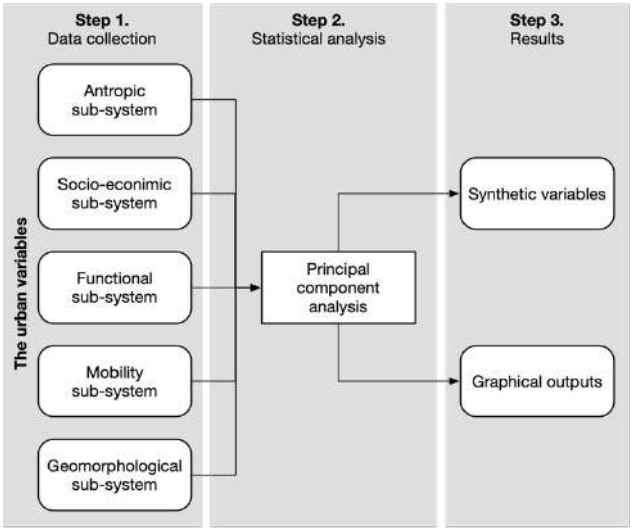

Fig.5 The conceptual procedure for the principal component analysis

For the execution of the analysis of the main components (PCA), data related to the 21 continuous quantitative variables were used as inputs to describe the urban phenomena of the Italian provinces.

The graph shown in Fig. 6 shows that the representation of the eigenvalues for each component has an "elbow" in correspondence of the fifth component that recommended to stop the search for significant components at this value.

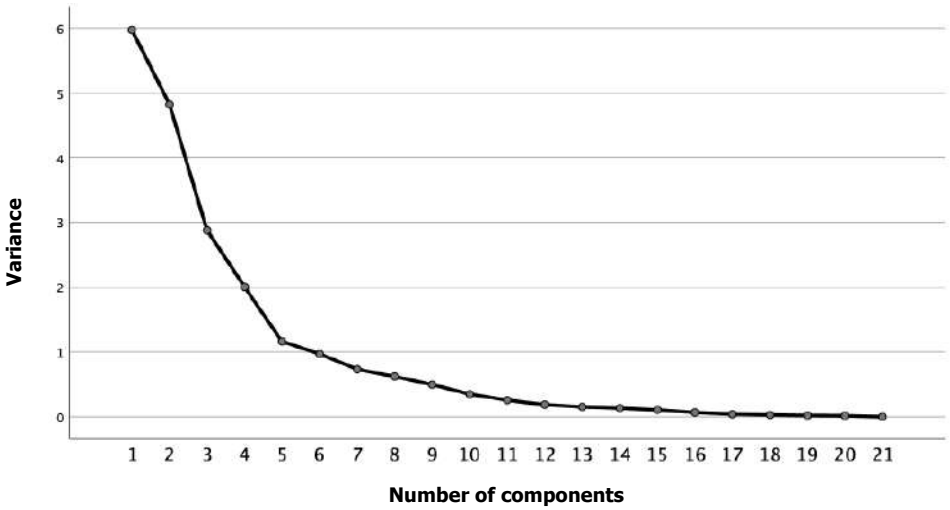

Fig.6 Scree-graph of principal component analysis

The following table shows the percentages of variance of PCA eigenvalues relative to the rotated matrix of the total explained variance. In fact, it should be noted that the distribution of the variables on the components presents some lack of homogeneity as they are grouped around values that are not vastly different from each other. Therefore, it was necessary to consider the sorting of the variables in the rotated factor matrix, which provides a more meaningful sorting of the variables. The first two components "explain" more than 20%, with a cumulative variance of more than 51%.

Factor	Rotation Sums of Squared Loadings		
	Total	% of variance	% cumulated
1	4.717	22.46	22.46
2	4.180	19.90	42.36
3	3.880	18.47	60.84
4	2.326	11.07	71.91
5	1.730	8.23	80.15

Tab.4 The rotated variance explained

Results of principal components analysis

The multivariate statistical analysis of the principal components, as mentioned above, was conducted from the same variables used for the multiple linear regression. The aim of this part of the work is to identify which characteristics (settlement, anthropic, functional, social, economic, etc.) play a relevant role in the urban and territorial structure of the Italian provinces.

The principal component method provides three outputs: the factorial axes that cut the case cloud along the main axes of inertia, the character coordinates (variables) and object coordinates (104 provinces) on the set of axes defined by the main components.

The first step for the analysis of the outputs consists of the analysis of the eigenvalue vector that enables the percentages of variance explained by each component in relation to the total to be obtained.

In this case, the system is definitely structured as the first 5 components explain 80% of the whole system variance.

The variance explained for each of the first three components assumes a value close to 20% (over 22% for the first, just under 20% for the second and almost 19% for the third) (Tab. 4).

The first component, which explains more than 22% of the variance of the system of variables taken into account, can be defined as an index of the metropolitan city effect. This index is characterised not only by the number of elderly population and the number of hospital beds that occupy the first two places in the ranking, but also by the population living in the capital and the density of settlements in the capital and the province.

It is a component that, albeit not significantly prevailing over the two components that follow it, is nevertheless relevant for the analysis of the territorial system in relation to the Covid-19 crisis, to which reference is made in the following cluster analysis.

The correlation values between the individual variables and the first component show that 15 are positively correlated and 6 are inversely correlated (three of which - active population, distance from the capital of the infection and universities - have values very close to zero and, therefore, not very significant for the interpretation of the index). Overall, there are 8 variables close to zero, with a plus or minus sign (with a value between +0.092 and -0.092).

Variables	Components				
	1	2	3	4	5
Territorial surface	0.230	-0.200	-0.574	0.131	0.557
Territorial surface of the capital	0.319	-0.184	0.215	-0.088	0.713
Mountain areas	0.043	-0.006	-0.904	0.115	0.185
Resident Population of the capital	0.877	0.058	0.079	0.063	0.244
Housing density	0.611	0.249	0.293	0.260	-0.405
Provincial capital housing density	0.770	0.174	-0.063	0.212	-0.417
Average age	-0.154	0.225	0.004	-0.929	-0.002
Over-65 population	0.964	0.105	-0.013	0.123	0.093
Natural balance	-0.773	-0.049	0.040	0.455	-0.214
Elderly dependency ratio	-0.145	0.241	-0.024	-0.931	-0.052
Active population per 1,000 inhabitants	-0.092	0.731	0.044	0.015	0.080
Unemployed per 1,000 inhabitants	0.025	-0.795	0.205	0.162	0.036
Average income per capita	0.209	0.645	-0.203	-0.166	0.047
Average income per provincial capital	0.404	0.758	-0.131	0.055	-0.031
GDP per province inhabitant	0.319	0.821	-0.226	-0.150	-0.001
University locations per 100,000 inhabitants	-0.022	0.165	-0.019	0.062	0.568
Average temperature value March 1981-2010	0.092	-0.396	0.867	0.063	0.114
Average temperature value April 1981-2010	0.082	-0.308	0.905	0.084	0.111
Average temperature value May 1981-2010	0.077	-0.245	0.912	0.098	0.120
Distance of the provincial capital from the province of first infection	-0.065	-0.838	0.181	0.300	0.165
Hospital beds	0.953	0.126	0.030	0.157	0.143

Tab.5 The rotated variance explained for each component

The variables that most characterise the first component refer to the age of the resident population. Specifically, the population over the age of 65 occupies first place in the order of variables, followed by the number of beds in hospital facilities and slightly spaced out from the resident population and population density of the province and the capital. The per capita income of the capital and the GDP of the province also contribute to the positive definition of this component.

The interpretation of the factor also seems to be confirmed by the variables that are on the opposite side of the order and correlated with the minus sign with the first component, such as the natural balance and, at a significant distance, the average age of the population and the old-age dependency ratio.

Three main considerations that derive from the observation of this output can be useful to note that only 30 of the 104 provinces are positively correlated to this component and that, in addition, in the first five places of the order, the 4 most populous metropolitan areas of the country are ranked: Rome, Milan, Turin and Naples. Following these, at a significant distance, is Genoa and, in addition, a group of 5 provinces composed of Palermo, Florence, Bologna, Monza and Bari. The presence of Monza is highlighted, which manages to climb the ranking, likely due to a large number of residents and especially due to the high population density.

The second component, which explains almost 20% of the variance of the system of variables taken into account, can be defined as the inverse index of the development delay, giving more weighting to the variables related to the minus sign.

Amongst the variables positively correlated with the highest values are the variables that describe the economic system: GDP, average income per capital, working population and per capita income per province.

The variable related to the distance from the area of high infection that assumes the highest value amongst all the variables with negative correlation is very important, which, together with the unemployed and the average temperature values, seems to define the southern provinces with high unemployment and average temperature.

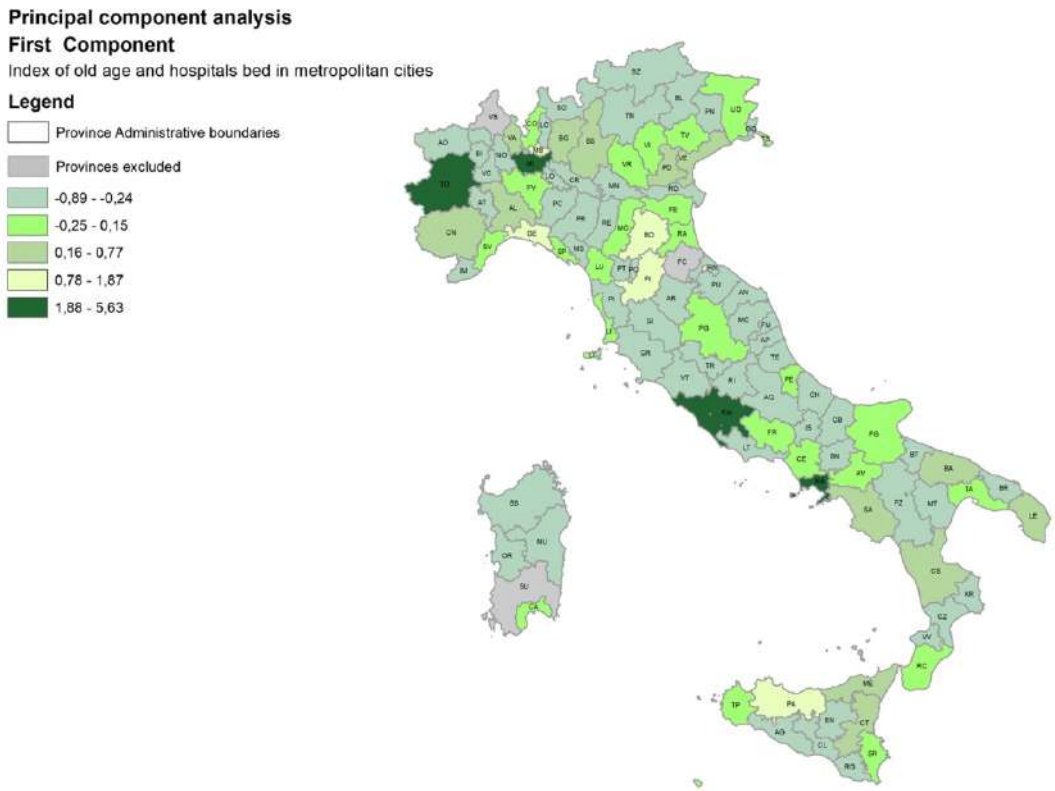

Fig. 7 The values of principal component analysis (PCA) of the first component for the Italian provinces

Specifically, GDP represents gross domestic product, i.e., the sum of all goods and services traded in a country, considered according to their value in euros, as opposed to per capita income, which is the average income of each citizen.

In addition, this component focuses on a variable that is particularly important for the spread of infection: the distance from the capital of the area of maximum infection.

In fact, in the ordering of the variables with respect to the second component, this variable assumes the highest value amongst those negatively correlated.

The correlation ratios between the individual variables and the second component show that, out of the 21 variables, 12 are positively correlated and 9 are inversely correlated; the variables closest to zero and, therefore, insignificant for the interpretation of the index are the eight variables between +0.174 and -0.184, amongst which we find universities, beds, elderly population and land area.

The output relating to the sorting of cases (104 provinces) according to the correlation of each one with the second component enables information to be added that seems to confirm this reading.

In the first place of the order is Milan, followed at a distance by Monza and then by a group of 5 provinces that assume remarkably close values: Parma, Siena, Pisa, Bolzano and Modena. It is worth pointing out that the first province in the South ranks 69 with Caserta.

For the considerations of this territorial system in relation to the Covid-19 crisis, please refer to the following cluster analysis; in fact, this factor finds full correspondence with the first cluster.

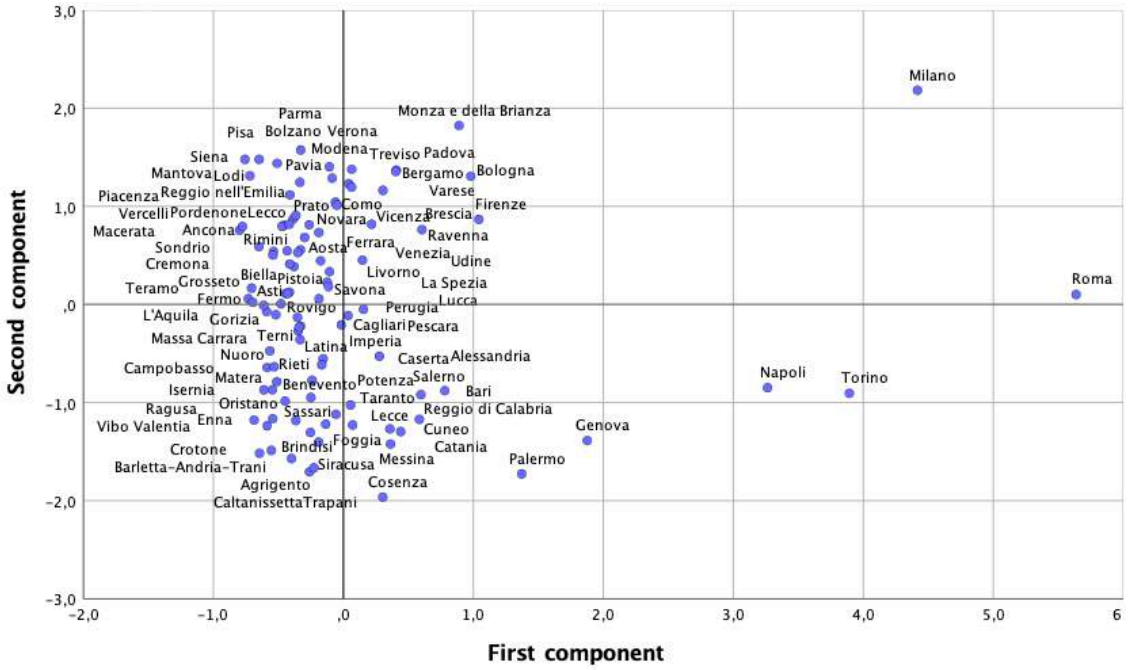

Fig. 8 Biplot graph of the principal component analysis (PCA) between the first and second components

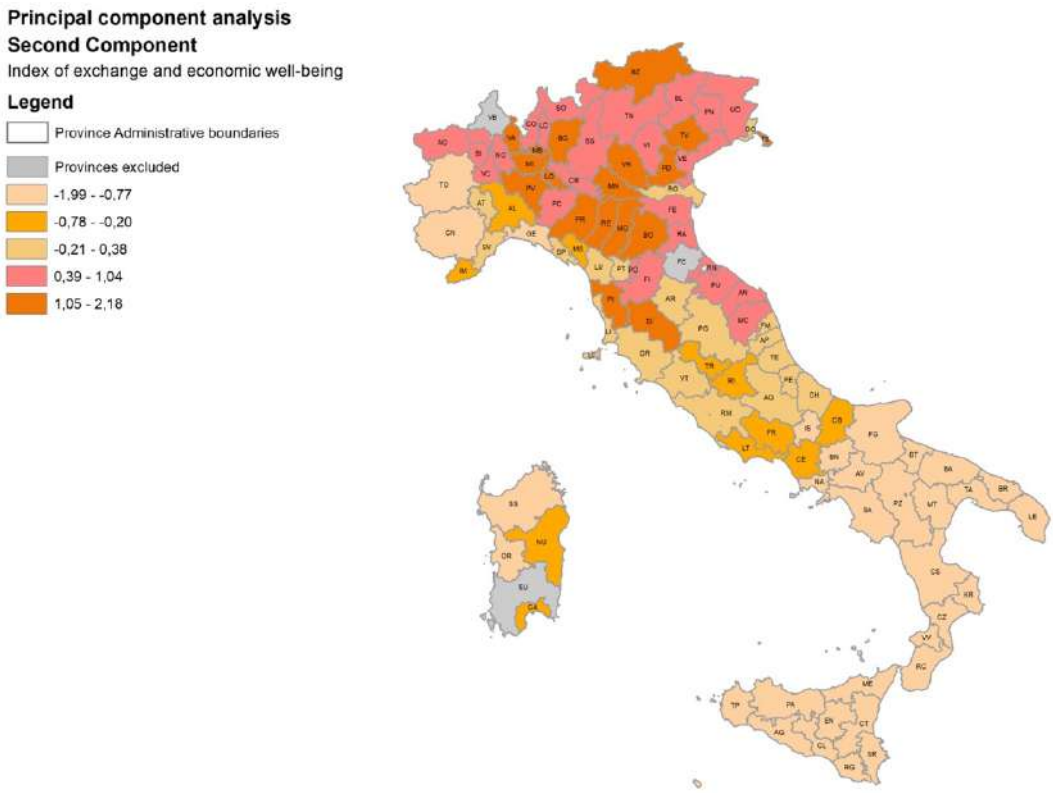

Fig. 9 The values of principal component analysis (PCA) of the second component for the Italian provinces

The third component, which explains almost 19% of the variance of the system of variables taken into consideration, can be defined as the inverse index of the dynamism of the production system.

At the top of the order and with values much higher than the following variables, we find the average temperature data for the months of May, April and March (referring to the years 1981-2010). Confirming the interpretation of the index is the variable related to the mountain area, correlated to the third factor with high values but with a negative sign.

Amongst the positively correlated variables are population density and the territorial surface area of the provincial capital and amongst the negatively correlated variables are the territorial surface area of the province and the GDP per inhabitant.

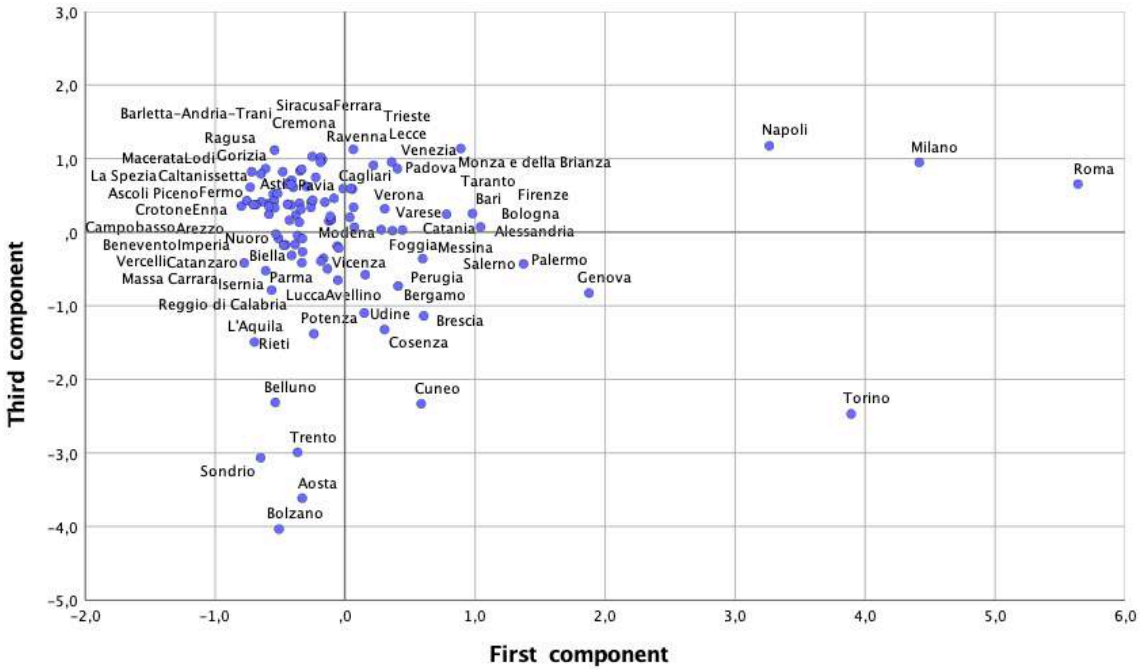

Fig. 10 Biplot graph of the principal component analysis (PCA) between the first and third components

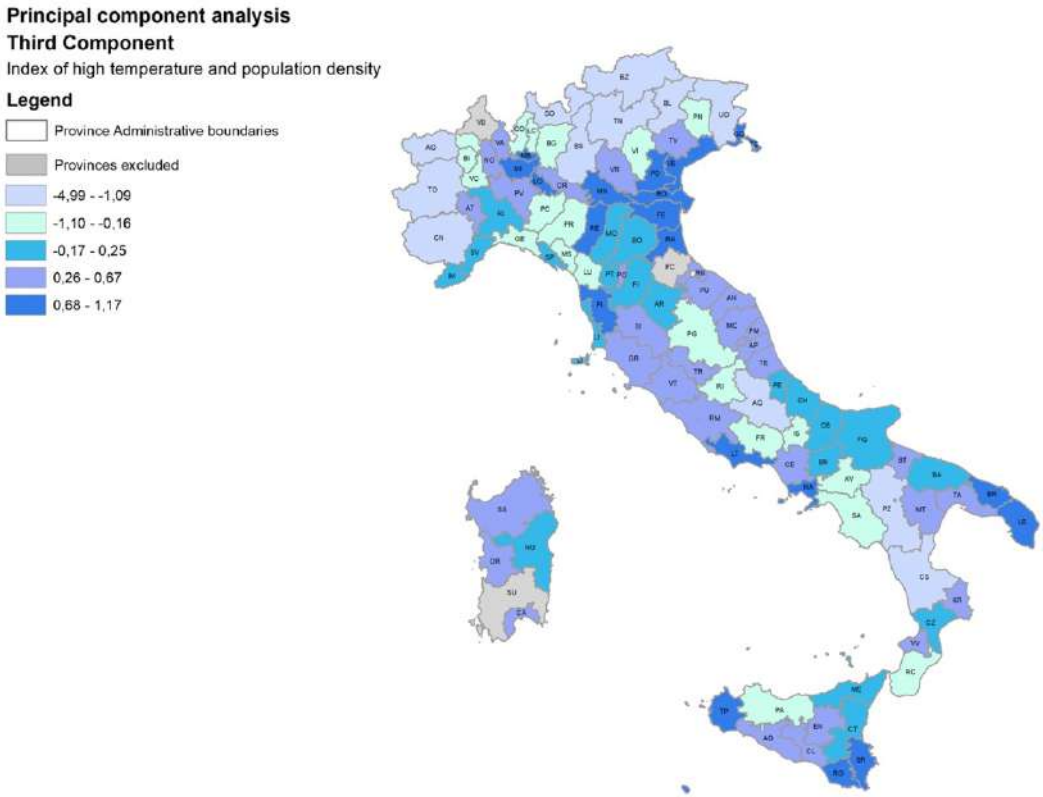

Fig. 11 The values of principal component analysis (PCA) of the third component for the Italian provinces

The output related to the order of cases (provinces) based on the correlation of each one with the third component confirms this reading, placing Naples in last place in the order, followed by Trieste (city in structural

crisis), Ragusa and Brindisi. At the top of the ranking are the provinces of Bolzano and Aosta, Sondrio, Trento, Belluno, not surprisingly all located in the pre-alpine area.
As regards the other main components, please refer to the comments proposed for the third cluster for the identification of phenomena of urban and territorial nature that may be associated, positively or negatively, to the spread of infection.
As regards the other main components, please refer to the comments proposed for the third cluster for the identification of phenomena of urban and territorial nature that may be associated, positively or negatively, to the spread of infection.
The fourth and fifth components play a relatively marginal role in the definition of the latent structure of the system, as they explain, respectively, only 11% and 8% of the total. However, the respective variances, added to the values of the components already analysed, reach (cumulate) more than 80% of the variance explained in the interpretation of the entire set of variables under examination. As regards the fourth component, the strong influences (with the minus sign) of the old-age dependency ratio and of the average age values are to be highlighted, whilst, on the contrary, with the plus sign, the natural balance is highlighted. The other values are relatively low (to be considered as irrelevant) and in many cases close to zero on the scale. In terms of a synthetic reading of the structure of the system, it can be said that the fourth component gathers in itself the dynamics (negative and positive) of the growing resident "ageing population". The fifth component refers, positively, to the size of the area affected by the provincial capital and the presence of universities. On the contrary, it explains, but with relatively low values, the settlement density of the capital and the province as a whole. In other words, it is possible to recognise the characteristic features of the "large metropolitan areas" not only due to the territorial extension but, above all, due to the strong influence of the provincial capital with respect to the entire province

4.3 The Cluster Analysis

The multivariate analysis techniques aimed at defining clusters are made up of a set of procedures useful to identify, amongst objects of any nature, some clusters that are mutually exclusive and tend to be homogeneous within them in terms of characteristics and quantity. To define the unambiguous belonging to a group, a distance from a representative point of the cluster is used, having set the number of groups to be obtained (partitional clustering). Alternatively, a hierarchy of partitions characterised by an increasing number of groups is constructed, which can be visualised by means of a tree diagram (dendrogram), in which the grouping (hierarchical clustering) is represented (Morrison, 1990).
The method chosen for the objectives of the study is the two-step analysis of the partitional clustering that enables natural groupings to be revealed within a data set that otherwise would not be evident. The algorithm used differs from traditional clustering techniques due to the ability to create clusters based on both discrete and continuous variables and for the ability to analyse large datasets. In addition, the two-step analysis allows the identification, using the Bayesian Information Criterion (BIC), of the optimal number of clusters into which to divide the data sample (Carpentieri & Papa, 2018).
The IBM SPSS Statistic Version 20 software was used to perform the two-step cluster analysis. Performing the two-step cluster analysis with this software requires some preliminary operations. As with the statistical analyses presented in the previous paragraphs, the dataset used (104 provinces and 21 variables) has been normalised in order to prevent the different units of measurement of the variables used from influencing the interpretation of the model outputs.
To enable data processing, data normalisation, cluster creation and the likelihood method for measuring the distance between clusters have been implemented in rapid succession.

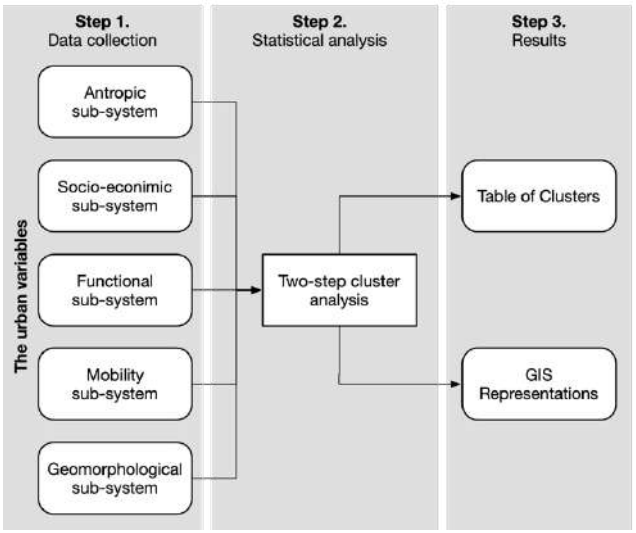

Fig. 12 The conceptual procedure for the Two-step cluster analysis

To complete the procedure, the software provides, as output, the optimal number of clusters into which to divide the data set, the table showing the value assumed by each variable in the different clusters and the table associating the cases (provinces) to the clusters. This last output also allows the realisation of graphic representations and/or on a map of the results of the division into clusters of the analysed elements.
After verifying the feasibility of clustering analysis, this process is defined us assessing cluster tendency and the model was developed.
The first application of the two-step cluster analysis provided three as the optimal cluster number through the Bayesian Information Criterion (BIC). Following the reading of the results obtained from this first application, it was decided to make further attempts at clustering, which would allow, for the same measure of validity (identified by the software in the internal cohesion), for an easier interpretation of the results considering the characteristics of the data and associated information. The number of clusters identified is six.

Results of the Cluster Analysis

After carrying out the PCA that enabled the structure of the settlement system to be determined, the Cluster Analysis was developed to define the "aggregation criteria" between territories, i.e., the distribution of settlement characteristics with respect to their geographical location. The comparison between the results of the cluster analysis and the data collected on the pandemic, which describe the intensity and spread of the infection in the Italian provinces, enables an association of the characteristics of the subsystems in which the urban and territorial system of the provinces has been discretized (settlement, social, economic, geographical, etc.) to the evolutionary phenomenon of the epidemic, in order to understand possible and different correspondences with homogeneous clusters of provinces.

Cluster 1 - Late Southern Italy development

The first cluster includes a large number of provinces (32) that geographically encompass the entire South, part of Sardinia and almost all of Lazio. The variables that mainly condition this cluster refer to the economic-productive characteristics, which assume values well below the national average. The distance from the area of first infection (the province of Bergamo), together with the variables related to the average temperature, above the national average values, contribute to the geographical definition of this cluster.
The analysis of the data on the intensity and spread of infection, both in absolute value and in relation to the population, shows that, in the provinces that constitute the first cluster, the epidemic on average has been

very low. The great distance from the areas of first infection, together with the measures of containment and social distancing adopted promptly during the lockdown period, were likely the two key factors to stem the pandemic in southern Italy. A second favourable circumstance, but only in times of pandemic, could be represented by the lack of economic-productive dynamism that has allowed the measures to be respected on time, reducing the possibility of infection.

Cluster 2 - The Italian province

The second cluster includes a large number of provinces (30) that are mainly distributed in Central and North-Eastern Italy. The prevailing feature that distinguishes this cluster is its small size. In fact, the size, both in demographic terms and in terms of territorial extension, assumes values far below the national average, both with reference to the province and the provincial capital. Further significant elements for the description of this cluster are the descriptive variables of the population structure, which show a high average age and a high old-age dependency ratio.

In comparison with the data by province on the number of infected people - both in absolute value and in relation to the population - and on the number of deaths, it shows that, in the provinces that comprise the second cluster, the epidemic on average remained at low values.

The low population size (together with its characteristics) and the low settlement density seem to have played an important role in containing the infection. Furthermore, the lack of economic-productive dynamism that characterises (even if to a lesser extent than the previous one) this cluster has allowed a stricter respect of the lockdown rules, reducing the possibility of infection.

Cluster 3 - The pre-alpine system

The third cluster comprises a small number of provinces (5) which are distributed exclusively in the territory of the Alpine crown. Given the population density, resident population and elderly population which have values well below the national average, the pre-Alpine system is characterised by a strong dynamism - both in terms of economy and production (income, GDP and active population) and in terms of demography (natural balance), with very high values compared with the national average, in provinces by territorial extension and by size of the relevant mountain area.

In comparison with the data by province on the number of infected people - both in absolute value and in relation to the population - and the number of deaths, it emerges that the pre-Alpine system was strongly affected by the epidemic.

Unlike cluster 2, in this case, the low population size and low settlement density failed to play in favour of containing the infection. This characteristic, therefore, does not seem to guarantee a viral containment if, at the same time, productive economic conditions of an opposite sign to those of the cluster under examination do not occur. In other words, it seems that the strong economic-productive dynamism, which distinguishes the pre-Alpine system, has contributed to the expansion of the infection, beyond the demographic and settlement characteristics which, therefore, lose relevance.

Cluster 4 - The economic-productive engine of Italy

The fourth cluster that we can define, without a shadow of a doubt, the economic-productive engine of the country, includes 20 provinces that, in the shape of a circular crown, develop around the Milan area and are in Lombardy (the predominant part) as well as in Veneto and Emilia Romagna. This cluster is characterised by some peak values, which are much higher than the national average, in the sectors concerning the percentage of the active population and the value of the average income per capita. With a natural balance higher than the Italian average and an average age lower than the average of the entire country, there is a GDP per

inhabitant that is second only to that of the large metropolitan cities. These territories are characterised by a relatively low settlement density with small provincial capitals and a relatively small number of university sites. The number of beds per inhabitant is below the national average, as is the presence of the over-65 population. The infection hit these areas hard, not only because they were close to the initial outbreaks or because they themselves fuelled new outbreaks, but also because the restrictive measures did not interrupt production activities of strategic interest, a characteristic recognised to all companies that with a self-declaration claimed to belong to a strategic production chain. The initial indecision as to whether such drastic measures should be taken for what many of the institutions and companies within this cluster considered, in the initial phase, the Coronavirus epidemic to be little more than a trivial flu, contributed decisively to the situation in these territories.

Cluster 5 – "Middle" Italy

13 provinces form part of this cluster, the fifth of the six clusters that constitute the output of the model used in this study, located almost exclusively on the Apennine ridge of Central Italy and on the Veneto-Romagna coast to the Trieste area. This grouping can be concisely defined as Middle Italy. The values that it presents with respect to the 21 variables that constitute the input of the model are very close to those of the national average, with some exceptions that, however, characterise these territories and enable the latent structure to be read. Firstly, these are areas that act as a crown outside the provinces of cluster four and are therefore relatively farther away from the areas of first and major infection in inner Lombardy. Secondly, they have average per capita income values aligned with those of the richest areas of the country, they have an over-65 population lower than the national average and they are characterised by an average age significantly higher than the national average in line with the areas of central Italy (luster 2). Cluster 5 is characterised by the highest percentage of universities in the whole country and an exceptionally low settlement density of the provincial capital. Also with regard to the Covid-19 infection, these areas have confirmed themselves as a median area between the most affected cities and territories and those where the infection has been relatively low.

Cluster 6 - The system of metropolitan areas

The sixth and final cluster includes the large metropolitan areas of Italy: Milan, Rome, Naples and Turin. This group is characterised by the abundantly predictable role of some variables typical of large metropolitan areas, such as the settlement density of the provincial capital, the average per capita income, the percentage of the over-65 population, the strong presence of hospital beds and, of course, the average income of the capital and the GDP per inhabitant. However, there are some anomalies concerning University locations where metropolitan cities are outclassed by the provinces of cluster 5, which has an almost double value and, above all, a natural balance that is not only far below the national average, but is equal to half of the values present in all the other clusters. The Covid-19 pandemic in these metropolitan areas has developed all its potential for infection and death due to the high density of settlements, the reluctance to accept, firstly in Milan and Turin, the need to interrupt not only social contacts but, above all, economic and productive activities. The widespread presence of the elderly population in these cities, with the exclusion of Naples, has been devastated by the virulence of the infection and by errors in emergency management, especially as regards the protocols of acceptance of hospital facilities (which have become real hotbeds of infection) and the guilty transfer of sick and/or recovering elderly people to care homes, with the natural consequence of a general transmission of the infection to most of the residents of these facilities. The metropolitan cities of Rome and Naples have managed to contain the impact of the infection as they were delayed by the spread of the virus, a delay that has enabled them to implement an effective preventive lockdown and to benefit from the mistakes

made in the areas most affected by the epidemic. Finally, the immediate closure of schools and universities, in conjunction with the prevailing commitment in the services businesses of city users and, therefore, the widespread possibility of replacing office work with work from home, further contributed to the containment of infection.

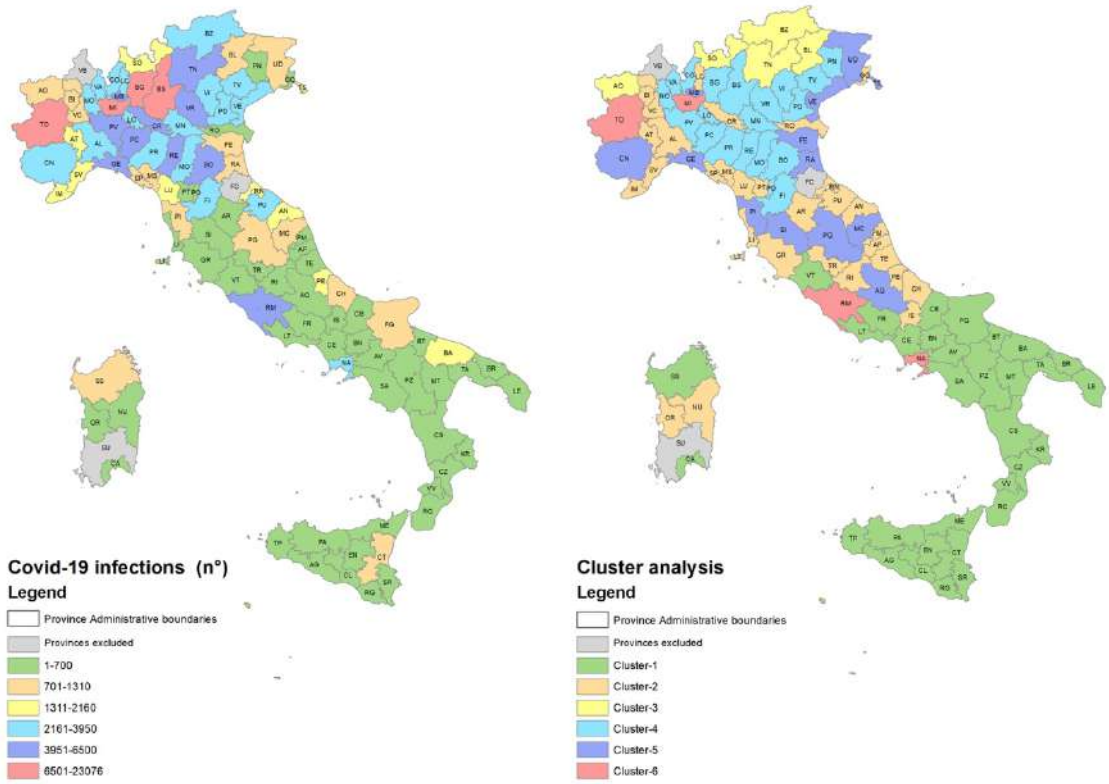

Fig.13 Comparison between the distribution of the infection at May 31, 2020 and the clusters of the Italian provinces

4. Conclusions

There are essentially three scientific questions that this work wanted to answer. The first concerns the possible correlations that can be established between the intensity and spread (as at 31 May 2020) of Covid-19 infection and the settlement system of our country. The second question relates to the identification of urban and territorial phenomena that may be associated, either positively or negatively, with the spread of infection. The third question concerns the update (2020) of the main phenomena of settlement nature (*inter alia*) that can be recognised within the system of Italian provinces in order to identify, with reference to the intensity and spread of infection, possible and different correspondences with homogeneous clusters of provinces.

Unfortunately, none of the variables identified are representative of the characteristics of urban and territorial planning - which is the specific discipline of urban planning in the strict sense.

However other predictors contributed - in conjunction with the identification of the latent system of the Italian provinces obtained through the analysis of the Principal Components and especially with the Cluster Analysis that complete this study - to identify phenomena of coexistence and collinearity between the consistency and distribution of infection and the settlement system of our country. The variable number of hospital beds is the most important predictor of the entire panel of variables given that its normalised coefficient (0.770) takes the highest value and its significance (0.003) the lowest value and consequently the highest importance. As expressly mentioned in the section of the study relating to the definition of the correlation between the variables used, this data is strongly correlated with other very significant indicators of the settlement structure of our country - resident population, over-65 population, vehicle fleet, daily movements, etc. - and, therefore,

the considerations on this predictor must take into account, the baggage of information underlying the beds variable. In other words, the number of beds can be identified as a multiplier of the infection, not only because the hospital facilities have become real multipliers of the infection, in conjunction with the RSA, but also because they are a measure related to the number of elderly people over the age of 65 (age group particularly exposed to the infection and with fatal consequences), the number of residents and the dynamism of the exchanges of each province.

The results of this analysis have suggested increasing the knowledge of the latent structure of our settlement system in order to complete the analysis underlying our study and allowing a comparison of the intensity and spread of infection and the anthropic, socio-economic, functional, spatial and geo-environmental characteristics of the metropolitan areas and provinces of our country. The Principal Component Analysis and Cluster Analysis highlighted the "aggregation criteria" between the different territories. The comparison between the results of and the data collected about the pandemic, which describe the intensity and spread of the infection in the Italian provinces, allowed an association of the characteristics of the subsystems in which the urban and territorial system of the provinces has been discretized (settlement, social, economic, geographical, etc.) to the evolutionary phenomenon of the epidemic, in order to understand possible and different correspondences with homogeneous clusters of provinces.

Author Contributions

The work, although the result of a common reflection, was divided as follows: Carmela Gargiulo: conceptualization and methodology; Federica Gaglione, Carmen Guida and Floriana Zucaro: data curation, investigation and visualization; Rocco Papa: supervision; Gerardo Carpentieri, corresponding author, software, formal analysis and investigation.

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"Passata è la tempesta …". A land use planning vision for the Italian *Mezzogiorno* in the post pandemic

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Abstract

The Covid-19 pandemic event can activate a comprehensive reflection on the change of development models, overcoming the current unsustainable ones. Present events in Italy are mainly affecting Northern Regions but also the Southern ones will suffer from economic consequences, related to the pandemic.
This is particularly relevant for the marginal areas of the Italian *Mezzogiorno*.
The article highlights issues that are deemed relevant for including inner areas of Italian Southern regions into the process of economic recovery after the pandemic, in order to avoid the deepening of the long lasting North South imbalance, in the light of the growing depopulation of this part of the Country.
The focus is on the role of Health Services, Education, Built up Environment and Transports, systems considered as key elements for promoting a well-balanced use of existing territorial assets. The real challenge is to reverse this terrible threat into an opportunity, introducing effective changes into the way we waste our limited planetary resources, especially the territorial ones. In this direction, Southern regions can play a fundamental role for increasing the resilience of the entire nation.

Keywords

Italian Mezzogiorno; Regional development; Regional planning.

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1. Introduction

The Covid-19 pandemic event is producing a large debate in almost all sectors of scientific research, including land use planning. Undoubtedly, what happened in the late winter and spring of 2020 appears as an epochal change. In this contribution, we propose hints for a new vision related to regional and urban planning, by "wearing new glasses" shaped by the augmented awareness stimulated by Covid-19.

Making forecasts on the long term effects is a risky exercise (Viesti, 2020). However, this event should activate a comprehensive reflection on the change of development models, overcoming the current unsustainable ones. The following considerations are mainly referred to as the Italian condition, assuming a point of view that focuses on the peculiar features of the weakest part of the Country: the so called Mezzogiorno. Some of the conditions that are characterizing the Southern Italian regions can be referred to other Southern European countries.

Going beyond the current effects of media overexposure, the progress of this debate is producing a growing number of proposals that are referred to as the territory. If the political elites and the entire national community will accept the challenge of the pandemic, this will become a great opportunity for referring future investments to territorial instances. A clear political stance is necessary, but it can be hardly adopted by Governments without a solid vision about the future and a consequent capacity of taking strategic decisions. It is wishful that, in Italy, the political debate about the revitalization of the national economy will be deeply discussed in the light of the next political elections[1]. The central point is, once again, the direction to give to economic recovery packages, reversing the current approach aimed at advantaging financial revenues and concentrating the efforts toward sustainable production of staple goods and overall improvement of quality of life.

Besides, there is a growing concern about the dramatic consequences that Covid-19 could have on measures for contrasting climate change. A recent working paper from the University of Oxford Smith School of Enterprise and the Environment (Hepburn et al., 2020), based on a survey of central bank administrators, finance ministry officials, and other economic experts from G20 countries, identify five policies with high potential on both economic multiplier and climate impact metrics. Three of these policies (clean physical infrastructure, building efficiency retrofits, natural capital investment for ecosystem resilience and regeneration) are more directly related to land use planning. The authors highlight that "the recovery packages can either kill these two birds with one stone – setting the global economy on a pathway towards net-zero emissions – or lock us into a fossil system from which it will be nearly impossible to escape".

1.2 Disasters: opportunities for urban public improvement

Planners know that major deadly environmental events have triggered substantial changes in the city infrastructure and management. We are entirely aware that diseases have always played a major role in shaping and improving cities. We can even go further by assuming that most significant urban development experiences are the result of the urgent need to give suitable answers to major problems of public health. The precondition for this is an enlightened urban policy, implemented by looking-forward decision-makers technically assisted by urban planning professionals used to deal with real-life problems. Unfortunately, it seems that this was more common in the past, as it appears from the following examples.

The Metropolitan Board of Works (MBW), in mid 19th century London, or the first generation of renovation and redevelopment Plans in post-Unitarian Italy are very well-known examples (Dato, 1987). At that time, the

[1] One of the first comprehensive opinions has been produced by the left oriented think tank Forum Diseguaglianze Diversità (https://www.forumdisuguaglianzediversita.org/wp-content/uploads/2020/05/ForumDD_Durante-e-dopo-la-crisi.-Per-un-mondo-diverso.x89907.pdf)

scientific and technical findings of civil engineering profoundly brought about changes in urban planning, contributing to the definition of its methods and tools.

It was only the "Great Stink", in the unusually hot summer of 1858, that force MBW to take serious and final measures to deal with drain issues in London, despite the ten years relentless campaign by Edwin Chadwick who moved his belligerence action from Poor Law Commission to the report "Sanitary Condition of the Laboring Population" to thrust the improvement of sewers. In that summer, due to the unusual climate conditions, the river Thames released a miasma that spread all around the City and Westminster alike penetrating even into the newly opened House of Parliament, forcing its abrupt evacuation. In fact, at that time, despite the pioneering research conducted by John Snow, the father of modern epidemiology, who had already made it clear that cholera was unquestionably linked with drinking water contamination, the disease was widely thought to be odor-borne. For this reason, the unbearable stink, caused by the enormous amount of excrements on the Thames bank, led to panic. "Disraeli was seen rushing from a committee room, 'his pocket-handkerchief…applied closely to his nose, with body half bent, hastened in dismay'. Gladstone did likewise" (Jenkins, 2019). The Great Stink drew attention to the unbearable condition of the river. The Parliament voted to make the Office of Works independent, giving it powers to borrow at guaranteed low interest. It also authorized the board to proceed without submitting their plans to the government (Hall, 1998). Sir Joseph Bazalgette's great embankments project could be easily started with two outflow sewers 132 Km long, north and south of the Thames, serving the huge drainage network with the pumping stations, that is still renown. London's most essential item of modern public infrastructure was in place thanks to "The Great Stink" that, as The Times declared, "should prove the best of all sanitary reformers" (Jenkins, 2019).

A century later, another major environmental event caused an equal relevant reform in environmental British history: "The Great Smog". From 5th to 9th December 1952 London was stuck in a smoke-laden fog that hidden the city and its suburbs. About 6,000 died in the following months as a result of the event and 100,000 more suffered from diseases due to the smog's effects on human respiratory tract; cattle at Smithfield market had been asphyxiated by the smog; travels were disrupted for days and millions of people faced serious inconveniencing, even if the own behavior of the same people affected by the smog was somewhat the cause of it (Bell et al., 2004). Churchill, in his last term as Prime Minister, at first, underestimated the issue but, as soon as he realized the relevance of the matter, he gave a firm institutional answer introducing a courageous, profound even if rather unpopular innovation, for that time. This dramatic event caused a rethinking of the air pollution issue, going beyond London's fog stereotype. This led to the first comprehensive pollution legislation that headed to the Clean Air Act of 1956. This act ruled for almost four decades the environmental policy and emissions limits in Great Britain, both for residents of urban areas and factories which were obliged to convert to smokeless fuels[2].

A similar situation happened in Italy in 1966. The Agrigento landslide, in July, and the river Arno flood in Florence, in November, revealed the limit of the unbearable urban development and uncontrolled growth that had characterized post-war reconstruction of the Country. Thanks to the work of a special Commission, established by the minister of Public Works involving prominent urban planners, it was possible to detect the real causes of this terrible landslide. By this far-sighted political and technical approach these tragic events turned into opportunities, opening up a profound reform in the Italian planning legislation. One fundamental achievement was the right for public services and green areas in any local plan[3].

The lesson learned by these events, and many others we can evoke, is that public policies for Land Use Management should have a crucial role in dealing with any form of risk. Consequently, land use planning has

[2] See. met.org.uk

[3] See "Urbanistica" n. 48, 1966.

to play again its relevant role in leading actions toward what is both necessary and desirable for the sustainable future of our Planet.

In every catastrophic condition, radical renovation can sprout. The Covid-19 should be the occasion to start this regeneration. We must say: "If not now when?", borrowing the title of Primo Levi's famous novel.

Ulrich Beck calls it "Emancipatory Catastrophism" and he underlines that, sometimes, commonweal can be considered as a side effect of evil. He writes: "It is the very experience of the catastrophe that violates the 'sacred' norms of civilization and humanity and thereby produces an anthropological shock. This shock is the starting point to create a possibility of suitable institutional answers and it can lead to institutionalizing them at a global level. It is not an automatic process but it happens through a complex series of cultural and political efforts" (Beck, 2016). It is precisely these cultural and political efforts that everybody must vigorously pursuit, according to her possibilities and specific responsibility.

It is necessary to think about tomorrow, already today. Otherwise, another of the usual dramatic "our tomorrow" will start. A condition to which the history of our country has unfortunately accustomed us. In the formation of public policies, in particular, those oriented towards risk mitigation, the mutual relationship between the "knowledge" of the phenomenon by public decision-makers and the necessary "consensus" plays a fundamental role (Douglas & Wildavsky, 1983).

Furthermore, our technical ability is enhanced considerably in emergency conditions. The current sanitary emergency must be addressed without diminishing the centrality of other equally highly relevant emergencies. These include, at global level, climate change and, at the local one, the safety of our built-up environment exposed both to seismic risks and to the progressive deterioration of its structural resistance capabilities. On several occasions, it has been highlighted that a true shared "Progetto Paese" is very much needed (INU, 2016). We have to look for a far-sighted, patient, and long-lasting commitment that focuses on maintenance as a consolidated practice of action on buildings and infrastructures, restoring a sense of shared responsibility.

2. The main issues at stake

The common theme that should characterize this comprehensive project for the future of Italy can be described by the concept of "well-balanced land use" a theme that has traversed planning history, although it has been almost neglected under the mounting wave of hyper laissez-faire market economy. The relationship between the unsustainability of the current development model and virus diffusion is not clear. Researchers in many fields are intrigued by the quest for assessing the a-priori epidemic risk of a geographical area, and by identifying high-risk areas within a country (Pluchino et al., 2020).

The correlation of factors (air pollution or characteristics of urban settlements, like built-up density) with the spread of pandemics are likely to be a trendy research field shortly. At the same time, the differences in the demographic, social, and economic structure among countries and regions are emerging clearly as fundamental factors of the response to the impact of the virus in the emergency phase[4]. Social distancing is the ugly term that is commonly used for describing the simplest action, but at the same time difficult to implement, to be applied for containing the spread of the infection. It is hopeful that a more politically correct term like "security distancing" will be adopted in the future but, in any case, it is certain that the way we use our cities and the regional settlement structure, will be not marginal to cope with present and future risks. Once again, reducing unbalances will be a sound objective for the post-pandemic agenda for regional and urban planning, in coherence with general objectives like sustainable production, energy efficiency, and contrast to climate change.

New welfare policies are required to transform these widely accepted principles into real actions.

[4] For data on the effects of social actions to contain see ww.endcoronavirus.org.

In Italy, reducing unbalances means not only reconsidering the characteristics of the two prevailing settlement models, compact cites, and sprawl but also to cope with the perennial issue of the North-South development distances[5].

The post-pandemic can be interpreted as a stimulus to deal, with a renovated strength, with the problems of Southern regions. In this direction, it is reasonable to recuperate the memory of the actions that were quite effective, like the major intervention implemented by the central government, the so-called *Cassa per il Mezzogiorno* in the first 15 years of its activity (Felice, 2013; Prota & Viesti, 2012).

A strategic plan will be required. It can assume different formulations (Boeri, 2020; Nigrelli, 2020; Pasqui 2020), but it is necessary to define a general a framework for proposing actions that are becoming more and more essential for "furthering the economic and social progress"[6] not only of Southern regions but also of the entire nation. The future scenario for *Mezzogiorno* is extremely complex and has been widely discussed since the Country Reunification in 1861. It cannot be summarized in a short article but only one novel element deserves to be highlighted: the recent acceleration, since 2015, in the depopulation of these regions.

This phenomenon is extending from the most disadvantaged clusters of municipalities that have experienced a long-term decline (De Rossi 2018; Caselli et al., 2020; Reynaud et al., 2020) to the main metropolitan areas. What is happening in the last five years is a clear sign of a progressive weakening of the capacity of resilience of the nation is facing economic crises. On the contrary, data on regional virus spreading have changed the scenario. Southern regions and marginal areas have been less involved in the pandemics visa-a-vis the most affluent and dynamic ones, first Lombardy.

Despite the considerable uncertainties about forecasts on Covid-19 (Petropoulos & Makridakis, 2020) or other similar pandemics, there is a growing consensus about the necessity of a careful approach for the future (Kissler et al., 2020; Pan et al., 2020). The possibility of "living with the virus" for a long period is likely to induce changes in the layout of living space and the settlements at various scales, from homes to cities, involving public realm layout, services provision, and the relationship among settlements at a regional level.

Italy is traditionally characterized by a settlement model based on a network of small and medium-sized cities (under 20.000 inhabitants according to UN definition). These centers have been the accumulation points of administrative, economic, and cultural services, fundamental for populations living far from the main cities and metropolitan areas.

This model has been heavily challenged by the prevailing logic that privileges metropolitan areas. The search for efficiency, in all fields, has shaped all sectorial public policies, mainly education and health. This Darwinian approach is producing small prosperous islands surrounded by an ocean of poverty and stagnation (Wolf & Ramon Roses, 2018). This is also emerging from the studies performed for defining the Italian National Strategy for Inner Areas (SNAI). It emerges that in inner and peripheral areas it takes more than 40 minutes to reach basic services, whereas in main metropolitan systems this time is 13 minutes.

The role of the accessibility to Services of General Interest (SGI) is key in accelerating the depopulation of inner areas, but this element has been widely underestimated in the political decisions taken to reduce these services in the last decades.

In the following paragraphs, some of these issues that we believe are particularly relevant in the post virus perspective will be presented, with a special focus to the Sicilian regional context which encompasses a range of settlement systems that can be assumed as a test field for reflecting on the possible future of the other Southern Italian regions.

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[5] For an interesting standpoint about the continuity of some problems of *Mezzogiorn*o from 1950s until today, see an article by two American political scientists (Perry Clark Carey & Galbraith Carey, 1955).

[6] This statement is part of the Article 1 of *Legge 10 agosto 1950, n. 646* that established the Cassa del Mezzogiorno.

2.1 Health Services

The quality of the Health Service is crucial for understanding what is happening in inner areas. For instance, a key point is a decision of closing small hospitals. The "technicians Government" (2011- 2013) led by Mario Monti, took this resolution saying it was suggested by budget review purposes.

Fig.1 Gangi and Etna volcano, Sicily

Many observers due consider this unreasonable decision as to the noteworthy negative turn of events that spring out its unbearable effects on the occasion of this pandemic. Actually, Monti's government has only pushed forward a process that had begun a decade ago, as immediately visible confronting yearly issued Istat data. As a matter of fact, most recent Italian Health Service figures show that in 2017 "hospital assistance relied on a thousand hospitals, among which 51.8% were public and the remaining 48.2% were private structures, accredited to Public Health Service (SSN).

The decreasing trend of those organizations built on the refurbishment, reconversion, or merging of numerous different structures, already significant in the past years, has now been confirmed" (Istat, 2019).

Moreover, in comparison with the previous decade a noticeable decrease, almost 20 %, has been reported, and the discrepancy becomes even more severe in the public sector. However, if we go deeper, confronting the above mentioned Istat 2009 data with those issued a decade before, it emerges that, in 1999, the active hospitals were 1,381 and among those 847 (61.3%) were public.

In other words, in the past twenty years, public hospitals have suffered a consistent reduction, from 847 to 518, whereas private structure decreasing has been less severe, from 534 to 482. In the same decade (1999-2009), hospital beds have been reduced from 311k to 225k, dropping to 191k in 2017. The latter could be interpreted as a positive achievement in those areas where the network of general practitioners has been reinforced, but surely it is not true in the South. Here, many health structures have been completely emptied of hospital wards, specialized staff, and medical tools. Although being officially opened on paper, they are nothing more than ghost organizations with the only purpose of representing false entities to avoid potential objections within the affected community.

If we consider that, in the meanwhile, sanitary expenses have been increased, then it appears quite evident that the above-mentioned facts are not strictly related. Consequently, the decision of shutting down so many

hospitals has represented a high price to be paid for the mainstream conception that has progressively shaped the welfare, with the deceiving belief of contributing to its improvement.
Currently, it seems that Regional Health Service planning is not adequately based on geo-localized data that could indicate where to find those mentioned ghost hospitals, or on the identification of communities needs taking into actual accessibility of hospitals. However, to realize that struggling to reach the nearby hospital is still a major cause for countless rescue attempts that end up with a fatality, it is sufficient to open a local newspaper.

Fig.2 Piazza Armerina Hospital (almost empty)

Changing this destructive trend is highly advisable but it is not always necessary to maintain the traditional way in which hospitals are managed. Telemedicine, the long-distance approach to healthcare, can be a solution to be integrated with physical facilities, but this requires relevant investments in data infrastructure and training, and most of all a U-turn change in the mindset of decision-makers.

2.2 Education

Also, the data on education services and facilities demonstrate a clear retreat of the public sector from inner areas. This attitude has contributed to making these zones less attractive, in comparison with medium-sized cities and metropolitan areas, the major providers of SGI.
In the period 2000-2020, the education system has been reformed several times, once again to comply with spending review objectives. This has produced the merging of existing schools, to reduce the total number of headmasters and administrative staff, based on the declining number of students.
Exceptions that were originally allowed for mountainous areas have been progressively abolished. The combined effect of emigration and birth rate reduction has increased the number of schools that are considered too small to keep their administrative autonomy.

A completely new phenomenon is the re-use or even the abandonment of school buildings, although this is quite difficult to quantify from official data[7].
Regional institutions in charge of education are supposed to merge existing schools according to not only the compliance with national norms but also applying criteria of both efficiency and efficacy, taking into account the difficulties that derive from the management of several branch facilities and their location.
On the contrary, official data show that the prevailing criterion is the number of students. For example, in Sicily, there are more than 800 headmaster positions. Some of them are in charge of more than 10 facilities, located in different municipalities (up to 18).
In Calabria, headmaster positions are less than 400 but they manage up to 15 branches, located in municipalities that are quite far from each other.
Cases of evident mismanagement are frequent: elementary schools merged with high schools but not including junior high schools or branches that require hours to be reached from the headmaster office.
The extreme conditions are referred to the most fragile areas in Southern regions, like the mountainous zones of Calabria (Sila) or Sicily (Peloritani and Nebrodi in the Province of Messina). In small remote towns are reappearing classes that include children of different ages (the so-called *pluriclassi*), a condition that in Italy was common in rural areas in the 1940-50s.
It is becoming quite common that boys that have to go to junior high schools have to commute to another town, with major inconveniences for their families. Also, in this case, this is a further incentive to move the entire family to larger towns.
The considerable reduction of investments in this vital sector could be explained also considering the progressive aging of the Italian population. It is fundamental to reverse this trend, especially in marginal areas.
The redundant school facilities could be used for hosting new modalities of teaching, introducing a wise use of new technologies, and experiment with new teaching formats.

2.3 Regional accessibility: roads

Inner areas are not attractive because they are far-flung places. Their accessibility is even worsening in recent times since road is not maintained and railway lines have been closed because they are not efficient.
According to the last National Account of Infrastructures (2019) motorways amount to 6,943 km, roads of National Interest to 22,399 km, regional and provincial roads to 142,149 km, the last ones represent 83% of the National road network. In the last 20 years, motorways have increased of 465 km, local roads by 40,000 km, including more than 26,000 km reclassified from national to local roads.
Data show that Northern Italy is better endowed by any considered parameter (inhabitants, geographical extension, vehicles in operation).
The worst situation is in Southern regions, Sicily and Sardinia included, were regional, provincial, and out-dated national roads are prevailing.
The situation of the road network that connects many small and medium-sized towns is often dreadful throughout the entire Country. In marginal areas, the situation is even worse and investments to recover from this problem are even less, due to the limited number of users involved.
Roads have been often closed because of landslides or lack of safety conditions since bridges are at risk of collapsing or the road surface is highly unsafe.
The provincial administrations, which are in charge of the intermediate level of the Italian road network, are crucial for guaranteeing the accessibility of inner areas, but these institutions are in political limbo since they have been the target of rather confusing reform attempts.

[7] This statement is part of the Article 1 of *Legge 10 agosto 1950, n. 646* that established the Cassa del Mezzogiorno.

Quite recently, the Union of Provincial Governments (UPI) highlighted this situation, proposing 2,25 billion investments on existing projects that are waiting for funds[8].
This situation has been highlighted by the Automobile Club (ACI). A recent report (ACI - Fondazione Caracciolo, 2018) states that this network is a fundamental asset for the economy of geographical areas, where the presence of SMEs that work on traditional assets (including cultural and environmental ones) is the main pillar of the local economy.
In the final remarks, the authors evoke the capacity of the county to recover, in about ten years from the "immense ruin" of national road infrastructure that followed WWII as an inspiring example for contributing to foster a new Country's development.

2.4 A new role for railways for boosting marginal communities

Railways lines are also fundamental for any policy aimed at strengthening the role of inner areas but, at the same time, it is very difficult to upgrade these infrastructures for several reasons, including how some of them were built.
Some examples can help in understanding problems as well as potentialities. Along the railway Palermo - Catania there is a station called *Roccapalumba – Alia*, about 70 km from the capital city.
The place where the station is located is very secluded, far from the surrounding small towns of this inner part of the island. The reason for this location lies in the original design of this railway line.
The aim of this railway was not to connect the two main Sicilian cities but to transport minerals from inner mining districts to the main harbors, accordingly it was not useful to have stations near the existing towns. Despite this, today there are still trains calling at this remote station, used mainly by commuters that work in Palermo and still live in the inner territories. Within a radius of about 10 km from the station, there are five small towns[9] that are progressively losing inhabitants but that still totals about 15,000. Despite the progressive weakening of the role of inner Sicilian towns the number of commuters that use this station can be interpreted as a feeble sign of resistance that requires swift actions to be strengthened.
These five small towns are still offering advantages that are capable of offsetting the burden of commuting (it takes 45 minutes to travel from Palermo). These advantages include mainly the cost of houses, but also other ones related to the general quality of life, including the opportunity of practicing the self-production of food, typical of these communities.
By favoring this kind of living conditions, it is not only reasonable to think that this will limit their demographic crisis, but it is also possible to imagine a modest revitalization of these towns. Young people from the main city can be attracted to these places, where it is possible to establish new businesses, revitalizing traditional activities or promoting innovative ones, based on ICTs or other high-tech productions.
Other industries that have large potentialities are the ones related to sustainable energy production and bioplastics. Commuting can be limited to some days or events, like the ones related to the attendance of leisure and cultural activities. In this way, the underused housing and the excessive development of the recent past can be recycled, assuming a new role for supporting the revitalization of these communities, reducing at the same time, the lack of attractiveness related to the remoteness and the low appeal of these places.
This model can be replicated around other major cities in Southern regions, triggering other kinds of synergies, taking advantage of existing infrastructures that have been built during the long season of investments aimed at reducing the North-South gap.

[8] See https://www.provinceditalia.it/strategia-italia-upi-destinare-le-risorse-non-spese-dalle-grandi-aziende-di-stato-a-grande-opera-di-modernizzazione-della-rete-viaria/ (in Italian).
[9] Alia (3,400 inhabitants), Lercara Friddi (6,700) Roccapalumba (2,300) Vicari (2,600).

For example, industrial estates, the so-called *Agglomerati Asi*, built during the period of *Cassa per il Mezzogiorno* are very often connected with railways lines, built for transporting raw materials and finished products. Some of these estates that are still partly empty, due to the limits of the development model adopted at that time (Martinico, 2001) but they can be re-used for hosting exchange nodes for transports and other activities, including labor-intensive ones, according to the TOD principle.
Some examples include the estates of Dittaino, in Sicily; Lamezia Terme, Saline Ioniche, and Gioia Tauro in Calabria; Pisticci in Basilicata. All these areas are typical examples, of legions of underused industrial estates that have great potentialities for being reconverted.

2.5 Urban mobility and public realm

On an urban scale, another key element is preserving and enhancing the role of the public realm since its enhanced quality will increase social distancing. By reducing the space devoted to cars (both for traveling and parking) there will be many more opportunities for walking and cycling and also for leisure activities. Open-air bars and restaurants can occupy larger areas along urban streets. This change can be even more relevant in Southern Italian cities that are often characterized by dense urban fabrics with a very limited public realm. This is particularly true in settlements built in the 1950-70s when development took place mainly based on rudimentary master plans or illegally.

Fig.3 Roccapalumba – Alia Railway Station

This approach is gaining momentum with the effects of the pandemic, many local administrations are incentivizing the use of outer areas, by reducing or eliminating taxes on this use of the public realm. This is happening also in places where climate conditions and traditions are not particularly oriented to this way of living, like in the Mediterranean countries[10].
It will be wise to promote a change of the contingent attitude that is emerging in this phase into a most established one. The instance toward increasing and redesigning public spaces cannot be limited to extending pedestrianization but it is advisable to transform into long term planning actions. A wise direction could be the

[10] For instance this is the case Vilnius Municipality in Lithuania that is promoting the use of public spaces after the emerging of the pandemic emergency. (https://vilnius.lt/en/2020/04/27/vilnius-set-to-become-one-giant-outdoor-cafe-municipality-shares-public-spaces-with-restaurants).

proposal of very limited "acupuncture" demolitions of bad quality or abandoned buildings, to increase the quantity and quality of the public realm. This objective could be included in detailed plans aimed at promoting the urban renewal of underused city centers.

2.6 Tourism

The layman's perception of the current situation tends toward a prevailing pessimism on the future of the tourism sector. Tourist operators' opinions swing between doomed and optimistic forecasts about their future. Also, in this case, it is too early to make realistic forecasts, considering that previous events like terrorist attacks or similar pandemics (even if considerably more limited in size) had very limited long-term consequences. However, the Covid-19 crisis should be seen as an opportunity to critically reconsider tourism's growth trajectory, and to question the logic that more arrivals are always implying greater benefits (Gossling et al., 2020). So far even the growing concern about tourism (Seraphin et al., 2018) has not stopped the steading increase of tourist volumes. The impact of the pandemic on tourism and landscape and is still unclear. For instance, the effect on Cruise ships, traditionally seen a safe environment was devastating, and there are also growing concerns about the reduced amounts of funds for the management of national parks worldwide, due to reduced revenues caused by the lockdown. The issue is how long this effect will last.

Looking back to the past, the idea of limiting the Coastal Development in mass tourism destinations is rooted in a long-lasting tradition. *Italia Nostra* the pioneering environmentalist association was battling fiercely against the uncontrolled development of the main tourist coastal destinations, the so-called *"rapallizzazione"* after the name of a well-known seaside resort in Liguria. Even the unique attempt of approving a National Territorial Strategy (*Progetto '80*) proposes a containment of uncontrolled coastal development. The results of these battles have been very limited so far, even when the planning authorities have produced acclaimed landscape protection plans, like the ones of Sardinia and Apulia.

The pandemic can act as a sort of catalyst for favoring a more balanced approach to tourism development. The new situation can boost low-intensity tourism at least in the initial phase. This form of tourism is typically applied to areas out of the major tourist destinations, that are likely to become particularly fashionable in the era of social distancing. The changing strategies of major internet platforms for searching accommodations are a clear sign of the new trend, engendered by the fear of the contagion. Holiday homes, especially the ones that are equipped with a swimming pool, are highly requested for the next summer holiday season. This opens up new market opportunities for inner areas of Mezzogiorno that can offer relaxing locations in the countryside, at cheaper prices in comparison with top-ranking European destinations like Tuscany or Provence.

Fig. 4 The archeological site of Morgantina in Sicily

The precondition for taking this opportunity is the capacity of offering a complete set of attractions for prospective visitors.
This is the correct way for boosting Alternative Deliberate Tourism (Weaver, 2000) in areas that, so far, have been marginally involved in the tourism industry.
Cultural and natural heritage are the main assets for attracting tourists, but this requires high levels of regulation (Trigilia, 2017).
Accordingly, wise and highly integrated management of the entire sector is fundamental. This includes the need to strengthen the role of Landscape and Environmental Planning, otherwise, the rhetoric of Sustainable tourism will prevail (Weaver, 2012).

2.7 Underutilization of the built heritage

In Italy, Census data on the availability of rooms in residential buildings show a steady increase after WWII. The comparison of decennial National Censuses indicates a 192% rise in rooms from 1951 to 2011[11]. In the early 1950s, the situation was still critical, the rooms/inhabitants ratio was 0.75 but it reached the optimal value (one) in 1971, jumping to 1.72 in 2011. In the same period, empty dwellings increased by 980%. The geographical distribution of the residential dwellings is quite homogeneous at the NUTS1 level[12], but it changes considerably at more detailed levels (NUTS2 and NUTS3). At the municipal level, the scenario is extremely fragmented.
Building activity in lagging Italian regions is only partially dependent on general economic conditions. This is emerging, looking both at the increase in the number of rooms in the period 1971-2011 and at the number of building permits issued in recent years (Tab. 1). For instance, in the less affluent areas of Southern Regions like the province of Agrigento, in the considered 40 years period, rooms in residential buildings increase by 107% whereas the national increase was only 82%. Tab 1 shows that after the 2007-2008 global financial crisis (GFC) the production of new residential buildings slowed down considerably throughout the country, but without relevant differences among Italian Regions.

Year	Basilicata	Calabria	Campania	Puglia	Sicilia	Total 6 regions	Total Italy	6 Reg./Italy
2008	5,324	28,705	30,957	46,269	46,523	157,778	658,034	24.0%
2012	1,828	12,540	19,379	18,472	23,573	75,792	289,876	26.1%
2014	1,638	5,975	11,707	11,756	13,096	44,172	168,941	26.1%
2016	1,566	5,803	9,877	12,063	10,449	39,758	163,086	24.4%
2018	1,163	5,278	13,979	16,263	11,468	48,151	197,501	24.4%

Tab.1 Rooms in new residential Buildings according to permits issued in a sample of Southern regions (Based on Istat data)

This negative trend is changing in the last two years, showing a slight growth at the national level. The same is happening also Southern regions where the relevant delay in recovering from the crisis seems to play a marginal effect. Southern Regions GDP is still approximately 10% below the pre-crisis value, whereas in Northern and Central ones this difference is about 2.4 % (Svimez, 2019). By the same token, the trend is still not influenced by the steady decrease in population in recent years. *Mezzogiorno* lost 256,300 inhabitants from 2003 to 2017, compared with a national increase of about 64,000, and the trend is accelerating in the last 3 years.

[11]Data are referred to rooms in conventional dwellings occupied by resident persons (Source: Italian National Statistical institute (www.istat.it).
[12]The Italian groups of regions are: Northwest, Northeast, Central, South and Insular, the term *Mezzogiorno* is commonly referred to both the statistical South and Insular NUTS1 units.

The main effect of these combined phenomena is the growing number of unused buildings. Most recent data available from the Italian tax agency (Agenzia delle Entrate, 2019) shows that, in 2016, the share of unused buildings in the majority of southern regions is almost double than the national average.
At the local level, the situation is even more worrying because inner areas are carrying the burden of the uncontrolled development of the past 50 years. A sample of 11 small municipalities in Sicily, selected based on the highest relative population decrease, confirm that about 75% of residential buildings are empty (Martinico, 2020 forthcoming). This phenomenon is common to several towns of inner areas of *Mezzogiorno* and is extending progressively outside the historical centers.
The overproduction of recent residential buildings is the long term effect of several factors that include illegal building activity but also the bad quality municipal plans that have induced extensive new development (Romano et al., 2018). Interestingly, similar conditions are emerging also in more affluent regions of Europe like the Flanders (Bervoets et al., 2015). Besides, in Southern regions, the quality of existing residential buildings is particularly low and its impact on townscape represents a limit to tourism development.
The future challenge is to try to turn this condition from a weakness into an opportunity, both in main metropolitan systems and in small and medium towns (Martinico, 2020 forthcoming).

Fig. 5 - Unfinished dwellings in Acquaviva Platani, Sicily

Managing unused buildings is a very challenging task but it can be seen as a way for optimizing these existing assets, especially in inner towns. Matching fiscal policies and land use planning provisions can be a way for using the excess of residential and commercial buildings for supporting the revitalization of inner areas.

3. Hints for the post-pandemic phase

The post-pandemic phase could be the chance for involving in the recovery strategy the 60% of the Italian Territory, an area that, in the last decades, has been considered as the "ball and chain" by the developed regions, no more than the market place for their industrial productions, useful for compensating the reductions in the exports of goods abroad.
Reducing the GDP North-South gap could become, again, a central objective for revitalizing the national economy shortly, heading for a more sustainable direction. Southern regions will play a fundamental role if they are not considered, anymore, as the "scrap material" (Nigrelli, 2020, forthcoming) of the production process.

A wise mix of tradition and innovation is the recipe for changing the historical unbalance that is slowing down the entire nation. It is not enough to consider the relevant endowment of cultural and environmental heritage as a way to promote the renaissance *of Mezzogiorno*. The idea of promoting Southern regions as a sort of territorial *Buen Retiro* park for the relaxing weekends of stressed financial managers or businesses men, that fly from wealthy Northern European cities, is too narrow-minded, a broader vision is needed.

This approach requires a deep change in the cultural attitude of decision-makers. In this sense, planners, have the moral obligation to contribute to this change, assuming a critical stance, accomplishing one important task of intellectuals: breaking down "stereotypes and reductive categories that are so limiting to human thought and communication" (Said, 1994).

The specificities of South European cities, as opposed to the northern European ones, have to be explored for understanding the capacity to contrast the economic crisis. Countries like Greece, Spain, or Italy well before the pandemic crisis, have responded differently to the stress of an economic crisis. Popular spontaneity and informality are constant features of South European communities, one distinguishing character is the joie-de-vivre "which constantly brings people out to the streets and piazzas […] in sharp contrast with the anti-urban narrative of Anglo-American cultures" (Leontidou, 2014).

It is not a chance that the North-South contrast is now harshly emerging in the European Institutions, as the effect of the pandemic. This deep contrast is full of contradictions since the attitudes of Southern Europeans are blamed by the Anglo-Saxon culture which is, at the same time, attracted by this way of life. A clear demonstration is a success of tourist destinations in the Mediterranean area, very popular among the Northern European. Illegal housing, tax evasion, and informal commerce have had, at the same time, extremely negative effects on the quality of urban settlements but they have also historically contributed to solving relevant problems, like the housing shortage that was inherited from the past.

The pandemic could accelerate the need for re-orienting the vitality inherent to the Mediterranean approach to life, as it is reflected in the prevailing urban culture. Finding a specific approach to cope with this new crisis could appear as a too ambitious objective. It can include actions aimed at limiting the negative excesses of this vitality, orienting the positive forces toward an alternative model. Once again, the challenge is using some of the weaknesses of Mediterranean culture to turn them into strengths.

As usual, the key issue remains how to implement this change.

The top-down ruling has proved to be not effective. For instance, it is useless to imagine extensive policies for demolishing excessive or incongruous buildings. Researches are demonstrating that worldwide communities are very reluctant to accept plans that change radically the urban structure, especially if they include provisions for the demolition of buildings. The application of environmental protection criteria has been a typical way of supporting exclusionary planning choices[13]. But this approach is likely to be unsuccessful.

The typical negative side of restrictive planning actions is the rising of housing prices. But this is not the case of inner areas, where the current condition of oversupply of dwellings and the consequent reduction of real estate prices, can act, in theory, in favor of new planning approaches, aimed at stopping new developments and favoring urban regeneration.

But current real estate dynamics are not working necessarily in favor of urban regeneration. On the contrary, they may act in the opposite direction, causing more blight and abandonment in inner small towns. This means that the issue of the oversupply of dwellings has to be carefully governed and subsidized, to be efficaciously contrasted. Any new strategy has to consider carefully the social perception of the built-up domain, the long-lasting result of the accumulation of personal investments in building their own houses or production facilities.

[13] "These includes actions that have substantial impact upon certain categories of people Their exclusion can be achieved through the use of large lot requirements, prohibitions of multi-family dwellings, deep set-back regulations". (Clingermayer 2004).

The psychology of Southern homeowners is one of the key factors for proposing any innovative planning action. Waiting for the decay of the unused built heritage, as a way to overcome resistance to change, is not feasible.

Regarding the mobility, in the overall settlement system at a regional scale, inner areas in South Italy could have a future characterized by a conceptual similarity to the one of the exurbia, "a landscape of second homes and estates well beyond the outer suburbs, yet still connected to the city as a source of employment", according to the original definition of the 1950s by Auguste Spectorosky (Barilla, 2011). The key point here is to try to decline this kind of use of extended urban settlements in a different way, matching it with the typical multipolar structure of many European countries. This can be achieved by using the excess of existing settlements instead of promoting North American style new sprawl.

Investing in the improvement of existing infrastructure is necessary for promoting this objective. This will increase the opportunity to change accessibility to inner areas, promoting the wise use of railways, mixed with road transport both private and public. The amount of required investments has to be carefully considered. It is necessary to avoid unrealistic programs, like building an extensive network of high-speed trains, similar to the French one. In France, tiny villages in the countryside are well connected to the main cities that are the hubs of an extensive network of high-speed TGV trains to main cities. This condition makes possible living and working in a relaxing and pleasant hamlet in *Haute Normandie,* where a mansion house with a large terrain costs even less of a small row house in the Parisian *banlieue,* without experiencing an excessive sense of isolation[14]. A more modest strategy of progressive upgrading of existing lines can be feasible in South Italy but this requires a high level of coordination and a wise phasing in its implementation[15].

More efficient transport infrastructure is a prerequisite, but it is not sufficient. As highlighted above, improving health, education, tourist services, and attractions, are the other pillars for building new competitiveness of small and medium towns. To be attractive, also data infrastructure has to be upgraded substantially. This can be the way of capitalizing some of the positive consequences of the recent boost of smart working, increasing the opportunity of living in an isolated town but working remotely in the nodes of rampant capitalism[16].

In conclusion, the post-pandemic perspective is focusing on a two-pronged scenario following the current emotional contingency: our life will be completely different or, on the opposite, in few months we will back at our Business-as-Usual life. From our point of view, the main risk is that, in both cases, regional and urban issues will be, again, progressively neglected. On the contrary, the regional and urban dimension has to be central for any recovery policy. For this reason, territorial planning has to play a central role in determining the choices of any future recovery package, by giving ideas and competencies for shaping public policies useful for enhancing community life.

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[14] For instance from Rouen it is possible to reach Paris in 1.30 hours with 22 routes per day.

[15] This was not the case of the Palermo-Catania railway line where the first phase of upgrading works (415 meuros) started not from the main city of Catania, which is still equipped with a single track line, but from a more remote section. https://www.fsitaliane.it/content/fsitaliane/en/media/news/2019/3/25/work-commences-to-double-the-bicocca-catenanuova-railway-along-t.html.

[16] See the case of Colletta di Castelbianco, a pioneer project by Giancarlo De Carlo, that is still working http://www.borgotelematico.it/index.php.

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Image Sources

Fig.1: Paolo La Greca

Fig.2: Fausto Carmelo Nigrelli

Fig.3: wiki commons

Fig.4: Concetto Scuto

Fig.5: google street

Author's profile

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Covid-19 and spatial planning

A few issues concerning public policy

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Abstract

This article analyzes some relevant questions as regards the impact of Covid-19-related social living conditions on spatial planning policies and practices. The proposed discussion aims at highlighting and assessing a number of outstanding topics of spatial planning which public administrative bodies, practitioners, entrepreneurs and organizations operating in the profit and non-profit sectors, and the local communities should carefully consider with reference to a new planning outset after the lockdown period. Innovative and creative approaches should be identified and implemented when dealing with collective public spaces and shopping malls, urban and regional mobility infrastructure and services, food-supply changes and their implications in terms of development of local food-producing practices, spatial social control and privacy, mitigation of climate change-related negative impacts, and public awareness and commitment towards losers, especially urban losers. Each of these items presents important challenges for the future of spatial planning. Some of these challenges are synthetically described and discussed in this article.

Keywords

Covid-19; Post-lockdown planning; Food self-sufficiency; Mobility; Climate change.

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1. Introduction

After the lockdown time, new approaches, aimed at mitigating the Covid-19-related risk, will characterize spatial practices that will possibly challenge a number of commonplaces of the current planning culture. In this article a number of these planning clichés are discussed in the light of the Covid-19 pandemic impacts. In the second section the issue of collective spaces, such as outdoor public meeting spaces and shopping malls, is analyzed in a post-lockdown perspective, and the traditional role of these urban and regional service areas is questioned, on the basis of the new need for social distancing. The issue of spatial social control and privacy is also treated, building on these premises as well. Food-supply changes and their implications in terms of development of local food-producing practices and entailed productive uses of a part of the available urban public spaces is the topic of the third section, while the fourth deals with mobility infrastructure and services. The fifth section focuses on mitigation of climate change-related negative impacts. In the conclusion, a radical planning-inspired perspective (Marcuse, 2017; Friedmann, 1987) is assumed to address the issues of public awareness and commitment towards losers, especially urban losers, as regards the topics discussed in the article.

2. A new approach to collective spaces planning and social control

The International Council of Shopping Centers (ICSC) is a leading international organization funded by two Foundations based in the United States and Canada (ICSC Foundation and ICSC Canada), whose mission is "to ensure the retail real estate industry is broadly recognized for the integral role it plays in the social, civic and economic vibrancy of communities across the globe"[1]. ICSC, which counts more than 70,000 affiliates throughout the world, identifies the following main social driver of shopping centers: "Retail real estate properties offer more than just financial profits — they're a place to hang out after work, walk around with friends or family, and experience life offline. They enrich the social fabric of the places the world calls home"[2]. Whether shopping centers were classified according to the taxonomy concerning the United States and Canada[3] or Europe[4], undoubtedly their main feature is represented by high concentrations of retailers and customers. Whether the shopping-oriented developments were located in the proximity or within the central business districts (CBDs), in peripheral contexts or in non-urbanized areas of the countryside, they often displaced small retailers, and, by doing so, eventually impoverished the livability of inner areas of cities and towns, whose urban fabrics have progressively lost their mixed-use characteristics, whose recovery should be identified as one of the most relevant points to implement effective policies of urban renewal (Mehanna & Mehanna, 2019; Grant & Perrott, 2010). Under this perspective, impoverishment and recovery are both based on the leading concept that livability is founded on concentration of people and retailers, which is precisely the point that has to be overturned in the ongoing post-lockdown period. The future of overcrowded shopping malls is seriously challenged. The newly-projected centers should be radically reconsidered, whereas the existing ones are at serious risk of becoming obsolete in the short run. The perspective of urban planning policies such as the approach proposed in the study by Mehanna and Mehanna (2019) should be overturned, since the call for increased attractiveness of inner cities and historical areas should give way to different measures, based on avoiding overcrowding of retail areas and on promoting a balanced distribution in terms of spatial location of retail activities across inner, peripheral and rural areas.

Newly-projected and existing outdoor public meeting spaces should be (re)planned on the basis of avoiding overcrowding as well. Systems of small- or medium-sized open spaces for outdoor activities such as sport and

1 Quoted from ICSC's, available at https://www.icsc.com/who-we-are/our-mission.
2 *Ibid*.
3 Available from ICSC at https://www.icsc.com/uploads/t07-subpage/US-Shopping-Center-Definition-Standard.pdf
4 Available from ICSC at https://www.icsc.org/uploads/t07-subpage/Europe-Shopping-Center-Definition-Standard.pdf

leisure, recreation, biking, performances, exhibitions and political meetings, should be substitute for large-sized stadiums, arenas and entertainment venues. Concept master plans which entail new metropolitan or urban large stadiums, projected as multifunctional facilities attracting thousands of people, should be carefully reconsidered since social distancing may probably be inconsistent with the adopted planning concepts. From this point of view, the New South Wales Stadia Strategy (NSW Government, Office of Communities, 2012) and the new Cagliari stadium (Balletto & Borruso, 2019) are outstanding cases, among many, whose approaches should be redesigned in the light of the Covid-19 implications related to big outdoor facilities.

A connected issue concerns the decrease in safety of urban contexts as a consequence of the social distancing conditions which characterize the post-lockdown spatial organization. As per Jacobs (1961, p. 36), "[T]here must be eyes upon the street, eyes belonging to those we might call the natural proprietors of the street. The buildings on a street equipped to handle strangers and to insure the safety of both residents and strangers, must be oriented to the street. They cannot turn their backs or blank sides on it and leave it blind." Jacobs' position identifies the natural social control by the city users, be they inhabitants, retailers, customers, urban workers, mayors, entrepreneurs, civil servants or street artists, as a most desirable characteristic in terms of public safety and livability. The eyes upon the street are generated by a multiscalar sense of community, which the local society is built upon. The community space is shared by people who are heterogeneous as regards social group, ethnicity, religion, age, expectations, education level, working expertise and so on. All these people share the property of the public space, are used to each other and aware of the urban environment that they live in and they contribute to build and improve on a day by day social learning basis (Friedmann, 1987). In other words, in Jacobs' perspective, the eyes upon the street not only generate safety, but also create a warm sense of community which permeates and qualifies the urban livability.

Fundamental conditions which operationalize this control are mixed use of public space and high density of city users at different times during the day (Carmona, 2015). The integration of these conditions generates urban quality and neighborhood attractiveness (Kotkin, 2000), which have represented the reference points for the implementation of the urban renewal policies of several metropoles and medium- and small-sized cities all over the world (among many, Cysek-Pawlak, 2018; Aghamolaei, 2017; Vorontsova et al., 2016; Biddulph, 2003).

These conditions and reference points are seriously questioned by the relative isolation implied by a sustainable safe coexistence with Covid-19. Urban planning programs which aim at increasing the attractiveness of neighborhoods whose mixed-use implies the simultaneous presence of many city-users may possibly become obsolete, and local development policies based on cultural tourism are likely to be radically rescheduled. Congress business and cultural tourism which have had a leading position in the international urban order and in the outstanding role played by the central business and historical districts of several cities and metropoles (Short, 1996) are possibly going to be replaced by extensively-urbanized spatial contexts almost totally lacking in urban identity.

Several examples can be quoted in order to put in evidence how much the most livable and attractive environments generated by farsighted and effective implementation of planning policies can look inconsistent with respect to the future spatial contexts where people should keep a physical distance from each other and minimize social relations in the name of safety from Covid-19. What about the Fifth Avenue between the Empire State Building and Central Park, or Times Square and its surroundings (Birch, 1996), or the Bostonian North End (Jones et al., 2019)? Will the areas between Piazza della Signoria and Piazza del Duomo in Florence (Alberti & Paloscai, 2018), or from Piazza Duomo to Piazza San Babila in Milan (Bonfante & Pallini, 2014), be still attractive for tourists? Will the Ramblas in Barcelona (Urbano, 2015; Casellas, 2009), or the immense historic center of Rome (Clough Marinaro & Solimene, 2020; City of Rome, 2018; Coppola et al., 2014) still be operational as relevant factors for local and national economic and social development? Even though, at

present, future scenarios are difficult to imagine, it is hard to optimistically forecast a future new urban order based on radiant garden city beautiful-inspired planning approaches (Jacobs, 1961), and a probably long-lasting learning-by-doing period will characterize spatial policies and visions, aimed at dealing with a problematic coexistence with the Covid-19 dreadful threat.

3. Food-supply changes and their implications in terms of development of local food-producing practices

Travel restrictions and border controls have been enforced in a number of countries (Anzai et al., 2020; Cohen & Kupferschmidt, 2020; Kraemer et al., 2020, Wells et al., 2020) to prevent Covid-19 outbreaks or hinder the spread of the disease. Such restrictions, mostly aimed at limiting people's movements, have also hit freight shipping (Rahman et al., 2020), hence deeply affecting all kinds of supply chains, that is the networks of multiple firms (both producers and distributors) that make it possible to produce a specific good and distribute it until it reaches the final consumer (Mentzer et al., 2001). The way supply chains have been impacted by Covid-19 depends not only on possible shortages in the labor force (Galanakis, 2020; Hobbs, 2020; Shahidi, 2020) and on possible disruptions in the transport networks, but also, and critically, on the types of goods and products (Gray, 2020; Ivanov & Dolgui, 2020). In this respect, in the Covid-19 epidemic, food supply chains have been proving their vulnerability; the reasons for such fragility can be linked to a number of factors, two of which will be briefly looked at in this section: first, their reliance on the "just-in-time" approach; second, changes in types of food purchasing.

As for the first issue, it is worth remarking that the food supply chain, in an effort to increase efficiency, has steadily progressed in the recent past towards a "just-in-time" approach, where supermarket stocks are kept to a minimum and the system relies on continuous flows (Benton, 2020; Hobbs, 2020). This allows for increased speed in the goods' sales and, consequently, for reduction in the space and volume required to stock goods, as well as for more responsiveness in meeting possible changes in consumers' demands, hence minimizing the risk of not selling perishable goods. As a response to Covid-19 outbreaks, panic buying and stockpiling behavior, or food hoarding, have been observed in a number of countries (Deaton & Deaton, 2020; Galanakis, 2020). Two main drivers can be highlighted as the reasons for these behaviors: first, the fear that food would become unavailable, or that its price would increase to the extent that it would become unaffordable in the future (Power et al., 2020), mainly because of the low levels of stocked goods and high dependency of some markets on imported foods; second, the need to comply with social distancing and movement restrictions, also entailing the need to reduce the number of trips to supermarkets and grocery stores. However, in many a case, food shortages were either temporary or not as severe as the consumers had feared (Deaton & Deaton, 2020; Hobbs, 2020; Patricolo, 2020).

A second factor that has stressed the food chain is the change in consumers' demands, due to the fact that many people, especially tertiary sector workers, have been made to work from their homes, and that lockdown policies in force in some countries have entailed shutting down restaurants, cafes and the like. As a consequence, a number of workers, who had previously been used to having at least one meal per working day in their company's canteen, or in a restaurant or a café, have had to shift their eating habits by eating at home (Hobbs, 2020; Gray, 2020; Kolodinsky et al., 2020), either by resorting to online deliveries, or, most likely, by preparing their own meals. From the food chain perspective, this has implied an increase in food purchasing in supermarkets and groceries, possibly leading to queuing and temporary food shortages on the shelves, until the food market would readjust to meet the new demands.

Both changes in consumers' demands for food and adherence to the just-in-time-approach have resulted in major pressures on the food supply system, or, to put it with Power et al. (2020), in "testing food supply chains to their limits". In this respect, the major weakness exposed by Covid-19 in food chains is not the

primary production in itself (Shahidi, 2020), but the food transportation and distribution system. The more primary production areas are distant from consumption areas, the higher the food system's dependence on long-distance transportation, and the higher the exposure to the risk of international restrictions on movements of goods (Cappelli & Cini, 2020).

Hence, if strengthening the resilience of food chains is to be achieved, then one key strategy would be reducing the physical length of such chains, and shifting consumers' preferences to locally-produced food so as to achieve some sort of "regional self-sufficiency" (Deaton & Deaton, 2000). This would, in turn, increase local employment and therefore quality of life at the local level (Cappelli & Cini, 2020); moreover, promoting short food chains would also be beneficial on the nutritional side, as it could, in principle, alleviate the "food desert" problem (UN-Habitat & World Health Organization, 2020), i.e. the shortage of fresh food in low-income areas and the reliance on industrial (and heavily processed) food, which causes severe diet-related health problems and even mortality. Furthermore, by reducing the food mileage, a decrease in fuel consumption would be achieved, resulting in a lower carbon footprint and a lower impact on climate change.

However, one major barrier to achieving this shift to local products cannot be neglected, and it lies in the food prices, which are perceived, and often really are, higher than those of industrial foods. It might well be, then, that the worse-off urban dwellers who cannot afford to buy local foods would be the most affected by food chain disruptions, because more dependent on long-distance, or even on global, food networks. One possible way out, in such cases, could be a resurgence of subsistence urban agriculture, which could take two major forms: i., community gardens in public spaces, and, ii., rooftop farming.

"Community garden" is a generic term that in the literature encompasses various forms of farming in the urban environment (Firth et al., 2011); in its wider acceptation, the expression denotes collective farming in shared spaces, often (but not always) publicly owned and accessible. Urban dwellers resorted to community gardens to cope with food shortages during major crises, such as the Great Depression, or wartimes (Armstrong, 2000; Twiss et al., 2003). Later on, community gardens have been promoted by some municipalities because of the multiple benefits they provide: besides securing food and therefore allowing for money saving (Samuelsson et al., 2020), they help exercise, hence increasing people's (and especially the elderly's) health; moreover, they provide opportunities to foster local communities' social bonds, and they offer closeness to nature, as well as a peaceful and quiet environment away from urban traffic and noise (Schmelzkopf, 1995), which in turns contributes to improving people's psychological well-being. Therefore, community gardens can provide local communities with provisioning ecosystem services (food production), as well as with cultural ecosystem services (recreational and spiritual experiences). At the wider level, i.e., beyond that of the urban farmers who make direct use of the garden, they can support pollination and provide habitat for animal species; finally, depending on their characteristics, e.g. location, size, previous uses of public spaces being farmed, community gardens can also provide regulating services such as air purification, carbon sequestration, mitigation of the urban heat island effect, stormwater reduction. Notwithstanding, community gardens can be vulnerable to planning choices: when the demand for new development increases, or when land values are driven up, possibly also due to improvements in the neighborhood livelihood brought about by the community garden themselves (Armstrong, 2000), the land can be reallocated to more profitable land uses (Schmelzkopf, 2002), especially when urban agriculture takes place on private vacant lots rather than in public spaces. Therefore, land-use planning regulations should include specific provisions aiming at setting aside public spaces for this purpose.

Rooftop agriculture, as the name implies, takes place on buildings; because it spares land, it has also been labeled "Zero-Acreage Farming" (Thomaier et al., 2015). It includes both rooftop open-air farming, and rooftop greenhouses (Sanyé-Mengual et al., 2016), and, in developed countries, it can be either commercial or non-commercial. For commercial activities, green roofs are preferable; these consist of a number of layers,

including soil, filter, drainage, a barrier to protect the building, and should carefully be considered within the design of the building because of the significant weight addition. For non-commercial activities, simple pots and some scaffolding can be used to easily convert a terrace or balcony into a food garden (Sofo & Sofo, 2000). Prominent examples of cities already hosting large-scale vegetable farming on top of buildings are reported in the literature (see Walters & Midden, 2018); however, planning regulations concerning allowed land uses have been found to be a significant barrier to the spread of rooftop agriculture (Thomaier et al., 2015). Therefore, the inclusion of specific planning regulations, or policy guidelines, such as those issued in Boston and Chicago (Sanyé-Mengual et al., 2016) would be needed to favor the conversion of unused rooftops into vegetable gardens. As in the case of community gardens, benefits extend beyond farmers, since green rooftops, and rooftop gardens more in general, can deliver a number of regulating ecosystem services, such as mitigation of the urban heat island effect (Yinghui Astee & Kishnani, 2010), air purification, carbon sequestration and reduction in noise pollution (Rowe, 2011).

4. What future for mobility infrastructure and services?

The Covid-19 epidemic has deeply affected the transportation sector in general; passenger mobility has especially been hit because of travel restrictions, stay-at-home orders, closure of any business activities deemed as "non-necessary". This, in turns, has brought about an unprecedented decrease in urban transport demand, both in car traffic and in public transport ridership (De Vos, 2020; Falchetta & Noussan, 2020). At the beginning of April 2020, Google launched its "Covid-19 Community Mobility Reports" (Google LLC, 2020) and the outcomes in the period April 3 - May 16 are staggering: in Italy, mobility trends' figures for retail and recreation (which includes restaurants, shopping centers, movie theaters) are at -61%, and for public transport hubs at -53%; in the United Kingdom, the negative trend is worse (-74% and -58% respectively), and it gets even worse in Spain (-76% and -59, respectively), while in countries where a strict lockdown was not fully enforced the trends, although negative, are far from these values: the Netherlands, for instance, show -36% for retail and recreation and -46% for public transport hubs, while in Sweden the figures are at -19% and -26% respectively. These sheer numbers concerning public transport seem to support the view that this sector has suffered the greatest impacts (Schmidt, 2020) among the various modes of transportation, even in the absence of strict stay-at-home regulations.

On the one hand, people are showing reluctance to make use of public transport, which is perceived as a vector for the distribution of the virus (TUMI, 2020): public transport has been designed to allow large numbers of people to move together, hence full capacity has always been looked for, and this does not go hands in hands with physical distancing among passengers (Musselwhite et al., 2020); moreover, laboratory tests have suggested that, in the absence of proper sanitation measures, the virus can survive for a number of days on metal and plastic surfaces (van Doremalen et al., 2020) such as those of the vehicles, which also applies to shared mobility services. On the other hand, public transport cannot be shut down: not only do dense city centers depend on public transport for their functioning, especially in monofunctional CBDs and in any case in which a good mix of functions is lacking, but also many people depend on public transport to get to their working places, and especially the worse-off, those who cannot afford car ownership, and who are more likely to be employed in the so-called "essential jobs and services" (e.g. cleaning operators, grocery store employees, nurses) and less likely to be able to work from their homes.

What is yet to be known is how the transport system will recover, and which new equilibrium state it will achieve once the epidemic is over.

The first signals from places where gradual reopenings are taking place point at two main directions: first, fear of crowded spaces, or even of shared spaces, is persistent, which means that whoever owns an individual vehicle prefers to use it instead of riding a bus or a metro; second, public transport services are suffering not

only due to the fear of contagion, but also because they are struggling to meet additional requirements to increase both the passengers' and the drivers' safety. These include, for instance, lowering the vehicles' capacities, increasing the frequencies, implementing frequent cleaning and sanitation (Schmidt, 2020). All of this entails additional costs, all the more significant because coupled to the loss in revenues due to declining ridership (TUMI, 2020). As a consequence, there is an urgent need to rethink mobility, especially in urban areas. How this will be done depends on how the epidemic will evolve, and on how society will adapt to it. For instance, a possible scenario has been suggested in which whoever can, or is allowed to, will continue working from his/her home, which would sustain the current contraction in mobility demand (Falchetta & Noussan, 2020), although at the risk of increased social isolation (Batty, 2020).

There is general agreement on the fact that demand for private car travel will increase (Berk, 2020; O'Sullivan, 2020; Schmidt, 2020) because cars are perceived as a safer environment; such perception might offset perceived risks associated with car accidents, or the time spent searching for parking lots in city centers. As a consequence, city managers, transport planners and urban planners should aim to provide better, and safer, alternatives to mass use of cars, which would be undesirable because of its obvious side effects (such as congestion, car accidents, environmental pollution, use of fossil fuels) that would prevent governments from meeting the sustainable development goals (UNECE, 2020).

In the past years, public transport has been promoted as the most desirable and convenient mode of transport in compact cities. To maintain the advantages of metros and buses in face of current fears, some cities are experimenting, or are planning to experiment, new ways to manage public transport. Beijing, for instance, is planning to implement a new system whereby users would need to make an online reservation prior to boarding a subway, which would prevent having crowded vehicles and stations (TUMI, 2020), while Milan is introducing a system to control distances among passengers onboard buses and metro trains and to allow automatically closing the entrances of metro stations when needed (O'Sullivan, 2020). However, it has yet to be understood how, and where from, governments will get the large amounts of public funds that will be needed to make up for the decrease in capacity (and hence in revenues) and the additional costs due to cleaning and sanitation requirements.

Alternative modes of transportation have increased under the Covid-19 epidemic, when distance allows to do so; cities are witnessing a resurgence in scooters and bikes (Berk, 2020), as well as an increase in popularity of e-bikes and e-scooters. The main reason for this is that they are meant for individual use, hence, contrary to public transport, they ensure both physical distancing and low contacts with shared surfaces, if any. In New York, a ban on the use of e-scooters was lifted because of Covid (TUMI, 2020); moreover, some countries and cities are providing financial incentives to purchase micro-mobility devices (Caprino, 2020; Hawkins, 2020; Zipper & Westervelt, 2020), which is expected to further speed up the demand. Walking is another alternative mode of getting to places that has increased; as with cycling, this "active mobility" has partly happened as a response to closure of gyms and swimming pools, to do some sort of outdoor physical activity rather than attending online gym classes from home. This increase in active mobility is, indeed, something which should be maintained in the long run: urban walkability (Blečić et al., 2015) is closely linked to safety and attractiveness of places, hence it is a significant indicator of urban quality. However, if micro-mobility and walking are desired, then major rethinking of street infrastructure, and of the way the space is shared, will be needed; the way public space is designed should be rethought by reallocating or prioritizing some uses over others (NACTO, 2020), which is something that a number of cities have been doing since the beginning of the Covid-19 spread (e.g. Barcelona: Cols, 2020; Milan: O'Sullivan, 2020; Paris: Reid, 2020; Portland: Maus, 2020; Salt Lake City: Bennett, 2020). Supporting, or spurring, current demand for active mobility and micro-mobility will probably be the only way out, if compact cities want to survive the pandemic by keeping their livelihood and retaining the Covid's positive by-products, such as decrease in air pollution or reduction in road accidents,

without giving way to diffuse networks of small, low-density towns which would be perceived as a less risky as far as this epidemic, as well as the others which will inevitably follow, is concerned.

5. Mitigation of climate change-related negative impacts

The economic crisis caused by the Covid-19 pandemic has entailed some positive impacts on climate changes in terms of emissions reduction due to the restrictive measures carried out to guarantee social distancing by preventing virus diffusion.

The social and economic crisis due to Covid-19 pandemic has changed people's life patterns all over the world in relation to a number of aspects. One of the main implications, in terms of mitigation of climate change-related negative impacts, concerns the rapid decline in energy consumption, and CO_2 and greenhouse gases emissions. Indeed, at the international level demand for electricity supply has declined as a large share of users, belonging to the industrial, commercial and tertiary sectors, have had to slow down or to stop their activities. For example, according to a report of the Italian General Confederation of Enterprises, Professional Activities and Self-Employment (2020), in Italy, during April 2020, after a decrease of 30.1% in March, electricity consumption declined by 47.6% compared to the previous year. On the other hand, although the residential use of electricity increases, it does not compensate for the decline in industrial use. According to a study by Mcwilliams and Zachmann (2020), the daily electricity consumption during peak hours (08:00 – 18:00) in relation to the working days from 30th March to 3rd April declined by 34% in Italy, 18% in France, 24% in Spain and 20% in Austria in relation to the corresponding week in 2019.

In relation to emissions, several studies (Mahato et al., 2020; Dantas et al., 2020), published during the lockdown period, put in evidence the positive effects of forced restrictions on air quality of important megacities. Mahato et al. (2020) monitor seven pollutant parameters (PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, O_3 and NH_3) in relation to 34 monitoring stations located in Delhi, the capital city of India, and one of the largest megacities in the world. The study shows a significant declining trend of some pollutant concentrations, such as PM_{10}, $PM_{2.5}$, NO_2 and CO, whose average concentrations declined by -51.84%, -53.11%, -52.68% and -30.35% respectively. Emissions reduction is strictly connected with mobility. According to a study by Badii et al. (2020) on the lockdown effects on mobility, transport and the urban environment in Florence, during the first days of April and May 2020 the whole daily flow of vehicles entering and exiting from Florence decreased by 18% and 52%, respectively, in relation to the corresponding days of 2019.

However, the comprehensive impact the lockdown-related measures are likely to generate on climate changes is quite controversial. On the one hand, the emission reduction is temporary and its effects as regards the stock of greenhouse gases in the atmosphere seems marginal. On the other hand, in the post-lockdown period, many countries will mobilize financial resources to address the world economic crisis and, by doing so, they will support highly-polluting industrial sectors, such as aviation and motor industry. Moreover, facing the increase of debt-to-GDP ratio, caused by the huge tax support introduced within the economic system, will probably reduce green investments. Many resources aimed at financing green transition programs could be diverted to support economic recovery policies, as it is highly likely within the European Union countries (Catalano et al., 2020). Therefore, the impact generated by the world economic crisis on climate change in the post-lockdown period will be affected by public policies and strategies introduced by many developed countries' governments. Indeed, "reducing the world's greenhouse gas emissions depends on the aggregate effort of all countries […] a single country cannot stabilize atmospheric concentrations of greenhouse gases all by itself—certainly not by reducing its emissions unilaterally […] the contributions by individual countries to stabilizing concentrations do not matter […]. Free riding is likely to be a much bigger problem for climate change mitigation." (Barrett, 2007, p. 6).

Moreover, the lockdown-related measures, such as closing shops and restaurants and smart-working practices, aimed at preventing social closeness in order to hinder the Covid-19 circulation, the so-called "social distancing" measures, produce important effects on people's behaviors. During the lockdown period, travel demand and car traffic decreased at a significant rate, and, as a consequence, traffic congestion and air pollution went down (De Vos, 2020). During the post-lockdown period, people might prefer to use private cars in order to avoiding contacts. Public transport might be perceived as a breeding ground for viruses (Troko et al., 2011) and therefore as a major source of Covid-19 diffusion. The likely increase in the use of private cars might entail negative effects on climate change mitigation. Policymakers and governments should encourage people to walk and to use bicycles as alternatives to private cars for short and medium range movements. However, many cities, e.g., most Southern Italy medium-sized cities, are not prepared to implement and manage cycling networks. In those cities, on the one hand the cycling network consists of small sections that do not connect to each other, and, on the other hand, the cycling paths are not safe, since they are not appropriately designed. According to King and Krizek (2020), walking and cycling activities should be encouraged by using little-used roadways as future pedestrian and cycling paths. Many cities around the world (Berlin, Philadelphia, and Mexico City) have experienced these policies (Laker, 2020). Furthermore, the use of public transport should be boosted by making buses and trains safer for commuters through redesigning and resetting their internal equipment in order not to reduce their capacity and to make them suitable to social contacts (De Vos, 2020).

Moreover, the restrictive measures implemented to prevent the Covid-19 diffusion have changed the habits of many citizens who are probably considering living in suburbs as an important alternative to CBDs, since in peripheral areas and in the country social distancing takes place much more easily (Cohen, 2020). This cultural change might encourage widespread urbanization at the expense of the compact city model, entailing more-or-less widespread land-taking processes and an increase in land surface temperatures. Indeed, as reported in a recent study (Lai et al., 2020), artificial urbanized areas and arable and permanent crops show the highest effects in terms of increase in land surface temperature. Moreover, the agricultural sector did not experience a significant reduction in emissions during the lockdown period (Helm, 2020). From this perspective, policy makers should promote and implement afforestation incentives in order to encourage the conversion from low-rent farming to forest farming (Lai et al., 2020). On the other hand, the optimal size of afforestation transitions and the ideal amount of financial resources to devote to these measures should be two central points in the political agenda (Zavalloni et al., in press). In addition, the direct commitment of local administrations to implement these measures, e.g. through direct purchase of private rural areas to convert into forest areas may convince local communities of the importance of mitigation of climate change-related negative impacts (Brouwer et al., 2015).

6. A radical planning-inspired conclusion

The spread of the Covid-19 disease has accelerated a generalized shift of white collars' place of business from their company's headquarters and premises towards their homes, since the work is organized on the basis of the smart-working mode. This approach will probably characterize private firms and public administrations not only in the very short term, but also in the medium and long run, since social distancing is one of the most outstanding features of the coexistence of Covid-19 and social life. This coexistence is not consistent with the pre-Covid-19 overcrowding of public collective transport, as per the discussion proposed in Section 4 of this article. Demand for office space is one of the main drivers of high density of city users in CBDs of cities and metropoles. Demand for office space generates, as a by-product, housing demand, and pushes up the real estate market towards gentrification (Leccis, 2019; Short, 1996). That being so, the decrease in office-space demand implied by the Covid-19 impact on real estate markets will probably entail a decline in the

attractiveness of previously-vibrant environments and, as a consequence, a fall in the funds availability for investment in the real estate market, such as urban renewal projects (Couch, 2008). On the other hand, smart-working practices, and the consequent increase in time spent at home by many previous users of the CBDs, will boost the relevance of the time spent in their residential areas by many workers, whose daily time allocated in commuting between home and their working places will be saved and utilized in more pleasant ways, thanks to cyber security and digital connectivity. In other words, the need to extend smart work to as many workers as possible, in order to increase social safety related to social distancing, has already sped-up and will progressively hasten the implementation of technological change into the local societies' everyday life based on widespread smart-working practices (Muggah & Ermacora, 2020).

A more balanced distribution of less-intensive residential, working and public service activities will probably drive the urban and periurban organizations towards a multicentered framework, where local communities will work as small villages, and the whole spatial context will be structured and planned as a network of villages (Magnaghi, 2000). The new city, conceived and organized as a network of villages, will be a chance and a challenge for present and future urban administrators and planners, since it will imply a new start in terms of mitigation and adaptation as regards climate change impacts, knowledge and protection of nature and natural resources (Lai et al., 2017), and increase in the availability of ecosystem services and green infrastructure (Magaudda et al., 2020). This situation will eventually entail a balanced and effective boost in urban resilience, which will be made possible by the novelty of a new-start condition (Muggah & Ermacora, 2020; Brunetta & Salata, 2019).

A new start, which builds upon urban resilience, implies public awareness and participation, implies "eyes upon the street" à la Jacobs (1961), or, eyes upon the planning process related to the project of the new network of villages. This position is strictly related to the radical planning tradition, which is vividly expressed by the following quotations:

- «As we have extracted it from the SM [social mobilization] tradition, radical planning is, like other forms of planning, concerned with the linkage of knowledge to action. Yet there is more than one way this linkage can be effected: planning for societal guidance is very different from planning for structural change and social transformation. It is this last which is of interest here» (Friedmann, 1987, p. 303);
- «It involves bringing out the hidden dimension of the alternatives underlying the one dimension of the actual. And then shaping the actual and realistic goal so that it points in the direction of the hidden dimension, the ultimately desirable […]. I call this "transformative planning" and locate it, on the opening paradigm, between the social/liberal and the critical/radical» (Marcuse, 2017, pp. 45-46).

As per Friedmann, the ongoing overturn of the organization of the urban structure and its spatial development implies a continuous and effective social control and mobilization on behalf of the local societies, which should work as a network of villages. Local administrations, which will play a decisive role in the identification and implementation of the planning practices and measures of the new start, should be fully accountable to the public opinion, whose awareness and involvement in decision-making processes will be a necessary condition for their effectiveness. Planners should work as social mobilizers, that is as deliberative practitioners à la Forester (1999), willing and able to build new narratives, directly responsible to and for the whole local societies rather than to public bodies.

In the light of Marcuse's point of view, creative approaches to planning science and technique, which may entail relevant and sometimes radical changes in the ongoing paradigms, should be carefully taken into consideration by the public administrations, since transformations are likely to develop into important steps forward which could imply significant improvement in the quality of life and social welfare.

In the evidence of true change, in the post-lockdown period policy-makers, theorists and practitioners should implement new conceptual frameworks in order to integrate in the planning processes the theoretical and

technical implications related to the uprise of new social behaviors with reference to demand for housing, recreational and tourist closed and open spaces, mobility infrastructure, education and university services, agricultural and industrial areas. The preference for low-density and extensive urbanization, implied by social distancing, smart-working and balanced spatial distribution of activities, should drive towards innovative theoretical and technical visions concerning categories such as land take, soil sealing, intensive versus extensive urbanization, transportation networks, carbon capture and storage, and, ultimately, environmental, social and economic sustainability.

Author Contributions

The authors have jointly contributed to the paper's conception and design. Individual contributions are as follows: Corrado Zoppi wrote sections 2, and 6; Sabrina Lai wrote sections 3 and 4; Federica Leone wrote section 5.

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Take advantage of the black swan to improve the urban environment

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Abstract
The outbreak of the Covid-19 virus for all humanity is a typical example of the birth of the black swan, a metaphor that indicates an unpredictable crisis event, because its very low probability. Statistics and probability theory teache that any deterministic hypothesis of forecasting this type of event is a chimera. More concretely, it is necessary to pay attention to the robustness of the socio-ecosystem, with respect to any crisis advent, not the pursuit of the specific black swan, which, by the way, takes different forms: from financial perfect storms to pandemics, to the unpredictable effects of climate change etc.. The paper refers to the health risk investigating the process of Urban Heat Island (UHI) which is a cause of health risk and of the increase in air pollution hazard. At the moment, there is a debate about the link between air pollution and Covid-19 diffusion, but, in any case, the precautionary principle pushes to take the opportunity of the crisis for a more sustainable city in terms air quality and citizen wellness. This paper presents a simple method to spatially classify areas of the city with different UHI-air pollution hazard, according to their morphology and land use. The possible employment of a such approach for planning has been discussed, to potentially pursue mitigation of the whole supply chain of urban climate-pollution-virus diffusion.

Keywords
Covid-19; Post-lockdown planning; Food self-sufficiency; Mobility; Climate change.

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1. Introduction

About half the world's population (over 3 billion people) lives in urban areas, and this number might rise to over 6 billion by 2050. Urban growth will be greatest in Africa and Asia, followed by Latin America and Oceania (Urbanet, 2020). This growth will not only result in more megacities (cities of more than 10 million people, increasingly concentrated in Asia) but also in more medium-sized cities, especially in Africa.

These were the forecasts, before the advent of the black swan, in the form of the pandemic coronavirus Covid-19 (hence forth Covid). The pandemic has undermined the belief of the triumph of the city (Glaeser, 2011) because under the carpet of the splendor of the civilization of encounter and economic development a lot of dust has been accumulated: actually 1 billion people live in slum-like conditions, and, with the world wide population predicted to expand to 9 billion by 2030, this number could reach 2 billion.

In developed countries, on the other hand, cities (above all Italian art cities) have become attractors for relatively affluent people and for tourists (Koolhaas, 2020) which are heavy city negatives, immediately from the social point of view, but also from a robustness point of view, because mono-functional postcard cities are very fragile. In fact, news of these days indicates the budgetary difficulties of Florence, caused by the lack of revenue from tourism. Urban environments can strongly affect human health and their correct planning and management increases systems resilience leading to more robust, reactive and even anti-fragile cities. The coronavirus Covid epidemic is the dramatic signal of overcoming and setting an era: the Enlightenment and mechanistic Modernity (Leone et al., 2018). Following Taleb's (2012) definition of Modernity, it is not the post-medieval historical period, but the era in which mankind predominated over the environment, a definition very close to that of Franco Cardini (2019) according to which the engine of Modernity is the "cancellation of the sense of limit". The consequence is the great fragility of modern systems, for example: megalopolis with suburbs affected by chronic social malaise and always on the brink of social explosion; on the other hand, food safety is threatened by industrial agriculture, dependent on chemistry, genetics and very few varieties of seeds and plant species, which today are even being attempted to patent.

The debate is not new, recalling the criticism of Sassen (2015) who identifies precisely in the global metropolis the place of the emptying of social rights.

This Modernity at the end of the cycle is under the illusion of controlling everything, but, in this way, it accumulates fragility (or entropy, see Leone et al., 2018) with the systematic smoothing of the factors of small stress, which instead have the function of "vaccine" for individuals and society (Taleb, 2012). On the other hand, it is useless to disappoint oneself and large crises and black swans call for a clever solution: the strengthening exercise brought on by smaller crises (precursor signals) and their dynamic function of developing "vaccine" and serendipity. Indeed, we have to learn from smaller crises and mistakes (Taleb, 2012).

Consequently, a second Modernity is required to mitigate all the distortions that the last phase of Modernity has introduced. One of these, among the most important in the urban field, is the care for the environment of and in the city, with a new role for the town planning: no longer a project aimed at "magnificent and progressive fates" (e.g. the over sizing of urban plans), but the empathetic effort in understanding and preventing the pathologies of urban living systems (Beck, 2013). This new season, however, is not a complete change of paradigm; on the contrary, its roots are in the origins of Enlightenment town planning, which arose also from the epidemics of the nineteenth century (Astengo, 1970; Benevolo, 1998).

Since change always brings conflicts, opposed by consolidated powers and their "allies" (Leone et al., 2018), such as the pessimism that generates fear of change and laziness. The crisis is an opportunity to overcome these problems by looking at the best tradition of the past.

Hence, rather than thinking about the virus as an architect of the future, it is necessary to use it as a lever to build a better future and, to do this, the environmental protection and management of urban systems is fundamental. The paper discusses the current Covid related environmental issues providing recommendations

for more effective actions that would address the urban planning towards a comprehensive sustainability of future cities. Section 2 presents a brief resume of the links between Covid and urban environmental issue, in particular, air pollution and urban heat island. Section 3, proposes a simple UHI assessment method for an exemplificative case in Bari city, Southern Italy. Finally, section 4 and 5 accounts the outlined discussion and conclusive remarks, respectively.

2. Covid and urban environment

The eruption of the environmental issue in urban planning means resuming, in a contemporary key, the urban hygienist tradition, because protecting the environment also means taking care of health, with the best care there is: the prevention of pathologies, firstly environmental and territorial. In fact, the hygiene requirements of the second Modernity consist above all in environmental care.

Regarding the presence and spread of Covid, it cannot yet be definitively said that air pollution favors the spread of the virus, but more than one scientific paper confirms the high probability of this hypothesis, especially for ammonia and fine-dust pollution. Xiao et al. (2020) investigated whether exposure to fine particulate matter ($PM_{2,5}$) increases the risk of Covid deaths in the United States. The results of this paper suggest that long-term exposure to air pollution increases hazard, i.e. the probability to experiencing the most severe Covid outcomes. These findings align with the known relationship between $PM_{2,5}$ exposure and many of the cardiovascular and respiratory co-morbidities patient (Rydin et al, 2012; Watty et al., 2015). This can be a contributory cause of the dramatically increase of deaths by Covid, because air pollution offers pre-conditions for both the development of respiratory related diseases and the complications and co-morbidities (Murgante et al., 2020). Similar results come from other researches: a position paper from various Italian universities (Setti et al., 2020) shows the strong correlation between the number of infected people and the average of exceeding the PM_{10} limits. The authors attribute this result both to the carrier effect of the atmospheric particulate matter and to its substrate action that keeps the virus in the air viable for a long time. These same authors cite previous studies, therefore more consolidated in the data, relating to avian influenza, in which the number of infected people is related exponentially to the concentrations of fine-dust.

Furthermore, Lu et al. (2019) report a similar situation in the case of a measles epidemic. Further confirmation comes from the recent Becchetti et al. (2020) study, which also assessed the effect of the lockdown in Italy. The study finds a very significant statistical association between pollution, contagions and severity of Covid outcomes, for which the quality of air is a strong predictor of contagion and mortality.

These studies are largely sufficient to demonstrate the importance of the link between air pollution and the risk of contagion, at least on the basis of the precautionary principle.

Furthermore, the "simple" fight against air pollution is already a duty of the town planner, given the numerous diseases that this entails (Rydin et al., 2012; Watty et al., 2015). The role of the planner is very important because planning can prevent or at least minimize the health crisis, through urban design and management, while the doctor is the last bulwark, with the disease arrived.

The analysis carried out in this paper is based on risk assessment, i.e. the careful examination of what, from atmospheric point of view, could cause hazard to people. A hazard is something that can cause harm, while a risk is the chance, high or low, that any hazard will actually cause somebody harm (Tiboni, 2002). In this case, the hazard factor is the urban heat island (UHI), which is a risk for the health of citizens, favors pollution and, likely, is a facilitator of contagion from viruses (Leone, 2019). Consequently, the management of the urban heat island problem becomes a powerful solution tool for all these problems. Furthermore, UHI is itself a pollution factor, because it triggers the chemical reactions that lead to the formation of ozone, one of the main atmospheric pollutants in the city, along with fine dusts and NO_2. Fig. 1 shows the conceptual scheme adopted in this paper.

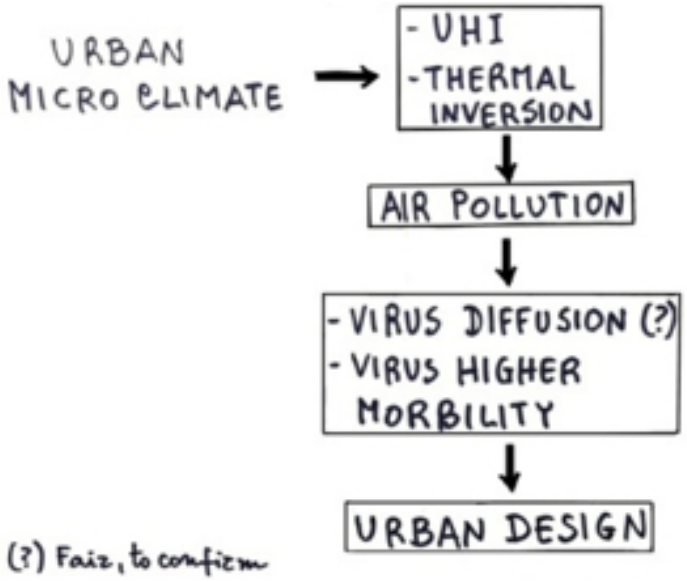


Fig.1 Urban microclimate and hazards.

The Urban Heat Island

The fundamental impact of the city on the atmosphere consists in the phenomenon of the urban heat island, i.e. the significantly higher temperature of the city, compared to the surrounding countryside (Gerundo et al., 2014). This phenomenon influences other processes, such as inversion of vertical thermal profile and even the amount of rainfall during the most intense events, as Zhang et al. (2018) demonstrated in the event of the Harvey hurricane, passing over the city of Houston, Texas.

The UHI is an intrinsic phenomenon of the city, which, especially for built environment materials and geometry, captures the incident solar radiation and retains the anthropogenic heat emitted by vehicles and conditioned buildings, to release it at night (Akbari & Rose, 2001). These processes are very variable, so urban microclimate is highly differentiated and understanding this variability is fundamental for the design and regeneration of the city that is comfortable for its inhabitants, which adapts best to climate change and to the risk of damage to health. UHI is a process that has occurred since long, before the global climate change and has a greater entity, see the example of Paris in Fig. 2: the phenomenon began in the early 1900s, with the great urbanization of the time. Furthermore, the figure shows that UHI is more sensitive to the minimum (night) temperatures.

The size of the city (in terms of inhabitants number, *P*) is the first trigger factor for a synthetic estimate of the phenomenon, Oke's (1981) model suggests of the maximum UHI ($\Delta T_{(u\text{-}r)max}$):

$$\Delta T(u-r)\max = 2{,}01 \times \log_{10} P - 4{,}06 \qquad [°C]$$

UHI has two effects on citizens' health: direct, because it alters the conditions of climatic well-being, which is already a mortality factor for weak subjects (Fig.3a); indirect, because it influences atmospheric stability and, therefore, the tendency to accumulate gaseous pollutants and fine dust (Fig.3b, Parry et al., 2012).

As regards air pollution, the following morphological factors of the city are very important:

- size of the urban canyons (Fig.4);
- height and slenderness of the buildings (horizontal section exposed to the wind), which determine the roughness of the urban surface, or its resistance to the motion of the air. The roughness index z_0 is the height at which the vertical profile of the wind extrapolates the speed to zero; it is defined by the following relationship (Erell et al., 2011, modified):

$$z_0 = \frac{H \times a}{2\,(A - A_P)} \qquad [1]$$

being H (m) the buildings' mean height (m), a (m^2) buildings' slenderness, A (m^2) the area of the sector examined, A_P (m^2) the area occupied by the buildings.

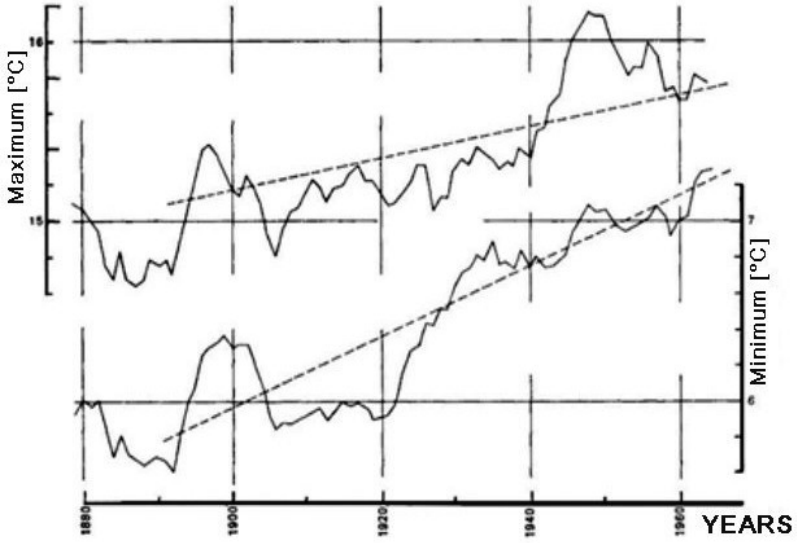
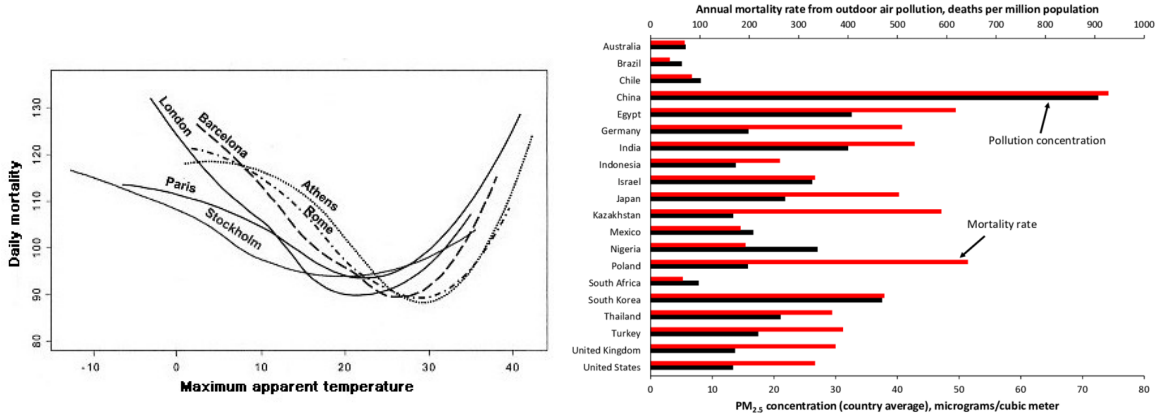


Fig.2 Average annual temperatures in Paris.



(a) (b)

Fig.3 (a) Mortality of weak subjects and thermal comfort (after Bargagli and Michelozzi, 2011); (b) Mortality and $PM_{2,5}$ concentration worldwide (after Parry et al., 2017).

From the point of view of atmospheric vulnerability, urban geometry has a double and synergistic action: i) the roughness z_0 makes the atmosphere more stable, reducing turbulence and wind speed, especially at night, just when the UHI is greater (Fig.5); ii) at night, it is released the energy stored during the day, so the thermal inversion is triggered, being the soil "warmer" and the air above it "colder".

It is well known that thermal inversion is the situation of greatest hazard (i.e. intrinsic vulnerability) of the atmosphere (Leone, 2019). The best indicator of this process is the vertical thermal gradient $\Gamma = \Delta T/\Delta z$ (°C/100 m) which is normally negative, because the temperature decreases with altitude. The more the gradient is negative, the less vulnerable is the atmosphere, because the pollutant particles introduced into the air are pushed upwards and dispersed. On the contrary, if Γ reverses and becomes positive (or close to zero), the vulnerability is maximum (Leone, 2019).

Figure 4 shows a scheme of the urban-rural gradient, with the urban positive gradient due to UHI ($\Delta T_{(u-r)}$), whose quantification can be obtained from the following relationship, coming from the reworking of the data provided by Landsberg (1981):

$$\Gamma = 1{,}49 \times \Delta T(u-r) - 1{,}94 \qquad [°C/100\ m]$$

Since a $\Delta T_{(u-r)}$=1,3°C is sufficient to generate thermal inversion (Γ>0), this equation shows that almost always the UHI generates a strong vulnerability to pollution of the atmosphere.

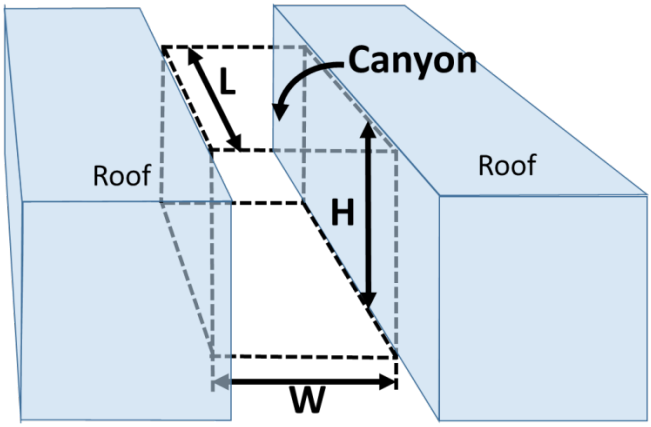


Fig.4 Building morphologies influencing UHI.

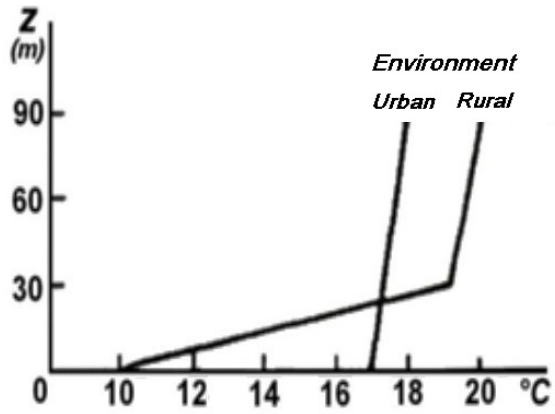


Fig.5 Vertical thermal profiles of urban and rural environments

Urban heat island, city planning and management

In addition to the effect on atmosphere vulnerability, the benefits of reducing UHI include decreasing energy demand and CO_2 emissions, reducing photochemical reactions that produce ozone on the ground. These advantages increase if urban greening is used as a control system of UHI, with all the further advantages that green brings to urban environment and people (i.e. ecosystem services, see Pelorosso et al. 2017a). Therefore, reducing the urban heat island is a fundamental, multifunctional, element of sustainability of the urban project and urban regeneration.

The city is a complex system and its climate is not an exception, as shown by the analysis carried out so far, from which it is observed that the "microclimate in the city" is more important than the "microclimate of the city", because urban different morphologies, physical, geometric and coverage characteristics (buildings materials, vegetation presence, wind exposition etc.) influence all weather-climatic parameters. Interactions and feedbacks among these parameters generate very different micro-zones that it is necessary to identify, to

increase sustainability, in the specific case pursued in terms of urban well-being, less energy consumption and lower emission of climate-altering gases (Alexander et al., 2015).

3. A proposal of UHI assessment

A powerful tool to manage UHI is first of all its quantitative estimate, which can be obtained through the Oke model (1981), which considers the geometry, the more significant process, as it is defined in Figure 3:

$$\Delta Tu - r\,(max) = 7{,}45 + 9{,}14 \times log10(H/W) \quad [2]$$

This model has been tested with good results for European and North American cities (Oke, 1984; Nakata-Osaki et al., 2018). It is widely used in literature (Roth, 2012; Nakata & Souza, 2013; Chokhachian et al., 2020) because it is based on easily available data and allows an immediate, general urban analysis. In fact, this model allows setting a zoning of the city for different degrees of hazard of the UHI, thanks to the GIS technology. In a second phase, stressed the "hot zones", it is possible a more detailed analysis, to carry the urban design.

An exemplificative application of this analysis is presented in study case, in particular nineteenth-century central district of the Bari city, South Italy. Figure 6 shows the Digital Surface Models (DSM, made by the Puglia region in 2006), coming from the LiDAR system, in which pulses of light travel to the ground allow to evaluate buildings height. The data of Figure 5 has been used to calculate UHI of the streets in the district by equation.

The results of Figure 7 were considered as the first screening on UHI, street by street, from minor to major. Later, a more detailed energy balance of the canyon has been applied to some of these streets, following the approach of the CAT model (Canyon Air Temperature, see Kaplan et al., 2016). In this way, the night UHI was estimated and the results were inserted in the well-being diagram of Olgyay & Olgyay (2015) for some significant days between June 15th to September 15th 2018 (Fig. 8).

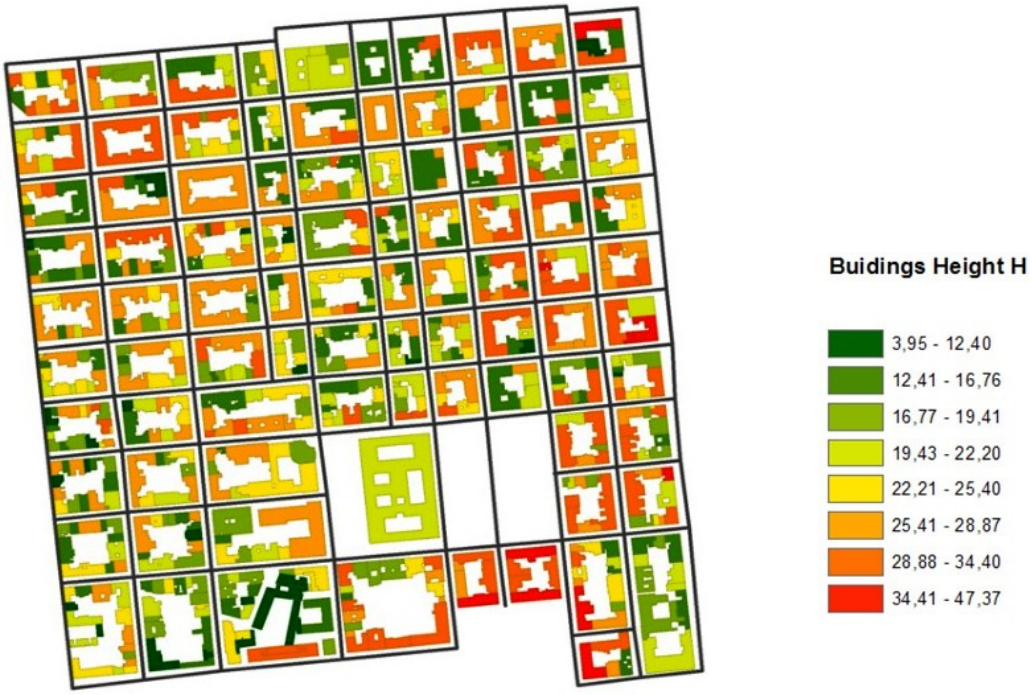


Fig.6 Bari downtown DSM analysis

Fig.7 Downtown UHI distribution following Oke's model

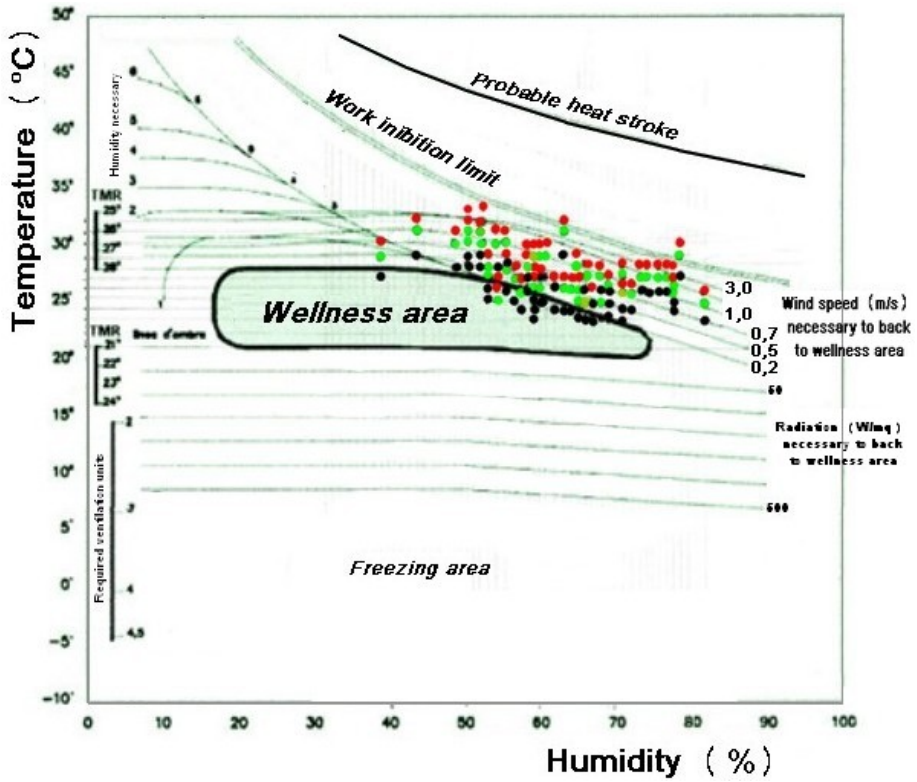


Fig.8 Evaluation of dis-comfort due to nocturnal UHI. The black points refer to the temperature and humidity recorded by the station of Bari, available from the weather archive www.ilmeteo.it; the green points relate to the minimum temperature surplus ("cooler streets"); the red points relate to the maximum temperature surplus (warmer streets).

4. Discussion

This paper aims to demonstrate how to prevent urban environmental issues related to the health status of citizen; specifically, it regards the UHI phenomenon, whose relevance is evident from Figure 8: for all the investigated period, UHI generates un-sustainable "tropical nights" for the whole period examined. The same

figure shows the importance of the wind, that can be sufficient to bring weather back to the wellness area, but, unfortunately, summer atmospheric calm during the night is frequent and urban geometry itself is a wind attenuation factor, as shown in equation 1.

In consequence, UHI is a relevant issue which will tend to increase the impacts on life quality in future cities. The opportunity to control this process effectively arises from Covid crisis, going in the direction of Taleb's postulate: rather than to chase the unpredictable black swan, it is necessary to improve sustainability, in order to absorb any future crisis.

In the specific case, the prevention of the UHI occurs through the art of designing wellness in the built environment and, furthermore, favoring adaptation to weather and climatic conditions. This aim has been pursued by distinguishing the different parts of the city, according to UHI productions factors, interpreted in a fine grain, street by street, with a sort of "precision urban planning".

The results expressed by Figures 6 and 7 are useful for various urban sustainability strategies. In fact, acting with the aim of reducing the UHI means, too:

- to counteract air pollution and virus spreading morbidity, an action which can, therefore, be an aid to the territorial medicine;
- to set the consequent health plans in case of occurrence of pollution beyond the law limits;
- to adapt the city to climate change also in the immediate term by supporting civil protection plans aimed to prevent the consequences of summer heat waves.

Understanding the hazardous areas forth phenomenon allows setting regeneration, whose outcome can be quantitatively assessed in terms of environmental sustainability and adaptation to climate change. For example, Stewart and Oke (2012) distinguished the local microclimate zones for universally describing neighborhood morphology and thermal climate: each zone is defined on the basis of parameters which impact on the thermal properties, such as green land cover, street canyons geometry, building materials, waste heat management and so forth.

In addition to the care for building materials (reflectance, emissivity, green roofs etc.), there are many other aspects of the sustainable urban project that can be supported by the results shown in Figures 6 and 7. Certainly, the most important outcome consists in the push for the widespread increase of green systems, which are the main mitigation factor of the UHI (Skelhorn et al., 2014).

For these objectives, parks are important, see also Figure 6, where it is evident the role of green areas. But also single and small widespread green areas can play an important role, especially in the compact city, where spaces are limited. For example, scientific literature demonstrates the importance of pocket parks and residual green areas in mitigating the UHI (Lu et al., 2019).

In this latter case, the example of the city of Bari is significant: downtown, practically, have not spaces for green regeneration, but the urban checkerboard structure leaves many spaces between the curtains of the buildings (Figure 5). Historically, these spaces were gardens, which disappeared about 60 years ago, to create warehouses. This tradition can be restored through greening the courtyard (e.g. grass cover and trees) and the technique of green roofs, a component of urban regeneration that can bring microclimatic improvements if opportunely irrigated (Pelorosso et al., 2017b; Pelorosso et al., 2018a; Pelorosso et al., 2018b; Leone et al., 2020).

Furthermore, the quantitative assessment of the UHI can allows Strategic Environmental Assessment (SEA) of regeneration plan to be improved. Indeed, too often the SEA paths neglect the measurable effects of the plan choices (Conticelli & Tondelli, 2013). Finally, spatial indexes of UHI as those proposed in this paper can be employed in innovative performance-based planning approaches based on climate and urban morphological factors (He et al., 2019; Pelorosso, 2020).

The environmental issue and the chain climate change-air pollution-virus diffusion risk is the strategic opportunity to fully address these problems and change the outdated beliefs and paradigms. The metropolis was thought to mean the future of quality, because its essence lies in making available goods, services, flow capacities and relationships, impossible for smaller realities (Glaeser, 2011). It is true, but Covid has showed metropolis' fragility, it is there that the virus has found vitality: in the way of living, moving, consuming and producing. It does not seem a coincidence that Milan's and New York's areas, the most Modernity paradigmatic cities in their respective countries, have been the most affected by Covid that seems to impersonate the barbaric people that attacked the heart of the Empire.

Regarding another Modernity's fragility factor, the global climate change, the online journalist Rob Wijnberg (2020) finds the following four similarities between the Covid pandemic and the climate crisis, considering, in any case, that the climatic emergency is worse than the Covid, because, beyond a certain threshold, it is irreversible and because there is no "vaccine" that allows people to continue living as always:

- the problem is mostly invisible and its invisibility is the problem.
- the problem is global: globalization is "the abolition of distance" and therefore promotes contagion; as well as the world shares a single atmosphere. Hence, concepts like "here" and "there" are misleading;
- the problem affects everyone, everyone can catch the virus, but it also discriminates the weakest people: elderly, people of color, immigrants, low-educated adults, people on lower incomes, people in developing countries, refugees, etc.;
- the climate crisis requires an equally fundamental restructuring of society.

Aiming to problem solving, the authors of this paper add a fifth similarity:

- solution to the above problems often coincide: the presence of open spaces for walking and cycling and the greenery of cities more accessible for the inhabitants are the same recipe, both for adaptation to climate change and for the fight against UHI, air pollution and Covid contagion.

5. Conclusion

Given their unpredictability, to mitigate the effect of black swans, it is necessary the construction of robust systems acting before they present themselves, so that, at that moment, the system can react and perhaps take advantage of the crisis to acquire new resilience.

The weak point in the application of this reasoning consists in the timing, because building robust systems means acting in a non-emergency situation, when the path is more difficult, and people don't believe in change. Politicians and decision-makers, even when sensitive and open to new strategic visions, know that acting in a non-emergency situation is rarely convenient in electoral terms. The advantage of the crisis is an opportunity also because it may give strength to the more advanced visions. Then, the strategy must be twofold: an immediate tactic, to mitigate the specific effects of the black swan, and a wide-ranging one, aimed at increasing new and more advanced balances.

The link between urban climate-pollution-virus diffusion discussed in this paper offers a concrete example in this sense. The positive feedback that connects all these processes makes it an unmissable opportunity for an authentic sustainable and fair city regeneration.

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Image Sources

Fig.1: Elaboration by authors;

Fig.2: Landsberg, 1981;

Fig.3a: Bargagli & Michelozzi, 2011;

Fig.3b: Parry et al., 2017;

Fig.4: Elaboration by authors;

Fig.5: Elaboration by authors;

Fig.6: Elaboration by authors;

Fig.7: Elaboration by authors;

Fig.8: Elaboration by authors.

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Imagining living spaces in extreme conditions: suggestions from a case study in Bari

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Abstract
The coronavirus pandemic has affected over 200 countries worldwide, finding an environment well-suited to its spread in cities as the heart of our civilization, as the meeting place for ideas, cultures and commercial exchanges. In these circumstances, prevention and control play a vital role, revealing the need to improve the current knowledge of users' perception of urban spaces and the way in which spaces are perceived and used. This work aims at investigating how the coronavirus emergency influenced perception of the surrounding spaces. In this regard, two questionnaire-based surveys were carried out on a sample of students from the School of Engineering of the Polytechnic University of Bari (Italy), one during the lockdown phase and one immediately after. Even after only a preliminary analysis, results showed some interesting patterns. They revealed, on the one hand, the expectations regarding possible changes, indicating places that are particularly important or symbolic for participants, and which are perceived to be missing, and on the other, the feelings of fear, worry and uncertainty with regard to the risk of contagion during post-lockdown access to and navigation through them. Nonetheless, some changes were considered positive, thus providing a strong indication of the expectations placed on future cities

Keywords
Spatial cognition; Covid emergency; Lockdown; Urban spaces.

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1. Introduction

The spatial dimension of planning is traditionally characterized by the concrete, structural, physical and physically perceived specificity of a confined space. The built environment, for example, finds an intrinsic, almost logical justifiability within this traditional interpretation, inherited from the first origin of spatial planning - residential settlements, neighbourhoods, cities (e.g. Geddes, 1915). This circumstance is historically evidenced by certain refined reflections on urban forms, urban fabrics and landmarks, used for example for semiotic, symbolic, identity and orientation characterization (Lynch, 1960; Rodwin, 1981). Yet, a decisive, almost fundamental contribution to spatial and particularly urban planning was instead provided by the need for spaces for services and socialization, whose degree of confinement is often achieved in a residual and/or occasional sense, through meadows, openings, natural squares, avenues, corridors, connectives etc. This need arose in purely functional terms, starting from the industrial cities of Northern Europe congested by the dramatic rhythms of the genetic industrial presence, and spreading to more historic cities devastated by unregulated residential growth, which challenged their surrounding natural environment (Jude Scott et al., 2002). Also, through this perhaps occasional, function-oriented opening perspective, a partial reinterpretation and a revaluation of the spatial dimension that characterizes planning, viewed also as extroverted, open and physically deconstructed, made its way. For a long time, this functional interpretation has been the main token of legitimization of unbuilt space, with an intentionally ancillary physiognomy, subordinated to a conceptualization of 'service' - urban, territorial, social.

Under the pressure of some contextual evolutions, especially of a social and environmental type, a new and widespread awareness of the characteristics of resilience and sustainability of the living conditions of human communities is constantly growing (Magnaghi, 2005; Newman & Jennings, 2012). The theme of the urban 'void' emerges with renewed interest, as an alternative to the more traditional urban 'full', as a value in itself not necessarily complemented by artificial elements of confinement. Eventually, progressive and specific analytical interests explored this characterization of the void, also through quantitative approaches, such as the well-known configurational analyses (Hillier, 2015; Cutini, 2001), or through richer and more complex aspects of spatial cognition, albeit often qualitative or quali-quantitative (e.g. algebras or spatial grammars: Freksa, 1991; Stiny & Mitchell, 1978).

These new reflections have opened up new analytical and modelling perspectives, ensuring more adequate emphasis on the management and characterization of space as a complex ontology. New modelling efforts have followed one another in a cognitive sense, of course first regarding confined spaces, characterized by the large and continuous presence and movement of navigating agents and/or users (Kuliga et al. 2019; Peponis et al., 2004). Hence, the interest has become more and more articulated and extended towards outdoor spaces, or towards open spaces or even spaces with extremely low population numbers, outside typical settlements (Mastrodonato et al., 2019). Clearly, these contexts have increasingly required similarly complex and refined forms of reflection, perhaps based on adequate IT tools to allow simulation models, as a necessary support for the evolution of the reflections themselves. Virtual reality environments have represented a new application frontier in this regard, together with other complex solutions (Montello et al., 2004; Frank et al., 2001). However, experiences have also shown some intrinsic limitations of these simulative settings, particularly in relation to the intrinsically and multi-dimensionally complex character of the space under investigation, whose simulation can only go through inevitably reductionist processes that often end up creating interpretative distortions and sometimes, therefore, bad decisions (Forester, 1984). Then it could be said that the degree of homothetic correspondence of a simulated environment with respect to the real environment represents a crucial feature for an effective simulation model. It is evident, however, that the knowledge derived from a long process of sedimentation of the aspects of the traditional dimensionality of space (the concrete, structural, physical and physically perceived ones) is more easily assimilated into

simulation models of analysis and interpretation of spaces. For instance, the classic multi-agent based virtual simulators are a contextual example (Frank et al., 2001). Yet research on ontologies applied to space, developed in recent times, has already shown the importance of classes and properties of not only structural or spatial - but also abstract (for example, temporal) nature. Among them, social, agentive elements and dynamics are defined as essential for constructing coherently representative ontologies of spatial concepts. And with them, the personality and behavioural properties of agents represent ontologically crucial characteristics (Borgo et al., 2017).

Therefore, the determination of these elements is essential, but it is not easy to elicit their forms and contents. In this context, the situational contingency of the Covid 19 emergency shows itself, if possible, as a somewhat privileged setting, from a perspective of analysis and research of said elements. The spatial cognition of knowledge agents forced in a home lockdown is certainly limited in its observation range and physical spatial relationship, but perhaps not in its imagination and evocation of and virtual relationship with the spaces themselves. The class exercise developed in a virtual classroom at the Polytechnic of Bari, during the spring of 2020 in the midst of a health emergency, is based on the above hypothesis. The simulation was carried out with students through multi-media questionnaires, with the aim of investigating aspects of cognition and representation of their living spaces – normally vague, perhaps implicit or even unconscious, incalculable in ordinary everyday life.

2. Planning in estate of exception

What we have said up to now takes on particular significance in a context such as that of the coronavirus pandemic. In such emergency conditions, the powers granted to planning authorities increase dramatically, legitimizing the copious production of detailed rules also referring to the use of spaces. In essence, decades of reflection on a way of governing spaces based on a horizontal rather than vertical organization seems to be irrelevant in such a condition. The impressive accounting of rules based on legal value and their instability over time, the segmentation of social categories and spaces attributed to particular uses by particular social categories identify modes of government that appears totally out of sync with the concept of governance as a relationship based on horizontal rather than vertical steering. In this way the effectiveness of this plethora of commands on individual and social behaviours, commands often cross-purpose, unstable and contradictory, is highly problematic.

The reference locality of this paper is that of the City, which, even today and despite the overwhelming phenomena of globalization, is conceived through the age-old opposition, loaded with political and legal connotations, between *urbs* and *civitas*, i.e. between the built environment and the community that inhabits it. This relationship is structurally unstable, skewed, dangerous, dysfunctional, in constant turmoil, and subjected to disciplinary projects which never reach complete fulfilment. Therefore, the relationship between society and space can never be posited in terms of rationality, be it the limited one of individuals or planners, or be it absolute or mitigated by the contamination of aesthetic values.

Looking at the problem from the point of view of those who must define space usage rules, a body of sociological literature, very rich but not discussed here, can be grouped according to two fundamental points of reference: the Foucauldian model and the model proposed by de Certeau. In both cases, command functions are not expressed through the vertical normative production of a centralized government, but through the microphysics of power, that is through the multi-scale and multi-local production of norms, often legally undefined, that characterize the so-called bio-politics; that is, the inclusion of living bodies and their spaces into the field of politics.

In the Foucauldian model, the microphysics of powers reaches a systemic effectiveness with a parallel reduction in the number of spaces assigned to the choice of individuals and groups. The result is a vision of

the *civitas* as a group of individuals and bodies that are often overdetermined, that is, endowed with only apparent freedoms. The old urban problem as a risky turmoil appears basically solved.
In de Certeau's alternative model, the *civitas* is capable of producing a myriad of behavioural inventions in contrast to the over-determinations and the microphysics of powers; capable of expressing an extraordinary creativity in terms of spatial uses, of the attribution of values to physical objects inserted in urban spaces that float disoriented, sometimes produced centuries ago and for radically different purposes. In this way, the urban turmoil remains in all its risky but fascinating creativity.
The paper tries to answer these questions through a questionnaire related to the use of urban environments, administered to a sample of Apulian university students.

3. A questionnaire for a case study

During the Covid-19 pandemic, an experiment was conducted with 150 students of the last year of the Territorial Engineering course of the Polytechnic of Bari. Each agent was given two questionnaires, the first during the lockdown period, the second immediately after the easing of restrictive measures. They were asked to freely choose a route in an urban environment, and to answer questions about their reactions and relationship towards various segments of the route itself. In the first questionnaire, relations with the environment are obviously imagined, given the confinement at home imposed by the rules; in the second case the chosen itinerary is tested.
The goal is to identify the spatial coordinates imagined and practiced by each agent in exceptional conditions and in an urban environment, and to capture any changes both in relation to the normality preceding the infection, and in relation to the loosening of restrictive measures.
This preliminary study takes into consideration the questionnaires completed by just one of these agents moving inside a large centre of the Bari hinterland, Bitonto, a city with over 60.00 inhabitants characterized by specialized olive and olive oil production. The path chosen by the agent is shown in the following image:

Fig. 1 Example of kmz file: track, photo snapshot and photo locations

Each of the 10 segments of the route has specific connotations linked to specific spatial forms structured in different times: from the peripheries of the twentieth century down to the medieval historical core; and each of these segments suggests various reactions from a formal, emotional and identity point of view.

Postponing to another occasion a detailed and differentiated analysis for each of the infra-urban spaces, it is possible, for now, to identify some basic characteristics of the responses to the questionnaires. The first one, sent out during the lockdown period, gives us a very strong feeling: the emotional character of the agent's relationship with space as well as a connotation of the physical elements as identitarian points of reference. An interesting index of this may be the word list used in the answers to the questionnaire, which completely overshadow any quantitative and formal assessment of the spaces both imagined and practiced.
In the following lines, we give an example of the answers to the first 2 questions relating to the restriction period, in which we highlight in bold the terms that seem significant to us:

A. Imagine you are looking around you: what would you like to see or what do you think you would see?
SECTION 0-1: I would like to go back to see people walking along this road and in particular to make eye contact with those acquaintances who, with a simple greeting or smile, were able to convey that feeling of freedom that is no longer there.
SECTION 1- 2: I finally see my grandparents
SECTION 2 – 3: The archaeological museum open
SECTION 3 – 4: I would like to see the crowded square
SECTION 4-5: I would like to see LED lighting across the square
SECTION 6-7: This area was re-evaluated and redesigned a few years ago, and I honestly think it doesn't need any further precautions.
SECTION 7- 8: I believe that at this intersection there must be a traffic regulation device since it has been subject to several drawbacks
SECTION 8-9: I expect a more enlightened place
SECTION 9-10: N/A

B. Do you think something has changed since the last time you went out? If not, why?
SECTION 0-1: I firmly believe that something has changed since the last time I went out and in particular I'm afraid of never finding again that usual feeling of light-heartedness; this virus has overturned our daily routine by undermining precisely that feeling of freedom that I mentioned earlier and that I am afraid of not feeling anymore.
SECTION 1- 2: Yes, because I see these locations differently after being alone for 2 months
SECTION 2- 3: I guess not, because I don't think there has been any change this period
SECTION 3- 4: I don't think anything has changed, because, when we are allowed to savour a little bit of freedom, we shall still be afraid of the consequences, and I think this square marked by the presence of the Carolino Obelisk will continue to be deserted.
SECTION 4- 5: I don't think anything has changed
SECTION 5 -6: I believe that the situation has always remained the same
SECTION 6 – 7: No
SECTION 7 – 8: No
SECTION 8 – 9: No
SECTION 9 – 10: N/A

The same operation can be conducted on the second questionnaire relating to the post-lockdown period, of which we report only the answers to the first question:

0. Look around, identify and briefly describe the place that surrounds you, through the characteristics you think most relevant
SECTION 0-1: I am in the vicinity of the cemetery, a place which is dark in its nature; there are few people walking about, there is certainly a different, cleaner air.
SECTION 1- 2: In this place there is a square populated by retired people who spend their time together. Further on there is a children's play area which is empty. It will certainly be the time of the day resulting in the scattered presence of people, but I perceive that people that desire to go out fear the consequences.
SECTION 2-3: In this central town square, more people walk about than in the previous sections. This place intersects with one of the best known streets in the city, Via Matteotti; here are several commercial stores, open.
SECTION 3- 4: Beautiful place, characterized by the grandeur of the Carolino Obelisk and the Basilica of the Saints Medici.
SECTION 4-5: This place is characterized by an area frequented by adults and children, Piazza Padre Pio, characterized by the statue of the Saint in the centre of the square.
SECTION 5-6: In this place we find a public garden, a leisure point par excellence for young and old. At this moment it is still closed, not allowing me to complete my experience after almost 2 months at home. Almost all commercial premises are already open.
SECTION 6-7: In this place we find the unique beauty of Torrione Angioino and Porta Baresana, more commonly called the "clock", since on top of the latter we find a huge clock that dictates time to the whole city. This is the place where the Immaculate Madonna appeared in 1734,

putting an end to the destruction of the city. From that time She was given the patronage of the city. Also in this area, we find the Aldo Moro square, home to the Bitonto nightlife.
SECTION 7- 8 This place is part of via Matteotti. There are quite a few people around, the street is quite busy.
SECTION 8-9 Place that does not have any particular characteristics.
SECTION 9-10 N/A

The obvious difference between the two questionnaires is the feeling of relief produced by the easing of the restrictions. On the other hand, the accentuation of the community, civil and emotional elements of the urban space is very strong in both questionnaires.
Elements of comparison between the two questionnaires can be obtained from the two series of answers to the same question, that relating to the three adjectives characterizing the places the agent went through:

Use three adjectives that you think characterize this place (separated by commas):

SECTIONS	DURING THE LOCKDOWN	AFTER THE LOCKDOWN
SECTION 0 - 1	security, adolescence, love	open, clean, free
SECTION 1 - 2	shootings, retirees, insecurity	long, fast, main
SECTION 2 - 3	quiet, cold, old	crowded, bright, safe
SECTION 3 - 4	crowded, sacred, illuminated	short, crowded, bright
SECTION 4 - 5	bright, crowded, safe	Safe, cleaned, bright
SECTION 5 - 6	leisure, safe, bright	imposing, safe, bright
SECTION 6 - 7	charming, central, crowded	central, fast, crowded
SECTION 7 - 8	insecure, busy, cold	short, fast, dark
SECTION 8 - 9	n/a	fast, short, comfortable
SECTION 9 - 10	n/a	n/a

Tab.1 Adjectives used to describe the same traits during and after the lockdown

In the transition to the opening phase, there is a clearer placement of adjectives of social character, prevailing in the shutdown phase, with adjectives with spatial connotations. The imagined city is above all the relational one, the practiced one is also a city of geometries and metric paths as well as physical qualities.
Venturing into some generalizations, it can be said that what emerges from this preliminary investigation is the resilience of itineraries of the identitarian and relational character attributed to the practiced spaces.
Here we list some toponyms loaded with this identitarian and relational meaning:

- old town;
- sea;
- park;
- theatre;
- bars / meeting places;
- churches;
- squares;
- meeting with friends / boyfriends / grandparents.

We should keep in mind that these words are distributed within narratives of itineraries, which, in a situation like this, eschew the functional geometric logic. The "shortest" path from A to B is not the straight line, i.e. the line traced through geometric rationality, but it is the one loaded with experiences of resocialization.
The most striking effect of the pandemic is the potential disconnection of the *urbs–civitas*, built environment/society relationship. The visual effect of unused urban spaces (think of the thousands of images of empty squares that have circulated online) is disorienting and to some extent fascinating.

The universally recognized basic characteristic of the Italian city, the square-dominated by the physical symbol of ecclesiastical power, the Cathedral, and by the physical symbol of civil power, the palaces of the people and nobility - has been profoundly re-signified by the urban crowds that consume goods and objects, but also build relations of mutual recognition and share culture.
The emptying of the square, in compliance with the exercise of exceptional power in times of Covid-19, is the celebration of the omnipotence of bio-politics. Is that a *potential* or *effectiv*e omnipotence?
This question will be addressed through analysis of a larger and more detailed set of questionnaire answers, of which the one we used here is just an example.

4. Conclusions

From these short notes we can draw some interesting suggestions regarding the spatial dimension in our planning analyses, even in unusual and extreme conditions. In them, space seems to emerge not only as a structurally perceivable physical space, but also as a space represented and interpreted cognitively, relationally and socially.
We have seen that students (in lockdown) use the imagination to describe the space in an urban path in their city, and then repeat the same path in vivo, describing and commenting it in the post-lockdown situation. We have seen that the students talked about fears, darkness, light, people, relationships, friendships, chats, walks, socialization, both during lockdown and after the reopening. They represented space with dismay, uncertainty and then surprise and hope, explicitly selecting themes and objects aligned with these emotional perspectives. A concept of space emerged from it, emotionally eccentric and in many ways difficult to interpret operationally. Yet this is the space in the students' narratives, they have focused sporadically on the geometries, on the landmarks, on the sky, on the sea, the squares, the churches, the buildings, with little emphasis. The sample has certainly limits of assortment and statistical bias - which limit results and comments to a minimal subset - compared to the multifarious cognitive agents and users of urban spaces. With similar evidence, however, the picture seems to indicate a very precise role and importance of cognition, of personal and interpersonal conceptualization of spaces, rather than their external, physical, structural perception - which is more commonly followed by recent literature in design and planning (Ratti, 2004; Hillier & Penn 2004). The support of the imagination, of an imaginative creativity forced by an extreme event, seems to have emphasized radical socializing, relational needs as criteria for interaction with living spaces. Surely this is affected by conditions pertaining to an exceptional, atypical and (hopefully) unrepeatable situation. On the other hand, it certainly makes us reflect on how the rhetoric of constructions and buildings "on a human scale", of the "living comfort" of "modern spatiality", can sometimes be misleading, when the desperate basic need for open contact and company emerges, thus minimizing the need for built environments 'per se'. Certainly, this provides a validation of research outlooks supporting the central role of the agentive and relational dimension of spatial cognition in spatial planning.
Clearly, this circumstance seems to be rather encouraging from a desirable perspective of rebalancing the role of the spatial dimension in planning. It is also encouraging because it rises against the eminently physical, structural and constructivist perspective, guilty of much of the socially (and environmentally) unsustainable transformation of our cities.

Author's contribution

This paper results from a common research work carried out by authors, who have read and agreed to the published version of the manuscript. In this framework, G.Mastrodonato wrote sections 2 and 3, whereas D.Camarda wrote sections 1 and 4.

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Risk, health system and urban project

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Abstract
The article aims to establish the relationship between risk and the Veneto health system. The analysis of this report focused on vulnerability and resilience, highlights the critical aspects on which to focus the reorganization and strengthening measures (health presidium) to face new pandemics and / or health crises. The strengthening of the health system, which has strong relations with the city, is also analyzed from the point of view of the urban project. Comparing various localization alternatives.

Keywords
Risk analysis; Vulnerability; Resilience: Health presidium; Urban project

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1. Introduction

The Covid-19 pandemic is not over and will probably return in autumn winter. Also, in the coming years we can expect virulent attacks probably in different forms from Covid-19 as history of the last 60 years has taught us.

This pandemic has shown that health care in the Italian regions is structured and managed in different ways.. Even the most "virtuous" regions have suffered from the overload imposed by the emergency. Therefore, interventions to strengthen the health system will have to be envisaged, although in a different way from Region to Region.

The question which this article attempts to answer is: how to strengthen the health service both with new structures and organizational systems and how to distribute them on the territory. The feedback will be based on two levels: that of risk analysis and that of territorial health connection.

The (health) risk analysis is a function that depends on the probability and intensity of a certain event, but above all on the vulnerability and the level of organization of the stressed system(resilience). Vulnerability is characterized by the provision of healthcare facilities and resilience is the ability to respond and rehabilitate the stressed system.

Particular attention will be paid to new hospitals which, in my opinion, should be dedicated to the treatment of infections, including viral infections, of any kind. In order to understand how much the various diseases involve the health structure, the causes of death in Veneto (which is the region studied in this article)[1] have been observed, which for tumors are equal to 30%, for the circulatory system are equal to 35.1%, for infectious diseases are only 2.7%. The latter have been the subject of an eradication strategy that has reduced the health facility's commitment for infections[2]. It has been observed that the number of infections caused by Covid-19 created a crisis in the availability of hospital accommodation for a limited period of time (a few months) after which normality was restored. However, this crisis highlights the need to create flexible structures[3] for the future (in the following these will be called Health Presidium).

The choice of places where to locate the new Health Presidium[4] has consequences both on the efficiency of the service[5] and on the functionality of the city as a whole. In fact, hospitals are public places with great power of attraction for other complementary functions and determine strong relations with the city.

1.1 Risk

There are damages of natural origin (earthquakes, floods, fires, pandemics, volcanic eruptions) and of anthropogenic origin (industrial, infrastructural, transport accidents, etc.). These damages occur with a certain intensity that can be measured after the event: energy released, tidal level, flooded areas, area of pollutant release, collapse of viaducts, infected and dead population, etc.

It is difficult to predict the intensity, place and time when a certain harmful event will occur. The risk theory had formulated that the high intensity of the event at a long return period. Little harmful events are very frequent and very harmful events are rare. In the case of epidemics and pandemics, their repetition has been observed with increasing frequency. This is probably due to the intensive exploitation of natural resources (Diamond, 2019).

1 Relazione Socio Sanitaria, Regione Veneto, 2018.
2 Ibidem
3 That is, equipped with a certain number of fixed posts and another number of variable posts that can be used immediately in emergency response facilities.
4 According to the first indications of the policy there will be a new hospital for every million inhabitants.
5 It has emerged (Dr. Avruscio president Anpo) that the lowest mortality rate (17.5%) is associated with the availability of high level multi-specialties present in the University Hospital of Padua.

The first scientific study in Italy on risk theory is by Luciano Di Sopra (1986), who clearly expressed that risk is a function of: the intensity of a certain calamitous event (which he calls magnitude), the probability of this event, the vulnerability of the affected system (composed of people and physical environment) and the ability to respond, which is called resilience.

Any form of damage generates a social demand for assistance which must be answered by the institutions. As will be seen below, the social demand that arises doesn't have a simple relationship with the size or direct intensity of the damage because in the course of the emergency secondary forms of amplification of the damage may occur[6].

The institutional response to mass emergencies is organized around two elements: prevention and emergency response[7]. The damage produces a destabilization of the system with respect to which autonomous rehabilitation - if prevention has been adequate - or assisted rehabilitation can be triggered. The latter is supported by external aid to the system which must support it in the crucial phase of the crisis, and which progressively enables it to proceed autonomously.

The magnitude of the damage[8] identifies the population size affected and the damage intensity profile - in this specific case - the "capacity" of the virus to infect.

Once the calamitous event has occurred - a pandemic due to a highly contagious virus - its immediate consequences depend on the vulnerability which, it has been observed, is mainly characterised by the equipment and places in intensive care facilities, the average age of the population with multiple pathologies[9].

At a later stage, the damage causes the loss of human life, and in order to avoid an unbearable overload on health care facilities, measures are introduced to restrict human contacts that cause the interruption of economic activities and social life. It is clear that with the same intensity of virulence, the different vulnerability of the territories has led to different damages.

"*Extreme events* - underlines Di Sopra [10]- *are not placed in an autonomous and isolated context with respect to the normal conditions of operation of urban and territorial organizations. On the contrary, extreme events make their general conditions of functioning more evident, in the same way in which the pathology contributes to better explain the physiology".*

The normal operating conditions of a social system are guaranteed by self-regulating operations called feedback processes. The system controls the flow through it by means of information, decision-making (to make the most appropriate choices) and action to implement decisions. These three factors are decisive in the emergency and are those that characterize the system's ability to respond (resilience) to external stress, they can accelerate the rehabilitation of the system or, on the contrary, they can increase its vulnerability and consequently the damage.

If structural defences and feedback capacity are limited only to responding to the most likely events (normality), high levels of vulnerability are achieved in the face of an unlikely situation. If, on the other hand, the system "retains the memory" of the greatest risks (the sequence and effects of pandemics over the last 60 years) and takes measures that make it less vulnerable, the risk of destabilisation will be lower.

It is evident that vulnerability depends both on a structural condition of the system and also on its ability to react to external stress.

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6 Ibidem, p. 21. The risk analysis studies following Di Sopra's are numerous and it is impossible to mention them all. University courses are held on the subject, and case studies are carried out. But almost none of them, to my knowledge, has highlighted the feedback phenomena of the system and their effect on damage.

7 Di Sopra p. 26 distinguishes between primary prevention and secondary prevention, but for immediacy we have adopted a terminology that can be understood erga omnes.

8 Ibidem p 37.

9 The vulnerability factors are these (perhaps the most significant) but there are still others.

10 Ibidem p 96.

What Di Sopra defines as an institutional response to the emergence of the social demand caused by the damage, is a set of measures that are implemented in the axis of time.
The positive or negative effect of these measures is determined by a precise sequence of events and actions: the impact of contagion and social emergency; measures to protect the health system and lockdown; the gradual reopening of activities associated with safeguard measures; economic, social and cultural support; recovery/rehabilitation of the system in all its components. An error in the implementation time of the response-rehabilitation measures, amplifies the damage. A complex system requires capillary information, testing and forecasting capabilities, non-contradictory information. An inefficient management of feedback processes becomes a damage amplifier.
In summary, the risk is a function of an event probability, intensity, vulnerability and resilience

$$R = (f)(P,I,V,R)^{11} \quad (1)$$

2. Remembering Pandemics[12]

Asian disease
First recorded in the Yunan Peninsula, China, the disease A (H2N2) virus of avian origin appeared in 1957 and in less than a year it spread around the world, killing one million people worldwide.
The Hong Kong disease
The so-called Hong Kong disease is a variation of the disease A virus (H3N2) was recorded in this city in 1968 and spread worldwide with a pattern very similar to the Asian disease. One million people died from this new strain of disease.
Another major scourge of recent decades is undoubtedly the Ebola virus, an animal pathogen that causes severe hemorrhagic fever in humans. The disease was officially identified in 1976, and has caused several epidemics, with mortality varying according to the virus strain involved.
The Human Immunodeficiency Virus (HIV)
One of the most serious and recent pandemics (1981) known to society today. It is estimated that HIV has caused around 25 million deaths worldwide.
In late 2002, SARS caused by a previously unknown coronavirus. It affected, in addition to China, other countries in the world, including several countries in Southeast Asia, Canada, also affecting several European countries, but in the end there were 8098 cases, 774 deaths, and a mortality rate of 9.6%.
In 2012, a new coronavirus, called MERS-CoV, appeared in the Arabian Peninsula. Cases were reported in Saudi Arabia, United Arab Emirates, Qatar, Oman, Kuwait and rare cases of imports to the United Kingdom, France, Germany, Greece and even Italy. The MERS coronavirus was much more dangerous: 2494 cases reported, 858 deaths, 34.4% mortality.
In 2019, a new coronavirus made yet another leap in species, perhaps less lethal, but much more contagious, and within a few weeks it had become a pandemic, a worldwide disaster. SARS-CoV-2 seems to be a little less lethal than the previous two, but unfortunately it appears instead highly contagious and, by the law of large numbers, the more people infected, the more it will kill, in the absence of treatments and vaccines to fight it.
The main difference between pandemics and other harmful events of natural origin is that the latter affect a limited area. So far, we have been able to see that these events occur separately from one another, but the possibility of them occurring at the same time has not been taken into account. Yet in 2018 the Veneto region saw the storm Vaia, which knocked down 14 million trees, affecting 41,000 hectares and causing 2.8 billion €

11 The studies subsequent to Di Sopra's are many and it is impossible to mention them but in each of them the concepts of risk, probability intensity, vulnerability and resilience are included.
12 http://www.univrmagazine.it/2020/03/30/dalla-sars-al-covid-19-cosa-insegnano-le-epidemie-del-recente-passato/

of damage. In 2019 there was an exceptional high-water level of 191 cm in Venice, which submerged about 80% of the ancient city, with still an imprecise estimate of the damage, which according to some people has reached 1 billion € and with the work MOSE not completed. In such conditions, monitoring and/or surveillance tools are needed to enable timely action at critical moments.

3. The intensity of virulence

91% of the excess mortality from Covid-19 found at the national average level is concentrated in the areas of high prevalence of the epidemic: 3.271 municipalities, 37 northern provinces plus Pesaro and Urbino. Deaths more than doubled in March 2020 compared to the average in March in the five-year period 2015-2019. Considering the period from February 20 to March 31, 2020, deaths rose from 26,218 to 49,351 (+ 23,133); just over half of this increase (52%) were positive deaths at Covid-19 (12,156). The average age of deceased patients positive for SARS-CoV-2 is 80 years. There are 10,936 women (39.1%). The median age of deceased SARS-CoV-2 positive patients is almost 20 years higher than that of infected patients (median age: deceased patients 81 years - infected patients 62 years).

More specifically, it can be noted that the contagion has affected Lombardy differently from Veneto. Out of a population of just over 10 million inhabitants (1/6 of the nation's total) 8.2% are the total infected and 0.15% the deceased, which corresponds to half of the national total: 15 thousand out of 30 thousand. In Veneto, out of a population of almost 5 million inhabitants, 0.45% were infected and 0.04% of the population died[13].

This difference between two contiguous and economically highly developed regions has provoked many controversies and clashes at political level, but it is clear that analyzing the difference in terms of risk assessment, the different incidence of covid-19 in Veneto compared to Lombardy is due to two factors: vulnerability and resilience.

Vulnerability can be expressed as fragility, which is an intrinsic characteristic of the system both structural and functional. A health care system without adequate ICU places has a greater vulnerability than a system with a high number of ICU places.

In addition, the lack of research facilities, the reduced stocks of therapeutic devices such as reagents, masks, instrumentation for rapid swab analysis, are all factors that increase the vulnerability of the system.

A research carried out in 2011 as part of the Epiair programme for the setting up of a health surveillance system at ASL 16[14] in Padua, provided a credible indication of the health situation of the population of the city of Padua, which amounted to 411.731 inhabitants[15]. In 2011, infectious diseases accounted for about 7% of the total, while cancer accounted for 11.3% and circulatory system diseases accounted for almost 15% of the total[16].

Data at regional level show a strategy aimed at the eradication of infectious diseases. In fact in Veneto the main infectious diseases show a constant decrease over time. In this structural situation, the pandemic has intervened, which has been discharged on the availability of beds and especially on those for intensive care.

2.1 Vunerability

The first parameter related to the vulnerability of the health system to face the pandemic is given by the beds in the intensive care unit, which have increased considerably in all regions during the pandemic. In the Veneto region, the number of ICU seats increased from 494 to 825 with an increase of 331, resulting in a ratio of 14.5

13 https://www.epicentro.iss.it/coronavirus/pdf/Rapporto_Istat_ISS.pdf
14 Since 2010 the ALS 16 has become ASL 6 including all the municipalities of the province of Padua.
15 www.demo.istat.it
16 www.epiair.it

ICU seats per 100,000 inhabitants; In Lombardy, the number of IT seats increased from 861 to 1299 with an increase of 438, resulting in a ratio of 6.6 TI seats per 100,000 inhabitants.
Unfortunately, we do not have homogeneous data and there are marked differences between those reported by the Civil Protection and the official data of the Veneto Region, but if both were to be true, it would result that from 2016 to 2020 the places in intensive care (ICU) in Veneto have gradually decreased over time, to be immediately reconstituted during the lock down.
In addition to this, the control of the spread of the virus also took place with a precise "logistics" which took the form of the definition of paths of entry and exits of covid patients separated from he rest of the hospital, as the experience of the city of Wuhan had clearly demonstrated at the time.

2.2 Resilience

Resilience is the ability of the system to restore pre-impact conditions and also to decrease vulnerability to the repetition or continuation of the same event in the future. Vulnerability and resilience are closely related.
The control of communication flows and times is a fundamental element to correctly address social behaviour. But it is essential that the difference between information and communication (Cavazza, 1997) is clear, i.e. that it is necessary that the issuer of the message uses a code understandable to the recipient of the message itself. Who is speaking, what is being spoken about, who is being addressed, are the factors of communication; if the speaker uses a code that is incomprehensible to the receiver, only the effect of causing noise is obtained[17].
In addition, when the crisis response measures are not announced[18] within the stated time frame, there are two effects: the first is aggravation of the damage[19] and the second is social mistrust[20].
The higher the contaminating "power" of a certain virus and the resulting demand for ICU posts, the more external help will be needed both to deal with the emergency and to restore the pre-existing conditions.
The high contaminant "power" of the virus and the consequent demand for ICU posts, requires external help both to cope with the emergency and to restore the pre-existing conditions. Therefore, we need a rapid intervention system equipped and able to activate help and collaboration mechanisms in order to move resources from undamaged systems (preferably within the limits of their surplus) to damaged systems.
In the case of Covid-19, this shift has shown precise limits by forcing the interruption of traditional treatments, such as cancer and cardiovascular treatments (which are the ones that engage the health system most in terms of hospitalizations), which will not decrease over time, but presumably will tend to increase as the population ages. These will not be able to withstand for long the transfer of resources such as ICU beds to the infectious sector. It is therefore necessary to establish an additional number of beds for hospitalization and pandemic IT. In addition, these additional beds should be of two types: stable and flexible. That is, the structure should be such that it responds to an immediate additional demand for beds every 5-10 years and maintains a supply of fixed (structural) beds that meets standard demand. Among other things, it is necessary to consider the availability of emergency medical personnel who in the Veneto case were recruited from postgraduate courses in medicine, which were of great help. Resilience therefore reduces vulnerability and is

17 Ibidem.
18 We mention only the basic concepts of communication without going into details of what happened in the pandemic, which deserves a separate discussion. But the information-communication dyscrasia has manifested itself not only in Italy.
19 Decision and implementation are two of the three elements that support the feedback of a system (V Di Sopra) and are the channels through which resilience runs.
20 One for all Mario Draghi in the Financial Times 25-3-2020. These, too, are aspects that go beyond the subject matter addressed in this article and require much more space, but their enormous weight in the current situation is evident.

based on two elements: rapid intervention and prevention, which must be supported by careful and constant monitoring.
The article by Binkin et al. (2020) confirms, albeit with the attention of the first analyses, that "Western healthcare systems have been built around the concept of patient-centred care, but an epidemic requires a change of perspective towards a concept of community-centred care".
The greater integration of health and hospital services in Veneto at local level and the presence of a strong public health infrastructure, have favoured the implementation of an initial community approach. This approach is based on solid epidemiological principles: sweep tests, contact tracing and limiting contact with healthcare facilities, where possible through mobile diagnostic teams and close monitoring at home.
This was facilitated by rapid communication via a computer system linking the laboratory, general practitioners and local public health units.

2.3 Monitoring

In Veneto the situation is monitored by a program, in use by the Region since February 24, immediately after the first death for Covid-19 at Vo' Euganeo, and active since March 8. It highlights the number of contagions updated from hour to hour. The system allows you to tighten the focus on the neighborhoods, with the streets and house numbers where there are infected. Tick the identity of each positive case and a list of related information: age, health card, doctor, cohabitants and, lastly, place and employer.
The people mapped by this geolocation system by May 5 were 18 thousand, but they are increasing every day. Knowing where the positives live makes it possible to identify their close contacts, find the micro outbreaks of contagion, and nip them in the bud.
The surveillance was accompanied by the policy of widespread swabs, even on asymptomatic patients. The reagents are produced on their own.
The data from three archives were cross-referenced: the health registry office to obtain the house numbers of infected persons and cohabitants, the health personnel database, and the Veneto Lavoro database, the regional agency that collects information from all employees of companies and employers[21].
In summary, the elements characterizing vulnerability/resilience to the covid-19 pandemic can be highlighted with the following list:

- ordinary and emergency ICU beds;
- logistics of routes;
- multiskilled high level;
- backup medical personnel;
- community-centered assistance;
- integration of health and hospital services;
- rapid response;
- epidemiological monitoring, materials and equipment.

3. Definition of vulnerability and resilience criteria

Ordinary and emergency intensive care (ICU) beds: ordinary ICU beds are those in hospital facilities that will be further increased in the new Covid hospitals or rather for infectious diseases. Their number will be defined not only on the basis of the experience of recent months, but of more articulated forecast parameters. The emergency ICU posts, on the other hand, are those necessary for influenza peaks, which will have to be set

[21] M. Gabanelli, Data Room Corriere della Sera del 9-5-2020.

up very quickly and then dismantled and stored in warehouses. The regulations in the process of approval (DL Revival of 16-5-2020) have introduced the possibility of reusing, through adaptation, even hotels that are not in operation;

Logistics of the routes: this criterion concerns two elements, the first of which relates to the entrances and exits from the hospital, which must not only be separated from each other but clearly distinct from all the others in the hospital in order to avoid any form of contagion. Secondly, it also refers to the local infrastructure network and its connection both with the hospital and with the major roads;

High level multi-specialties: this concerns the presence of high level skills normally, although not exclusively, present in University Hospital Organizations.

Spare medical personnel: these are personnel with sufficient basic medical skills to guarantee the care and assistance of patients in times of peak disease.

Community-centred care: this parameter concerns the public health network that showed these differences between the two regions Lombardia and Veneto: Public Health Laboratories: Lombardia 1/ 3 every ml/ab and Veneto 10/ 3 every ml/ab. Departments of Public Health Prevention: Lombardy 1/1.2 ml/ab and Veneto 9/ 1.2 ml/ab. Integrated Home Care: Lombardy 1/ 100,000 ab and Veneto 3.5/100,000 ab .

Integration of healthcare and hospital services: blanket testing, contact tracing and limiting contact with healthcare facilities, mobile diagnostic teams and home monitoring. Rapid communication through a computer system connecting the laboratory, general practitioners and local public health units.

Rapid intervention: availability of means, personnel and organization to make the integration of health services efficient.

Epidemiological monitoring: creation of a surveillance system for the number of infections, with location of the neighbourhoods, streets and house numbers where the infected are located. With identification of the identity of each positive case and provision of a list of related information: age, health care, treating doctor, cohabitants and, lastly, place and employer.

Monitoring of materials and equipment: it concerns the constant control of materials and equipment essential to cope with the onset of influenza peaks, with lists of certified suppliers.

Availability of areas: this factor is decisive in the health/territory relationship as the provision of areas, better if free, is a very important procedural aspect for the acceleration of time.

4. The reference population

From 2011 to 2016 the health structure of the ULSS was modified by re-merging them in relation to the Provinces for which the ULSS 16 became ULSS 6 Euganean coinciding with the perimeter of the Province which has 936,000 inhabitants.

The metropolitan area includes 13 municipalities and has a population of around 430,000 inhabitants, therefore the remaining 507,000 are distributed between the Upper Padua area which is more populous and the rest of the province. All these districts have an "ordinary" hospital facility.

5. The alternatives

First alternative: use of the city's equalization areas

This solution provides for the relocation of one or some of the structures in the semi-peripheral areas of the city. From the urban planning point of view, these are functions of a certain importance for their ability to redevelop the settlements in which they are located.

The Municipality of Padua has prepared over time a series of areas, called integrated and environmental equalization, as in the image map below.

The urban equalization set up in Padua as in many provincial capital cities in central and northern Italy, provides or the unification of the properties of which 70% of the surface is given free of charge to the City and the remaining 30% is built by the consortium of private individuals. These are areas of various sizes but can reach a total of 150,000 square meters of which more than 100,000 can be made available for one or more local hospitals.

Second alternative distribution of the health presidium in the metropolitan area

The second alternative is to locate the health presidium in an area coinciding with that of the Metropolitan City which includes Padua and all 13 municipalities of the first belt. The fundamental difference from the first alternative consists in a possible greater diffusion on the territory but it introduces the urbanistic problem of the availability of the areas because all the other municipalities of the Province, including those of the belt, are without forms of free transfer of the areas.

Fig.1 Equalisation areas in the Municipality of Padova-in orange the integrated urban equalisation and in green the environmental urban equalisation

Third alternative supported by the social-healthcare facilities and distributed the health presidium in the Province

Connecting the structures to the social and health districts by providing a section for infectious diseases functionally separated from the rest of the structure with specialist equipment also in intensive care and with a space for the installation of a field hospital for health emergencies.

The district is a structure that operates on a specific territorial area spread throughout the Province and the ASL which is equipped with technical-managerial autonomy and operates for primary care, in outpatient and home, through general practitioners (MMG), pediatricians of free choice (PLS), night and holiday medical services and specialized outpatient clinics; it coordinates the GPs and PLS with directly managed operating structures and with specialist outpatient services and hospital and extra-hospital facilities; and it provides social-health and nursing services.

6. The scenarios

The scenarios taken into consideration are two: a short-term one that assumes a resurgence of the infection in the months of autumn-winter to which can only be responded with a strengthening of the emergency response and resilience parameters associated with it such as field hospitals, reserve personnel, etc..

The second scenario, on the other hand, is a medium-term one (2-3 years) in which it is possible to carry out the necessary hospital works (health presidium) and all those interventions that reduce structural vulnerability. The criteria considered in the short term are the following and all related to response capacity (resilience): Emergency ICU posts, emergency medical personnel, emergency response, route logistics, epidemiological monitoring, material and equipment monitoring.
In the logic of the comparison method adopted - compensatory aggregative multi-criteria analysis - the criteria highlighted in Fig.2 acquire greater importance than the others, as shown in the column of eigenvalues expressed as percentages.

	Criterions	Importance
Vulnerability	Structural intensive care unit	3,7%
	Research and training	3,7%
	Multi-specialty	2,7%
	Comunity assistance	1,7%
	Integration of health and hospital servic	1,7%
	Avalability of areas	1,7%
Resiliency	Emergency intensive care unit	15,9%
	Emergency medical staff	15,9%
	First aid	15,9%
	Route logistics	7,0%
	Epidemiological monitoring	13,9%
	Monitoring of materials and equipment	16,3%
	TOTAL	100,0%

Fig.2 Short term scenario

In the medium-term scenario, it is assumed that structural interventions are carried out, i.e. those that lower the structural and functional vulnerability that will result in the logic of multi-criteria as an increase in the importance of the relative criteria. Fig.3 highlights this change in relative importance.

	Criterions		Urban area	Metropolitan area	Country
		importance	performance	performance	perfomance
Vulnerability	Structural intensive care units	13,9%	0,0580	0,0402	0,0402
	Research and training	13,9%	0,0731	0,0461	0,0193
	Multi-speciality	9,3%	0,0562	0,0236	0,0149
	Community assistance	6,4%	0,0172	0,0178	0,0206
	Integration of health and hospital servic	6,7%	0,0193	0,0193	0,0193
	Availability of areas	7,1%	0,0431	0,0181	0,0114
Resiliency	Intensive emergency care units	6,6%	0,0191	0,0191	0,0191
	Emergency medical staff	6,6%	0,0346	0,0191	0,0105
	First aid	7,1%	0,0376	0,0237	0,0100
	Route logistics	5,8%	0,0170	0,0170	0,0170
	Epidemiological monitoring	8,4%	0,0243	0,0243	0,0243
	Monitoring of materials and equipment	8,4%	0,0243	0,0243	0,0243
	TOTAL	100,0%	0,4239	0,2927	0,2310

Fig.3 Medium term scenario 1

In the comparison between the alternatives, it is preferable to locate the hospital in the urban area and the determining factors (highlighted in red in Fig.3) are:

- The posts in structural ICU;
- The prlurispeciality: which is a fact linked to the proximity to the high specialization centres within the university hospital function of the city;
- Research and training.
- The availability of areas: this factor is decisive because, as explained above, the city has free areas at no cost and without the need for changes in the urban plan.
- The emergency medical staff: which in the case of the city is mainly made up of trainees present only in medical university facilities.

Emergency intervention: which is linked to logistics and favourable road routes.

Other criteria factors are location-independent such as the number of emergency IT stations, logistics and monitoring. Finally, the criterion of Community Assistance, which depends on the proximity to the territory, shows greater effectiveness the more widespread it is throughout the province.

The multi-criteria analysis lends itself to verify even if the variation in importance of the criteria also varies the performance of the alternatives.

	Criterions		Urban area	Metropolitan area	Country
		importance	performance	performance	perfomance
Vulnerability	Structural intensive care units	9,4%	0,0395	0,0274	0,0274
	Research and training	10,8%	0,0571	0,0360	0,0151
	Multi-speciality	7,3%	0,0439	0,0184	0,0116
	Community assistance	20,2%	0,0587	0,0587	0,1363
	Integration of health and hospital servic	20,7%	0,0601	0,0601	0,0601
	Availability of areas	4,6%	0,0135	0,0135	0,0135
Resiliency	Intensive emergency care units	4,2%	**0,0121**	**0,0121**	0,0121
	Emergency medical staff	4,2%	0,0220	0,0121	0,0067
	First aid	4,7%	0,0250	0,0158	0,0066
	Route logistics	3,8%	0,0110	0,0110	0,0110
	Epidemiological monitoring	5,4%	0,0158	0,0158	0,0158
	Monitoring of materials and equipment	4,6%	0,0135	0,0135	0,0135
	TOTAL	100,0%	0,3722	0,2944	0,3297

Fig.4 Medium term scenario 2

Fig.4 shows an attribution of importance that gives priority to community care and the integration of hospital services with percentages above 20% compared to 6% in Fig.3. On the basis of this assessment, the total performance of the Country alternative rises almost to that of the Urban alternative. However, the overall distribution of total performance values between the Fig.3 and Fig.4 alternatives does not change. But the greater importance attributed to "Community assistance" and "Integration of health and hospital services" could reflect an evaluation of health strategy - which cannot be defined in this article - which, by favouring these criteria, suggests that it is necessary to attribute more financial resources to this component than to others. In this case, the value of performance becomes a parameter of comparison between the different allocations present in the regions and the related strengthening commitments to cope with future epidemics/pandemics. The criteria of vulnerability and resilience, adopted, which refer to the strengthening of the hospital structure (health presidium) privilege the urban alternative. The criteria that refer to the

strengthening of community care and the integration of services privilege a widespread distribution throughout the provincial territory. The other criteria concerning logistic and monitoring functions are equivalent among the alternatives considered, but this does not mean in absolute terms that the strengthening can be renounced. On the contrary, the monitoring functions are fundamental because they make it possible to keep the functioning of the health system under constant observation, they make it possible to outline trends and verify the achievement of set objectives and consequently to act promptly to make corrections.

7. The relationship health territory

The new infection control structures (health presidium) should carry out a series of health care activities such as to make these structures a real hospital and to avoid the "lazaret" effect and, in addition, spaces should be provided for them to set up field hospitals to be used for emergencies and to cope with overloads.
The organisation of the facilities is both a preventive and an emergency response. Preventive because it puts in place a territorial structure closer to the citizen and his "daily" health needs and lightens the central structure of all these functions, allows monitoring on site, but also from the point of view of the emergency can provide support to sudden peaks of infections.
The issue of location immediately opens up the issue of the availability of areas and the consequent relationship with the government of the territory. One of the major obstacles for the rapidity of the realization of works of the sanitary type, but not only these, is the excessive bureaucratization of the Public Administration. This opens a bifurcation in the decision-making process: following the path of the derogation from the Urban Plans (urged by many political and entrepreneurial forces) or preparing variants centred on the principle of the urban project. The danger of the first solution is that the possibility of combining new interventions with urban quality will forever escape. For this reason, we have added among the parameters of vulnerability that of "Availability of areas".
Hospitals have so far been designed and built as self-referential structures and never alongside spaces (squares) of "mediation" of interpersonal and social relations which are the natural extension of the primary public function towards the urban context. The square is the place of organization of irradiation of the hospital's relations with the city (Archibugi, 2003). The hospital (which must, however, maintain a series of accesses separated from the square) until today has been formally conceived as a structure that "turns its back" on the city even though it has very intense relations with it.
Given their attractiveness, these structures must be inserted within precise relational spaces, with differentiated entrance and exit routes, places of social relations (squares) and the location of complementary functions: trade in health products, catering and hospitality, connected medical and health practices, parking and areas for the transit of public and private non-confrontational transport, reserved pedestrian and cycle paths, etc..
The most recent projects and related achievements of hospitals are designed as places self-referential as if they could be placed in any place or territory not keeping and not even the speculative processes that trigger them. The engines of major urban transformations such as hospitals, bring into play considerable interests and considerable forms of pressure, because they trigger upward real estate values. This appreciation for private individuals, which derives from the investment of public money, must have as counterpart a benefit for the community, first of all, in terms of urban quality.
For this reason, the project for a new hospital must also and above all be an urban project. This term means not only a foreshadowing of the form and construction methods, but above all of the ways in which the new project relates to the existing city, the environmental impacts it produces and must take into account the public consultation. To be as clear as possible let's say that the effect of a new hospital can be compared to the introduction of the turbo on an aspirated engine: in order for the car so enhanced not to go on its own, it

is necessary to adapt brakes, suspensions, chassis, exhausts, tires, introduce an electronic control. The relationship of the engine to everything else is under discussion. Out of metaphor only in this way you get the urban quality and triggers the city effect (Archibugi, 2003) that is a multiple outcome as multiple is the city (Camagni, 2002). The city has become more and more a product-goods to sell on the market within the supply-demand ratio that does not arouse heimat[22] and search for new needs but disorientation (Duso, 2003). On the contrary, the city is a set of agglomeration and spatial interaction in a multiple, composite, articulated physical space that at the same time is the place of life and work of citizens, the place of proximity, the general condition from which each one of them is recognized, and to this end its parts must be organized.

8. Conclusions

The pandemic response legislation is constantly evolving, and it is not excluded that new measures will be introduced in the future which could partially change the framework of this article. The fact remains that a number of elements have now been defined (the assessment criteria for vulnerability and resilience) and we believe that there will be no major changes.

During the writing of this article, Phase 2, i.e. the progressive resumption of activities suspended with lockdown, began in Italy. Fears of a resumption of contagion are still high and there are still many uncertainties on the scientific-medical, economic and social level in general. Then it is not yet known how Phase 3 will be set, which should lead to "normalization". But it is already known that a large part of the economic activities of labor-intensive services will be significantly downsized and will face increasing costs. Not all industrial activities will resume and there is likely to be a fall in income and domestic demand. Phase 3 will have to address the issue of a new fiscal policy and the de-bureaucratization of procedures.

In such a delicate moment the daily emergency does not allow us to look far and for this reason we have tried to tackle the relationship between health and territory with a certain scientific rigor in order to offer the political decision-maker the instruments that are based on solid foundations.

It is clear that the place of life of the population, the city, will be the physical space in which the pandemic-induced change will be experienced. Of this space, the health system is an important part of it, both as concentrated and distributed physical structures; as competences; as monitoring and communication systems; as emergency assistance and service integration devices and for all the induced activities it generates.

The application of multi-criteria analysis should not be understood, in this case, as a method to exclude or prefer one alternative over the other, but rather to understand, in the face of the selected criteria of vulnerability and resilience, how to restructure this system in the various regions of the country where the major critical issues have been highlighted and how this restructuring or strengthening will affect the territory.

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Geographical analyses of Covid-19's spreading contagion in the challenge of global health risks

The role of urban and regional planning for risk containment

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Abstract

This research develops from a set of basic geographical questions about the outbreak of Covid-19 out of China in Europe. The questions dealt with why and why with such strength Italy has been seriously hit, one of the most important cases in terms of death toll out of Hubei Province and mainland China, in the world, making the country a worldwide study case for epidemic concentration and diffusion. Questions were also related to geographical similarities among the areas hit, and particularly the Po Valley region and Wuhan metropolitan region in Hubei province, and also related to why such a divide of the virus spreading was identified in Italy between Northern and Central and Southern regions and provinces. In order to try to give an answer these questions, authors realized a vast and articulated database of indicators at provincial level in Italy, performing several geographical analyses - ecological approach - based on Spatial autocorrelation and Geographical Weighted Regression, coming to the conclusion that aspects such as land take, pollution can seriously influence the phenomenon and justify a pattern as that observable in Italy. The analyses and observation of the phenomenon also suggests that policies based on urban regeneration, sustainable mobility, green infrastructures, ecosystem services can create a more sustainable scenario able to support the quality of public health.

Keywords

Covid-19; Italy; Po-valley; Air quality, Climate changes; Land take; Spatial diffusion processes

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1. Introduction

With this research, we tried to find some answers to the questions raised by the Covid-19 outbreak in Italy, first among European countries, after Southeastern Asia. In particular, an attempt was made to highlight some elements connected to the causes of the diffusion of the virus in Northern Italy, in the Po Valley megalopolis, which also includes the metropolitan city of Milan.

In this sense, we analyzed the data relating to Covid-19 - infected and deaths at the provincial level - as of 31 March 2020 and 30 April 2020, useful dates for observing the phenomenon after the country's lock down of 10 March, which placed severe restrictions on mobility and industrial production and services, in order to slow down the spread of the epidemic, and the disease's spatial behavior after such policies.

Furthermore, as a starting point it was possible to observe similarities between the Wuhan area in the province of Hubei with those of the metropolis in the Po Valley, referring in particular to the geographical and climatic conditions - presence of rivers and water bodies, flat land, limited atmospheric circulation and scarcity of wind – socio-economic conditions - industrial production, transport and mobility infrastructures, population distribution and density, population aging and life expectancy -, as well as similarities relating to concentrations of pollutants in the atmosphere and soil consumption. We hypothesized the existence of a relationship between pollutants and the spread of the virus in the outbreak of the epidemic and its lethality.

In particular, we took into consideration soil consumption and air pollution, referred to particulates - $PM_{2.5}$ and PM_{10} - and those deriving from human activities, as industry, traffic, domestic heating, agro-industry and intensive farming, as CO_2 and nitrogen-based components, such as NO_x and NH_3. - The basic idea is that the presence of atmospheric pollutants can generate health pressures on the population and determine the pre-conditions for the development of both stress on the diseases related to the respiratory system and of complications related to them, including those that are health-threatening, which may explain the excess lethality that occurred in the area under consideration.

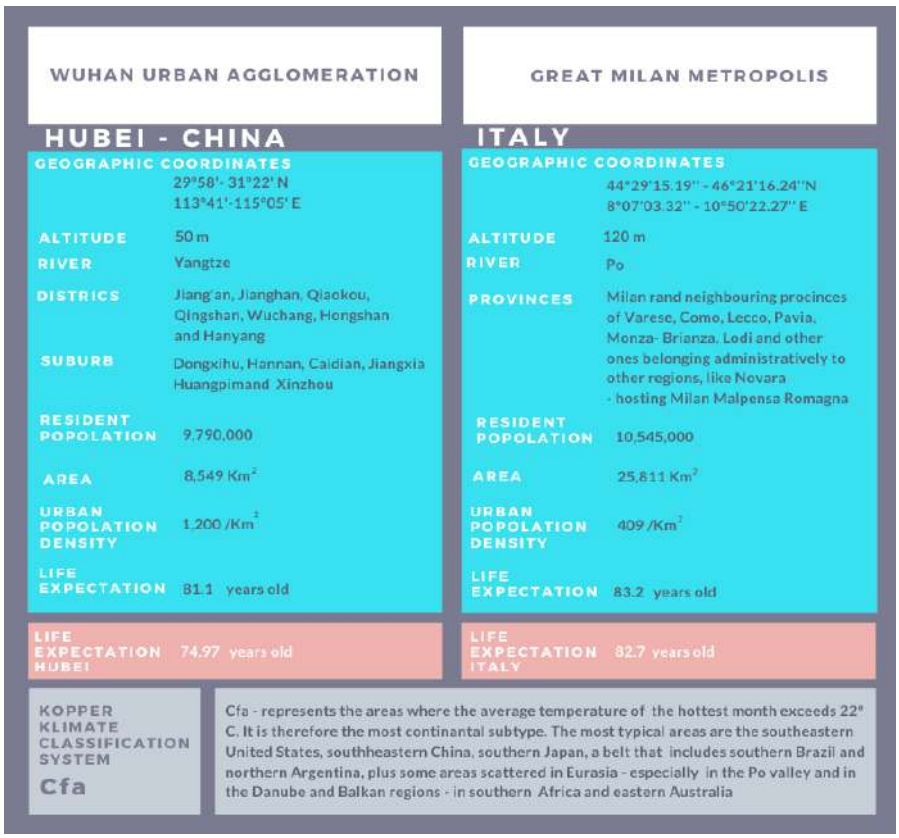


Fig.1. Synthetic comparison - Wuhan urban agglomeration and Great Milan metropolis. Authors' elaboration

In particular, relations between high concentration of atmospheric pollutants and the diffusion of pathogenic microorganisms has already been demonstrated (Peng et al., 2020). Moreover, being exposed to higher concentration of atmospheric pollutants can also explain the basa inflammation condition that can afflict the population altering the physiological conditions and leading to a greater predisposition to infection and symptomatic development of the disease (Chen & Schwartz, 2008; Conticini et al., 2020).
Furthermore, the particular weather conditions, including thermal inversion, typical of the winter period, may have worsened the environmental situation in the areas - of Wuhan and the Po Valley - such as low rainfall and a milder winter than the previous ones.
The two areas, in fact, have the same Köppen climatic classification Cfa subclass 'humid subtropical', typical of temperate continental areas (*Global climate change, 2020*, 2020; Skarbit et al., 2018) and profound analogies typical of the fluvial plain contexts, characterized by a fairly isotropic space. Both are located in an alluvial plain, Wuhan urban agglomeration - Yangtze river and Great Milan metropolis - Po river (Fig.1).
Both mega urbanizations have industrial and post-industrial functions, with a heavy presence of manufacturing companies, in machinery, automotive and ICT, as well as advanced and cultural services, particularly in the major center. Both the areas share a strong promiscuity with agricultural activities and a wide progression of the sprawl (Lu et al., 2020; Pezzagno et al., 2020; Romano et al., 2017; Senes et al., 2020).

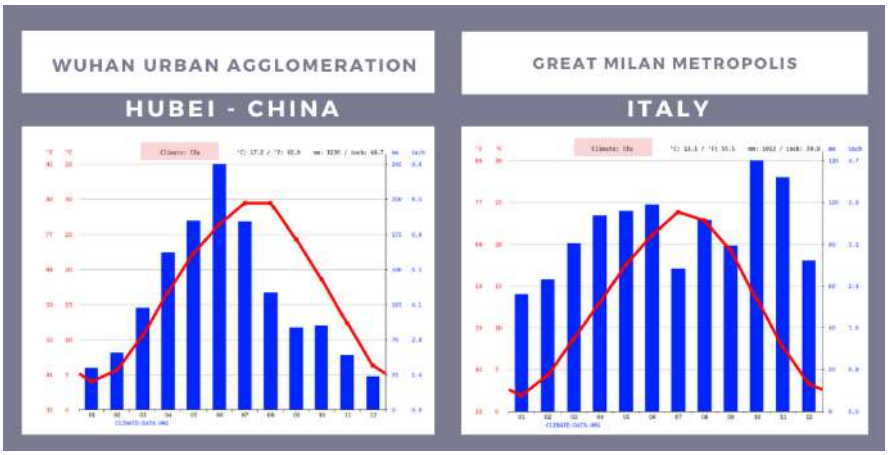


Fig.2 The climatic classification of Köppen. Authors' elaboration

In this complex international framework, we developed the present research, which does not pretend to be exhaustive, but to show the first results of an interdisciplinary ecological approach. In this regard, the basic conditions refer - for both cases examined as Wuhan agglomeration and Greater Milan metropolis - to an intense and prolonged exposure to air pollution, as peaks of concentration of fine dust and other pollutants, constitute a pejorative factor in cases of epidemics Covid-19 (Setti et al., 2020). We also paid particular attention to the relationship between climate and air quality (Du et al., 2019). Climate changes on the one hand affect the atmospheric processes and on the other cause changes in the functioning of terrestrial and marine ecosystems which can, in turn, affect the atmospheric processes (Jacob & Winner, 2009). However, these two environmental emergencies are still considered separately both at the level of the scientific community and those responsible for environmental policies, as in the case of the Covid-19 emergency (Setti et al., 2020).
According to the EEA - European Environmental Agency - although air pollution (European Environment Agency, 2018) affects the whole population, as collective health costs, only a part is more exposed (European Environment Agency, 2020) to individual risks (Chalvatzaki et al., 2019; Mitsakou et al., 2019; Reames & Bravo, 2019). In particular, Greater Milan metropolis and most of the Po Valley represent the outcome of industrial, agricultural and intensive farming globalization in Italy, which presenting an increasingly critical

quality of air (Pezzagno et al., 2020). Although in the last decade in Italy there have introduced important taxation and incentive measures for the purchase or improvement of the ecological performance of home heating (Magnani et al., 2020)) and public and private road vehicles however, the levels of air pollution for 150 days (2018) have exceeded EU regulatory limits - much lower than WHO ones. Furthermore, this situation is prolonged in time as high level of air pollution and concentration of pollutants in the air have been constantly reported in the previous years (Legambiente, 2020). In addition, the climatic and geographical 'handicap effect' of Greater Milan metropolis, is not secondary in the air quality (Zullo et al., 2019). This geographical framework - mainly isotropic - is also characterized by a community with a high life expectancy and a strong national hospital migration that can put health services under stress (Volpato et al., 2020).
The rest of the paper is organized as follows. Paragraph 2 is dedicated to Materials and Methods. In paragraph 2.1 we present the study area, Italy with its intermediate administrative units; paragraph 2.2 presents the data used for the analysis. In paragraph 2.3 the methodology adopted is presented, consisting in the ecological approach and a set of fitted for purposes spatial analyses, including the SMR (Standardized Mortality Ratio) and areal analysis for autocorrelation and estimates, as the GWR (Geographical Weighted Regression) and LISA (Local Indicator for Spatial Autocorrelation).
Paragraph 3 hosts the results, with paragraph 3.1 dedicated to the results obtained from GWR, while paragraph 3.2 dedicated to the results obtained from LISA; paragraph 4 Discussion and 5 Conclusions the paper and propose further developments.

2. Materials and methods

2.1 The study area (Italy)

The analysis regards Italy as the area where the outbreak of Covid-19 is analyzed. Italy spans over a surface of 302,072.84 sq km, with a population of 60,359,546 inhabitants (ISTAT, 2019) for an average population density of 200 inhabitants per square kilometer. Italy is organized in 20 Regions - one of them,Trentino Alto Adige, organized in 2 Autonomous Provinces with regional competences. In the analysis, we considered the intermediate administrative subdivision in Provinces, Metropolitan Cities (Ref. L. No. 56 of April 7, 2014) and a set of former provinces now used only for statistical purposes.
We considered the overall country for the analysis, although our initial attention was concentrated on the Po Valley geographical region. Such an area covers approximately 55,000 km2, with nearly 22 million inhabitants, with a population density of 400 inhabitants per km2 - double than that of the rest of the peninsula, reaching different peaks in the main urban areas of the Greater Milan metropolis - the neighboring Milan and Monza Provinces exceed 2000 inhabitants per square kilometer. It is the economic engine of the country, and is also the mostly affected area by Covid-19 outbreak.

2.2 Data

The research has been performed using different datasets mainly referred to Italy and related to the Covid-19 outbreak, as well as socio-economic and environmental data, considered useful for examining the territorial aspects of the virus outbreak in Italy. Covid-19 data considered the number of total infected people at 31 March and 30 April 2019 at province level, as reported by Italian Ministry of Health, as collected by the Civil Protection. An important novel dataset, originally built from scratch by the research group, is the number of deaths at province level. In many cases data were provided by regional administration, while in other cases the research required counting and referring data to provinces from the local health agencies and other official sources (Istituto nazionale di statistica (ISTAT), 2020; Istituto superiore di sanità (ISS), 2020).

Among the others, the major difficulties were found in locating at province level data for important regions in terms of the Covid-19 outbreak as Lombardy and Piedmont; also, big regions as Liguria, Lazio, Campania and Sicily required an extra-effort for locating deaths at provincial level.

Date	Provincial level deaths	Regional level deaths	Provincial level infected	Regional level infected
31 March 2020	12,105	12,428	102,440	105,792
30 April 2020	27,249	27,967	215,084	205,463
Source	authors data - set	Italian civil protection	authors data-set	Italian civil protection

Tab.1 Covid-19 deaths and infected localized at Provincial and Regional level

The complete study data set consists of over 100 indicators/indices. However, to simplify the discussion, we indicate only the specific ones mentioned in the paper, divided into four categories representative of the ecological approach taken. (Tab.1).

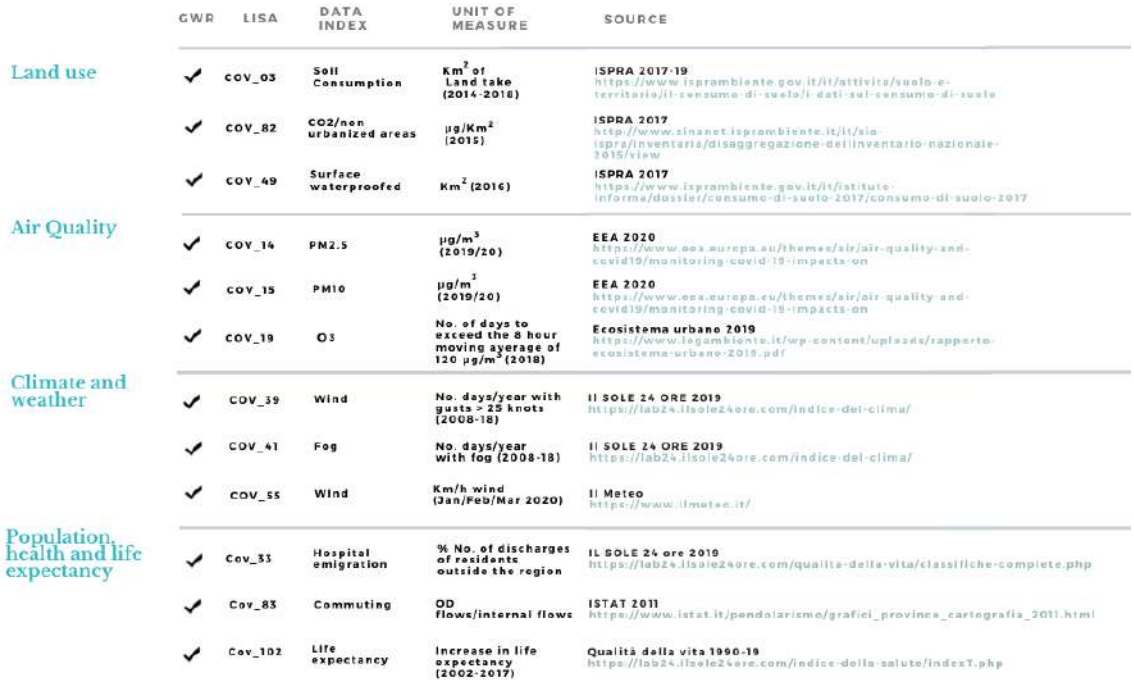


Fig. 3 Data set - Ecological approach

In particular, the retrieval of data - open data -, their cataloging, representation has always been consistent with the ecological approach (Fig.3), precisely in order to evaluate the phenomena in their complexity and entirety, to confirmed within the geospatial correlation - GWR and LISA, as presented in the next paragraph.

2.3 Methodology

The research carried on is based on an ecological approach, where the physiological traits of the virus are examined together with a set of selected relevant variables, covering different environmental and socio-economic aspects. Virus-related data as infected cases and (standardized) deaths were examined and referred to several variables. We concentrate on particular elements related to aspects that, in an integrated manner, can be considered important in understanding the human-environment relations between human activities, geographic and climatic conditions and virus outbreaks.

The quantitative analysis supporting our approach has been performed on area-based methods, particularly aimed at analyzing spatial autocorrelation among the area units considered – data at Italian province level. Autocorrelation is analyzed at local and global level by means of Geographically Weighted Regression (GWR) and Spatial Autocorrelation (LISA).

Standardized Mortality Ratio (SMR)

Mortality has been standardized using Standardized Mortality Ratio, that is keeping tracks of the different age structures that can be found in different regions considered for an analysis. It in fact takes into account the fact that different regions can have different population structures, and / or different mortalities. Standardized Mortality Ratio is therefore a method to analyze the patterns of deaths considering age composition. It calculates the expected number of deaths over the distribution of population by age group, and considering the age-specific rates of deaths for each areal unit considered.
Values around unity portrays a situation where mortality is behaving 'as expected', or in line with the trend of the area. Values higher than 1 are characteristic of a situation of a higher than expected mortality, while values lower than 1 suggest a mortality lower than that expected (Gatrell & Elliott, 2002). Mortality was standardized for the Italian provinces and for age groups - 10 groups; first group 0-9 years; last group 90-∞ -, with reference to the national population figures in the year 2019 (Istituto Nazionale di Statistica, 2019).
An indirect standardization was performed for computing specific mortality values by age group, obtained by dividing the number of Covid-19 deaths confirmed by the Italian Higher Institute of Health Care (ISS - Istituto Superiore della Sanità, sorveglianza integrata Covid -19) with the 10 defined age groups. The number of expected deaths for Italian provinces for the age groups previously identified and based on the Italian provincial population at provincial level (Istituto Nazionale di Statistica, 2019), was calculated as in the formula:

$$e = \sum_{i=1}^{K} n_i R_i \,, \tag{1}$$

with ni being the specific age group population in each observed province; Ri the national mortality rate for the specific age group.
The Standardized Mortality Ratio (SMR) was than calculated comparing the number of events observed in each province with the respective number of expected events:

$$SMR = 100\frac{d}{e} \tag{2}$$

with d the number of observed deaths and e the number of expected deaths.
Finally, the 95% confidence intervals (95% CI) were calculated, following the rule as in Vandenbroucke (Vandenbroucke, 1982).

Geographically Weighted Regression (GWR)

Geographically Weighted Regression (GWR) (Brunsdon et al., 1996; Casetti & Jones, 1992; Casetti, 2010; Fotheringham et al., 2002; Fotheringham et al., 1997; Stewart Fotheringham et al., 1996) is a method which allows to analyse how a phenomenon spatially changes within a particularly place. Starting from Tobler (Tobler, 1970) first law of geography "Everything is related to everything else, but near things are more related than distant things", GWR can be considered as a spatial extension of multiple linear regression. GWR is not limited

to global parameters, but it considers also local parameters. Also, the mathematical formulation is very similar to the typical regression analysis (equations 3, 4).

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_m x_{mi} + \varepsilon_i \quad with \ i = 1 \ldots . n \tag{3}$$

Where:

- y_i = Dependent variable
- x_i = Independent (also the term Explanatory is adopted) variables
- β_0 = Coefficients (sometimes the term Parameters is used) expressing the relationship between dependent and independent variables.
- ε_i = Residuals, i.e. the part of dependent variable not explained in the model
-

$$y_i = \beta_0(u_i, v_i) + \beta_1 (u_i, v_i)\, x_{1i} + \beta_2 (u_i, v_i)\, x_{2i} + \ldots + \beta_m (u_i, v_i)\, x_{mi} + \varepsilon_i \tag{4}$$

In Geographically Weighted Regression the term (u_i, v_i) is also considered, which represents coordinates of point i in the space.

It is possible to have positive or negative relationships between dependent and independent variables: according to the kind of relationship, a sign (+/-) is associated to the coefficients.

In order to model in the best way, the phenomenon to be investigated it is fundamental to define all factors which may influence the analyses. The central point is to find the main variables in phenomenon modelling, defining the dependent variable and identifying the possible independent variables. It is also important, before analysing data with GWR, to test with Ordinary Least Squares the possible independent variables to adopt.

Two main measures of Ordinary Least Squares are useful in understanding if the variables adopted in the analysis are meaningful: R2 or adjusted R2 and Akaike. R2 results are generally included between 0 and 1. A better predictive performance has been highlighted by values close to 1. Akaike Information Criterion (AIC) (Akaike, 1973; Hurvich et al., 1998) has not an absolute scale of measure, but it is useful in comparing two models, with the same dependent variable, in order to assess which of them fits better the phenomenon. Smaller values of the AIC indicate a better simulation, if the difference is not big, less than 3, two models can be considered equivalent.

Another important check in model performance concerns Residuals. It is fundamental to analyse that spatial dependence does not occur in residuals, verifying a random spatial distribution. Residuals have to be analyzed by Moran Index I. Moran Index I (Moran, 1948) is a global measure of spatial autocorrelation and its values can be included between -1 and 1. If Moran Index I is close to zero data are randomly distributed, if the term is higher than zero, autocorrelation is positive, otherwise it is negative.

Regression coefficients are estimated using nearby feature values. Consequently, main parameters are kernel and bandwidth which provide a definition of nearby.

There are two kinds of kernel, fixed and adaptive: the first one defines nearby according to determined fixed distance band; while adaptive kind defines nearby according to determined number of neighbours.

Fixed kernel is adopted if observation points are regularly located, otherwise, if observation points are clustered, adaptive kernel is more suitable.

Bandwidth controls the size of kernel and can be defined in three ways: directly by the analyst (it is possible to directly define distance or neighbours number), by means of AIC method, which minimises Akaike Information Criterion (AIC), or by using CV, which minimises the CrossValidation score.

Spatial Autocorrelation

Geographical objects are generally described by means of two different information categories: spatial location and related properties. In data analysis there is a huge literature concerning methods which separately compute attributes from spatial components.

The most interesting property of spatial autocorrelation is the capability to analyze at the same time locational and attribute information (Goodchild, 1986). Consequently, spatial autocorrelation can be considered as a very effective technique in analyzing spatial distribution of objects assessing at the same time the degree of influence of neighbour objects. This concept is well synthesized in the first law of geography defined by Waldo Tobler (Tobler, 1970) "All Things Are Related, But Nearby Things Are More Related Than Distant Things". Adopting Goodchild (Goodchild, 1986) approach, (Lee & Wong, 2000) defined spatial autocorrelation as follows:

$$SAC = \frac{\sum_{i=1}^{N}\sum_{J=1}^{N} C_{ij}W_{ij}}{\sum_{i=1}^{N}\sum_{J=1}^{N} W_{ij}}, \quad (5)$$

Where:

- N is the number of objects;
- i and j are two objects;
- c_{ij} is a degree of similarity of attributes i and j;
- w_{ij} is a degree of similarity of location i and j.

defining x_i as the value of object i attribute; if $c_{ij} = (x_i - x_j)^2$, Geary C Ratio (Geary, 1954) can be defined as follows:

$$C = \frac{(N-1)\,(\sum_i \sum_j W_{ij}\,(x_i - x_j)^2)}{2\,(\sum_i \sum_j W_{ij})\sum_i (x_i - \bar{x})^2}, \quad (6)$$

If $C_{ij} = (x_i - \bar{x})(x_j - \bar{x})$, Moran Index I (Moran, 1948) can be defined as follows:

$$I = \frac{N\ \sum_i \sum_j W_{ij}\,(x_i - \bar{x})(x_j - \bar{x})}{(\sum_i \sum_j W_{ij})\sum_i (x_i - \bar{x})^2}, \quad (7)$$

These two indices are very similar, mainly differing in the cross-product term in the numerator, which in Moran is calculated using deviations from the mean, while in Geary is directly computed.

These two indices are global indicators of spatial autocorrelation. They provide an indication about the presence of autocorrelation. The precise location of elevated values of autocorrelation is provided by Local Indicators of Spatial Association. One of the most adopted indices of local autocorrelation is LISA-Local Indicator of Spatial Association developed by Anselin (Anselin, 1988, 1995), considered as a local Moran index. The sum of all local indices is proportional to the value of Moran one:

$$\sum_i I_i = \gamma\ I, \quad (8)$$

The index is calculated as follows:

$$I_i = \frac{(X_i - \bar{X})}{S_X^2} \sum_{j=1}^{N} (W_{ij}\,(x_j - \bar{x})), \quad (9)$$

It allows, for each location, to assess the similarity of each observation with its surrounding elements. Five scenarios emerge:

- locations with high values of the phenomenon and high level of similarity with its surroundings (high-high H-H), defined as *hot spots*;
- locations with low values of the phenomenon and high level of similarity with its surroundings (low-low L-L), defined as *cold spots*;

- locations with high values of the phenomenon and low level of similarity with its surroundings (high-low H-L), defined as potentially *spatial outliers*;
- locations with low values of the phenomenon and low level of similarity with its surroundings (low-high L-H), defined as potentially *spatial outliers*;
- locations completely lacking significant autocorrelations.

LISA (Local Indicator of Spatial Association) provides an effective measure of the degree of relative spatial association between each territorial unit and its surrounding elements, allowing highlighting type of spatial concentration for the detection of spatial clusters.

In equations 5, 6, 7, 9 the only term not well formalized is w_{ij} related to neighbourhood property. The most adopted approach in formalizing this property is spatial weights matrix, w_{ij} are elements of a matrix considered as spatial weights, equal to 1 if i and j are neighbours equal to 0 in the case of self-neighbour or if i and j are not neighbours. This approach is based on the concept of contiguity, where elements share a common border of non-zero length. It is important to give a more detailed definition of contiguity and more particularly what does a border of non-zero length exactly mean.

Adopting chess game metaphor (O'Sullivan & Unwin, 2010), contiguity can be considered as allowed by paths of *rook*, *bishop* and *queen.*

3. Results

3.1 Ordinary Least Squares and Geographically Weighted Regression (GWR)

All variables, previously described, have been tested using Ordinary Least Squares in order to understand in which measure they are reliable. First results and elaborations of statistical tests suggested to exclude some variables from the analyses for low correlation or redundancies. More particularly, the number of deaths have been considered as a dependent variable and annual average of $PM_{2,5}$ and PM_{10}, Ozone (O_3 - number of days to exceed the 8 hour moving average of 120 µg/mc), Wind gusts (annual days with gusts> 25 knots), Fog, Surface waterproofed to year 2016, Wind (Km/h, Jan - Feb - Mar 2020), Hospital emigration, Commuting, CO_2 in not urbanized areas have been adopted as explanatory variable. The results are quite interesting, R2 is 0.705979, Adjusted R2 0.671935 and Akaike Information Criterion (AIC) 1392.44. Variance Inflation Factor is less than 7.5, all values are lower than 3.5, this means that the explanatory variables are not redundant.

It is also important to analyze residuals. The residuals of a good model should be normally distributed with a mean of zero. I our case the residuals histogram matches the normal curve indicated in blue in Fig.4.

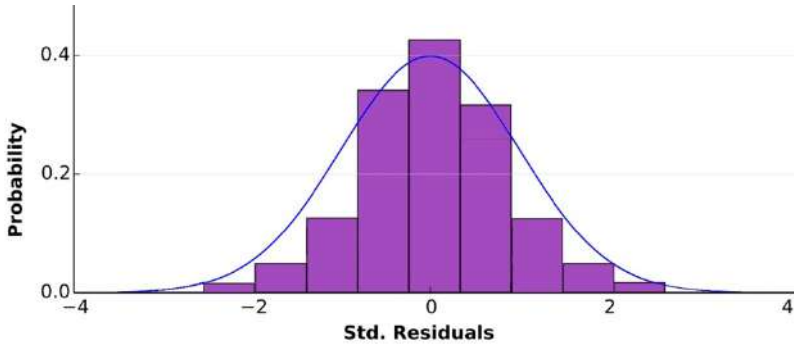


Fig. 4 Histogram of Distribution of Standardized Residuals

The other important aspect is the spatial distribution of residuals. More particularly, standardized values of residuals, calculated by means of Ordinary Least Squares, have been used as input data in calculating spatial autocorrelation, in order to understand if residuals were autocorrelated or not.

Spatial autocorrelation has been calculated adopting Moran scatter plot and considering standardized variables of residuals as abscissa and spatial weighted standardised variable of residuals as ordinate. In the graph, Moran Index corresponds to direction coefficient of linear regression, which represents the scatter plot. Positive autocorrelation corresponds to spatial clusters in upper right and lower left quadrants. Lower right and upper left quadrants can be classified as spatial outliers.

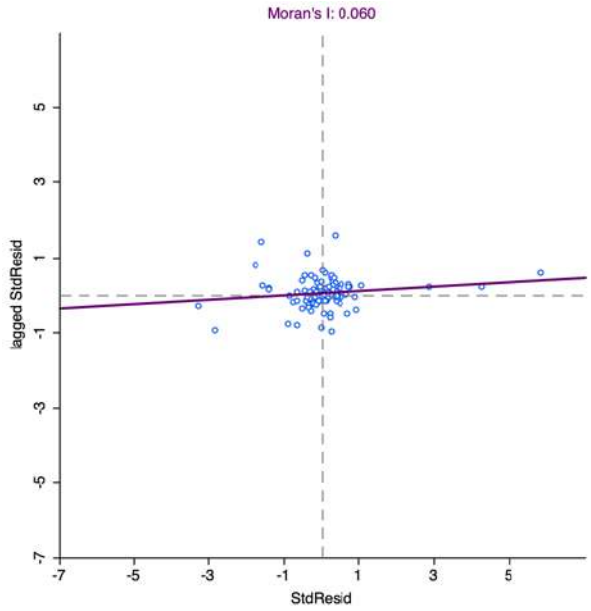


Fig.5 Moran scatter plot of residuals standardized variable

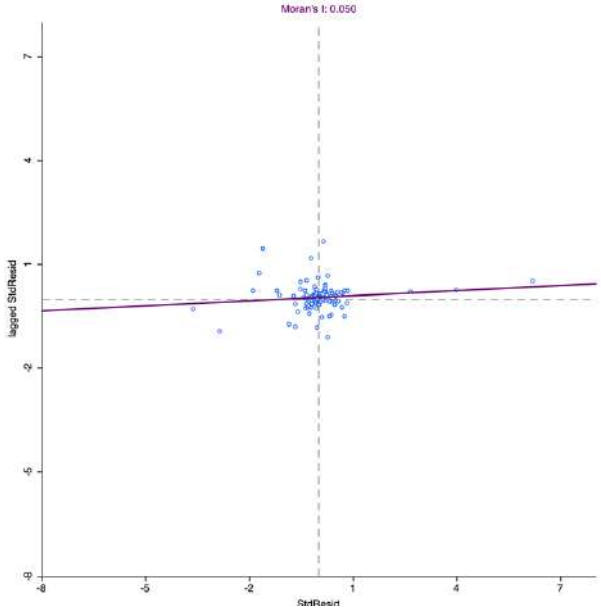


Fig.6 Moran scatter plot of residuals standardized variable

Fig.5 shows that the slope of Moran Index is close to zero coinciding with abscissas axis, this means that residuals are not spatially autocorrelated.

Ordinary Least Squares allows to analyse the relationship between dependent variable and explanatory variables, deleting also redundant and not significant variables.

After the good results obtained with Ordinary Least Squares it is important to analyse how these relationships vary over space. This is possible using Geographical Weighted Regression. As expected GWR results are better than those achieved with OLS: namely, R2 is 0.741573518, Adjusted R2 0.689031597 and Akaike Information Criterion (AIC) 1389.801618.

Also, in this case residuals are not spatially autocorrelated. Fig.6 shows that Moran Index is 0.05 this means that the spatial distribution is random.

Local R^2 is a parameter included between 0.0 and 1.0, it is an indicator on how the local regression model fits the observed values. If the indicator is close to zero the local model is far from the observed values. In this case all values are close to 0.7 (figure 7) and there are not great differences. Despite the local values are quite equivalent the map at national scale describes the Italy divided in four zones with the highest level of R2 in the northern part of Italy.

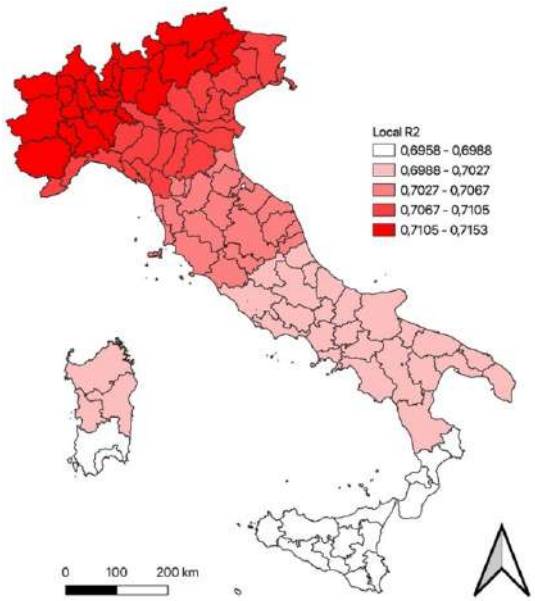
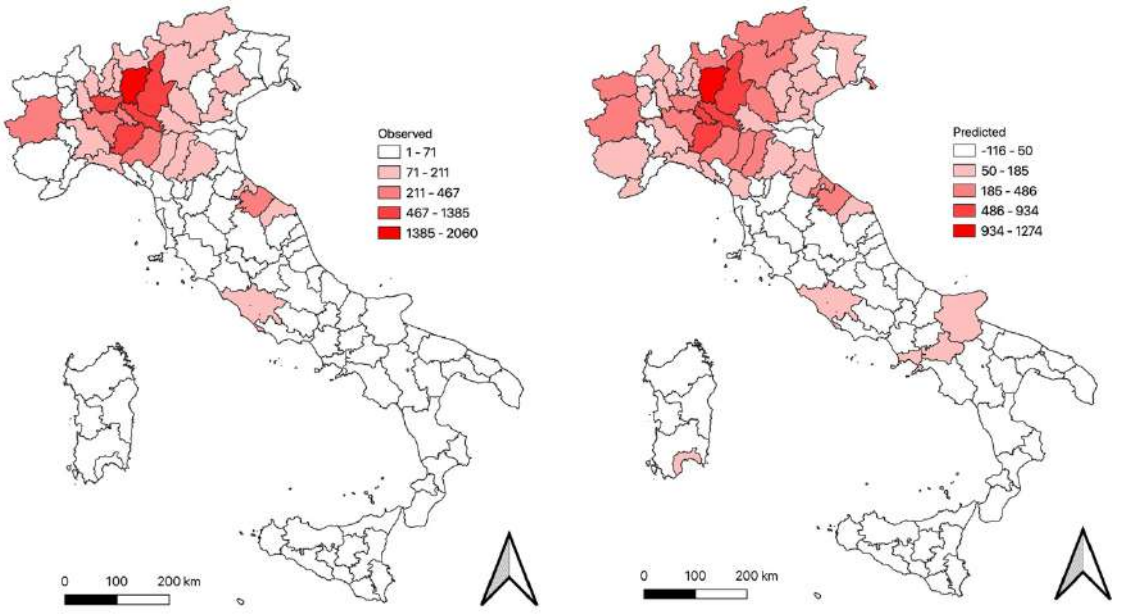


Fig.7 Local R^2 map



(a) (b)

Fig.8 Observed (a) and predicted (b) values

Analyzing Fig.8 It is possible to observe that there are small differences between the observed and predicted values also at local level, this means that the local regression model fits very well the analysed phenomenon.

3.2 Local Indicators of Spatial Autocorrelation (LISA)

In the Po Valley megalopolis the local climate changes (Fig. 9) and the significant change in relative humidity and air quality - non-disjointed phenomena - (Blum, 2017; Maione et al., 2016; Manes et al., 2016; Reames & Bravo, 2019)) affect the quality of life, which is exposed to several actions combined with poor air quality (Reames & Bravo, 2019).

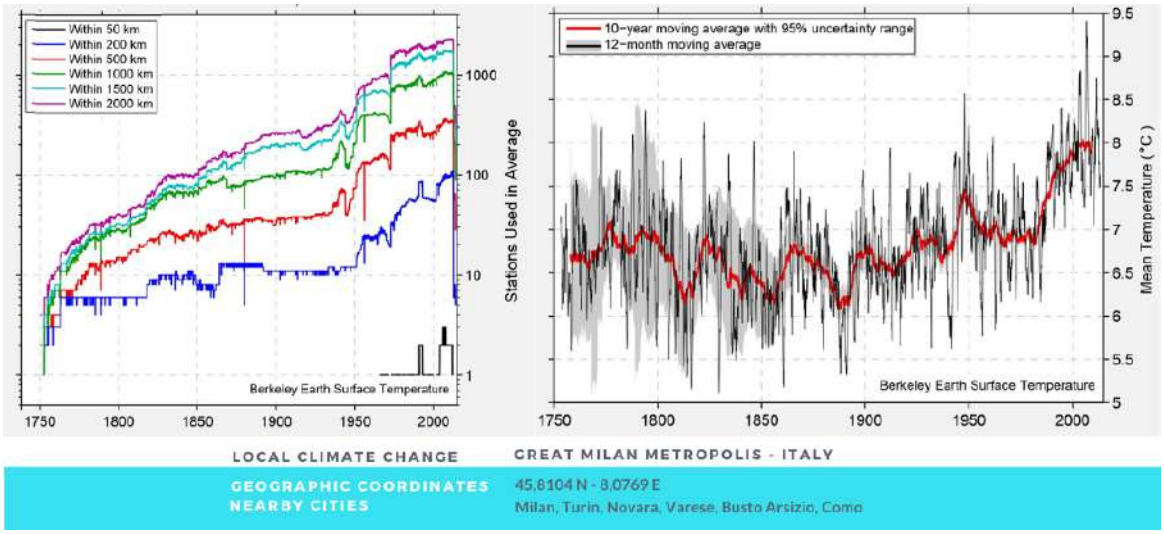


Fig.9 Local Climate Change - Great Milan Metropolis

These are in fact apparently unrelated phenomena, which in reality, besides being profoundly dependent on each other, do not act as a mere sum on environmental ecosystems and communities, but in the form of combinations that are in turn related to urban geography - land use: efficient land use, sprawl and ecosystem services. It should be noted that the law on air quality has substantial differences from country and country (Fig 10). Furthermore, the reference targets for making comparisons are still those of the 2005 WHO guidelines. It is worth mentioning WHO Guidelines (*WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide*, 2006) that for $PM_{2.5}$, they set a daily limit of 25 μg/m^3; year limit 10 μg/m$_3$ and that in Italy with Legislative Decree of 13 August 2010, n. 255: 25 μg/m^3 year limit was lowered to 20 μg/m^3 only from 1st January 2020. However, this new national target of $PM_{2.5}$ does not take into account the direct and indirect effects deriving from the geography, urban and climatic weather conditions of the contexts, which in the Po Valley are certainly an important element for the purposes of air quality (Ferrero et al., 2019). In particular, local climate changes such as temperature and humidity, poor air quality and the persistent absence of wind, make the Po Valley a one of a kind area, both at national and international level. Furthermore, frequent and persistent thermal inversion phenomena in the winter months, especially in periods of high atmospheric pressure, traps the cold air near the ground, together with the pollutants (Caserini et al., 2017). In the Po valley, urban phenomena of industrialization and intensive farming (Romano & Zullo, 2016), intertwine and more than 50% of national GDP is produced, as well as almost 50% of national energy is consumed (Arpa Emilia-Romagna ARPAE, 2018). The transition to compatible solutions related to well-being seems not exactly close, despite the several regional and national plans to monitor and improve air quality (Marongiu et al., 2019). Furthermore, life expectancy for both genders is substantially stable, confirming for longer in Northern Italy (Istituto Nazionale di Statistica, 2019), also a consequence of social inequalities, disabilities and access to health services, contributing to the North - South social divide. Finally, also in the North there is also a greater and specific health care over 65. In this complex framework, land use takes on a significant dimension.

In this research aimed at evaluating why Northern Italy was marked by Covid-19, the data set - selected from different sources and open data) used for the development of the Lisa Maps played an important role, supporting the interdisciplinary ecological approach: Land use; Air quality; Climate and weather; Population, health and life expectancy. In particular, the LISA maps on indicators relating to these phenomena: Cov_14, Cov_15, Cov_19 and Cov_72 - confirm these first evaluations of the air pollution in Po Valley megalopolis (Fig. 11, Fig. 12 and Fig.13) and at the same time highlight the other side of the metropolis: the increase in life expectancy and the provision of related health care (no. of geriatricians / 1000 ab over 65).

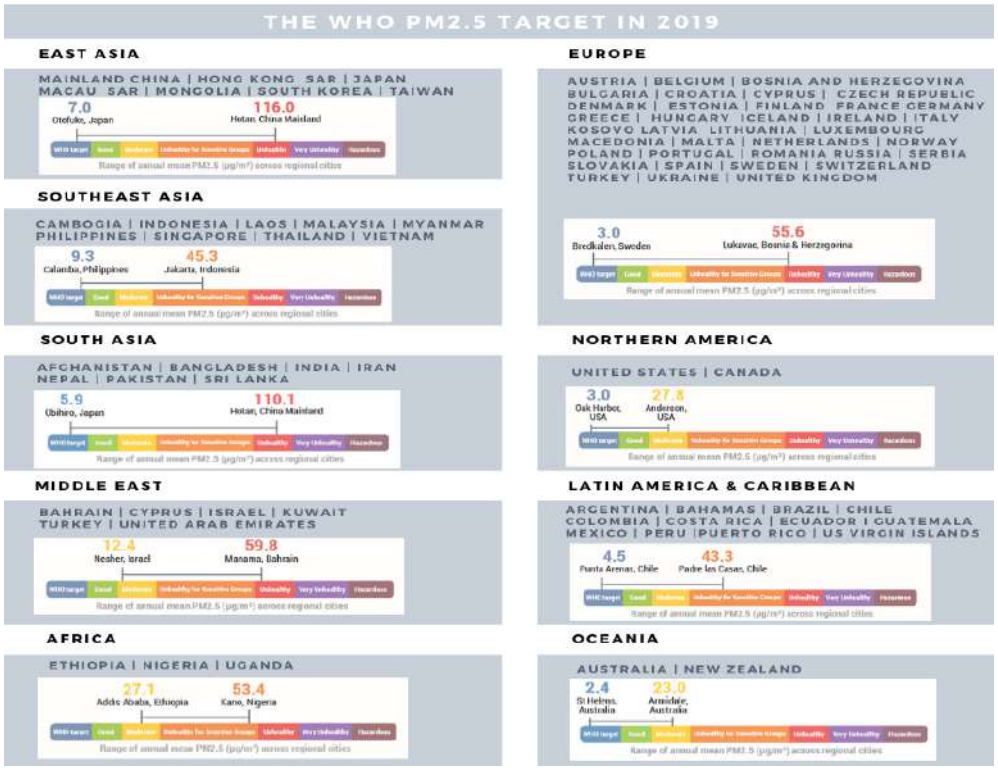
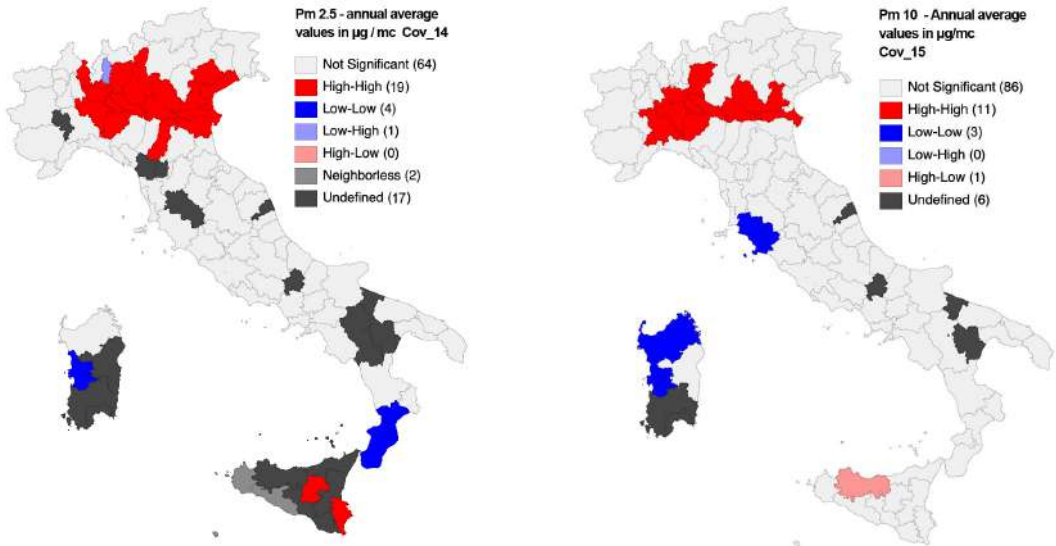
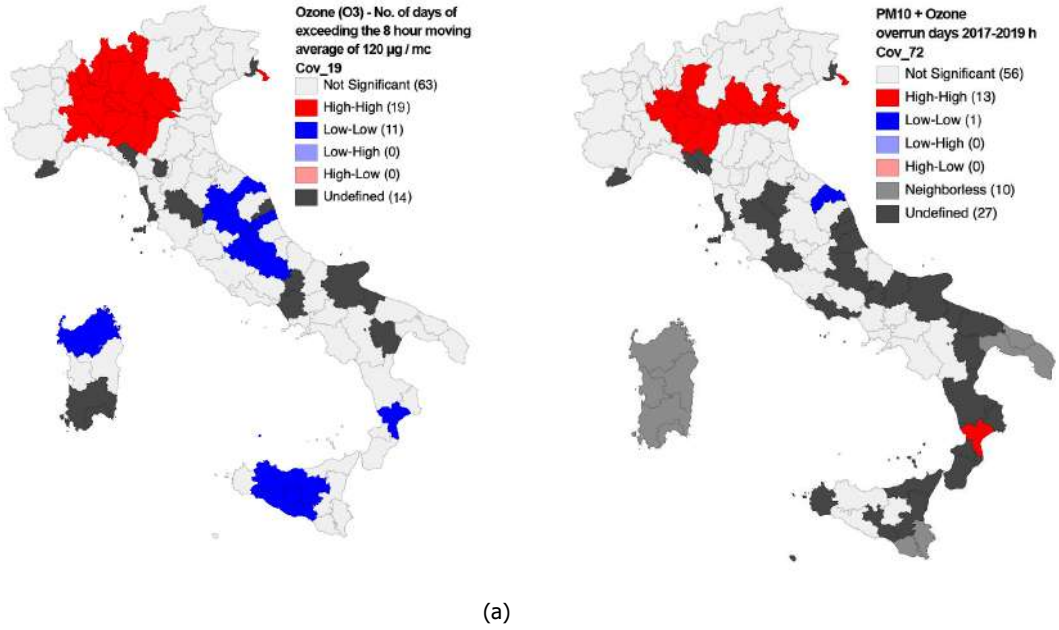


Fig.10 The WHO PM 2.5 target in 2019



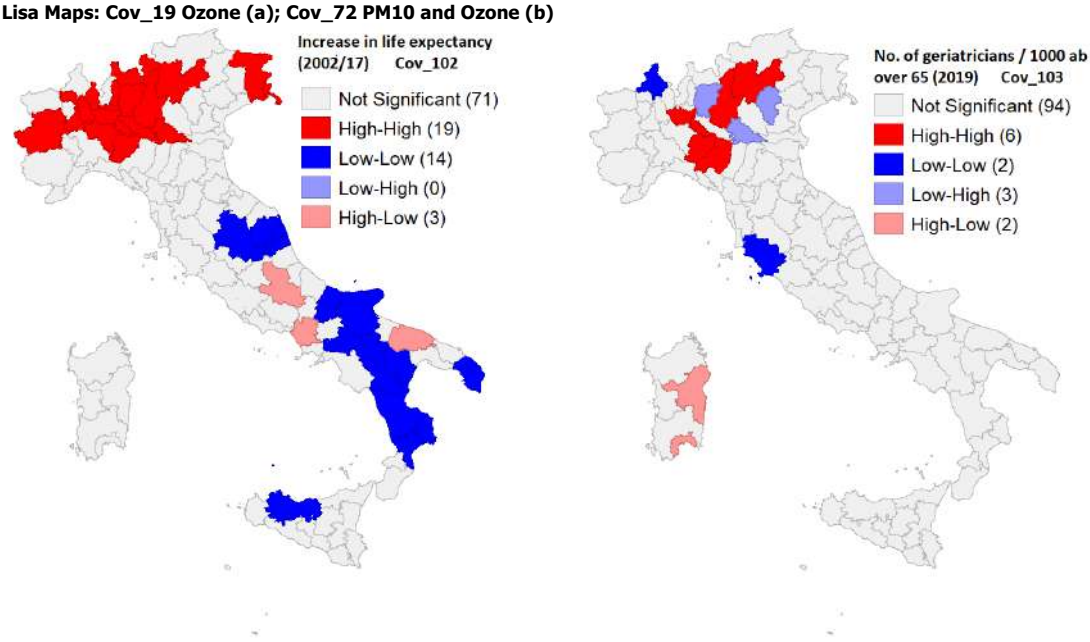
(a) (b)

Fig.11 Lisa Maps: Cov_14 PM2.5 (a); Cov_15 PM10 (b)



(a) (b)

Fig.12 Lisa Maps: Cov_19 Ozone (a); Cov_72 PM10 and Ozone (b)



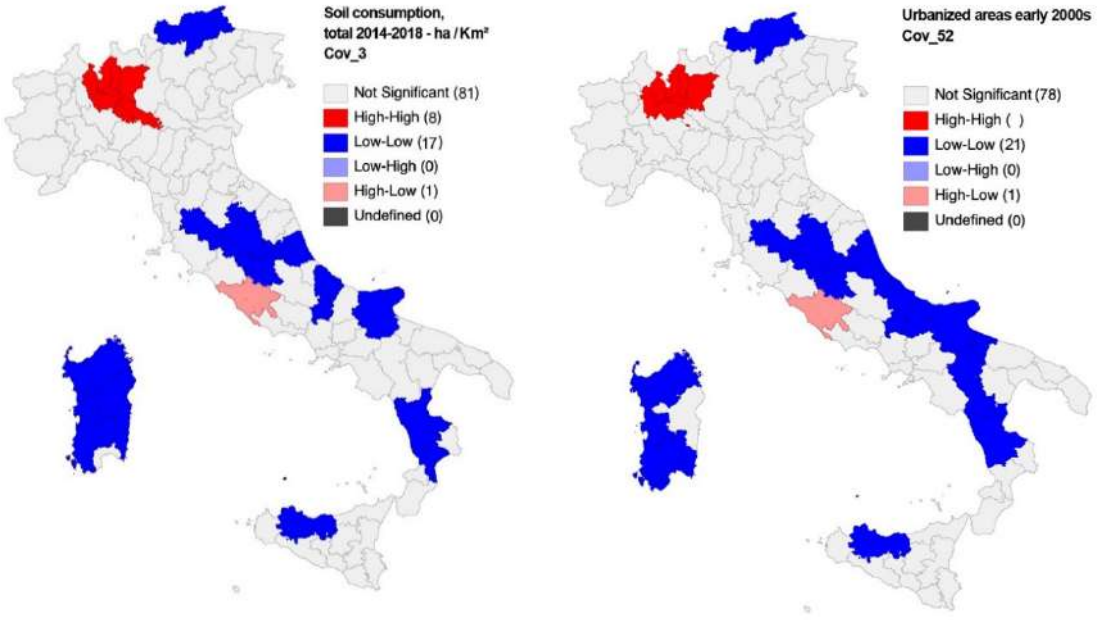
(a) (b)

Fig. 13 Lisa Maps: Cov_102 Increase in life expectancy (2002-2017) (a); Cov_103 No. of geriatricians / 1000 ab over 65 (2019) (b)

In other words, in this complex case study of the Po Valley megalopolis we can observe the persistency of: poor air quality - climatic handicap (Ferrero et al., 2019), inefficiency of land use (Romano et al., 2017) and increased life expectancy (Poli et al., 2019; Sarra & Nissi, 2020) of the population with a presumably consequent impact of Covid-19 in terms of both infections and deaths (ISTAT & ISS, 2020).

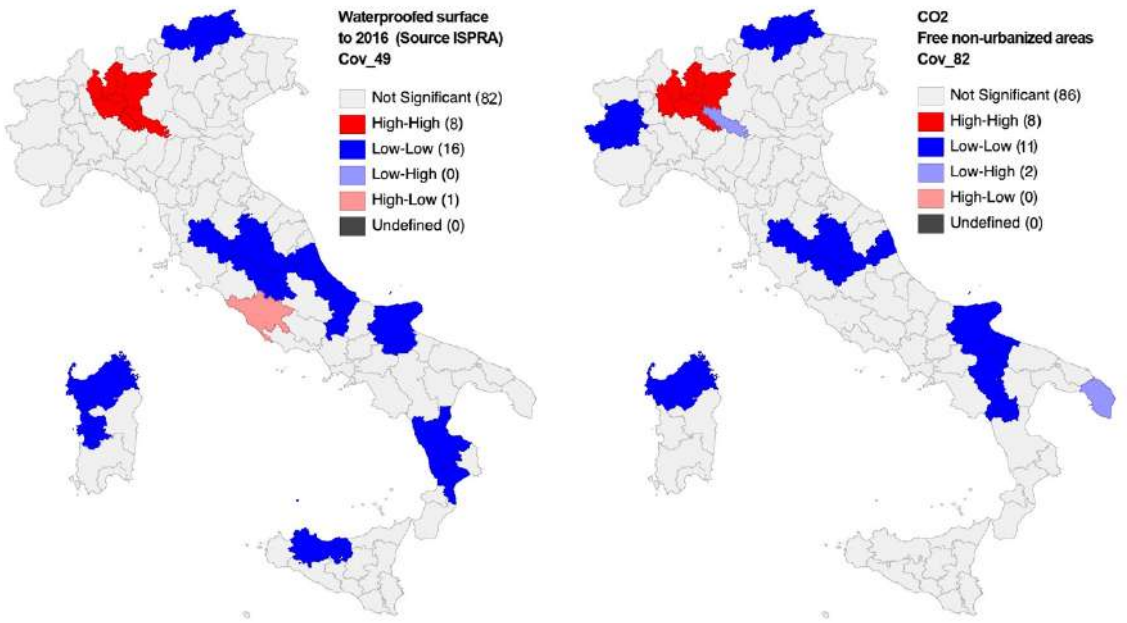
As previously explained, Po Valley has spatial configuration as basin completely closed by Alpine Chain and Apennines and it is characterized by an a homogeneous and isotropic space. While the former feature represents a strong impediment to air circulation and distribution the later increases the probability that urban sprawl phenomenon occurs. The two aspects are strongly related because the soil is an important element in the carbon cycle allowing CO_2 sequestration and storage. Consequently a lack of attention to the spatial

planning can generate negative effects producing a loss of these properties (Zomer et al., 2017). Soil and related ecosystem services are important elements in the improvement of air quality reducing PM10 and O_3 (Fusaro et al., 2017; Manes et al., 2016). Po Valley is the most attractive area of the country because great part of productive activities are concentrated, consequently it is fundamental to have a lot of not urbanized areas capable of allowing CO_2 storage. Unfortunately annual reports of Italian Institute for Environmental Protection and Research (ISPRA) (Munafò, 2019), other important researches (Martellozzo et al., 2018; Pileri & Maggi, 2010; Romano & Zullo, 2016) highlight that Land take phenomenon in Italy is mainly concentrated in the northern part of the country.



(a) (b)

Fig.14 Lisa Maps: Cov_3: land take between 2014-2018 (a); Cov_52: land take up to 2000 (b)



(a) (b)

Fig.15 Lisa Maps: Cov_49: sealed soils (a); Cov_82: CO_2/non urbanized areas (b)

Also spatial autocorrelation analysis confirms this trend with the more elevated values concentrated in Lombardy region. More particularly figures 14 and 15 analyze LISA index of land take between 2014-2018 and up to 2000, sealed soils at 2016 and CO2/non urbanized areas. The concurrence of these factors led to a dangerous combination with a high concentration of elements dangerous to health with a strong decrease of areas which, in some way, represent the only possibility to air cleaning.

4. Discussion

In the geographical context of Po Valley, elements as land use, life expectancy, commuting, climate handicap and poor air quality certainly played a role and contributed to increasing the effects of the epidemic. Furthermore, local climate changes such as temperature and humidity, poor air quality and the absence of wind make the Po Valley an area unique of its kind, both nationally and internationally. It represents an isotropic territorial context suitable for anthropic activities, but at the same time with latent health risks. In particular, in the Po Valley, urban industrialization phenomena are characterized by a high entropy and by an increasing consumption of resources, given its contribution to over 50% of national GDP and, as a side effect, the consumption of almost 50% of national energy. Despite the existence of several regional and national plans to monitor and improve air quality, climate, soil consumption, etc. the transition to compatible solutions related to well-being does not seem close. Furthermore, on the occasion of the Covid-19 epidemic, PM_{10} emissions in the Po Valley were high and sometimes exceeded the limits and must be related to the combined climate - wind, winter thermal inversion - and human actions - remained active in the lockdown period - domestic heating, urban logistics, food production and retail. In this context, certainly not simple for both human, environmental and anthropic geography, the ecological approach has allowed us to obtain the first results and the first policy proposals with supported by GWR and LISA analysis, referring to the combined action between urban design, monitoring and health risk plan (Fig.16).

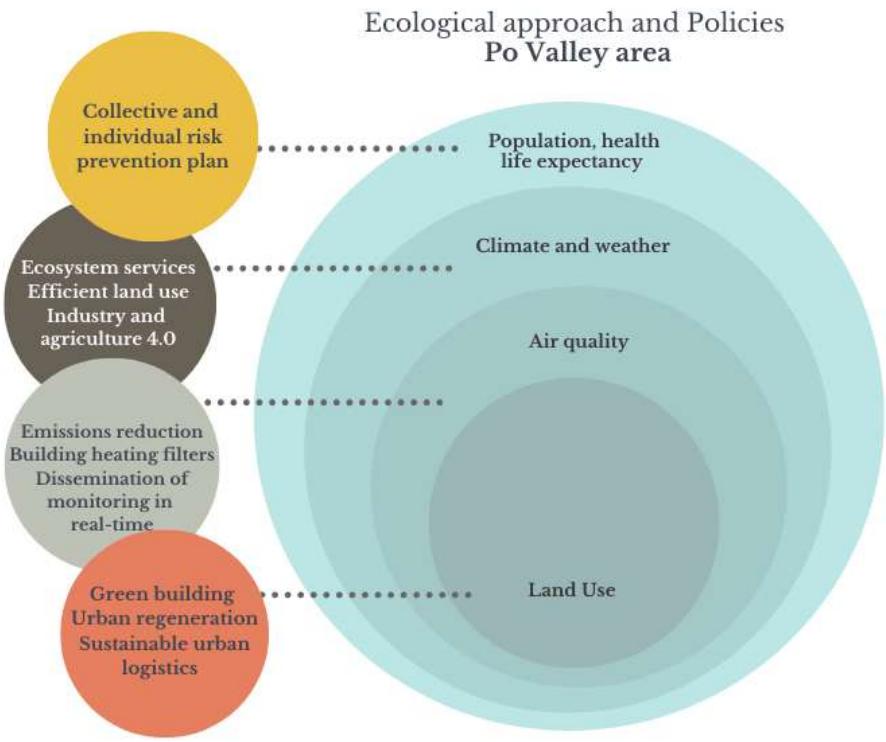


Fig.16 Ecological approach and Policies - Po Valley Area.

The health emergency has highlighted even more how in many cases the urban and territorial plans are old, very far from the current reality or based on old laws, which do not allow the production of tools to respond rapidly to current and immediate problems. The outcome is a scenario that leads to a consumption of resources greater than the planet's capacity. The result is that the main planning goals are very far from providing a serious response to the transformation demands that daily arise. This old system, based on vintage planning (Romano et al., 2018) or ghost planning (Scorza et al., 2020), can lead to a situation of potential peak and overshooting of the environmental carrying capacity (represented on left part of Fig.17).

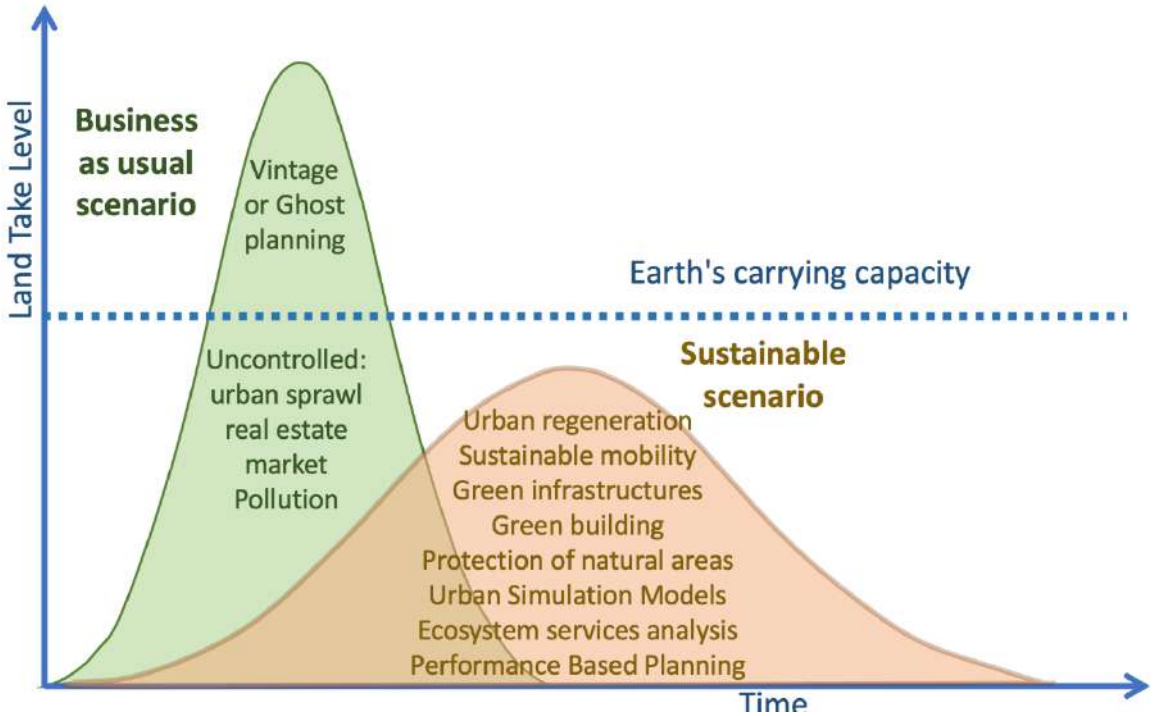


Fig.17 Ecological approach and Policies - Po Valley Area

As in the most dramatic moments of the Covid-19 outbreak a quest for flattening the curve was requested to avoid a peak and an extra stress over the national health systems, planning seem facing, now more than ever, the same risks and challenges. If, as said, ghost and vintage planning can barely allow tackling short run, ordinary solutions, for long run and extraordinary cases a change of pace is needed. An alternative to be pursued is an ecological approach based on simulations in assessing transformations impacts, that allows planners to take into account several land use scenarios, choosing the more suitable solutions for transformations. Such an approach to planning can also consider the possible losses of ecosystem services in simulations (Geneletti D., 2016; Gobattoni et al., 2016). The vast amount of data to date available, together with the vast array of instruments for modelling scenarios, as Multiagent Systems, Space Syntax, Geodesign (Cocco et al., 2020; Steinitz, 2012), etc. can take into account a lot of components in detailed simulations. A Performance Based Planning represents the summary and the container for all of these models and simulation tools. Such capacity of gathering and elaborating data to produce scenarios can help in meeting objectives of protecting natural areas and consequently of human health be more easily.

Furthermore, adopting urban policies based on urban regeneration, sustainable mobility (Battarra et al., 2018; Bonotti et al., 2015; Papa et al., 2018; Tira et al., 2018) and the creation of green infrastructures (Balletto et al., 2020; Lai et al., 2018; Ronchi et al., 2020) can create a more sustainable scenario able to flatten the curve under the Earth carrying capacity (Gargiulo & Russo, 2018; Maragno et al., 2020; Pietrapertosa et al., 2019).

5. Conclusions

In this paper we focused our attention on the Covid-19 outbreak in Italy and on the effect of the interaction among geographical, environmental and socio-economic characteristics. The occasion of the massive outbreak in the Po Valley area, which has been analyzed and compared in its main character with the Wuhan – Hubei Province in China in terms of some similarities, led us to consider a wide set of variables and analyze them by using spatial analytical methods. This was done to evaluate some relations and to provide with some suggestion in terms of integrated planning and policy actions. From a wide selection of variables we highlighted four big families, grouped for 'land use', 'air quality', 'climate and weather' and 'population, health and life expectancy'. These were related to mortality, expressed in terms of SMR – Standardized Mortality Ratio - examined in terms of spatial autocorrelation, and considered both from the spatial and attribute point of view. Geographically Weighted Regression - GWR - and Local Indicators of Spatial Autocorrelation LISA – Spatial analytical techniques as were performed and were useful in confirming a relation between a set of conditions and the spreading of the Covid-19. The analysis helped to understand more the relation between environmental conditions and health aspect, and on the need to introduce and systematize analytical tools to support spatial decisions, to plan in ordinary and extraordinary conditions.

Future developments will concern the systematization of medium and long-term policies in relation to health risk.

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The resilient city and adapting to the health emergency.

Towards sustainable university mobility

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Abstract

The concept of a resilient city is an increasingly critical one. Resilience represents the ability of an urban system to adapt to an external event. In the past, urban resilience was mainly addressed to natural rather than anthropic risks.

Considering the Covid-19 pandemic emergency, the relationship between urban resilience and anthropic risk, especially health risk, has inevitably distorted the "normality" to which we were accustomed. The emergency has had significant long-term effects on the times, uses and organization of cities. Adaptability requires the synergic work of all actors who live or work in a city. This mobility-focused research aims to highlight the importance of the Quadruple Helix principle by analysing the specific measures that each actor -Public Authorities, Research, Enterprises and Citizens- can implement to reduce health risk.

The paper outlines the contribution of the University of Genoa within the confines of a ministerial project to promote sustainable mobility for students, when travelling between home and university, using prizes/incentives. This good practice will play an increasingly important role in the return to normality

Keywords

Resilience; Quadruple helix principle; University students' sustainable mobility

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1. The resilient city and adaptation to the health emergency

The concept of a resilient city is an increasingly critical one. Resilience represents the ability of an urban system to adapt to an external event and quickly return to normal.

The concept of resilience, as a response to environmental, socio-economic and political uncertainty and risk, has captured the attention of academics and decision-makers in all disciplines, sectors and scales (Brown, 2013, Cascio, 2009, Meerow & Newell, 2015).

Urban resilience refers to "the ability of an urban system - and all the ecological and socio-economic networks that make it up on a temporal and spatial scale - to maintain or quickly return to the desired functions in the face of a disturbance, adapting to change" (Collier et al., 2016). A resilient city reduces or avoids risk situations, establishes procedures to manage emergencies and to restore the damaged system after the event (Wamsler et al., 2013).

"Any eventual disaster or emergency is impossible to plan, but to implement a scalable, adaptable system and an organizational structure so that the affected communities can recover quickly from the harmful event is possible. The origin of most of these disasters depends on climate change …" (De Simone, 2015).

In the literature there are many studies related to resilience from natural events, such as seismic, hydrogeological, and in general related to climate change.

Considering the Covid-19 pandemic emergency, the relationship between urban resilience and anthropic risk, especially health risk, has inevitably distorted the "normality" to which we were accustomed.

The emergency has had significant long-term effects on the times, uses and organization of cities. Adaptability requires the synergic work of all actors who live or work in a city. From healthcare to high street retail, transport to food and medical supply chains, the coronavirus (Covid-19) outbreak, has exposed the limited resilience of our cities (Chong,2020). The immediate priority of those who govern the territory is obviously aimed at health and solving the critical issues connected to the pandemic. But according to the "learning-by-doing" approach, the crisis can be an opportunity to learn from how the cities have responded to this event. We can therefore rethink the way we plan, design and manage our cities, implementing the best strategies to build more resilient and responsive cities if other similar crises occur. As with any analysis involving natural or anthropic risks, a complete knowledge framework is essential. Through knowledge, the priority to interventions, to the distribution of resources by addressing them primarily to services (health, school, commercial, ..), areas and people most vulnerable is possible to give. In addition, the cognitive framework also allows to evaluate whether the good practice valid elsewhere can be applied in another territorial context if it has similar characteristics (number of inhabitants, surface area, prevalent uses, ..). Everyone's collaboration is also needed to respond to emergency. Communication, awareness and training allow to increase and share knowledge in order to make it a common factor to ensure citizen safety.

"Cities can be understood as complex-adaptive systems that have the opportunity to manage their resilience towards sustainability through processes of transformation" (Olazabal, 2017). The interconnectedness and dependencies of cities' many systems mean coordination is central to achieving effective resilience. (Chong,2020). Adaptability does not depend only on the actions carried out by public authorities, but it requires the synergic work of all the actors who live or work in a city.

This mobility-focused research aims to highlight the importance of the Quadruple Helix principle by analysing the specific measures that each actor - Public Authorities, Research, Enterprises and Citizens - can implement to reduce health risk (Fig. 1).

"Users in the Quadruple Helix framework can also be defined in several ways depending on the context of the arena (the fourth helix) and what value adding activities they bring to civil society. Thus, users can be businesses, organizations, citizens, society, and many more things" (Hasche et al., 2019). These four "key actors promoting a democratic approach to innovation through which strategy development and decision-

making are exposed to feedback from key stakeholders, resulting in socially accountable policies and practices (Carayannis & Campbell, 2011). Citizens insights are crucial for understanding future cities that are not only functional effective and efficient but also sociable and liveable etc. To become a sociable smart city that is of meaning to its citizens, a strong position for citizens in the design process is required to address people's values (Van Waart & Mulder, 2014).

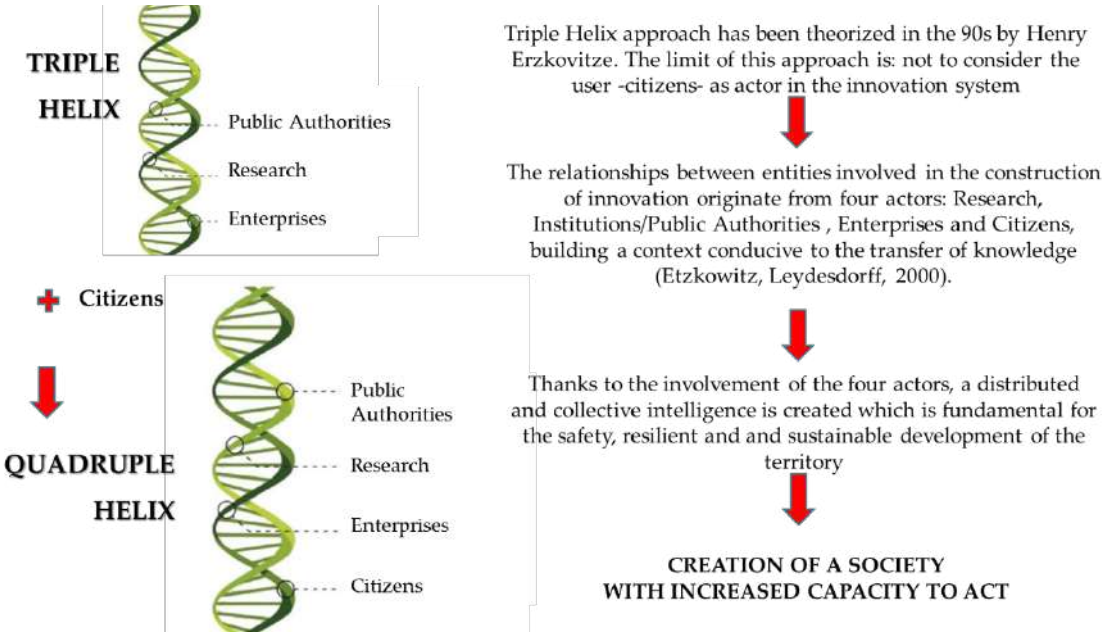


Fig. 1 The concept of Triple and Quadruple Helix for a multi-stakeholder governance resilience process

Among the subsystems, or priority themes at urban level, there is certainly mobility.

During the lockdown phase, the cities were emptied of private means and partially also of public ones. This immobility has been associated with a considerable reduction of harmful emissions into the atmosphere. From May 4, in Italy the phase 2 entered during which partial reopening of some activities is expected. Due to the fear of contagion, the population is moving towards less sustainable modal choices: the use of local public transport will be reduced in favour of greater use of the private vehicle perceived as safer. The expected scenarios are therefore worrying in terms of sustainability.

The subsequent phases foresee a general reopening of the activities. Then in universities, as in the rest of urban areas, to plan strategies to promote sustainable home-university mobility will be essential. Universities are certainly a delicate aspect to manage in pandemic times. In fact, they have an important impact on cities given the number of people who gravitate to them. At this regard, the paper considers an existing good practice in the university setting that can improve system resilience in this post Covid recovery period.

2. The PRINCE project as good practice towards sustainable university mobility

Universities are one of the major attractors / generators of traffic and they have an important impact both on the organization of urban mobility, and on education and behaviour related to the mobility choices of the population. In this regard, in 2017 ISTAT estimated that in Italy about 30 million people move every day to reach their place of study (18.5%) or work (over a third of the population equal to 35.5%). The displacements generated by the school system have a significant impact on the mobility of the area because they are very concentrated in certain time slots. At the same time, the concentration of hours can help

optimize demand. This through the promotion of zero or low emission collective mobility practices such as piedibus, bicibus, carpooling and the correct organization of the public transport service.
Universities can also be an example for modal cultural change, promoting the implementation of practices in favour of green mobility. Universities play a key role in the formation of future generations and in the dissemination of knowledge within society, also with reference to the ability to promote sustainable development, that is, a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Sachs, 2015; Brundtland, 1987).
In addition, schools and universities play a key role in terms of education, facilitating dissemination of sustainable mobility practices for travel every day.
The increase in the sustainability of home-school, home-university (and home-work) travel also improves the liveability and healthiness of the environments around these structures, as well as the safety of the routes themselves by reducing the circulation of private vehicles.
University of Genoa, like others, has joined to the Italian University Network for Sustainable Development, RUS, promoted by the Conference of Italian University Rectors, CRUI, and works through its Commission, Sustainable Unige. The RUS Network is the first experience of coordination and sharing between all Italian universities committed to the topic of environmental sustainability and social responsibility. Sustainable universities are those institutions that transform a precise political choice into a long-term transversal process. This process considers the issues of environmental protection, community well-being, social equity and economic development "in an integrated way". Within the Sustainability Commission there are several working groups, including that of sustainable mobility.
This paper describes a good practice that the University of Genoa is carrying out precisely through its Sustainability Commission. This good practice is PRINCE "AWARDS and INCENTIVES for modal change", a project funded, in 2018, by the Italian Ministry for Environment, Land and Sea Protection as part of the "National experimental program of sustainable mobility home-school and home-work". The project intends to promote sustainable mobility (public transport such as buses, underground, car-bike sharing, bicycles, feet, ...) for students, when traveling between home and university, using prizes / incentives. The general objective of the project is in fact the definition and promotion of incentives/reward/discounts which seek to encourage students to change their choices and behaviour by using clean and sustainable means of transport for urban journeys to go to university.
The PRINCE project involved seven different partners: leader partner is the Municipality of Genoa -Mobility Department - and the other partners are companies related to the world of urban transport, technological companies and the University of Genoa.
The main actions of the project are: analysis of student travel behaviour; the development of new technological systems, with the implementation of ICT tools and the creation of an APP; the definition and implementation of loyalty and incentive policies (Fig. 2).
The innovation introduced in the project is precisely linked to the introduction of incentive policies to change the mobility habits of university students towards more sustainable forms. Changing mobility habits is not a simple process and it is usually forced through the introduction of restrictive policies or structural actions such as expensive parking fee or traffic calming interventions o limitations zone.
The new proposed way to promote urban sustainable mobility instead provides the use of incentive policies as leverage for sustainability. In literature there are few examples of research developed on the topic of incentives. An example in this regard is provided by Petri et Al, who "seek to increase the use of sustainable means of transport in urban areas - to improve air quality- through good mobility practice rewarding or of mobility demand management systems (credit market mobility-tradable mobility credit). and using rewards / incentive as one of the possible solutions" (Petri et al., 2016). Herrador et al introduce other positive

aspects: "The breakthrough of this business model is that it enhances awareness of sustainable mobility practices, increasing their attractiveness as perceived by the stakeholders with diverse benefits; citizens (and indirectly, the municipalities) initiate a new consumption pattern of "coupons culture" linked to sustainable mobility, the urban economy is stimulated, and the use of mobility services grows, providing a new business opportunity Incentive-based and behavioural tools, seeking to encourage consumers to change their choices and actions, are example of additional policy measures that can be taken" (Herrador et al., 2015). In the logic of the project, an appropriate mix of restrictive policies and incentives (monetary and social) based strategies could represent a winning strategy to encourage students to reduce by a significant percentage the mileage made with private cars or scooters in the urban environment, or to switch to other means of transport. This solution presents interesting elements of scalability and replicability in other situations with similar characteristics; for example, for other systematic trips (home-work) that the population usually carries out every day.

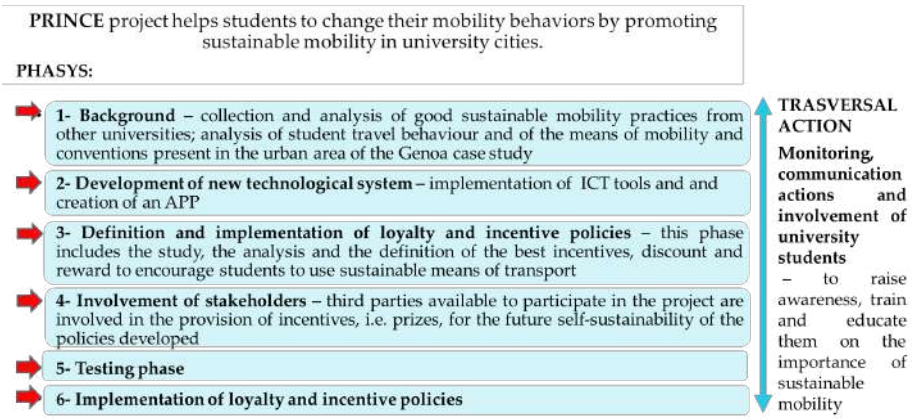
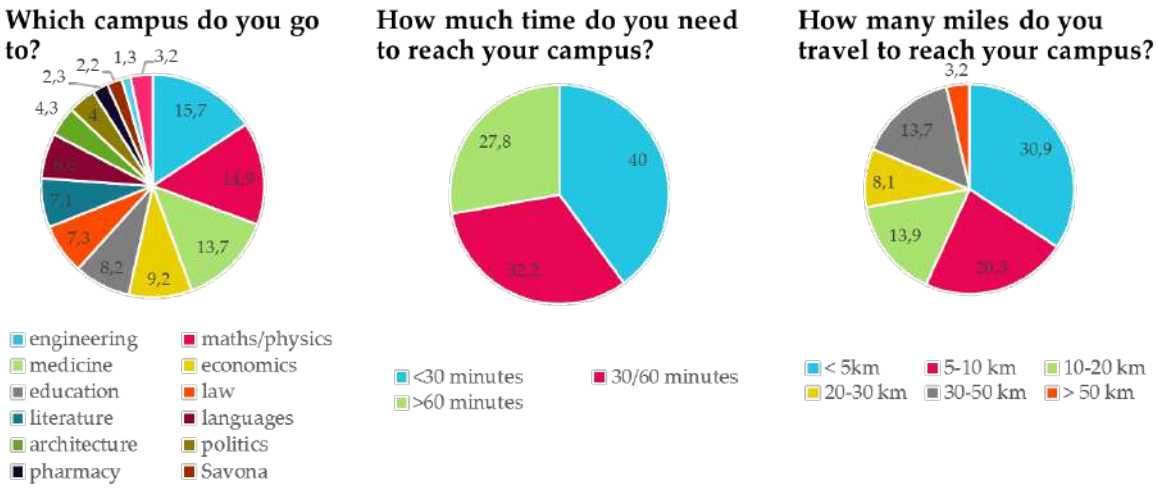


Fig 2 The phases of the PRINCE project

The background phase of the project began with an analysis of the state of the art of good practices developed by other universities in the field of sustainable mobility. Subsequently, this phase focused on the Genoa case study. Initially, by distributing a survey to the users of the university (students, teachers, administrative staff), students 'mobility behavior was analyzed and the students' journey to the campus was mapped. 4,613 users answered the questionnaire, including 4,029 students. The survey asked useful questions to know the direction of the move (neighborhood or municipality of origin and university campus where you go); about the means used, the times and the distance travelled to reach the university (Fig. 3).



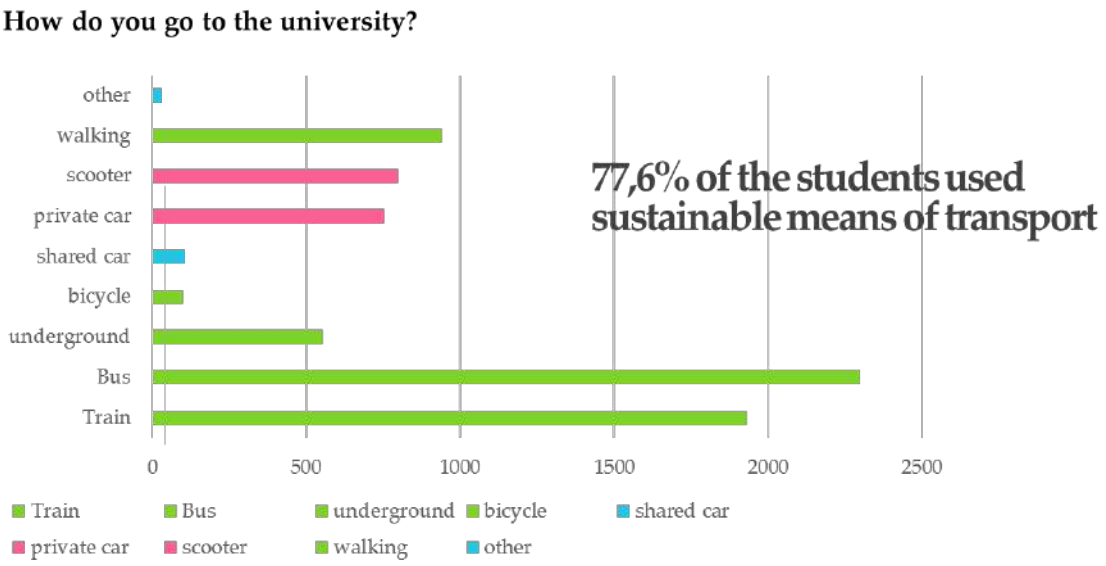


Fig. 3 Answers to the survey: how the Genoa University students travelled before the Covid19 emergency

This initial phase was fundamental to intersect the information obtained and try to understand how the current offer of public transport available and the places of origin (residence) and arrival (University) affect the students' mobility choices. In fact, a close correlation has emerged between these two aspects: Faculties located near the stops of the Metro network or the railway stations are mostly reached using public transport. But even universities without public parking or in restricted traffic areas are generally reached by students with sustainable means. As for distance, the questionnaire showed that the least sustainable students are those who live closest to the faculties (distance less than 5 km) who use the scooter.

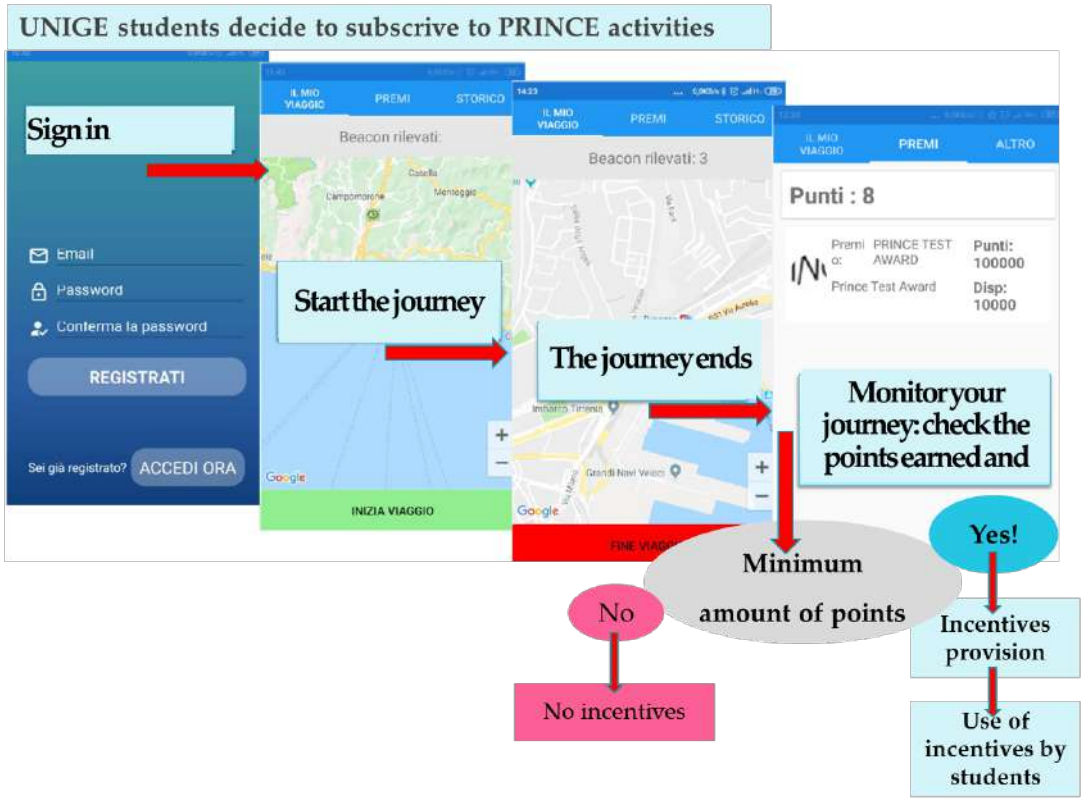


Fig. 4 ICT solutions and incentives approach to support sustainable university mobility

The next phase of the project concerned the design and implementation of ICT solutions for "smart" mobility, created specifically for students' needs in order to encourage and monitor changes in their travel habits to reach the university. Local buses, shared bikes and cars have been equipped with beacons: small devices that allow the control of the location - route -, the duration of the trip and the type of means used. University students are invited to download an App, designed by the PRINCE partners, which transfer their travel information through the beacons connected to a web platform. Thanks to this technology, student's travel from home to University and vice versa is possible to map.
The first two phases are preparatory to that of defining the incentive as a reward. The project, through the involvement of third parties, therefore awards prizes to those who use sustainable means to go to the university. The App, through rules, modifies the information relating to sustainable travel in points that correspond to prizes such as discounts tickets for public transport or for entrances to theatres, museums, coupons, ... In addition, at the end of each trip, on the App the student can view the percentage of CO_2 saved thanks to the use of sustainable means (Fig. 4).
The last activity carried out by the project partners before the health emergency linked to Covid-19 was the test phase in December 2019. This phase was carried out to monitor the functioning of the PRINCE application - detection of beacons and implemented rules -. About a hundred students participated in the test phase who, by filling out a travel diary, helped the project to detect some critical issues that have been solved.

3. University mobility in the post lockdown: a new challenge for the actors of the Quadruple Helix towards a resilient city

Mobility is certainly one of the most delicate issues to manage in the post lockdown. Mobility, at least in the short term, will be revolutionized by significant changes in the modal choices induced by the search for safety from contagion.
In today's situation (i.e. circulation of Covid-19-2), according to the INAIL 2020 classification, the entire public transport system must be considered a medium-high risk environment, with the possibility of higher risk during peak times for metropolitan areas with high urbanization.
A study conducted by Urban Radar analyzed the variations in the use of public transport by combining their data with those of CityMapper, World Population Review, GitHub and Moovit. The European cities analysed are six: London, Paris, Barcelona, Stockholm, Milan and Berlin; (Urban Radar, 2020). The study highlighted how the use of public transport has already decreased before the containment measures came into force, then suffering a sharp fall after the adoption of these measures. The reduction in demand varies, for example, from 60% in Stockholm to over 80% in Milan.
This worrying scenario forces researchers and public administration to try to counter a strong risk that, in terms of environmental sustainability, it can lead to a worsening compared to the already problematic previous status quo.
There are many actions already undertaken in the mobility system for the various means such as sanitation, disinfection and sanitization measures, organizational measures, prevention and protection measures; there are many solutions that have yet to be studied.
In this context there is the problem of university mobility which, especially in phase 3, will see a partial or total reopening of the University. Mobility policies also at university level are therefore necessary to be reviewed. These strategies aim to evaluate adequate home-university mobility policies aimed at not increasing congestion, traffic and pollution at urban level.
Adaptability, as underlined in the first paragraph, does not depend only on the actions carried out by public authorities, but it requires the synergic work of all the actors of a city. The paper introduces the concept of a

Quadruple Helix, where the relationships between entities involved in the construction of innovation originate from four subjects: research, institutions, businesses and the population, building a context conducive to the transfer of knowledge (Etzkowitz & Leydesdorff, 2000). Thanks to the involvement of the four actors, a distributed and collective intelligence is created which is fundamental for the safety, resilient and sustainable development of the territory. This innovation allows the creation of a society with greater ability to act.

Reasoning about the actions that the individual actors of the Quadruple helix can carry out can represent a solution to the approach of urban resilience towards the health emergency. The proposed methodology is therefore based on the proposal of specific actions that each of the actors - Public Authorities, Research, Enterprises and Citizens - can implement within risk scenarios. It can therefore be asserted that the resilience of the urban system is a function of the resilience of the various stakeholders which can mainly be grouped into the four actors of the Quadruple Helix. In particular, the function matured as part of a research developed by Pirlone and Spadaro 2020 is reported:

$$\begin{aligned}&\mathrm{Resilience}_{\mathrm{Urban\ system}}\\&= f(\mathrm{Resilience}_{PublicAuthorities};\ \mathrm{Resilience}_{Research};\ \mathrm{Resilience}_{Enterprises};\ \mathrm{Resilience}_{Citizens})\end{aligned} \tag{1}$$

Reasoning about the PRINCE project (described in paragraph 2), as a good practice that can be exported to other realities, the partnership (Public Authorities, Research, Enterprises) and the beneficiaries (students / Citizens) of the project represent the actors of the Quadruple Helix. They can contribute to increase the resilience of urban mobility through the definition and subsequent implementation of specific actions.

Through the definition of specific actions carried out by each actor, the resilience of university mobility, and therefore to the impact of urban mobility, is possible to contribute to increase. Initially, the project was promoted to change the mobility habits of students who used their own means of transport (such as scooters or cars) to reach university. The unsustainable students of the Genoese university before the lockdown were 25-30%. Following the health emergency, the project has acquired an even more important role since, as already mentioned, the number of students who will use private vehicles will likely grow, contributing negatively to congestion, traffic and pollution of our urban areas.

In this context, to think of new home-university travel plans - post-Covid, differentiated according to distance and temporality, is necessary.

For trips of less than 5-7 km, active mobility (pedestrian and cycle) must be promoted. The municipal administration can, for example, plan and create new emergency cycle paths and infrastructure for cyclists. But universities must provide new safe spaces to dedicate to bicycle parking (racks, lockers, ...). Several examples of emergency cycle paths are under construction in many Italian cities, including Genoa. For journeys of more than 5-7 km, journeys by public transport and the use of peripheral interchange parking lots, compared to the city center, are encouraged. On the part of the local public transport partners: buses, subways, car sharing, bike sharing, ... is necessary to adapt and strengthen the safety systems to guarantee the distance and the hygienic-sanitary controls. A careful planning of timetables, spaces and available means to strengthen intermodality is requested from the Municipality and from the local public transport companies.

The student, the fourth actor in the Quadruple Helix, must prove that he is responsible His responsibility must be manifested primarily in compliance with the rules laid down at national level by the government: reduction of travel, social distancing, mask, ... But just as important is the planning of your travel: times (time of day but also days of the week), selected means of transport (preferably sustainable ones or at least a mix of private and sustainable means).

The home-university travel plan - post-Covid together with the actions described, must consider a temporal reorganization of university activities, such as the planning of lessons in different time slots (in the evening

or on the weekend) can combine environmental, social and economic sustainability with reasonable degree of distance and health security.

The plan, originally in its aims, was created to provide indications on how to activate sustainable mobility practices, alternatives to the use of private cars, such as Bicibus and bike / car sharing. The home-university travel plan - post-Covid represents another opportunity for this policy, seeking to transform a tragic situation into an opportunity.

The launch of the PRINCE project with the involvement of the students of the Genoese University Poles should have started in April 2020. The Covid emergency and the lockdown led to the physical closure of the university structures and therefore to the blocking of home-university travel for students. The project therefore stopped on its principle activities, but other actions are still being developed. Such actions are useful to support the actors of the Quadruple helix in the planning choices of student mobility.

In phase 3, the PRINCE project, through the ICT tools (App and beacons) created and its incentive policy that rewards those who travel consciously, can therefore promote and encourage sustainable mobility in all its forms. The project can be important both to encourage the use of alternative means to the private means (target that following the health emergency has become even more important), and to monitor the use of such means by monitoring the movements of students with the App. This good practice will play an increasingly important role in the return to normality. In this context, the University can also confirm its role not only in training, but also as an important actor in the context of innovation in the cooperation of the Quadruple Helix. Role that opens the University to the needs of the territory, creating opportunities to broaden a public consensus around the issues of greatest interest and urgency, such as adaptation to the health emergency. In this way University can become a laboratory to experiment innovative and participatory solutions.

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Image Sources

Fig.1: "The concept of Triple and Quadruple Helix for a multi-stakeholder governance resilience process" is an elaboration of the authors

Fig.2: "The phases of the PRINCE project" is an elaboration of the authors

Fig.3: "Answers to the survey: how the Genoa University students travelled before the Covid19 emergency" is an elaboration of the authors

Fig.4: "ICT solutions and incentives approach to support sustainable university mobility", is an elaboration of the authors

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Physical spacing and spatial planning

New territorial geographies and renewed urban regeneration policies

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Abstract

After several months of total emergency, many of the countries concerned seem to have the Covid-19 pandemic under control. Measures and policies have been implemented almost worldwide to support the difficult economic and social recovery. The different national systems will be tested in terms of the degree of overall resilience and capacity and effectiveness of actions. In this sense, the reform of local autonomous areas and Regions becomes today even more necessary to start a long and complex process of decision-making and government-level reorganization fostering new relations, in terms of political representation and competences of the different institutional levels.

The responses to limit the impact of the Covid-19 pandemic on the country's growth and development imply a reconfiguration of territorial and institutional geographies. In this context, the discipline of spatial planning can promote some useful reflections at two different scales of intervention: territorial and urban. This study follows these two trajectories, starting from the consideration that the choice of forcing so-called "physical distancing" (better than the ambiguous term "social distancing") has certainly represented one of the most effective ways of contrasting the contagion.

Keywords

Physical spacing; New territorial geographies; Urban regeneration.

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1. New territorial geographies for the relaunch of the country system

In the economic revival of our country, starting from phase two of the Covid-19 emergency, the ability to plan effective strategies and policies that can promote proper use of resources and avoid their waste or misuse will be fundamental, given the huge financial resources that will be made available.

In a country like Italy - in a condition of structural crisis in many sectors, even before the pandemic - we should not delude ourselves about an easy recovery of the country's system.

It will be necessary to put in place a process for successful implementation of interventions aimed at real-time monitoring of outcomes and impacts, and at the implementation of strategies for assessment of the effects produced and, if necessary, for intervention by correcting the plans and programs in a continuous and iterative process.

The reform of local autonomous areas and Regions becomes even more necessary today in order to start a long and complex process of decision-making and government-level reorganization privileging new relations in terms of political representation as well as expertise of the different institutional levels.

How can we not think about the critical issues experienced in our management system especially on occasion of the current health crisis and the consequent initiatives for recovery and exit from lockdown? A revision of the competences and powers shared between the State and Regions (certainly in a deeply revisited organization of the Regions that also looks at the issue of differentiated autonomy) offers an effective way of making the politics and public administration system more efficient and transparent.

A reform of the institutional geography which, starting from a macro-regional reform of the country, looks above all at a new multi-municipal/super-municipal dimension as the intermediate body (from metropolitan areas to internal areas), completing the interrupted process of suppression of the "current" provincial administrations, now emptied of powers, resources and actual political representation functions.

In the Italian context, the pulverisation of municipalities, the hyper-territorialization and the inadequacy of the current administrative network continue to be most likely causes of ineffective and inefficient public policies. Recognition of the interdependence that links the effectiveness and efficiency of policies to the territorial areas to which they refer is a crucial issue, especially within the framework of the government of the territory.

Hence, there is an urgent need to address the problems arising from an overall redesign of the institutional architecture to direct the current territorial and urban dynamics towards more institutional forms and institute instruments of territorial governance that are more responsive to the new challenges to which public action must respond. Therefore, we can imagine new forms and organizational structures for multi-municipal space and, in the case of Territorial Governance, more appropriate planning and management tools for the different territorial dynamics.

It is a matter of configuring a more appropriate institutional framework representing the "hard core" of policies and projects, capable of producing sedimentation and cumulative processes (Preto & Occelli, 1994) while recognizing "variable geometry" strategies, policies and actions (Celata, 2008; Dematteis, 2003,).

In recent years, there has been an increasing interest in these issues; specific research activities[1], starting from the close link between territorial and political areas, proposed experimentation for seeking possible criteria for the identification of multi-municipal areas, functional to the management and implementation of renewed development strategies and processes of territorial rebalancing.

The area of experimentation includes the southern regions of Campania, Puglia and Basilicata[2]. The area of study is of considerable interest for several reasons. These include the presence of border territories where peculiar interregional dynamics are observed as well as the heterogeneity of territorial study contexts; we

[1] The research is widely documented in the text of the authors Pontrandolfi and Cartolano

[2] Calabria has not yet been included for the objective data unavailability that prevented the production of the same analysis carried out for the other Regions.

move from the metropolitan areas of Naples and Bari to the numerous "internal areas" present in each region considered (Fig. 1).

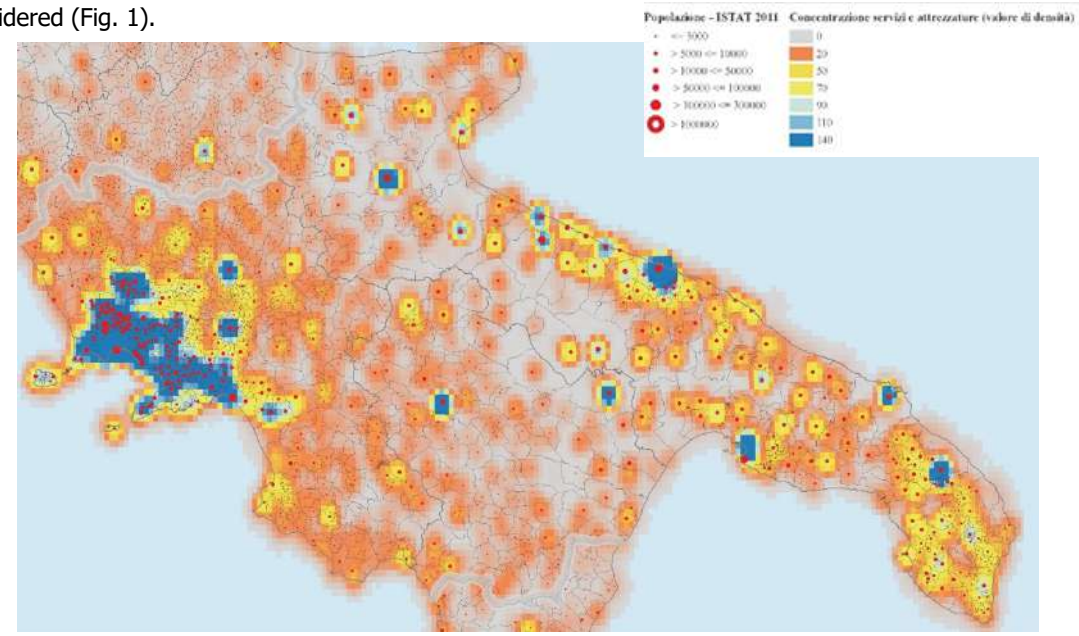

Fig. 1 Concentration map of services and equipment (from grey to blue the increasing intensity of territorial concentration of geolocalised services and equipment)

In light of recent events, it is becoming extremely difficult to ignore the importance of the experimentation topic in terms of physical distance transferred to the territorial scale. That means limiting the population concentration in large metropolitan/urban areas, encouraging instead the stable residence of significant proportion of the population in medium-size centres or even in the most inland villages of the territory, imagining, as we will see below, to structure and consolidate new urban systems able to guarantee a "city effect", also from a perspective of complex territorial rebalancing of functions and services and life and work opportunities.

The identification of preliminary multi-municipal morphologies based on the construction of a cognitive framework in addition to a plurality of information layers (often giving as a result very different organizations and territorial forms): services and accessibility, flows of people and goods, frameworks for planning and territorial districtualizations, physical, ecological-environmental and land use narratives, identity perception narratives.

The present work aims to identify territories that, remaining stable over time, can represent a design and management reference, a background upon which the different actors are placed and interact.

Experimentation is based on proposal of a taxonomy of six different multi-municipal morphologies (Fig. 2): from metropolitan areas (with novel proposed perimeters) to four types of multi-municipal morphologies that are characterized by the different demographic urban pole sizes and a different function involving a larger territory and its neighbouring municipalities (Pontrandolfi & Cartolano, 2019).

The sixth and last proposed multi-municipal morphology refers to areas classified as "rebalancing services" and coincides with the internal areas of the country, classified as peripheral and ultra-peripheral by SNAI (National Strategy for Internal Areas). No urban centres are present in these areas and, therefore, their configuration presupposes and requires, as a priority, policies to strengthen services and infrastructures for mobility to be implemented at the multi-municipal scale.

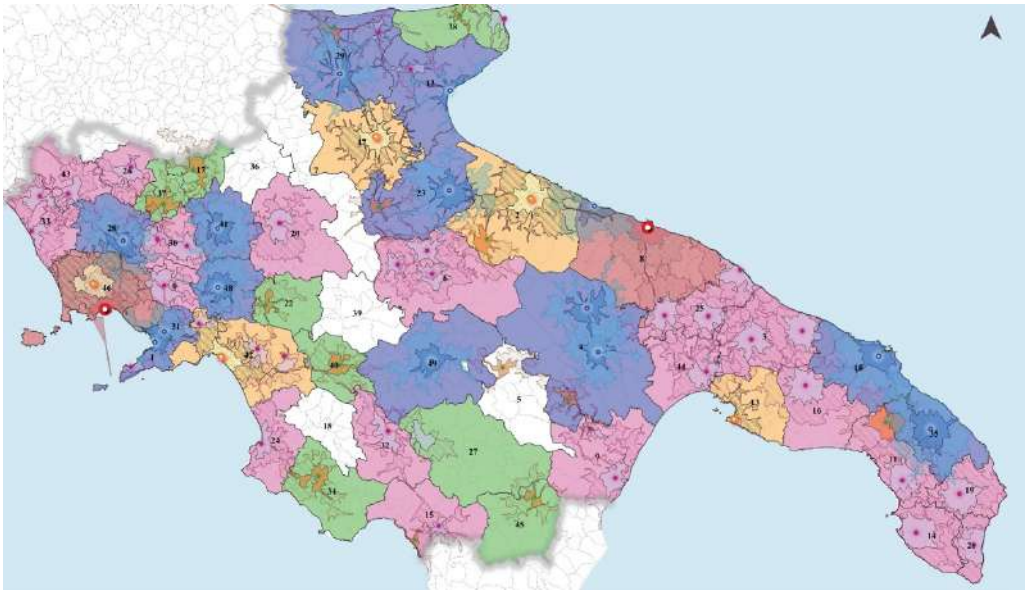

Fig. 2 Map of proposed multi-municipal morphologies (in each proposed morphology the isochrones of the times of accessibility to the urban poles are indicated)

In this last group, complex territorial areas are identified with the presence of several inhabited centres with weak functional relations between them (Parr, 2004). In particular, the centres considered, which generally have a reduced demographic size, should integrate into "city systems" to achieve, together, the so-called city effect, overturning the existing and traditional condition of dependence and gravitation with respect to higher-ranking, often distant, functionally overloaded and hypertrophic centres. This is what is called a "strategy of integration and polarization" (Archibugi, 2002).

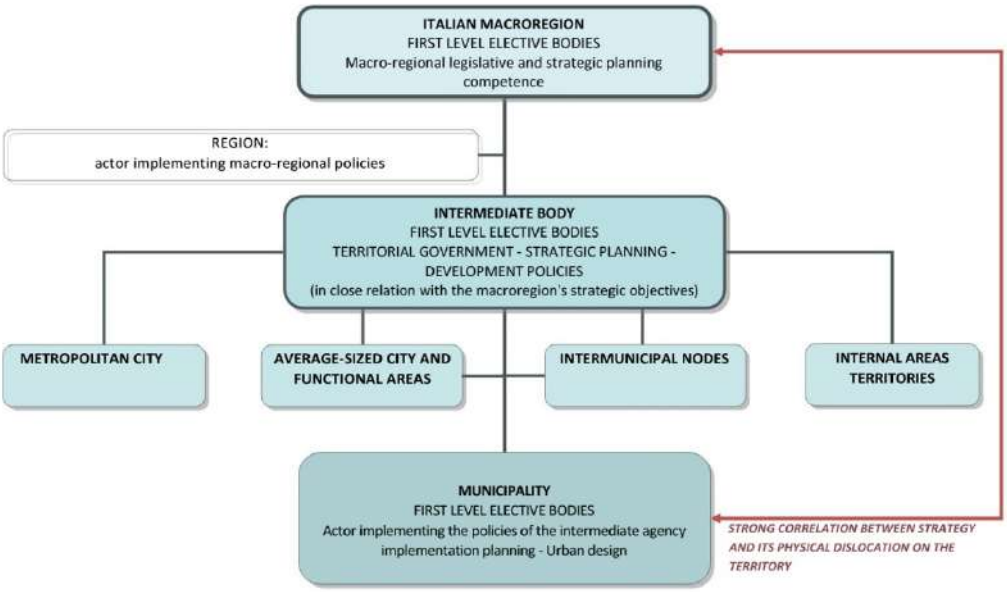

Fig. 3 Proposal for the institutional rearrangement of the country

A networked urban model (Camagni & Salone, 1993) in which the role of a centre does not necessarily depend on its size but also, and above all, on its ability to enter into exchange circuits - not only economic - by bringing its environmental and cultural specificities into play (Fanfano, 2001). Once the mutual accessibility between

the various centres has been verified to be within a maximum of 40 minutes, it is a question of imagining polycentric urban models based on existing potentials in terms of services and equipment.
Especially in the sixth type of multi-municipal morphology, appraisal of the proposal should be assessed through a strongly participatory evaluation process by public and private stakeholders. In this sense, the narrative criteria proposed in the research work could be guiding criteria for local actors (public and private) in a conscious self-recognition of the territories, inspired by the logic of interdependence and complementarity. The proposal to reconfigure the "institutional landscape" (Haughton & Allmendinger, 2008) is therefore characterized by the centrality of the intermediate dimension in its multiple configurations.
Metropolitan cities, supra-municipal aggregations of medium cities and relative belt areas, inter-municipal poles and aggregations of municipalities in internal areas, represent the possible aggregations imagined for the intermediate level.
With reference to the entire national territory, this articulated intermediate territorial dimension is part of macro-regions that are capable of supporting the economic development and competitiveness of the territories (Fig. 3).
In addition to the overall reinterpretation of administrative geographies, functions and competences, there is a need for new instruments of territorial governance (Fig. 4), flexible forms of planning, adaptable to the spaces to be governed (Allmendinger & Haughton, 2007).

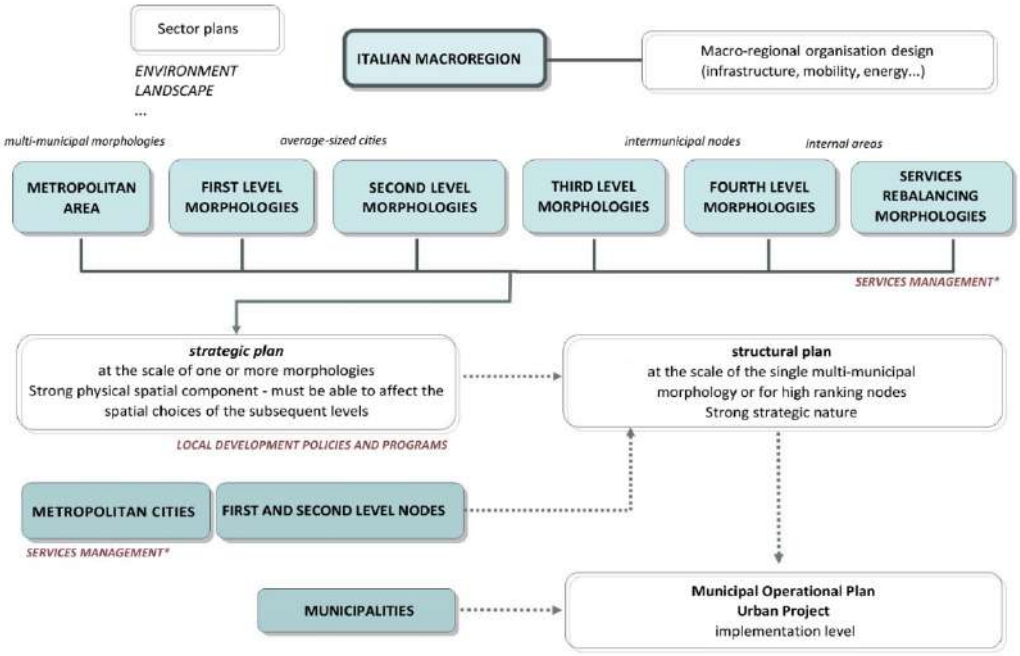

Fig. 4 Morphologies and territorial planning and governance tools

In particular, it is desirable that a deep and different conception of the strategic-structural dimension of the plan is fostered, envisaging a strong connection between programming and planning at the supra-municipal scale.
On the one hand, forecast of a strategic tool, possibly developed at the scale of several inter-municipal organisations, should enshrine the local development project, bring coherence to the various sectoral policies and have a strong spatial component for the operational translation of strategies.
On the other hand, each intermediate organisation should be responsible for drawing up the inter-municipal structural plan in full coherence with the strategic vision, possibly drawn up at the scale of several intermediate

aggregations. Finally, the Municipality, individually or associated, has the task of proceeding with the programmatic and operational translation of the choices made[3].
In this context, a reconfiguration of territorial and institutional geographies is essential for the responses implemented to limit the impact of the Covid-19 pandemic on the country's growth and development. The discipline of spatial planning can promote some useful reflections at two different scales of intervention: territorial and urban, starting from the consideration that the choice of forcing so-called "physical distancing" has certainly represented one of the most effective ways of contrasting the contagion.

2. Reshaping the territory and the question of inland areas

Nowadays, what does it mean to interpret the theme of physical distance in light of the functional organization of our territories and cities? What does it mean to imagine the slowing down of the progressive and accelerated urbanization of the population? Under what conditions is it possible to imagine that significant proportions of the population might prefer to live and work in the country's small, depopulated villages, using (currently present only as rhetoric statements) innovative forms of "agile work" and services mainly provided through the new communication technologies?
In Italy there are 7,998 municipalities; 5,585 of these are small municipalities with a population below 5,000 inhabitants and represent 70% of Italian municipalities. The territorial surface area of small municipalities represents more than 50% of the entire national territory and these places count more than 10 million inhabitants, 16.59% of the Italian population.
Municipalities are defined as "small towns" or "small villages" with reference to the number of inhabitants, territorial extension or the presence/absence of functions and services of daily living.
Currently, there are three types of minor villages in Italy:

- inhabited villages, already included in processes of valorisation;
- villages at risk of abandonment, for which it is necessary to launch a strategic policy for local development;
- villages now abandoned for some time, for which numerous investments are needed to start regeneration[4].

Nowadays, most of these small places suffer from depopulation and progressive physical and social degradation. Their recovery plays a crucial role in regulating economic and social aspects that can link the new generations to the local territory and attract new residents. In this sense, the proposal to re-inhabit small villages may decongest the large urban centres and at the same time promote physical distancing of the population across the territory. Considering the recent health emergency, this perspective appears to be an adequate response to the foreseeable effects and the new conditions.
The past decade has seen the development of the aforementioned perspective in some interesting initiatives trying to reinterpret the role of the minor and marginal centres of the peninsula.
In 2017, Anci promoted the "Counter-exodus Agenda" to reverse the migration flow. It attempted to attract new families to non-urban areas, namely internal, peripheral, rural and demographically small areas, that can become highly attractive by offering a certain level of quality of life.

[3] The proposal involves overcoming the experience of the so-called associated plans that often take the form of mere sum of the choices of individual municipal administrations. In fact, in view of the Delrio reform, an associated plan, even if referring to a very large territory, always remains a municipal-level plan if it cannot highlight super-municipal issues but only local interests. It is not a question of size or technical expertise, but of the approach to the topics of a larger area, requiring a cultural and methodological change.
[4] http://community-pon.dps.gov.it/areeinterne/postignano/

On September 30, 2017, the Parliament approved Law no. 158, "Measures for the support and enhancement of small municipalities, as well as provisions for the redevelopment and recovery of the historic centres of the same municipalities". The measure aimed to support and enhance the value of small municipalities and made available a multi-year budget from 2018 to 2023[5].

To date, over two years after the law's approval, there have been no significant initiatives for its implementation. In fact, there are still major critical issues, such as the lack of approval of the implementing decrees and the inadequacy, compared to the size of the problem, of the allocated financial resources.

There is the need for a National Plan for the requalification of small municipalities, giving priority to the recovery, requalification and safety of buildings and the maintenance of the territory.

Perhaps the best results are being achieved with implementation of the programmes within the so-called National Strategy for Internal Areas (SNAI), started in 2014, significantly by using the resources earmarked by European Union programs.

The main strategical objectives are to improve essential services accessibility, enhance the population's quality of life, increment the rate of employment, increase the use of territorial capital, reduce the social costs resulting from inadequate and unsustainable anthropization processes and foster local development (Borghi, 2017).

In particular, the projects involve protection of the territory and local communities, enhancement of natural and cultural resources and sustainable tourism, agro-food systems and local development, energy efficiency and local renewable energy supply chains, know-how and craftsmanship[6].

Thus, the projects aim to revitalize the internal areas by investing in economic initiatives to retain young people that are still residents as well as to attract new people[7].

The attractiveness of the territories is increased not only by the relaunch of local economies but also and above all by a comprehensive reorganization of basic services, to ensure an acceptable quality of life for both new citizens and current residents.

In fact, the marginalization of internal areas is mainly due to poor accessibility to services. The actions to be implemented must include the reorganization, in an inter-municipal dimension and in a perspective of complementarity of the services offered by each urban centre, of the supply of services by improving the time and methods of commute within the areas concerned and from these towards the higher-ranking external centres.

Only in this way will it be possible to define the size and location of individual facilities based on adequate demand, so as to guarantee high levels of quality in the provision of services and above all an acceptable economic return in the management of the offered services.

Interventions in favour of mobility and local public transport and the innovative reorganisation of the basic services network (health and education in particular) become strategic in this perspective[8].

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5 Municipalities characterized by hydrogeological instability, economic backwardness, strong demographic decrease, inadequate housing, inefficiency or absence of essential citizenship services and a long distance from major urban centres can benefit from the loans granted.

6 http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/Aree_interne/Strategia_nazionale_per_le_Aree_interne_definizione_obiettivi_strumenti_e_governance_2014.pdf, *Strategia nazionale per le Aree interne: definizione, obiettivi, strumenti e governance*, p. 44.

7 In this sense, a serious relaunch of the reception policies of migrants in the municipalities of the internal areas should not be underestimated, reinforcing the reception and integration projects started in the recent past by initiative of the State, Regions and many Municipalities.

8 Speaking of the new government approaches to be adopted after the disastrous effects of the latest health emergency, it is necessary to reorganize the national health system. In internal areas, for example, the use of hospitalization is high even for interventions that do not require such an intervention method. It is necessary to invest in territorial assistance distinguishing the management of emergencies from the management of diagnostic services; rapid interventions must be guaranteed and the healthcare service should be brought closer to patients (health houses, telemedicine, home care). As part of the health services, the Strategy introduces innovative interventions such as: family and community nurses, the development of telemedicine, the creation of health points where, in associated form, various services are provided and integrated with home care.

In such an approach, particular importance is given to information infrastructures to favour the diffusion of new technologies on the territory; in fact, only with highly innovative methods will it be possible to guarantee living conditions and quality of services that are competitive with what is presently offered in urban and metropolitan contexts.
All this will help transform the very definition of marginality for "internal areas", defined as the distance of a community from access to basic services. But the role of digital technologies is not limited to the effects on the concept of marginality; on the one hand, they can open the doors to new strategic development assets and on the other hand, they can directly affect the geographical and spatial configuration of territorial systems "relevant" for the launch of realistic local development policies.

3. Regenerate the existing city: an opportunity

At the urban scale, how to conceptualise the theme of physical distancing? Is it possible to imagine models of life that do without the undoubted advantages and opportunities that only social concentration favoured by high population density in metropolitan areas can guarantee? Is it possible to hypothesize tout court the rarefaction of urban settlement and a gradual further population growth of the open territory as some authors already claim? What does it mean to inhabit the countryside for 21st century man in terms of quality of life, employment opportunities and social relations? Who could afford such a settlement and housing model and at what individual and collective costs? In all this, can we still think of drastically limiting (as at least in Italy an attempt has been made, in truth without success) further land consumption?
A possible alternative to a policy of further settlement dispersion is the radical adaptation of the existing urban structure. It is realistic, in fact, to effectively address the issue of physical sprawling by intervening first of all on the gradual redesign of existing cities.
The housing emergency ensuing after the Second World War was determined primarily by urbanization and demographic growth, and was addressed mainly through a quantitative response, with little attention to the qualitative aspect of the built environment, generating peripheral built-up areas often without adequate urbanization works and essential services.
A considerable percentage of residential buildings built in those years have now exceeded their performance efficiency limit, both because of the degree of widespread obsolescence and often because of the lack of maintenance interventions necessary to combat their unstoppable degradation. From the processing of data, mainly from ISTAT sources, it is estimated that in Italy 70% of residential buildings are over 30 years old, while 55% are over 40 years old, a time limit beyond which substantial maintenance interventions are essential.
This comprises an asset of about ten million dwellings that, often, not presenting acceptable performance qualities, have also lost a significant part of their economic value. In this sense, the residual economic value inherent in existing cities becomes crucial to defining economically and socially sustainable urban regeneration processes (Micelli, 2014).
An in-depth examination of the methodological aspects underlying credible urban regeneration policies and the recovery/optimization of the existing building stock is of particular interest today, also with reference to some policies that the government intends to promote after the health emergency of recent months for the economic revival of the country.
Fiscal incentive policies to support the building sector are aimed in particular at favouring interventions for the recovery and efficiency of the existing building stock.
The opportunity offered is particularly interesting because it is linked to the effective possibility, for all property owners, to transfer to third parties the tax credits granted by the State for each property unit. In this way, it

is possible to carry out recovery and efficiency improvement interventions also in the case of multi-family buildings and condominiums.

Such an opportunity, however, should not be wasted with respect to the need for a more widespread and articulated rethinking of the physical and functional assets of our cities. The risk is to carry out an indiscriminate recovery of the existing building stock. On the one hand, an effective economic evaluation of the convenience of the recovery is necessary, as opposed to building replacement. On the other hand, it is essential that an assessment is made of the need for more radical interventions that also affect the form and organization of the parts of the settlement system, imagining more comprehensive urban redevelopment interventions that can significantly contribute to urban quality: from those more directly related to the housing heritage to those related to equipment and infrastructure, and finally to the ones relating to the perceived and environmental quality of the urban space.

It is necessary to imagine selective ways of recovering the existing building heritage and redeveloping the current urban structure, in order to assess the complex system of economic and procedural advantages that guide the selection of interventions and the choice of priority urban areas on which to concentrate public and private financial resources, urging and encouraging the widespread real estate to take advantage of tax benefits. In some cases, it is a matter of promoting complex regeneration projects that can include partial demolition and reconstruction of the existing building heritage when it is not convenient to intervene on the overall structural and functional retrofitting of the buildings.

Relevant and targeted cognitive analyses in different contextual situations, from the building scale to the urban scale, are the precondition to promoting widespread and effective processes of regeneration and redevelopment of existing cities.

The issue revolves around defining interventions for the gradual replacement of large parts of existing cities, which, even with appropriate relocation of the necessary portions to be rebuilt, earmark, for example, large recovered areas for urban green areas for social agriculture within urbanized areas, or envisage the construction of centres for new neighbourhood equipment fostering pedestrian or bicycle mobility.

Interventions on existing cities find in physical planning the methods and tools to coordinate and direct the policies of urban regeneration; in this sense this discipline needs to reflect on redefining methods and tools for city planning and design, also consolidating interesting experiences that, in recent years, have developed in our country[9].

For example, it is interesting to recall here the research experience carried out in some urban contexts by the Sustainable Cities and Towns Observatory of the Interactive Territory Department of the Polytechnic Institute and the University of Turin[10], and, in particular, the development and testing of an index for the quantification of the degree of environmental quality of urban residential space, namely the space constituted by housing and basic services[11].

The residential space serves families most directly and represents a large part of the urbanized territory. Thus, an index that measures its quality is sufficiently representative of the quality level of the urban environment that hosts the daily life of the population. Experimentation with the proposed model started from this assumption. For each single land unit (buildings and appurtenant areas), indices were generated considering the characteristics of the land unit itself, the characteristics of its urban context and the offer and accessibility of the social services actually used by the citizen.

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9 With specific reference to the relationship between health and well-being and urban planning tools, see also the experience promoted in recent years by part of the Association of Municipalities of the Bazzanese area in Emilia in preparation of the Municipal Structural Plan and Operational Plans.

10 With particular reference to the studies and research carried out by the working group coordinated by Prof. Carlo Socco.

11 An interesting investigation of residential quality indicators was performed in the Municipality of Reggio Emilia.

Finally, the overall quality index of residential space is the weighted sum of the different quality indices of: living space in the strict sense; service space; the environmental context perceivable from the dwelling; the basic social services and the home-basic social services pathways.
Mapping of the values of the overall index (or even of the partial specific indices) for the different land units allows identification of the areas of intervention and of the type of intervention, also implying a more direct interaction with the citizens concerned. Subsequently, it is possible to proceed to urban planning by areas of intervention and to perform a pre-evaluation of the changes induced by the project, repeating the calculation of the index for the project configuration. Based on a detailed design, different intervention alternatives can be formulated in terms of performance by measuring their effectiveness (environmental quality improvement effect) and efficiency (cost of the intervention compared to effectiveness). The evaluation of the different alternatives necessarily involves, also in this case, the citizens concerned.
For evaluation of the quality indexes of the individual residential unit (single-family or multi-family), availability of the so-called building dossier or specific information on the construction characteristics and on structural and plant engineering adequacy of the building structures becomes fundamental.
The complexity of urban redevelopment and building recovery operations at the scale of parts of the city could be addressed by relaunching STU's organizational form (Società di Trasformazione Urbana – Urban Transformation Society), with its ability to ensure effective coordination between public and private. The promotion of a STU would allow the Municipality to maintain the administrative control of the initiative and, at the same time, to entrust a public-private entity with the direction and coordination of all the operations foreseen by the urban transformation and regeneration process.

4. Conclusions

Given the huge resources that will be available in the economic recovery phase after the health emergency, it will be necessary to plan effective strategies and policies that can encourage the proper use of resources and avoid waste or misuse.
Such a condition is not to be taken for granted in a country like Italy that already showed evident system inefficiencies and a ten-year delay in the definition of structural reforms capable of supporting a new model of social and economic development.
In particular, it is extremely difficult to ignore the existence of the need to match policies and intervention programmes with a "fair and relevant" territorial dimension, consistent also with the different institutional levels of government, in order to make effective use of the considerable financial resources that are expected to be made available for the economic revival of the country.
Reform of local autonomous areas and Regions becomes today even more necessary to start a rearrangement of decision-making and government levels. The process can create new relations in terms of both political representation and of the competences of the different institutional levels.
Recognition of the interdependence that links the effectiveness and efficiency of policies to the territorial areas to which they refer is a crucial issue, especially within the framework of territorial government.
From a more strictly academic perspective, we must also note that among the lessons learned from the recent health emergency, physical distancing has certainly been effective in containing spread of the epidemic. So effective that some authors see its possible future implementation, in a stable form, even when the current emergency will be overcome, and as a preventive measure to deal with other possible future emergencies.
Physical distance can become an interesting goal to pursue also in the planning and design of cities and territories. For example, limiting accelerated urbanization phenomena in large urban centres and metropolitan areas means making attractive those territories and urban centres that presently are more marginal and peripheral, favouring the demand for both return and new housing. In order to make even the most internal

territories an attractive alternative to large urban concentrations, it is necessary to imagine new territorial and institutional geographies in which, starting from a more effective organization of citizenship services and accessibility conditions (internal and external), it is possible to imagine the implementation of sustainable and concretely implementable economic development paradigms.

In this sense, internal areas are contexts in which it is possible to launch new initiatives, foster new economies and create new centralities thanks to technical, social and administrative innovations (De Rossi, 2018).

For example, considering the new conditions imposed by the health emergency, why not intercept the new demand for "proximity" tourism by further developing the forms of slow tourism, as an alternative, for example, to the mass tourism typical of some more mature tourist resorts in our country? Small municipalities and inland areas could revive through projects capable of re-creating community bonds and reactivating the local economy. In a country like Italy, which has a significant part of the world's cultural heritage, such prospects for promoting the territory take on even more particular significance. In fact, the depopulation and abandonment of the internal areas of the country would represent the irreversible abandonment of a significant part of our cultural heritage present not only in the so-called art cities, but often widespread in territories also characterized by significant natural resources and distinctive landscape features.

At the urban scale, economic and productive recovery should be based on the spread of urban regeneration practices with particular reference to the recovery and efficiency of the existing public and private building heritage.

Awareness of the collective costs linked to the further consumption of agricultural land is the premise for policies that, at national and local level, promote the redevelopment of the already urbanised parts of the territory.

Recent laws and regulations strongly encourage the recovery and re-functionalisation of existing buildings. However, a careful evaluation of what is actually worth recovering is necessary, in terms of the effectiveness of the technical interventions and the economic convenience of the intervention, but also in relation to an effective revaluation of the value of the recovered real estate assets.

In many cases it will be appropriate, on the basis of specific programmes of broader scope, to promote complex urban regeneration interventions that also include demolition and reconstruction of the existing obsolete building stock for which it is not convenient to provide a structural and functional retrofit of existing buildings.

The relaunch of the country's economy after the health emergency of recent months must look to the development of highly innovative sectors and policies that, also from experience, point to a real and widespread implementation of the paradigm of sustainability.

Indeed, regeneration processes are underpinned by the compliance with criteria of environmental, social and economic sustainability. In particular, environmental sustainability must be pursued through strategies acting on the transformation of urban spaces, reducing the consumption of new land, increasing the resilience of existing urban structures, i.e. reducing its vulnerability to possible natural events or environmental changes.

From this point of view, promoting interventions to replace the building heritage that it is not convenient to recover could, within the context of more elaborate projects on the urban scale, also favour a greater physical distance between activities and functions to be relocated across the territory.

We are certainly facing the prospect for numerous potential changes, even radical ones, which will certainly affect the disciplines of territorial and urban planning and design.

More generally, however, regarding the different sectors within which action will have to be taken in the coming months, it will be necessary to promote profound reforms of the country’s system so that significant results can be produced within a short time.

As with many other events, there is the risk of essentially returning to the previous conditions of normality, missing the great opportunity to proceed rapidly with deep innovation processes underpinned by economic

and social policies and, above all, by the methods associated with public administration and representation of collective interests.

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Image Sources

Fig.1: Concentration map of services and equipment (Pontrandolfi and Cartolano, 2019)

Fig.2: Map of proposed multi-municipal morphologies (Pontrandolfi and Cartolano, 2019)

Fig.3: Proposal for the institutional rearrangement of the country (Pontrandolfi and Cartolano, 2019)

Fig.4: Multi-municipal morphologies and spatial planning and governance tools (Pontrandolfi and Cartolano, 2019)

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Megacities facing Covid-19 pandemic

How to use urban spaces in Tehran after the new pandemic

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Abstract

The first cases of Covid-19 occurred in the winter of 2020 in Wuhan-China. The distinctiveness of the new pandemic is that it has occurred in '20th century megacities, cities with a large population who use the city as their second home during the day to commute to work, socialize & etc.

After the emergence of Covid-19 in February 2020 in Iran, and its capital city, Tehran, new restrictions and rules were put on the way citizens of Tehran were to use their city and its public spaces. These restrictions limit the use of these spaces to a great extent and it seems like these new limitations are here to stay for an unpredictable amount of time until a new medicine or vaccine is found.

The main questions here are: How can the threat of this new pandemic in cities be reduced and controlled in the future? And how can urban spaces be used from now on? In this paper, the new ways people are using the city in Tehran after arrival of the pandemic have been studied and suggestions for guaranteeing the safety of urban spaces from now on have been discussed.

Keywords

Covid-19 Pandemic; Megacities; Urban spaces; Physical distancing; Tehran

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1. Introduction

As of March 11th, 2020, the World Health Organization (WHO) declared the novel coronavirus disease (Covid-19) a global pandemic (UNDP,2020). A pandemic is a disease epidemic that has spread across a large region, for instance multiple continents or worldwide, affecting a substantial number of people (Hickok, 2002). The coronavirus Covid-19 pandemic is the defining global health crisis and the greatest challenge the world has faced since World War Two. Since its emergence in Asia late last year, the virus has spread to every continent except Antarctica. Cases are rising daily in Africa, the Americas, and Europe.

Countries are racing to slow the spread of the virus by testing and treating patients, carrying out contact tracking, limiting travel, quarantining citizens, and cancelling large gatherings such as sporting events, concerts, and schools. The pandemic is moving like a wave, one that may yet crash upon those least able to cope.

But Covid-19 is much more than a health crisis. It is a *health-social-economic* crisis. By stressing every one of the countries it touches, it has the potential to create devastating social, economic and political crises that will leave deep scars. Dozens of the world's greatest cities are deserted as people stay indoors, either by choice or by government order. Across the world, shops, theatres, restaurants and bars are closing. Every day, people are losing jobs and income, with no way of knowing when normality will return (UNDP,2020).

In Iran, the first cases were officially announced on February 19 in the city of Qom. As of May 3rd, 2020, 212 countries have reported a total of 3,497,006 cases with 244,874 deaths. Along with China, USA, Italy, Spain, UK, France and Germany, Iran has been suffering the hardest burden of the Covid-19 outbreak. Today, in Iran, 96,448 Covid-19 cases have been reported with the total of 6,156 deaths. Worse still, Iran is struggling with the double burden of political sanctions to provide life-saving medical equipment and medicines to combat the emergency (Worldometers,2020). In Iran the disease epidemic began in the city of Qom and spread quickly throughout the country; Tehran, the capital city of Iran, was hit badly by the virus due to its population density and high concentration of many important industries, jobs and offices in comparison to the rest of the cities in Iran. Ever since the declaration of the spread of the disease in Tehran, many limitations have been put on the presence of citizens in public and urban spaces.

In other words, the way these spaces have been used has changed to a great extent, a change that may be present for an unpredictable length of time. The main way this new disease can be spread is through 'respiratory transmission' (person to person). There are also findings suggesting that the virus could be left on surfaces and stay alive for hours and even days, therefore it can be transmitted indirectly to some extent as well. Based on the virus's mode of transmission, which makes it highly transmissible, new measures were taken by the government to put restrictions and bans on the way people use the city during this pandemic.

Although the outbreak of Covid-19 is slowing down after almost two and a half months of placing restrictions and *physical distancing (social* distancing) in outdoor urban spaces, given the virus's mode of transmission there is still the fear of 'rising numbers of new cases' by reducing the restrictions in place. An additional concern relates to a potential rise in numbers in Autumn 2020 due to the start of the colder season, although the relationship between this disease and the seasons and temperatures has not yet been fully confirmed. This fear has resulted in precautions being taken that must be applied until a new vaccine or a type of medication is made available.

The main questions here are: how can the threat of this new pandemic in cities be reduced and controlled in the future and how can urban spaces be used from now on. In this paper, the new ways people are using the city in Tehran after arrival of the pandemic have been studied, and suggestions for guaranteeing the safety of urban spaces from now on have been discussed.

1.2 The city of Tehran facing Covid-19 pandemic

Tehran is the capital of Iran and of the Tehran Province. With a population of around 8.7 million in the city and 15 million in the larger metropolitan area of Greater Tehran, Tehran is the most populous city in Iran and Western Asia and has the third largest metropolitan area in the Middle East (after Cairo and Istanbul). It is ranked 24th in the world by the population of its metropolitan area (Madanipour,2016), (Fig. 1).

Fig.1 Tehran's geographical location in Iran

Since the beginning of the pandemic, although there is no official lockdown in any cities yet, as in China and Italy, traveling in and out of Iran's 36 provinces and cities is restricted. This travel ban includes cities like Isfahan, Shiraz, Yazd, Gilan, Mazandaran, Kish Island. The authorities have taken various measures like closing schools, universities, theatres, and even parks and outdoor recreational spaces, putting public religious ceremonies on hold and urging people to stay at home and not leave for unessential activities. These restrictions were put in place on February 21st, 2020 as first cases were found and went on for about 8 weeks. During this time, almost all the streets and public places were empty. People on the street, buses and supermarkets were asked to wear a face mask, disposable gloves and to keep a physical (social) distance of about two meters. After two and a half months, as new cases numbers began to drop, authorities began to lift restrictions step by step, along with imposing new precautions for using the city streets and spaces. One of the recent ones are protecting taxi and bus drivers with special shields that separate the driver from the passengers, while passengers are asked to stand or sit following the appropriate distancing on trains and other public transportations (Fig. 2).

As for appearing on the streets, squares, parks and other outdoor and indoor spaces, people are required to cover their faces with masks, wear gloves and keep their hands clean at all times (Fig. 3). What is missing are methods to help guide citizens to keep their distancing on the streets and sidewalks. And the major issue is population density in this megacity. As public places are being opened up to citizens of Tehran, streets are getting crowded, therefore distancing is becoming more difficult. So as can be seen so far, in Iran and other countries, based on the knowledge that has been gathered about the virus and the way it is transmitted, authorities of the countries involved, and also citizens themselves, have come up with ideas and methods to protect lives against the virus in this short space of time and to so far somehow be winning the battle with this invisible enemy.

Fig.2 Passengers of public transportation and drivers must wear face masks and keep the safe physical distance

1.3 Conclusion and suggestions

To conclude, t can be claimed that rules and restrictions have gradually formed with the passing of time, it is in human beings instinct to defend themselves against a biological enemy. These methods, rules and restrictions, although preliminary and impetuous, have been quite successful so far, therefore it can be suggested that:

- These rules should be maintained and even developed into planning strategies, principles, design methods & etc;
- Since this disease has been predicted to stay on the planet for quite a while, it is a good time for experts to establish fixed rules and restrictions after the first decrease in numbers of the disease so that the next time it arises, it will be easier to use public spaces and the city, without having to lock down people in their homes and to shut down businesses which imposes a great economic and social burden on people;
- In order to keep physical distancing on streets and footpaths and parks , the right distances must be marked with color or any urban elements to help citizens find the places to stand or do exercises outdoor or even to stand for a chat with a friend;

  If Covid-19 is categorized as an environmental contamination, it can be seen how fast a contamination in one corner of the world can be spread to other parts pf this planet. Many environmental contaminations spread through out the world via oceans and air, but since they are not visible or because they don't harm human beings directly, they are not taken into consideration. Now that this contamination (if

considered one) has aimed at human life directly, the way a contamination can be spread through out continents, can be seen more easily. It is a good time to attract the attention of the leaders of the world to environmental issues especially climate change. More research must be done on the reasons of the occurrence of this pandemic. The relationship of this pandemic and climate change must be further studied and if proved, actions must be taken as quick as possible to help save this planet for future generations.

Fig.3 Due to large population living in Tehran, after removing restrictions, the city streets and spaces is once again croweded with people which makes it quite difficult to keep the safe distancing with others

- What this crisis has highlighted is the importance of public health in megacities. Major healthcare reforms must be done by local government, but institutionalization of public health measures in urban planning practices must also be considered. An example would be that hand sanitizers must be provided in all urban areas such as entrances to shopping malls and public restrooms. Face masks and disposable gloves must be provided at low prices and even for free in different parts of the city, most importantly at metro stations and on buses. On the whole, keeping public spaces clean at all times, washing and cleaning buses, metro stations, parks, sidewalks and all types of public places with special sanitizers, must be done on a regular basis for an unlimited time;
- One of the most important changes that could be made to cities would be to introduce more greenspaces, which help purify the air and absorb better light, and to also provide a sanctuary for citizens to have access to outside spaces during lockdown times, for spiritual and mental needs and also to use for exercising. It is clear that, even in these green areas, guides to help citizens with the required distancing must be included either by colors on the ground, or by planting a special tree at every correct distance or by signs. These greenspaces will be multi-functional, not only people but the planet will benefit from them;
- As in social resilience studies, the most vulnerable group of citizens facing climate change or any natural disaster are the poorest. In this pandemic, again, they are the most vulnerable because they lack adequate means of sanitation or even a place to stay safe. Locating these groups of citizens and making sure they are staying safe and healthy is very important. Many of these citizens have been reported to have had Covid-19, and to be living outdoors with no shelter.

On the whole, this pandemic has many sides to it: as stated above, it is a social-economic-health and even political crisis, so actions need to be taken on all these fronts to help address this issue. Pandemics rise, spread and disappear, as has been the case throughout history, but in return they can help change cities for the better. Strengthening urban pandemic preparedness presents an opportunity to improve global health and urban resilience and sustainability.

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Image sources

Fig. 1: Google n.d., 2020

Fig. 2: Google n.d., 2020

Fig.3: Google n.d., 2020

Author's profile

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Rethinking rules and social practices. The design of urban spaces in the post-Covid-19 lockdown

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Abstract

In the last months a pandemic has changed the daily life of billions of people. Among the efforts to reduce the impact of the disease, social distancing has had huge consequences and raised may concerns, from the inadequacy of contemporary urban design to the social inequality of national and regional lockdown. This paper focuses on the consequences that this experience is having on the design of urban public and private areas. Everybody admits that our cities are going to change but, beside the first quick adaptation to social distancing, it is unclear how to rethink today's urban areas. We start from our previous work on the classification of architectural rules and on the study of how creativity is expressed via architectural rules, to discuss the principles and social aspects of newly proposed designs. The motivation for this analysis is to investigate and raise awareness of the consequences of changes in social practices: given that we are in need for new structures and service organization, we can still make choices and should balance the positive and negative aspects of these design alternatives. The community should be aware, as much as possible, of the intrinsic forces that novel solutions exert on our social system and urban environment.
This work shows just one way to analyse architectural design, and should be considered as a contribution to a much needed broad and inclusive discussion about how we want urban spaces to be.

Keywords

City; Architecture; Rule; Ontological analysis; Social practice.

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1. Introduction

The recent Covid-19 infection has disrupted our everyday world at many levels. It has forced people to stay home, to transform home space into office space, to learn to substitute physical contact for virtual protocols, to avoid relatives and friends for mutual safety, to go out for emergencies only, and so on.

Listening to technical and medical experts (Lichfield, 2020) and to comparable historical cases (Knobler, 2005; Spinney, 2017), the end of the Covid-19 emergence will likely not mean to return to normal life, at least not in the sense 'normal' was understood in 2019. First, our social system is today very interconnected and offers diseases an ideal environment (compared to any other period in history) to spread quickly. Of course, hygienic conditions are today much better, at least in most parts of the developed countries, but hygienic conditions are not enough as the last pandemic has shown. Second, the frequency of epidemics has been increasing in the last century (Bedford et al., 2019) and it is time for our social systems to reorganize for future cases. Third, the lockdown has not changed our social practices only temporarily. This might have been true for SARS in 2015 (Rothstein, 2015) since the problem was confined within a few countries, and for Spanish flu of 1918 (Spinney, 2017) because there were no real alternatives to physical interaction. Today, after the massive expansion of internet and the availability of online services, from commercial (e.s. shopping) to social (e.g. group meeting), from civic (e.g. voting) to cognitive (e.g. psychological treatment), the changes that we experienced almost worldwide during the spring have not just put on hold most physical activities, they pushed us to exploit other ways to interact: we now know that we can reorganize our everyday life with little or no physical contact. One may wonder whether people will be willing to go back to the previous life of 2019. Some perhaps will but, as social experts warn, many will not. How much everyday life in 2021 will differ from that in 2019 is hard to predict. Nonetheless, we must be ready to recognize and accept the new attitudes and social practices. This means, among other things, to develop and provide structures and services that comply with the new lifestyles, when possible, and that drive the evolution of our social systems towards sustainable and socially positive urban environments.

During these months of the pandemic, there have been several attempts to predict how our urban systems are going to be in the future. The interest in this exercise of imagination can be explained by the fear of change and the desire to anticipate (in this way making it somehow familiar) our future lifestyle. The focus of these discussions has been, almost exclusively, about urban life. There are two reasons for this. Rural areas have been marginally touched by the pandemic because they are more resilient to the security norms imposed for the Covid-19 disease. In rural areas people can easily spend time outside without coming into close contact with each other and, where social activities are involved, they can easily find places where the required social distancing can be maintained, at least if the number of people is limited as it happens in many cases. Of course, there is the psychological impact of avoiding physical contact, but this problem does not end up disrupting the core of the rural lifestyle. Major disruption has occurred in all those areas where compression and optimization of space have been a driving and welcome force, i.e., in urban areas. The need to exploit space as much as possible has pushed people to squeeze into little spaces and to rely on shared areas, making them at a loss when social distancing was suddenly imposed.

In this contribution, we take a step back and look at how architecture and urban studies can help cities to cope with the new situation and to rethink urban areas. The goal is not to add to the pile our own guesses about future cities and social practices. Instead, we aim to look at architectural rules as a magnifying glass to understand how newly proposed design may transform cities in the post-pandemic period. More precisely, we are interested in how a new design may change the perception and functionality of existing urban organization and social practices, and consequently to redesign interpret the meaning of these urban spaces. We develop this analysis starting from our previous work on architectural rules and on the expression of creativity via architectural rules as presented in (Borgo & Stufano Melone, 2019).

This paper is organized as follows. The next section briefly presents our general framework on architectural rules and meta-rules aimed to discuss design and creativity. Then, we describe new proposals for the design of urban spaces, and discuss them in the light of our framework. These designs satisfy the restrictions related to the Covid-19 pandemic but also push to rethink urban spaces and the associated activities. The next section makes a similar analysis on the (re)design of urban private spaces. The last section adds further considerations and emphasises the need to choose design solutions depending on how they alleviate existing social inequalities.

2. Rules and meta-rules for architectural design of urban spaces

The design process in architecture and urban planning starts with a need, e.g., the (re-)organization of an area, the construction of a new building, or the rethinking of an existing one. The architect is asked to propose a solution which on the one hand must answer the given need and, on the other, must introduce novelty, interest and some form of surprise.

This high-level view of urban design helps to identify one core element of architecture practice: the combination of rules and creativity. In a previous work (Borgo & Stufano Melone, 2019) we proposed to analyse the rich framework of architectural rules from an ontological perspective, and investigated how creativity find space within such a framework. In this part, we briefly review the framework since it will be used to discuss, from the social and architectural viewpoint, some design solutions proposed for rethinking urban spaces in the post-Covid-19 period.

The steps in the design process, from requirements' collection and analysis to the idea conception and selection, to the complete drawing of the area or building (perhaps including a scale model), have a double nature as they evolve at both the cognitive and the physical level. This interplay between the architect imagination and its physical verification (generally by drawing), generates a sort of feedback loop that is functional to make sure that the ordinary goals are satisfied, and that a sense of beauty and surprise emerges from the proposed solution. The presence of an architectural object, let it be an open area (park, square), a closed area (theatre, station), or something in the between (bridge, a gallery), changes the sense of space and of possible activities in the eyes of who perceives and experiences it. These aspects are foreseen and controlled in architecture via general solution patterns that in (Borgo & Stufano Melone, 2019) are called architectural rules.[1]

Note that architectural rules are not compulsory. In this sense they are distinct from, say, the rules of civil engineering for the stability and safety of the object to build. Architectural rules are choices to create an object in a certain way, which is one among many possibilities. The motivations to follow or not a rule can vary and include cultural, historical and aesthetic factors. These factors, as well as the rules themselves, might not be fully aware to the architect herself. The space of architectural rules is broad and architects are aware of it to some extent due to their professional studies, sensibility and design experience.

Taking an ontological approach, in (Borgo & Stufano Melone, 2019) we moved away from traditional studies in architecture, which are more oriented to historical periods, schools or individuals (e.g., those that today we call archistars), and proposed to look at architectural rules as relathionships organized in a rule space. We also proposed a classification of these rules in families as reported in Fig. 1.

[1] We prefer to use the term 'rule' because of its neutrality. In architectural textbooks, one would more likely find descriptions of architectural rules in terms of style, aesthetics or the likes. It is clear that the perspective we take here is not concerned with aesthetic aspects. On the other hand, the term style suggests clustering of rules as to characterize an architectural period, school or interpretation. Our study is neutral and focuses on the logical nature of the rules disregarding their possible 'meaning', i.e., what an architect aims to express with them.

Class	Topic of the rules	Example
Framing	the tension across the parts, harmony	Golden rule, the Modulor scale
Quality	the physical and aesthetic qualities of buildings	Color, open/close space harmony
System	the relationship and interactions across parts	Usability, integration metrics
Location	the integration of building and environment	Ecological harmony
Perception	the perception of the building and its environment	Wellbeing metrics
Function	the purpose of the building	Airport layout
Society	the social role of the building	Town hall symbolism
Living	the use and personalization of the building	Open form rule, social exploitability

Fig.1 Table of classes of architectural rules. Source: Borgo & Stufano Melone, 2019

Note that most rules that one finds in a design are often forced or uncritically adopted. There are multiple reasons for this: the architect may have some style of reference which she adopts by default, the project requirements may posit architectural constraints, the environment may enforce come choices due, e.g., to the urban context or local regulations, and the cultural-social period itself exerts influence on the work of the architect. The space of architectural rules is introduced primarily as a logical reorganization of these rules. It has to be integrated with historical, social and cultural data in order to be applied in the analysis of the work of architects or of the evolution of architectural types. In (Borgo & Stufano Melone, 2019) a few examples of architectural rules are discussed, like: any cornerstone must have direct support (e.g. a column, a wall). This rule, which has been instantiated for centuries, is contrasted with a rule introduced by the Modern Movement in the 20th century (Pevsner, 1936): if the weight of a cornerstone is spread over other supports (columns, walls), then the cornerstone itself has no direct support.

Since rules give general guidelines, the adoption of a combination of rules may generate conflicting situations. In these cases, the architect investigates possible changes including rule transformations and rule reinterpretations. This is a crucial point to discuss creativity in architecture as there are several strategies to solve such conflicts as discussed in (Borgo & Stufano Melone, 2019) where these strategies are called meta-rules.

3. Rethiking and redesigning urban public spaces

After the first period of lockdown in Italy and other countries in spring 2020, the architectural design of public spaces and, more generally, the organization of existing public spaces in urban contexts, started looking awkward. The social practices these designs promote, the conventional sharing and living of public space they portrait, were suddenly perceived as coming from another epoch. In the turn of a few weeks, social expectations have changed, and new practices were emerging in inhabitants of urban areas. Amid the discussion of these changes among sociologists, anthropologists and psychologists, designers have picked up the new challenge, and started to investigate novel design solutions. We propose to look at some of these proposals in terms of architectural rules with the goal of highlighting intrinsic changes that these solutions enforce on pre-pandemic social practices. Our method is to highlight which types of architectural rules these solutions affects, and to investigate which tensions these changes introduce in the existing urban organization. The expectation is that such tensions will force a transformation of the social practices and, even though we do not try to foresee the changes, we are able to identify some aspects that are put at risk.

One reason for the lockdown has been to enforce the so-called 'social distancing', perhaps better described as 'physical distancing'. The goal is to create a gap between any two bodies, that is, to set a metric relationship. Sometimes it suffices to change words to change the problem, as words drive our understanding of the situation and our thinking in searching for solutions. Wearing masks and gloves is an extreme solution that focuses on physical distancing. The use of communication tools, e.g., for video calls (at least for those that

have access to suitable devices and connections) is a way to overcome the identification of physical distancing with social distancing. The separation between physical and social distancing made possible to maintain during the lockdown core functionalities like public and private administration, schools, commerce and so on.

Social distancing puts under scrutiny all our social practices and public space organization. This, in turns, changes our house organization. For instance, the interface between the customer and the retailer provided by the traditional shop is now split into two parts: the trading interface is being moved online in a process that started a decade ago, the physical interface is moving into the house transforming the entrance into a reception-style room. But rethinking spaces is not only about where some activities can be performed. It goes deeper affecting the time, the occurrences, the distances, the organizations of social practices from working to visiting museums, from going to school to playing in public parks.

The first technical solutions for the social distancing focused on widespread services like restaurants. These include the introduction of plexiglass panels around and in the middle of the table. Such proposals are attempts to maintain the status quo while satisfying the new restrictions. A solution that requires more than minimal adaptation is to 'break' the consuetudinary expectation about tables, e.g., designing tables using new shapes (e.g. star or flower-shaped) and size so that the new distance regulations are automatically satisfied when they are arranged in a room. One can even imagine alternative solutions focusing on controlling the air-flows at the table. Technical and technological development, including the use of material with special properties, may lead to improved solutions.

Recall that we are not interested in the table or the restaurant per se. We focus on the 'eating at the restaurant' as a social practice crystallized via a set of architectural rules (in terms of the structure of the building, service and room organization, table formats and distribution, seat accessibility, etc. The question is whether and how this practice is going to change using as insight the architectural rules that are overwritten. For instance, it is a social rule that people at the same table should be able to see each other. This has led to an (often implicit) architectural rule that space above the table should be empty at least up to head level (roughly, about 70-80 cm). The rule belongs to the class 'Living' of Figure 1 and is broken by a design that would project a floating plexiglass separator in the form of a large hairdryer hood as proposed by the French designer Christophe Gernigon (Block, 2020). At first sight, this solution might be considered as a simple adaptation via the introduction of a new device. Yet, the way it changes the social practice of eating at a restaurant is subtle. Gernigon's solution maintains several aspects: as in the past, people can see each other, share dishes, pass salt and drinks, even hold hands while eating. The protective hood shields only faces and breath, metaphorically it protects the realm of thoughts and consciousness, not the body, not the center of emotions. It is then open to the restaurant customers to decide how close to get physically with the body, mentally with the thoughts. Leaving aside the actual practicality of the proposal, Gernigon's design has the merit to reinterpret and even enrich the social practice of eating at the restaurant.

During the lockdown, it was prohibited to go to the park. This restriction has raised many concerns since it exacerbated social inequalities, and even more towards children perhaps constrained for long periods in small apartments. The traditional design of the playground showed all its limitations. Play areas are in need of a new organization if we want them to survive in the post-pandemic period. A recent proposal by Martin Binder and Claudio Rimmele, called Rimbin (Figure 2) (from rim and bin), shapes play areas like a cluster of water-lily pads on a pond (Hitti, 2020). Rimbin enables children to interact with each other avoiding direct contact. This is made possible because every 'flower' forms an island but is interconnected with one or two others via hollow tubes (for voice communication) and seesaws. The impact of this design changes two types of architectural rules: perception and living. The second one is expected since we know that social practices have to change to comply with the new restrictions. Regarding perception, we observe that traditional playground where primarily a flat field with some structures (e.g. playhouse, slides, climbers) distributed at some distance.

One clear and primary affordance of traditional playgrounds is running (clearly delimited to allow direct control by the adults). The new design breaks this view, the Rimbin playground is a very noticeable set of constructions that has little of the open field. The perception changes from a natural field with a few scattered structures, to a large structure with a few scattered empty spaces.

Fig.2 Rimbin concept by Binder and Rimmele. Image via Dezeen

Fig.3 Parc de la Distance concept by Chris Precht. Images via Dezeen

Since parks are important urban areas, let us look at another proposal in the same domain. Chris Precht designed a maze-like park named 'Parc de la distance' (Fig. 3). This conception takes the rules of social distancing as a design guideline (Ravenscroft, 2020). The 'Park de la distance' has numerous routes divided by 90-centimetre-wide hedges to maintain a safe physical distance between its visitors. The paths form a finger print-shaped swirl with many routes, separated by gates, that can be used simultaneously combining the French baroque gardens and the Japanese zen garden. In this case, the change is again on the living rules but more strikingly is it the change at the level of functionality. The park proposed by Precht decouples the vision of a quiet place where one is surrounded by nature from the idea of a recess area where to lay down

listening to the wind moving through grass and leaves: it is a place to enjoy a stroll, not to sit and read a book or have a picnic.

4. Rethiking and redesigning urban private spaces

In the present days, the desire to resume the activities suspended for the pandemic is strong. Many activities previously lead in public spaces have been adapted for closed and private spaces. People have now exploited possibilities that were present even before but perhaps were not attractive enough. Other changes happened only because during the lockdown there was no other option.

Woods Bagot, an architectural firm, has studied the AD-APT system (Fig. 4): a series of adjustable walls and screens that would be used to segment an open-plan apartment into various dedicated spaces (Bahadursingh, 2020). Thanks to a split-shift mode the house changes its configuration, adapting to the principal function needed during the day, the night, or for special events like parties.

Fig.4 AD-APT system designed by Woods Bagot. Images via Architizer

Fig.5 Changeable house designed by PKMN architectures. Pictures by the author

Even in this case, the proposed design breaks traditional composition rules, e.g., walls may now not be structural elements. In Bagot's design walls maintain their role of space delimiters but are now seen as mobile furniture, the difference between walls and furniture being primarily in size. Similarly, PKMN architectures presented at the Biennale di Architettura di Venezia in 2016 a changeable house (Figure 5). Overall, we see that the house stops being a static partition of space pushing us to rethink consolidated protocols. This is a major change in the house architectural type since it touches rules in different classes of (Figure 1): living, perception, function and system. Their analysis increases the flexibility and usability of the space leading to improvements in the life quality in the house. However, this conception needs to be accompanied by pubic regulations as new flexibility in the use of house space may push for the construction of even smaller apartments, making today's critical situation even worse.

Finally, we observe that the traditional view of 'secondary' areas like balconies, gardens, terraces, and accessible roofs has changed during the lockdown. They are now like buffer zones between the private house and the unsafe outside, they have become the threshold, the skin of the house since open to the outside but still shielded and safe. It will be interesting to follow the evolution and redesign of these spaces, spaces that

will likely become more central to the new social practices. At this time, we have not identified new design solutions for these buffer zones.

5. Conclusions

Frank Lloyd Wright designed the Solomon R. Guggenheim Museum of New York as a space to be walked in a linear unique path that follows the spiral shape he conceived. During the visit of the museum, people have a double experience: they watch at the same time the painting artworks and the museum architecture. Today we can imagine the pressure for stronger ruptures in public spaces. Individual distancing may push to keep the visitors in a fixed position and move the artworks towards them in a museum organized as an open-space. Similarly, in a bookstore (assuming they will survive this period) we might have bookshelves moving toward the customers which are asked to remain in some assigned position.

No matter what new design solutions will develop and what new infrastructures our cities will be able to implement, the form and structure of our urban socio-technical systems are going to evolve with the changes in our social practices. The existing inequalities, made strikingly evident by the impact of the pandemic on inhabitants, push us to follow more closely the activities of designers and decision-makers, and to give people a real chance to control and co-design the system they are in. We need to give them newly organized urban spaces that comply with the evolving social practices, and the ability to understand how these changes are improving, or else, their lives (Guarino, 2015). Especially in a crisis situation, people's input must be heard to help the decision-makers to push for fair solutions.

Architects and urban designers have a central role in this scenario. They have the creativity to propose new solutions and should show the right sensibility to guide the evolution of urban spaces towards more inclusive and socially acceptable solutions. In this paper, we showed a framework developed for architectural rule analysis and creative meta-rule changes, and used it to highlight how new designs may change the meaning of social practices. We hope this approach can become a tool for deepening awareness in how new design solutions change urban objects, their social use and the consequences that these have on people's life.

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Image Sources

Fig.1: https://www.dezeen.com/2020/05/19/rimbin-playground-concept-coronavirus-design/; http://www.bindermartin.com/.

Fig.2: https://www.dezeen.com/tag/coronavirus/page/3/?s=precht&hPP=40&idx=vetg_livesearchable_posts&p=0&fR%5Bpost_type_label%5D%5B0%5D=&is_v=1; https://www.precht.at/.

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Fig.4: Images via Architizer.

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Data analysis and mapping for monitoring health risk
What has the spread of the Covid-19 pandemic in northern Italy taught us?

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Abstract
The construction of the knowledge framework is a fundamental phase in the territorial governance process and data analyses, together with their mapping using GIS software, provide a fundamental basis for the structuring of a system for making decisions. With reference to the issue of risk management, monitoring of spatial and temporal evolution of the phenomena is equally fundamental.
The aim of the paper is to address these issues in relation to health risk, starting from the pandemic situation that affected northern Italy in the early months of 2020.
The paper presents an ex-post statistical analysis of the ISTAT data on mortality in the Italian provinces, comparing the currently available 2020 data to previous years. A territorial analysis is then presented, using a GIS, regarding the spread of the Covid-19 infection in the 205 municipalities of the province of Brescia. The paper also proposes a comparison with analysis conducted for other territories outside Italy. Finally, a reflection is offered on what we have learned from this pandemic regarding the need to have a monitoring system for phenomena related to health risk, in order to reduce the vulnerability of the health system.

Keywords
Data mapping; Data analysis; Risk; Monitoring; Prevention.

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1. Safety in the city

1.1 The importance of planning for reducing and monitoring risk

In the aim of planning and building a safer city, particular importance is given to the prevention and management of risk, both of natural and anthropogenic origin.

Researchers have long acknowledged the centrality of the theme in planning (see among the others Foster, 1980; Varnes,1984; Tira, 1997; Tiboni, 2007; Fistola, 2011; Zoppi & Lai, 2011; Tira & Zazzi, 2012; La Rosa, et al., 2013), and the specific Covid-19 pandemic situation that hit the whole world in the first months of 2020 requires us to extend our reflection to health risk or, more generally, to any type of risk, not only of natural origin, but also anthropic.

The risk is due to an event that sets off the disaster that occurs in a limited period and/or space, even if the effects may continue over time and spread to affect a larger area than that immediately involved.

The risk level perceived by a society is the discriminating factor for establishing how much that society is prepared to pay to eliminate the phenomenon that determines the risk. This decision is the result of the definition of a maximum risk level considered acceptable, a risk which the society decides not to eliminate because it considers the effects of the event as acceptable.

Risk specialists and experts tend to emphasize the numerical data regarding recurrence, intensity and destructiveness of disasters. This is a purely scientific approach that aims to set out the dynamics of the events and pinpoint possible solutions.

The sociological aspect of the risk, on the other hand, regards politicians and citizens who are unable to distinguish between objects/people and the values attributed to them. This aspect is linked to fear, uncertainty and problems understanding the event.

The concept of risk is often mistakenly confused with that of hazard. Indeed, the hazard is an integral part of the risk, but the two concepts are not synonymous.

The two terms have a precise philological definition:

- Hazard is "a threatening situation which is the source of the risk". For example, a natural phenomenon in general, such as a landslide, heavy rain, a hailstorm or an earthquake;
- Risk is "the product of the probability that the event occurs and the losses that this can generate".

The number of times a physical phenomenon recurs may be studied by analysing the historical data, enabling us to understand how likely a certain zone is subject to the specific event in question.

This information is useful for a technical evaluation of the hazard, but does not indicate the number of people, assets and infrastructures exposed to the event.

For an effective analysis, we need to introduce the concepts of vulnerability and exposure in order to take differences in geography and population density into account.

The generic concept of loss, or better the damage rate, is therefore replaced by:

- Vulnerability (V), understood as the propensity to suffer damage because of a certain event;
- Exposure (E), understood as the quantity and value of the assets (human beings and material assets) present in the area involved by the event.

So, risk should be measured in terms of expected damage, obtained from the combination of the cause (hazard), the system vulnerability and exposure, relative to both the human and economic component:

$$\text{Risk} = f(\text{hazard, exposure, vulnerability}),\ R=f(H, E, V)$$

Hazard, vulnerability and exposure depend on the intensity (I) of the event and the type (T) of elements at risk:

$$H=f(I),\ V=f(I, T),\ E=f(T)$$

The risk function thus takes on its complete form:

$$R=f(I, H, V, T, E)$$

Where:

R=risk

I=intensity of the event (the magnitude of an earthquake, the volume of a landslide);

H=hazard, the probability that a phenomenon of a given intensity (I) takes place within a certain time period and in a certain area;

V=vulnerability, or rather the propensity to suffer damage as a consequence of an event of a certain intensity (I) and on the basis of the type of elements (T) at risk;

T=type of elements potential subject to the effects of disasters (population, material assets, infrastructures);

E=quantity and value of the type of elements (T) at risk.

1.2 Hazard, exposure and vulnerability: some definitions

Starting from literature in the field of urban planning, short reflections on the definitions of the three variables will be presented below, with the aim of extending the widely studied approach to natural risk to the case of health risk (Tira, 1997; Tiboni, 2007; Fistola et al., 2020; Giuliani et al., 2020).

Hazard

Hazard depends on specific parameters based on the characteristics of the phenomenon in question. In the field of regional planning, it always refers to three parameters: intensity, frequency, location.

Different parameters for measuring the intensity are in place for each type of event. It is important to know how often the phenomenon reaches an intensity held to be significant and when an event above the safety threshold may presumably occur.

Exposure

The exposure is a function of the number of people who could potentially be affected by the event and all the economic assets in the area at risk.

If no asset (either human or economic) is exposed to the hazard, there is no risk.

The urban environment is an exposed place, due to the intense presence of people, structures, infrastructures and strategic functions, but the conditions of the subjects at risk may vary greatly in time and space and therefore have a major effect on the system's ability to respond. It is also possible to imagine different levels of exposure: for the single object at risk or for the regional system, where the exposure is also conditioned by spatial distribution and regional hierarchies of towns.

This leads us to deduce that, in risk analysis, exposure is a constantly changing factor, because cities change in form and, more rapidly, in use.

Exposure reflects the concept that the risk increases with the increase in quantity and value of the subjects affected. From this point of view, it is important to identify a method able to associate a value with each exposed element, to be able to establish a safeguarding order. Estimative methods (costs/benefits and risks/benefits analysis) can be applied to material assets, but it is completely unrealistic to quantify the value of human life. In the insurance field, there are some estimative methods based on the investments made by the society in the individual rather than on the presumed income, but none of these analyses can take into account the impact that the loss of a loved one has on his or her family members. Whilst this is emotionally true, effective planning must surely ascribe a value to life? Otherwise you end up with what in economics-speak is called a lexicographic preference ordering - possible outcomes will be ranked first solely on loss of life. Only if two outcomes have the same loss of life would a second factor such as financial loss be considered.

Therefore, human life is the main asset and the most important thing that needs to be protected.
Vulnerability and exposure have various elements in common, which should be borne in mind in order to avoid considering the same variable twice in the risk assessment. The concentration of assets, services and people in a given area, in other words the exposure, is also an indicator of vulnerability, because there is an increased probability of subsystems or fragile elements and a greater number of interdependencies that increase the vulnerability of the system as a whole.
If our goal is to reduce the risk to which a community is exposed, we will have to work to reduce one of the 3 variables that make up the risk (hazard, vulnerability, exposure), or better yet act in parallel on each variable. It is obvious that if there are no hazards (i.e. H = 0), there is no risk, and high exposure and vulnerability can generate a high-risk level also with a low hazard level. Hazard is only a part of the risk. In order to know the risk level of a region, it is necessary to know vulnerability, exposure and hazard levels in each point of the region, so that combining the three variables a risk map algebra could be produced (Tiboni & Tira, 1997; Tira et al., 2006; Zoppi & Lai, 2014).
The more the area is unprepared, or the more inadequate the response, the greater the system's vulnerability. This brings us to the importance of a "Mitigation Plan", or rather all the operations devoted to mitigation: the emergency is the manifestation of the vulnerability found in a certain area.

Vulnerability

A structure is vulnerable if it is inclined to suffer damages from a specific event.
Vulnerability is a function of the specific characteristics of the stressed system, but it only enters in play when the cause surpasses a certain severity threshold.
It can be interpreted as that level of severity (understood as a combination of intensity, spatial expansion and frequency in time) beyond which the system is no longer able to withstand the stress without breaking up. If the level is high, the system is not very vulnerable and is even able to withstand very intense events, while if the level is low, the system is very vulnerable and reaches crisis point with even a small amount of stress. The vulnerability analysis therefore involves the evaluation of numerous system/hazard combinations to be subjected to events with different levels of intensity. Evaluating the response of different regional systems is indispensable for creating vulnerability evaluation models.
The concept of "socio-systemic" vulnerability also expresses the possible damage that could occur in a given social system in terms of human, economic and environmental resources, but also the propensity for damage that this system presents in terms of risk or poor response capacity. The vulnerability therefore expresses, in qualitative and quantitative terms, the possibility that the system is struck by any external event in a limited period of time.
It is easy to understand how the socio-economic-environmental system's propensity to damage is substantially linked to two factors:

- the type of "risk" that the system is subject to;
- the system's response capacity (in terms of organization, for example).

In fact, vulnerability is also a function of the community's level of risk awareness, not just of the hazardous agent, but also of the spatial and social distribution of the vulnerability itself and of the material and human resources in place to combat it. Two communities subject to the same risk are not equally vulnerable, inasmuch as some societies have adopted regulations and implemented many projects targeted at risk reduction. Therefore, a society that has adopted a disaster prevention policy will be far less vulnerable than a community that has not put any provisions into place. Many forms of ground usage may increase the level of vulnerability, just like the increase in the complexity of the social system (Greco et al., 2019).

The vulnerability of the physical, social and institutional structure of the area, that is to say how much the physical structures (such as houses built on the basis of anti-seismic criteria, in the event of an earthquake), and the social and institutional structures (for example if there is an organized response structure, and if emergency contingency plans are in place) are prepared to deal with a calamity, determines the risk level.
The more the area is unprepared, or the more inadequate the regional response, the greater the system's vulnerability.

2. Health risk: the case study of the Covid-19 pandemic in northern Italy

2.1 Introduction

The definition of risk proposed in the previous section finds plenty of applications in the urban planning field, namely for what concerns natural risk (seismic, hydrogeological, volcanic, …).
The use of GIS software (Geographic Information System) is consolidated for risk scenarios definitions, particularly for analysis and adaptation to phenomena linked to hydrogeological instability and seismic vulnerability of the land (Campagna & Craglia, 2012; Amato et al., 2015; Campagna, 2016; Martellozzo et al., 2018; Giuliani et al., 2020; Scorza et al., 2020). Furthermore, in recent years, the amount of research aiming to define possible scenarios for the development of urban settlements has increased. Those researches employ GIS capabilities in assessing land resources, namely the ones linked to natural assets and ecosystem services (Arcidiacono & Ronchi, 2019; Campagna, 2016; Manganelli et al., 2016; Martellozzo et al., 2018; Scorza et al., 2020).
The application of methodologies traditionally applied to the analysis of physical risk, to the study of health risk, does not constitute an element of novelty, on the contrary! Already in 1854, the English epidemiologist John Snow had used a tracing system, during a cholera epidemic in London, to trace the source of the infection. However, in recent years the use of GIS software for this type of applications has been limited as recent seismic and flood events, partly related to climate changes too, have imposed other research priorities and today, the use of GIS for urban management and adaptation to health risk is a field that is suitable for numerous experiments.
The aim of this article is therefore to propose a reflection on the importance of applying this same approach to health risk management, reflecting on what happened in the first months of 2020, with the Covid-19 pandemic, in order to draw lessons from it for the future (Murgante et al., 2020).
The ex post analysis can help us to understand what is important to monitor, such as fundamental data for the management of the phenomenon, with reference to the three variables (hazard, exposure and vulnerability) that contribute to the definition of the level of risk.
In thus work we propose an analysis of data on the spread of infection and mortality, with a focus on northern Italy, the area most affected by the disease.
To apply the definition of risk to a pandemic, the "exposure" variable will certainly be a function of the population living in the territory affected by the virus. Population will be investigated not only in absolute terms (the number of people residing or present in that territory), but also by studying specific features to which can be linked different characters of vulnerability.
The variable "hazard", essentially morbidity in the epidemiological sense, depends on factors such as the spread of the virus, its contagiousness and virulence. A topic that can be addressed both with epidemiological models specific to the medical sciences and by analysing the available health data. With reference to the case study, the number of infections detected in the area compared to the total population was considered an expression of the hazard.

In relationship to the type of health risk to which people are exposed it is possible to have different individual vulnerability degrees. Those degrees are related to the so-called unchangeable risk factors such as age, gender, ethnicity or genetic aspects and changeable risk factors like nutrition, lifestyle and past illnesses.
This is only one of the aspects that contribute to define vulnerability. Beyond individual vulnerability it is important to study systemic vulnerability too. This aspect depends on how the system (social system, health system, …) can react when a phenomenon occurs.
To understand the difference between the two components of this variable it is feasible to consider as an example the case of seismic risk: in this case vulnerability is given by both the capability of single structures or buildings to respond to seismic stresses that allows them to remain undamaged until the event reaches a certain threshold (assuming their construction according to anti-earthquake criteria) and how the anthropic system react to the event.
To better understand this second vulnerability aspect it is useful to think at the interruption of a road due to the collapse of a bridge: systemic vulnerability will be lower if the system is able to react identifying temporary solutions that will guarantee the accessibility to the isolated territory (with the creation of a new alternative path or a new temporary structure that can replace the fallen one) in the short and midterm or, in the long term, with more articulate and complex solutions. These solutions can lead to a rearrangement of the previous vulnerable system.

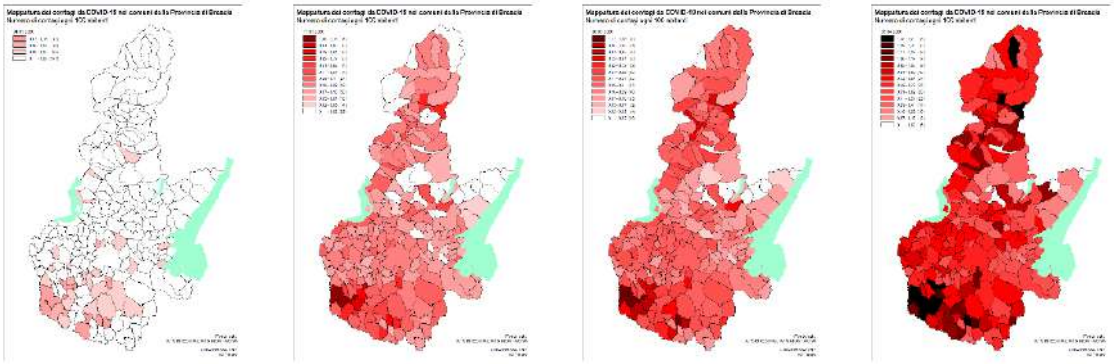
2.2 Data analysis and mapping

For the analysis of the spread of Covid-19 epidemic in Italy and in the northern regions we have considered data coming from different sources:

- data about the daily number of affected people registered by Territorial Health Agencies (ATS) of Brescia province in the period from March 4th 2020 to April 11th 2020, subdivided by day and City of residence;
- data about resident people distribution in Italian Municipalities observed by ISTAT on January 1st 2019 and subdivided into classes of gender and age. This is the last official available datum about resident population in Italy;
- mortality archive registered between January 1st and April 15th related to the five-year period 2015-2019 for all of Italian Municipalities and the update related to the same period for the year 2020 observed by ISTAT for those part of Municipalities who joined the early data collection. Data are available with information related to any cause of death in Italy, distributed by city of residence, ages and day of the year.

If the last two data have an irrefutable validity as they are based on the official information of municipal registries (residing in 2019 and dead until 15.04.2020) the spread of the infection has a very reduced reliability as it is now clear that in the critical period of the emergency, and namely in the Lombardy Region, this figure largely underestimates this phenomenon due to the limited monitoring activities implemented by the regional health authorities.
However, it is possible to consider that datum as a valid form of sampling for understanding the spatial and temporal distribution of the phenomenon. Absolute values don't have the same value. Today there is no official and validate figure about the extension of the phenomenon and the spread of the disease.
Using a desktop GIS software, it was feasible to manage layers containing georeferenced data about the spread of the pandemic. This allows to obtain maps at municipal, provincial and regional scale and heat map that are referred to sequential time thresholds. They show the temporal evolution of the spatial distribution of the pandemic.
This type of map shows the spread of the disease in the territory under consideration.

Although it is now publicly ascertained that the number of official infections in Lombardy, the region most affected in Italy, as well as that of deaths officially associated with the virus, are only the tip of the iceberg, for the small number of diagnoses made, however, it is valid It is worth seeing how this tip of the iceberg has moved over the territory over time, as illustrated in Figures 1 and 2, relating to the province of Brescia.



(a) 04.03.2020 **(b) 17.03.2020** **(c) 20.03.2020** **(d) 03.04.2020**

Fig. 1 Brescia province, variation in time and space of the number of positive Covid-19 cases per 100 inhabitants

Why is a detailed mapping of contagions essential? Obviously to identify and isolate the outbreaks, to see how the phenomenon moves on the territory, but also to see what are the effects of the measures put in place.
The work could be even more detailed, going down to the street and house number scale. If the infection was identified more precisely, this would allow activating a tracing process, isolating the cases found and their contacts. A model approach to the spread of this type of contagion is precisely that implemented for this same pandemic in other territories such as South Korea and Taiwan.
The analysis cannot be addressed only on a large area scale, with data aggregated by province, because the problem must be tackled locally.

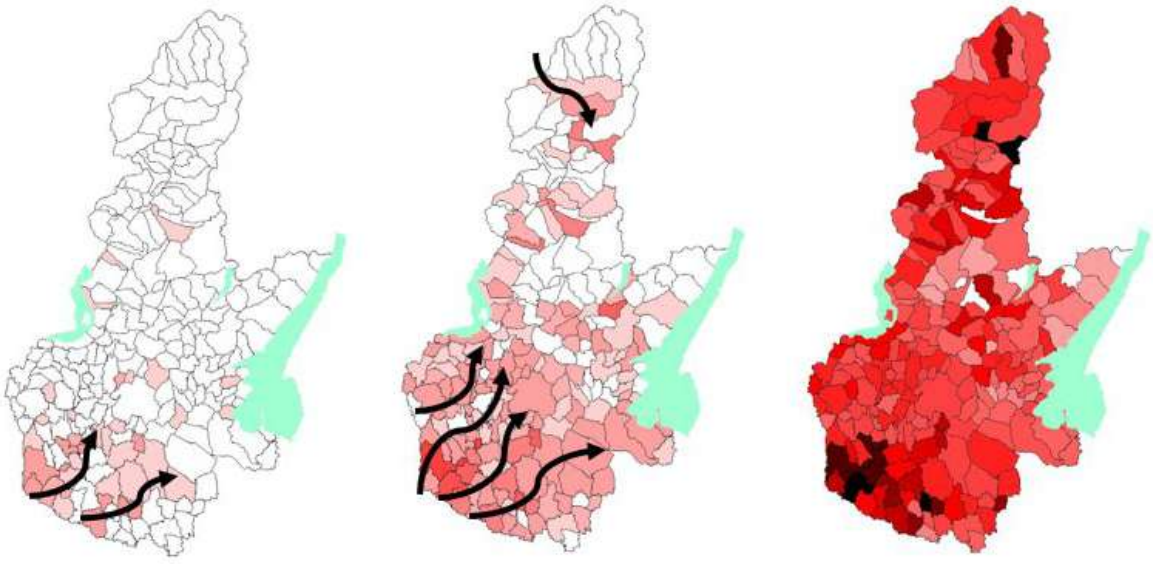


Fig. 2 Possible identification of the routes for spreading the infection through the mapping of cases

On the contrary, the choice to operate by analysing the number of deaths and the comparison with the average of the previous five years, is irrefutable and, however extreme, a quantitative sign of the effects of the pandemic on the population.

As shown in Tab. 1, mortality data for 4,252 Italian municipalities were considered (in red in the map of Figure 3), out of a total of 7,904 and represent 57% of the Italian population. The distribution of the municipalities that participated in the data collection promoted by ISTAT is mainly concentrated in the northern regions that are most affected by the pandemic. For that area the population considered in the mortality analysis represents 69% of the residents while in the centre 56% and in southern Italy 44%.

Region	Resident population on 01.01.2019	Population considered in the analysis						percentage of population considered
		Age						
		0 - 24	25 64	65 - 74	75 -84	over 85	all	
Abruzzo	1'311'580	161'076	402'080	85'283	61'136	29'432	739'007	56%
Basilicata	562'869	28'243	70'149	13'703	10'013	5'239	127'347	23%
Calabria	1'947'131	167'340	373'156	73'906	49'896	22'329	686'627	35%
Campania	5'801'692	383'393	826'014	153'131	97'684	40'366	1'500'588	26%
Emilia-Romagna	4'459'477	819'895	2'019'952	417'237	326'276	154'389	3'737'749	84%
Friuli-Venezia Giulia	1'215'220	92'096	229'879	53'944	38'912	16'184	431'015	35%
Lazio	5'879'082	275'701	669'287	134'137	89'283	37'125	1'205'533	21%
Liguria	1'550'640	236'131	616'219	149'525	125'516	61'310	1'188'701	77%
Lombardia	10'051'747	1'809'424	4'277'675	854'839	651'271	276'016	7'869'225	78%
Marche	1'525'271	159'245	388'308	84'120	66'178	31'640	729'491	48%
Molise	305'617	35'910	90'080	19'549	13'550	6'997	166'086	54%
Piemonte	4'354'636	555'934	1'362'662	312'145	238'369	105'066	2'574'176	59%
Puglia	4'019'194	572'948	1'309'587	278'307	187'271	79'809	2'427'922	60%
Sardegna	1'639'591	184'735	508'436	106'554	71'125	29'603	900'453	55%
Sicilia	4'999'891	616'999	1'350'038	272'818	180'852	77'256	2'497'963	50%
Toscana	3'729'641	636'515	1'590'919	352'663	272'242	126'404	2'978'743	80%
Trentino-Alto Adige/Südtirol	1'062'940	102'434	222'001	45'250	32'496	15'319	417'500	39%
Umbria	882'015	137'123	336'147	73'071	57'416	27'426	631'183	72%
Valle d'Aosta/Vallée d'Aoste	125'666	24'259	57'820	12'531	9'368	4'118	108'096	86%
Veneto	4'869'591	811'863	1'924'673	394'900	294'883	125'198	3'551'517	73%
Italy	**60'293'491**	**7'811'264**	**18'625'082**	**3'887'613**	**2'873'737**	**1'271'226**	**34'468'922**	**57%**

Tab.1 Distribution of the resident population in Italian Regions and in the municipality considered in the mortality analysis

Fig. 3 In red municipalities included in analysis of mortality with data collection promoted by ISTAT

The Tab. 1 also shows the breakdown of the resident population by age group considering five different classes: young people up to 24 years old, working age adult (25-64 years) and elderly population divided into three subclasses (65-74 years, 75- 84 years and over 84 years old).

As shown in Table 2, the number of deaths recorded in Italy in the year 2020 shows significant differences only for some regions and only for some age classes. The Covid-19 epidemic did not affect the different Italian regions in the same way, but it was concentrated in some regions of northern Italy. In this section we will not investigate the reasons for differences in mortality, just identity them.

The analysis was also conducted at the level of the 105 provinces in which the municipalities that participated in the transmission of mortality data to the National Statistics Institute fall, with results superimposable to the considerations that emerged on a regional basis.

Region	Number of death (from January 1st to April 15)																	
	Average 2015 - 2019						Year 2020						Difference 2020 vs. Average 2015-19					
	Age						Age						Age					
	0 - 24	25 64	65 - 74	75 -84	over 85	all	0 - 24	25 64	65 - 74	75 -84	over 85	all	0 - 24	25 64	65 - 74	75 -84	over 85	all
Abruzzo	11	268	331	808	1'374	2'793	6	267	339	807	1'447	2'866	-5	-1	8	-1	73	73
Basilicata	2	47	56	148	253	506	2	46	59	117	244	468	0	-1	3	-31	-9	-38
Calabria	15	255	313	737	1'062	2'381	12	248	349	696	1'098	2'403	-3	-7	36	-41	36	22
Campania	33	631	714	1'520	1'988	4'887	24	593	736	1'370	2'078	4'801	-9	-38	22	-150	90	-86
Emilia-Romagna	58	1'130	1'551	3'843	7'048	13'630	55	1'359	2'051	4'878	8'531	16'874	-3	229	500	1'035	1'483	3'244
Friuli-Venezia Giulia	6	147	221	454	766	1'594	7	135	197	453	796	1'588	1	-12	-24	-1	30	-6
Lazio	20	456	578	1'157	1'746	3'956	12	376	576	1'058	1'736	3'758	-8	-80	-2	-99	-10	-198
Liguria	16	431	629	1'546	2'754	5'376	12	415	727	1'864	3'161	6'179	-4	-16	98	318	407	803
Lombardia	113	2'430	3'225	7'591	11'871	25'230	106	3'187	5'454	13'041	19'102	40'890	-7	757	2'229	5'450	7'231	15'660
Marche	12	212	297	739	1'446	2'706	11	250	365	940	1'787	3'353	-1	38	68	201	341	647
Molise	2	66	78	195	332	673	2	67	71	165	304	609	0	1	-7	-30	-28	-64
Piemonte	40	917	1'308	3'089	5'015	10'369	26	964	1'553	3'710	6'282	12'535	-14	47	245	621	1'267	2'166
Puglia	41	821	1'090	2'387	3'576	7'916	32	816	1'068	2'262	3'766	7'944	-9	-5	-22	-125	190	28
Sardegna	14	382	432	823	1'243	2'895	8	374	429	866	1'368	3'045	-6	-8	-3	43	125	150
Sicilia	57	959	1'261	2'837	3'956	9'072	52	904	1'227	2'472	3'967	8'622	-5	-55	-34	-365	11	-450
Toscana	38	931	1'317	3'141	5'805	11'232	28	883	1'346	3'191	5'974	11'422	-10	-48	29	50	169	190
Trentino-Alto Adige/Südtirol	10	119	157	343	680	1'308	5	120	211	433	957	1'726	-5	1	54	90	277	418
Umbria	7	181	265	633	1'263	2'349	8	167	245	599	1'214	2'233	1	-14	-20	-34	-49	-116
Valle d'Aosta/Vallée d'Aoste	3	39	57	125	192	415	1	33	75	154	267	530	-2	-6	18	29	75	115
Veneto	62	1'096	1'448	3'309	5'652	11'566	35	1'107	1'485	3'663	6'324	12'614	-27	11	37	354	672	1'048
Italy	**560**	**11'520**	**15'327**	**35'425**	**58'022**	**120'854**	**444**	**12'311**	**18'563**	**42'739**	**70'403**	**144'460**	**-116**	**791**	**3'236**	**7'314**	**12'381**	**23'606**

Tab. 2 Number of deaths in period 01.01 – 15.04 for pre Covid-19 period (average 2015-19) and in the year 2020, and difference

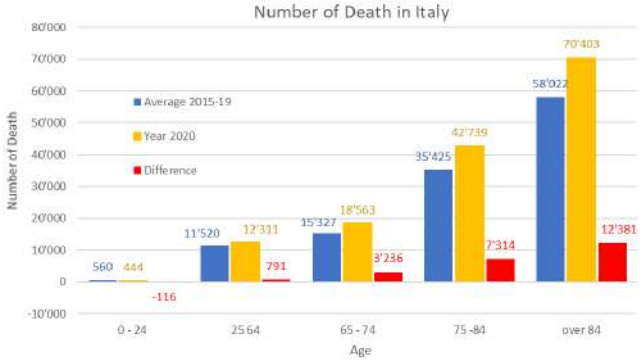


Fig. 4 Number of deaths in period 01.01 – 15.04 for age

It is also possible to give a territorial representation of the same information using thematical maps generated with a GIS software starting from data presented in summary form in Tab. 2 but also available at municipal level. The two Figures 6a and 6b present the distribution of mortality on the national territory in the five years preceding the Covid-19 epidemic (a) and subsequently. Data indicate the number of deaths recorded per 100,000 inhabitants in the period 01.01 - 15.04 of each year, for a total of 105 days observed.

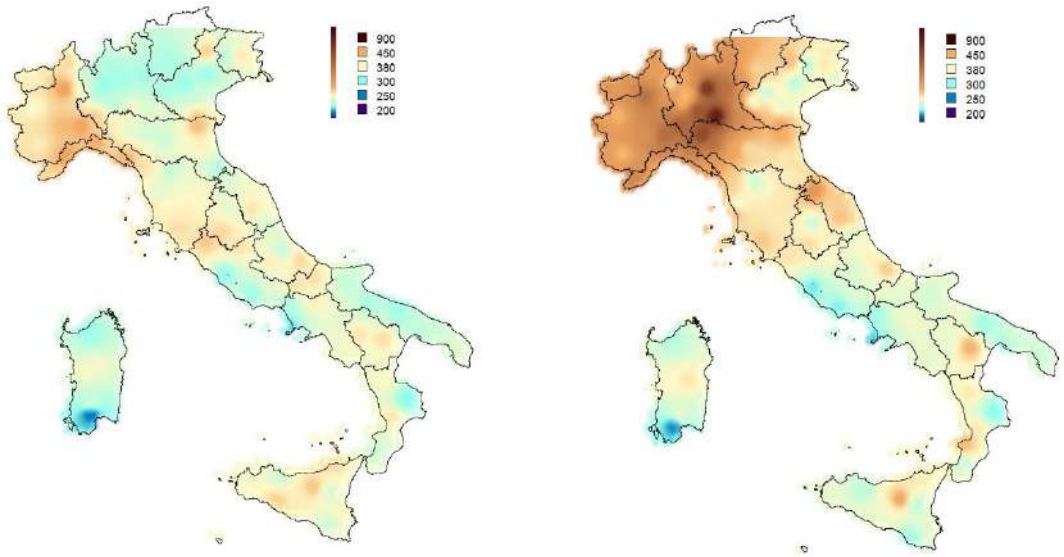


Fig. 5 (a) Deaths per 100,000 inhabitants – Average of years 2015-2019 and (b) Deaths every 100.000 inhabitants – year 2020

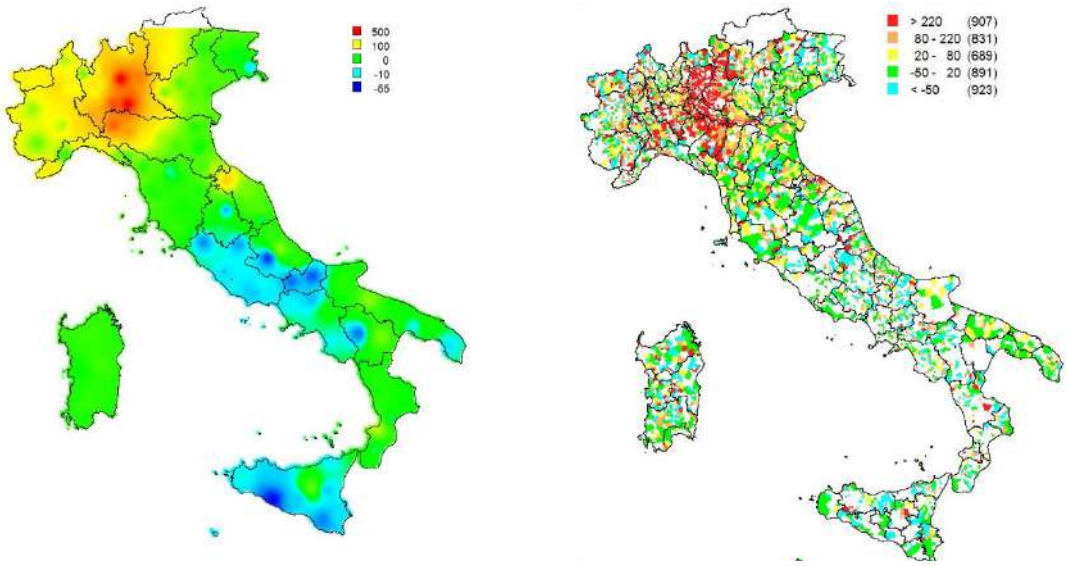


Fig. 6 (a) Variation of deaths per 100,000 inhabitants – year 2020 VS average 2015-2019and (b) Variation of deaths per 100,000 inhabitants – year 2020 VS average 2015-2019 subdivided for Municipalities

The two figures show the variation in mortality recorded in the same period in the form of a heat map (a) and on a municipal basis (b). The white areas indicate the territories of the municipalities that did not participate in the timely transmission of the mortality data.
Table 3 shows the distribution of mortality by age group and by region.

Region	Mortality Variation - 2020 vs. Average 2015-19 [number of death] Age						[deaths / 100'000 inhabitants] Age					
	0 - 24	25 64	65 - 74	75 -84	over 85	all	0 - 24	25 64	65 - 74	75 -84	over 85	all
Abruzzo	-5	-1	8	-1	73	73	-3.1	-0.3	9.1	-2.0	248.0	9.9
Basilicata	0	-1	3	-31	-9	-38	0.0	-2.0	24.8	-311.6	-164.2	-29.7
Calabria	-3	-7	36	-41	36	22	-1.6	-1.8	49.0	-81.8	162.1	3.2
Campania	-9	-38	22	-150	90	-86	-2.3	-4.6	14.4	-154.0	222.0	-5.7
Emilia-Romagna	-3	229	500	1'035	1'483	3'244	-0.4	11.3	119.9	317.3	960.3	86.8
Friuli-Venezia Giulia	1	-12	-24	-1	30	-6	1.3	-5.1	-44.9	-3.6	184.1	-1.5
Lazio	-8	-80	-2	-99	-10	-198	-2.8	-11.9	-1.3	-110.7	-26.4	-16.4
Liguria	-4	-16	98	318	407	803	-1.8	-2.6	65.8	253.4	663.5	67.6
Lombardia	-7	757	2'229	5'450	7'231	15'660	-0.4	17.7	260.7	836.8	2'619.9	199.0
Marche	-1	38	68	201	341	647	-0.8	9.8	81.1	304.0	1'078.4	88.7
Molise	0	1	-7	-30	-28	-64	0.6	0.7	-35.8	-218.5	-405.9	-38.7
Piemonte	-14	47	245	621	1'267	2'166	-2.6	3.4	78.5	260.7	1'205.7	84.1
Puglia	-9	-5	-22	-125	190	28	-1.5	-0.4	-8.0	-67.0	237.6	1.2
Sardegna	-6	-8	-3	43	125	150	-3.5	-1.5	-3.0	60.5	420.9	16.7
Sicilia	-5	-55	-34	-365	11	-450	-0.8	-4.1	-12.5	-202.0	13.7	-18.0
Toscana	-10	-48	29	50	169	190	-1.5	-3.0	8.2	18.3	133.9	6.4
Trentino-Alto Adige/Südtirol	-5	1	54	90	277	418	-4.9	0.5	119.3	278.2	1'808.2	100.0
Umbria	1	-14	-20	-34	-49	-116	0.6	-4.2	-27.1	-59.2	-177.2	-18.3
Valle d'Aosta/Vallée d'Aoste	-2	-6	18	29	75	115	-8.2	-10.7	143.6	313.8	1'831.0	106.0
Veneto	-27	11	37	354	672	1'048	-3.3	0.6	9.5	120.0	537.1	29.5
Italy	**-116**	**791**	**3'236**	**7'314**	**12'381**	**23'606**	**-1.5**	**4.2**	**83.2**	**254.5**	**973.9**	**68.5**

Tab. 3 Number of deaths in period 01.01 – 15.04 for preCovid period (average 2015-19) and in the year 2020, and difference in age group

A further analysis that has been developed is the one related to the variation of mortality on a municipal basis assuming time as a variable. Fig. 4 shows the overall trend of mortality in Italy and Lombardy and its distribution among the different age groups.

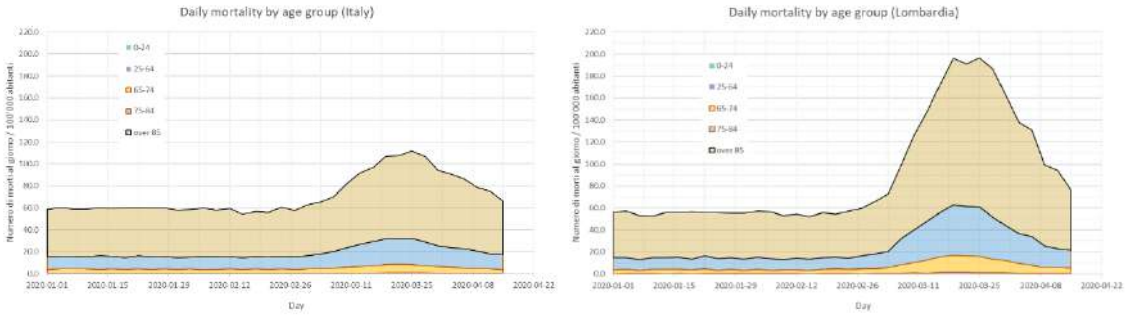


Fig. 7 Time history of daily mortality in Italy (a) and in Lombardy (b) for different age groups

From the analysis of these graphs, some considerations emerge: the age group most affected by the epidemic is that of the oldest population, over 65 years of age and especially for those over 85.
The population groups composed of young (under 25 years old) and adult (25-64 years old) are affected marginally in terms of mortality.
The second consideration regards temporal and spatial aspects: from early March the number of Covid-19 cases in Lombardy was much more notable, implying that the virus had been circulating since at least late February.
The provincial analysis shown in Fig. 5 highlights that the infection started from the province of Lodi (yellow) to first involve Cremona (pink) and Bergamo (dark blue), finally followed by Piacenza (light blue) and Brescia (orange) The province of Milan (green) on the contrary was affected only marginally by the event. The national (red) and regional trends of Lombardy (blue) are reported too and are shown as dotted line.

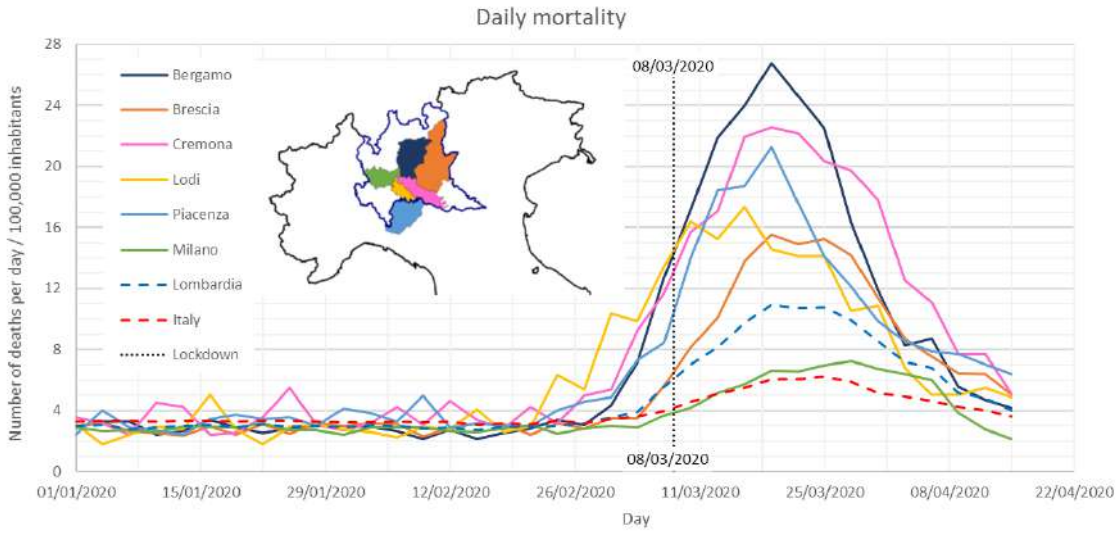


Fig. 8 Time series of daily mortality in various northern Italian provinces

March 8th 2020 is highlighted because it is the day on which the national government announced the lockdown of all of Italy, while restrictive measures were adopted only for Lodi area in the previous days. From this graph it is possible to understand that these measures were adopted only after the disease was already widespread and many deaths had occurred.
Similar considerations can be made at the regional level as shown in Fig. 6. The change in anomalous mortality spread first in the Lombardy region and then continued in Emilia Romagna and Piedmont. The Veneto region did not have a significant variation in mortality, although the first cases of Covid-19 were recorded in that area in the same days in which the cases in the province of Lodi were found.

It is significant to note that the regions of southern Italy, Campania was reported as an example, have had, in relation to the lockdown, a reduction in mortality compared to the ordinary situation.

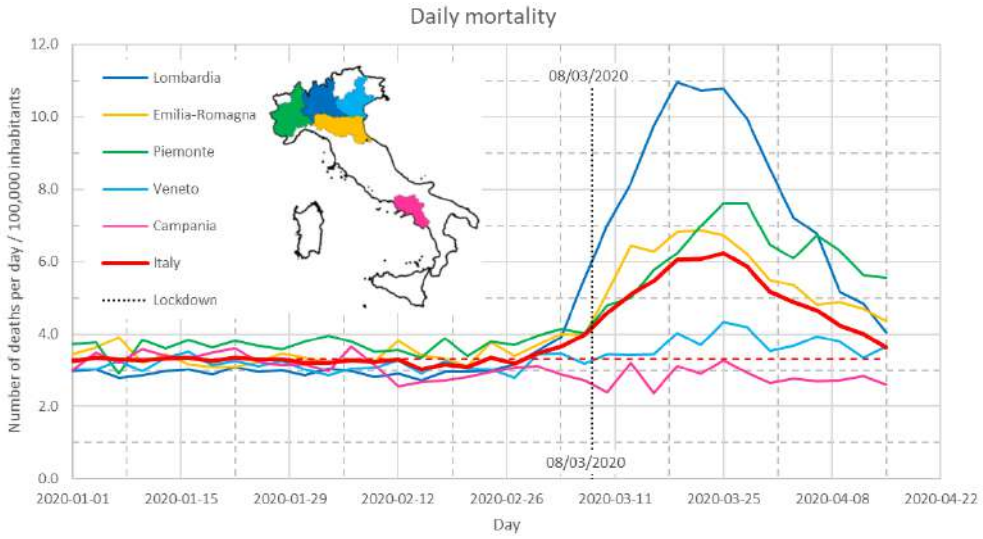


Fig. 9 Time history of daily mortality in some regions of Italy

Finally, the same analyses were performed, based on the data of the individual municipalities, and it was possible to map them.

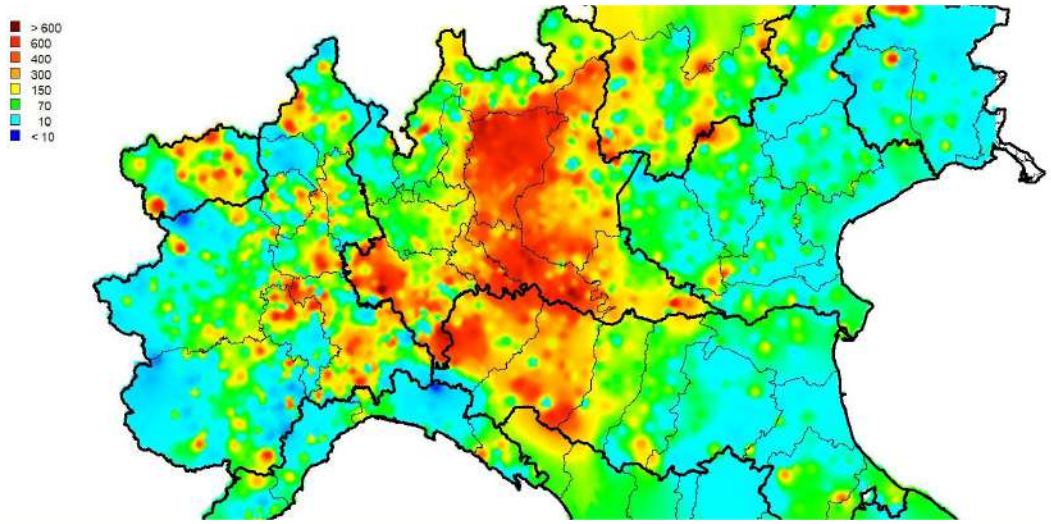


Fig. 10 Deaths variation map 2020 VS average 2015-2019 at municipal level

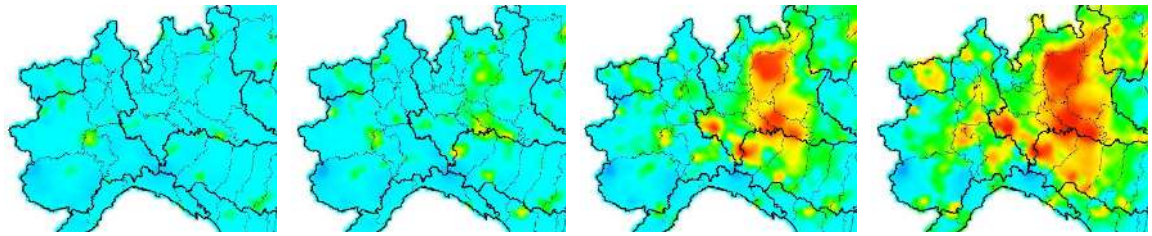


Fig. 11 Deaths variation map 2020 VS average 2015-2019 at municipal level

The maps developed on a provincial scale for the entire national territory show that the area of Bergamo, Lodi, Brescia, Cremona and Piacenza is the one with the highest number of confirmed deaths and with the greatest variation in mortality compared to the previous five-year period.

No further statistical analyzes are presented in this paper about the mortality data presented, however several considerations have been made using the ANOVA variance analysis.

Preliminarily, it was analyzed with a one-way ANOVA analysis if there were no significant variabilities in relation to the 2015-19 mortality data, and if for each province the average deaths in the observation period could be considered constant in the five years considered. This analysis gave a positive result with good significance (alpha<0.05 for all the provinces considered). The analysis was considered considering the 105-day period divided into 15 weeks. This result made it possible to consider the average mortality of the five-year period as a reference, for each individual province, for mortality variation analysis.

After, a two-way ANOVA variance analysis was conducted to verify whether the variation in mortality observed in 2020 relative to the Covid pandemic was statistically significant different from the variation in mortality for the provinces most affected by the phenomenon (first classification) and in the period following the beginning of the pandemic (second classification). This analysis also gave a positive result.

This kind of analysis was widely implemented to monitor data all over the world. Similar maps and data elaborations have been developed to monitor the level of the disease in England too (Fig. 12).

These maps show the evolution of the phenomena in relations to different parameters assessed with geodata analysis and georeferenced with a desktop GIS software which allows to understand which is the spatial development of the disease.

As it was done for the Italian case, similar analyses were developed for the British case too Fig.13) in which is explained the outbreak of the virus referred to different scales, such as national or regional (Upper Tier Local Authorities).

The British case study and the Italian ones are similar because they both consider the mortality rate related to the distribution of people because, as it was said by Frank Snowden: "Data for mortality were always more reliable than those for morbidity" (Snowden, 2019).

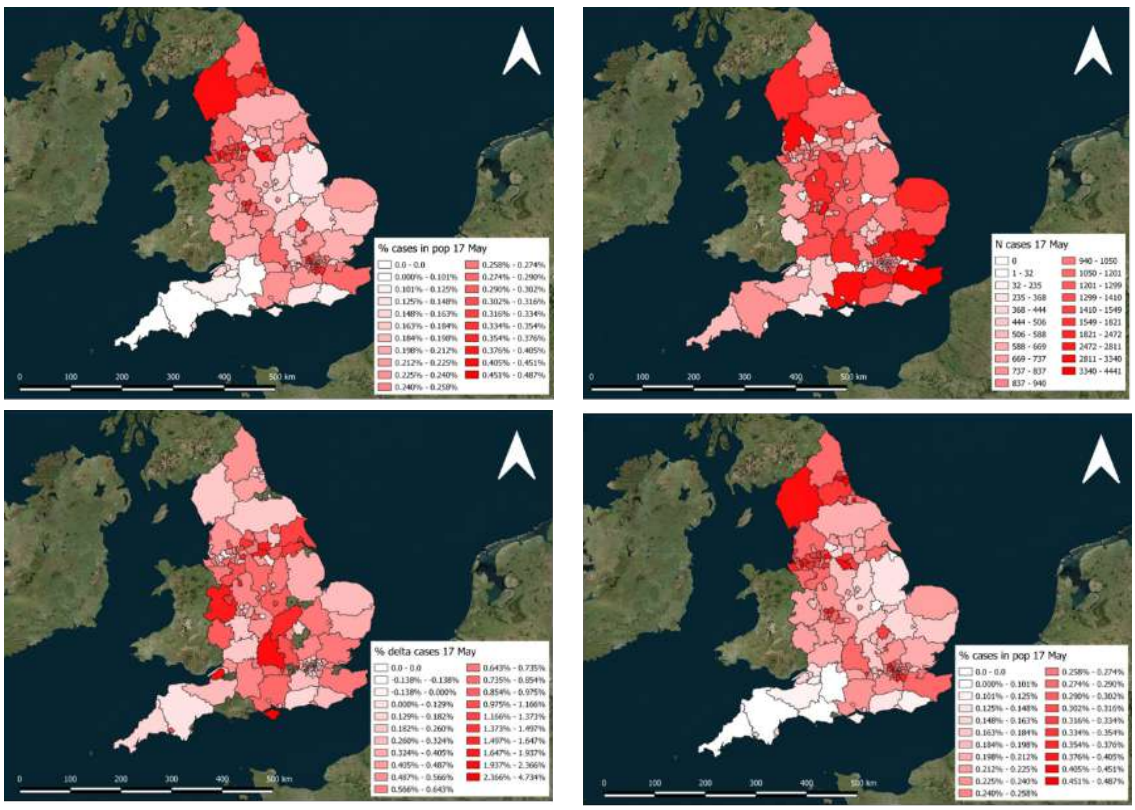


Fig. 12 Example of maps at national level in which different data about the epidemic in England are highlighted.

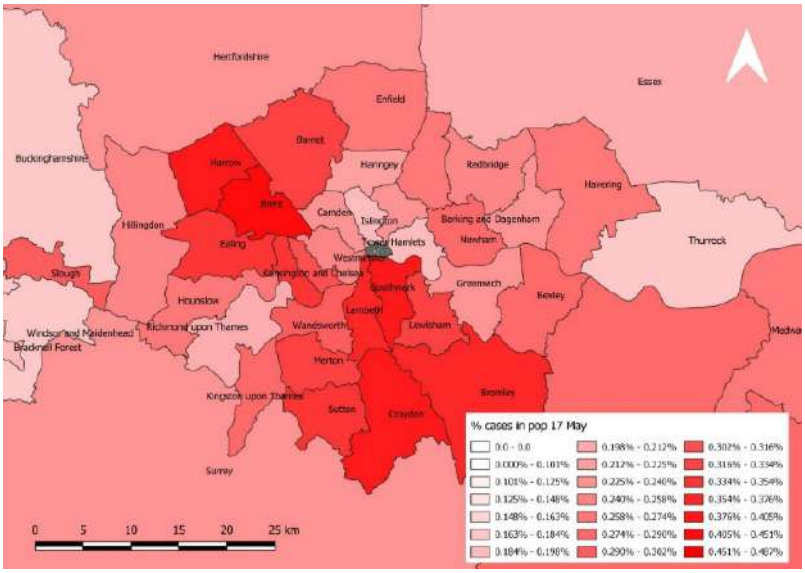


Fig. 13 Example of maps at Upper Tier Local Authority level in England.

2.3 From desktop GIS to dashboards for sharing information and supporting decision-making

The processing of the information layers described above allowed to move to the next step in which the processed data were uploaded on interactive online platforms, with a purpose that could be both communicative and operational (Environmental Systems Resource Institute, 2020a).

Risk communication should not be underestimated. Public administrations, at all levels, often have to manage complex situations linked to environmental health determinants, sometimes in a tense climate. There are many factors that contribute to a rapid aggravation of events. These may also include greater sensitivity to uncertain risks, an unequal distribution of risks and benefits and less trust in institutions and bodies responsible for public health decisions.

This is why it is important to manage information, evidence and communication of possible risks (Environmental Systems Resource Institute, 2020b, 2020c).

The online platforms offer different solutions such as webmaps and dashboards (Fig. 14), in which the georeferenced data are accompanied by a series of interactive and customizable graphs and indicators. Therefore, they are useful to communicate the developed analyses and processed data with possible users. Users that can be both technical analysts employed in the decisions field or common people.

Fig. 14 Example of dashboards with visualization of numerical elaborations and data mapping, in order to highlight the diffusion of the phenomenon at national, provincial, municipal level

This kind of dashboard is highly used worldwide. Thanks to the possibility to customise the interface and add graphs and data they found broad diffusion as a solution to highlight up-to-date data that would help local authorities and residents to make decisions to reduce the impacts of the disease (Geraghty & Lanclos, 2020)

and are an example of how experts in geodata analysis can have an important role in assessing and reducing health risk (Fig. 15).

Fig. 15 Example of dashboards developed to monitor the evolution of the epidemic in Florida in which data about the illness have been linked to the ZIP code to obtain the spatial distribution of the virus.

Webmaps and dashboards have the advantage of being able to be interrogated and therefore each object is associated with popups that "explain" the information shown on the map. They also offer the possibility of comparing different cartographies, namely, with the creation of dashboards it is possible to highlight different themes in parallel, thus allowing to immediately observe the variation of the analysed phenomenon in relation to previously fixed parameters.

This type of tool has a double value: on one hand it can be used to provide citizen with information on the phenomenon and its evolution and, on the other side, it can be a grounding point to build a system for the monitoring phase that can provide data to engage the decision-making process at all levels.

For communication purposes, data are shown in aggregate form, without violating the privacy rules (Environmental Systems Resource Institute, 2020a). This, in fact, is a very sensitive issue in the world of online applications, as there is risk of disclosing personal information. However, by showing the overall value by territorial portions, the point references to individual cases are lost and only the general trend for the analysed area is shown.

Different is the case in which the applications are intended for decision makers for the emergency phase in which the aggregate data may not be enough.

3. A lesson for the future: knowing how to provide support for risk management and decision making

What have we learned from this pandemic that has affected one of the most populous areas in Italy?

The need to have a system for monitoring phenomena connected to health risk has certainly emerged, aimed at promptly intervening and implementing procedures to contain the spread of the phenomenon.

We have seen that GIS can be, for this purpose, an important support tool, both from an operational point of view and as a communication and information tool, thanks to the spatial-temporal mapping of data. What everyone sees, after an event has occurred, is nothing more than the consequence of previous actions (or failure to act). In other words, a highly vulnerable area will be struck heavily by a calamity, not because the event is exceptional, but because the area is not sufficiently protected against that eventuality.

We can now add that this implies the need to tackle latent emergencies, before they actually arise. The latent emergency concept is fundamental for understanding the "risk mitigation" concept.

If it is understood that an area has some imminent hazards, it is necessary to act in order to reduce the damage. Given that, for example, we cannot prevent earthquakes, all we can do is try to draw as near as possible to V = 0 so that we can face on the events without suffering damage.

The three systems to be worked on, with structural and non-structural operations, are:

- the health organization, which expresses the vulnerability of the system;

- the social system, which expresses the social vulnerability; this includes all the measures of a collective nature that can be put in place, such as more careful regional planning;
- the political system, which expresses management (or organizational) vulnerability. In this case, "political" means the ability to equip ourselves, forward thinking in the organization of human resources, precise planning, but also creating public awareness and generating agreement on technical/organizational measures, necessary in order to prevent things from happening, and not after an event has occurred. If the politician/decision-maker ignores the seriousness of the latent phase, the vulnerability of the regional system increases exponentially.

These first studies carried out on the pandemic from Covid-19, with an in-depth study of the Lombardy provinces, show how appropriate and indispensable it is to prepare surveillance, prevention and limitation plans for the disease, in order to modulate the health risk. Diagnostic ability is essential for disease control and surveillance (the topic is discussed in many papers, among others we mention Ascione et al., 2013; Torrisi et al., 2017; Gargiulo et al., 2018).

As with all dangerous situations, what must be assessed is the socially acceptable risk of a present danger.

In the case of the Covid-19 pandemic, the Lombard system has proved in our view extremely vulnerable from a systemic point of view. The management of human health has not been able to contain the spread of the phenomenon, on the one hand by not promptly identifying the first cases of contagion, and then, with the large numbers, not having the adequate structures to deal with the health emergency.

A systemic vulnerability that has dragged individual vulnerability (it is sufficient to think about the age groups most affected), thus amplifying the overall risk. There is certainly also a need to reflect on the general rejection of what was happening. It is surprising that the finding of the virus in a young patient with incurable pneumonia was random and not the result of a monitoring plan that was to be expected.

Western countries are united in their failure to recognize the globalization of disease: if a person can travel from Beijing to Milan in 12 hours, so can a virus!

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Image Sources

Fig.1: Processing of ATS Brescia and ATS Valle Camonica;

Fig.2: Processing of ATS Brescia and ATS Valle Camonica;

Fig.3: Processing of ISTAT data (Deaths 2015-2020, observation period Jan 1st-Apr 15th);

Fig.4: Processing of ISTAT data (Deaths 2015-2020, observation period Jan 1st-Apr 15th);

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Fig.11: Processing of ISTAT data (Deaths 2015-2020, observation period Jan 1st-Apr 15th);

Fig.12: Processing of PHE - Public Health England data;

Fig.13: Processing of PHE - Public Health England data;

Fig.14: Processing of ATS Brescia and ISTAT data;

Fig.15: Geraghty & Lanclos, 2020;

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About the Sustainability of Urban Settlements.

A first reflection on the correlation between the spread of Covid-19 and the regional average population density in Italy

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Abstract

Urbanization is an onerous human activity: it affects municipal budget and foremost it costs the environment. Nevertheless, an ever-growing number of people (more than 75% of the European population) is living in cities and towns, so that identifying sustainable urban development solutions is a dramatically urgent need. Already in the 70s, some researches proposed parameters to evaluate urbanization costs in Italy, but they mainly focused on the economic and financial sustainability of real estate development. The land value capturing approaches proved to be inadequate when municipal budgets are facing growing social unbalances and critical environmental threats. The question being not just "where the money for urban infrastructures could come from", but also "what could be a more sustainable development model". In any case, now we are forced to rethink the whole organization of our urban life to defend ourselves from largely unknown threats, pandemics, Covid-19 being probably one among others that we could face in the near future. It is not yet clear if a link exists between the spread of the virus, the health consequences and the environmental conditions, but what probably will need to be assessed is the effect of population density on the spread of contamination. Even the traditional provision of services and public spaces will need to be defined again in order to protect and serve urban population. New evidences will force planners to redefine their thoughts and schemes

Keywords

Sustainability; Urban development; Pandemic.

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1. Introduction

Urban growth, both spontaneous and apparently unplanned and uncontrolled, is a significant and growing issue in Europe and all over the world (Brueckner, 2000; Batty et al., 2003; Bourne, 2005; Tira & Badiani, 2009; Christiansen & Loftsgarden, 2011). Development patterns always have several social and economic causes. From the perspective of land economics, high land prices in the core of the city force developers to seek lower prices in the more peripheral areas, as the price of agricultural land is universally much lower than the price of land zoned for housing or the development of services. From a social point of view, the lack of public funding and the new needs of urban population rise the pressure of new developments on greenfield.
From a physical point of view, the environmental concerns, the need for energy saving and for natural risk protection are some of the drivers for new constructions. Anyway, now we are forced to rethink the whole organization of our urban life to defend ourselves from largely unknown threats, pandemics, Covid-19 being probably one among others that we could face in the near future. The worldwide context in which we observe the spread of the virus has completely changed since the last pandemics. An estimated 500 million people from the South Seas to the North Pole fell victim to Spanish Flu (1918-1920): one-fifth of those died. At the time (see Fig.1), the world population accounted something less than 2 billion people, so more than 25% of the world's population was hit by the pandemic. In 1957-1958 the Asian flu pandemic, with its roots in China, claimed more than 1 million lives (being 2.5 billion the world population). AIDS became a global pandemic in the 1980s and it continues as an epidemic in certain parts of the world. AIDS has claimed an estimated 35 million lives since it was first identified. At 13th June 2020, 7,274 thousands cases of Covid-19 pandemic were recorded all over the world, and more than 413 thousands deaths. The world population is now 7.7 billion (2019), and it is expected to reach 11 billion by the fall of the Century. "The urban population of the world has grown rapidly from 751 million in 1950 to 4.2 billion in 2018. Asia, despite its relatively lower level of urbanisation, is home to 54% of the world's urban population, followed by Europe and Africa with 13% each" (UN, 2019). In the same period, "the rural population of the world has grown slowly and is expected to reach its peak in a few years. The global rural population is now close to 3.4 billion and is expected to rise slightly and then decline to 3.1 billion by 2050. Africa and Asia are home to nearly 90% of the world's rural population in 2018. India has the largest rural population (893 million), followed by China (578 million)" (UN, 2019). At what cost did all this happen and under which conditions it can be sustained in the future projections? What will be the consequences of present and future pandemics on this increasingly concentrated urban population?

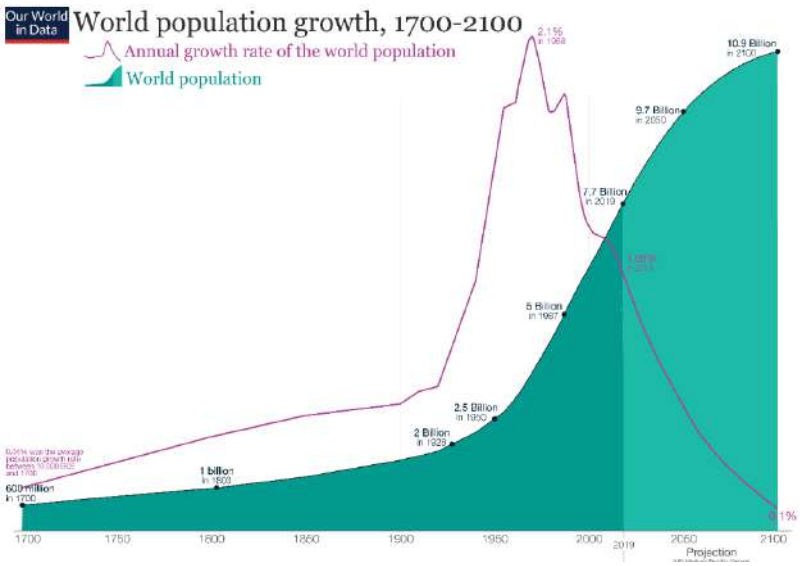

Fig.1 World population growth, 1700-2100 (Source: Our world in data, based on UN, 2019)

2. World's population growth

Two are the main factors at a macro-scale: world population is growing, and namely urban population is rapidly on the rise. "The world's population continues to increase: it is projected to grow from 7.7 billion in 2019 to 8.5 billion in 2030 (10% increase), and further to 9.7 billion in 2050 (26%) and to 10.9 billion in 2100" (See Fig.1; UN, 2019).

However, growth rates vary greatly across regions. "Nine countries will make up more than half the projected population growth between now and 2050. The largest increases in population between 2019 and 2050 will take place in: India, Nigeria, Pakistan, the Democratic Republic of the Congo, Ethiopia, the United Republic of Tanzania, Indonesia, Egypt and the United States of America" (UN, 2019).

The world's population is not just increasing but also growing older, "with persons over age 65 being the fastest-growing age group. By 2050, one in six people in the world will be over age 65 (16%), up from one in 11 in 2019 (9%). By 2050, one in four persons living in Europe and Northern America could be aged 65 or over. In 2018, for the first time in history, persons aged 65 or above outnumbered children under five years of age. The number of persons aged 80 years or over is projected to triple, from 143 million in 2019 to 426 million in 2050" (UN, 2019).

Falling proportions of working-age people are putting pressure on social protection systems and consequently on the provision of urban social services. Combining that evidence with the reduction in population size of a growing number of countries, the economic sustainability of urban public services is at stake: the fewer working people will have to support the services for the most, thus being obliged to work longer.

Whilst the world's population is growing, people living in cities and towns are rapidly increasing: "today, 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050. Projections show that urbanization, the gradual shift in residence of the human population from rural to urban areas, combined with the overall growth could add another 2.5 billion people to urban areas by 2050, with close to 90% of this increase taking place in Asia and Africa, according to a new United Nations data set" (UN, 2019).

The 2018 Revision of World Urbanization Prospects produced by the Population Division of the UN Department of Economic and Social Affairs (UN DESA) notes that future increases in the size of the world's urban population are expected to be highly concentrated in just a few countries.

3. How matter size and density of urban settlements

We know relatively well the economic and environmental effects of this tremendous change at a macro level. Even if urban areas cover the 1% of the global ice-free land surface (IPCC, 2019), they are responsible for the 60 to 80% of energetic consumption, the 75% of CO_2 emissions, large part of landscape degradation and rare events. Urban areas heavily affect the environment and human health. "Urbanisation can enhance warming in cities and their surroundings (heat island effect), and it can also intensify extreme rainfall events over the cities" (IPCC, 2019).

Nevertheless, at a micro scale, "urban areas, urban expansion and other urban processes and their relation to land-related processes are extensive, dynamic and complex" (IPCC, 2019).

The demographic dimension of urban settlement is one of the elements to explain that complexity. We are highly impressed by the huge extensive megacities: "Tokyo is the world's largest city with an agglomeration of 37 million inhabitants, followed by New Delhi with 29 million, Shanghai with 26 million, and Mexico City and São Paulo, each with around 22 million inhabitants. Today, Cairo, Mumbai, Beijing and Dhaka all have close to 20 million inhabitants" (UN, 2019). Nevertheless, urban dynamics are all but linear. "By 2020, Tokyo's population is projected to begin to decline, while Delhi is projected to continue growing and to become the

most populous city in the world around 2028" (UN, 2019). Moreover, the relation between demographic dimension and other economic and social parameters is manifold and even if "by 2030, the world is projected to have 43 megacities with more than 10 million inhabitants, some of the fastest-growing urban agglomerations are cities with fewer than 1 million inhabitants, many of them located in Asia and Africa" (UN, 2019).

The percentage of people living in medium sized towns is bigger: "close to half of the world's urban dwellers reside in settlements with fewer than 500,000 inhabitants" (UN, 2019) and in Europe a large portion of urban dwellers live in small and very small settlements. That is particularly true for Italy, where around 88% of urban population (shown in Fig.2), that is the 62% of the total, live in cities and towns with fewer than 500,000 inhabitants, as shown in Fig.3. Moreover, some 70% of the urban settlements account less than 5,000 inhabitants in Italy.

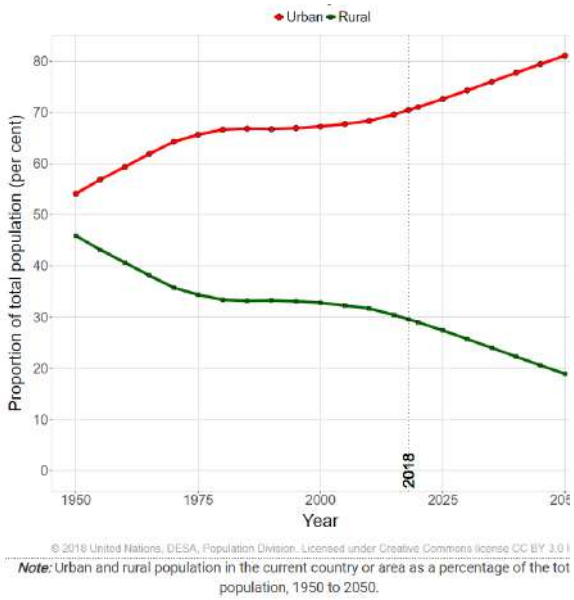

Fig.2 Percentage of urban population in urban and rural areas in Italy (Source: UN, 2019)

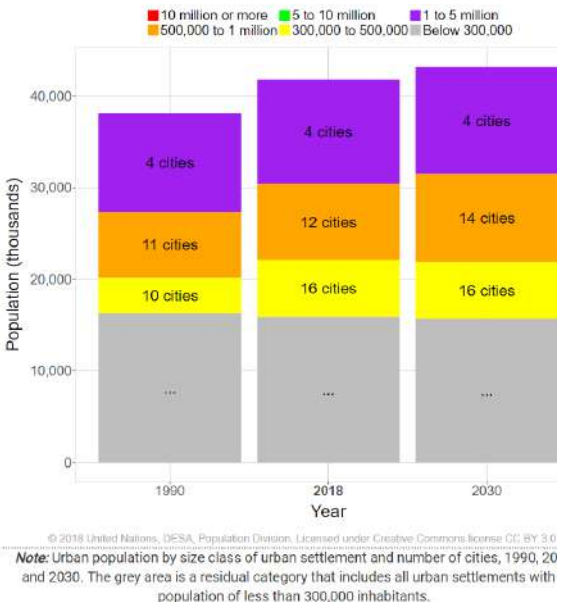

Fig.3 Urban population by size class of urban settlement in Italy (Source: UN, 2019)

Those phenomena that cost the earth are not confined to megacities. Probably, the easiest example is that of public transport. It is widely recognized that an efficient and vast network can significantly reduce private motorized mobility. At the same time, no public transport facility can be implemented under a threshold of minimum population: the costs would be unsustainable. Similarly, waste collection can result in a much more efficient system in low-density settlement, as the space for landfills (when other solutions for disposal are not implemented) is hard to find in large and dense urban areas.

When looking at pandemic, as shown in the paper, even local concentration of population and activities can spread contamination at an unsustainable level. That is the case of small villages in the Provinces of Brescia and Bergamo during the hardest phase of Covid-19 diffusion.

At the same time, according to the last report on Land consumption in Italy (ISPRA, 2018), the greatest contribute to greenfield transformation took place in the minor communities (71% of new land consumption between 2016 and 2017 regards those municipalities with less than 20,000 inhabitants). Population density on urbanised areas is roughly diminishing with town dimension, at such extent that it can halve in small communities, when compared to bigger cities. A recent research has shown how urban density has diminished to one third in almost 60 years in a low-density urban district in Lombardy, made of small and very small communes (Mazzata & Tira, 2008). The debate around pros and cons of a compact city, even concerning

sustainability is long lasting and the results controversial. From one side, "there is a remarkable consensus among international institutions as well as local and national governments to implement large and compact cities as a way of reducing the ecological impact of urban settlements, and hence of contributing to the achievement of sustainable development" (Gaigné et al., 2011). On the other side, density has always been and still continues to be a tricky matter (see among others Burton et al., 2003). At the time of the first industrial revolution, it was a dramatic negative characteristic of cities and towns. Pandemic dramatically brings us back in time: even the most efficient urban settlements can suffer from the spread of un-known virus, quickly transmitted by an increasingly complex and inter-related urban environment. One Century ago, the Garden city movement and then the rational urban planning with the definition of urban standards aimed at loosing the overcrowding, cause of innumerous negative impacts. That could have been a bright way to address the problem and it is still considered as a possible solution (Hardy, 2008). Nevertheless, when the disruptive private car ownership exploded, the new mobility freedom paved the way to the urban sprawl. The compact city shows its ecological impact, due to the growing energy demand especially for buildings and the great dependence on a large (and so often distant) rural area. It can maximise the scale economies for many public facilities, like transport systems, but we observed an high vulnerability to pandemic. The low-density scheme pays the cost of extending lifelines and road network to an unwise dimension and paves the way to an irrational use of motorized private cars. At the same time, it is a most suitable scheme to energy self-sufficiency and easier for arranging social distances, as during the pandemic. Understanding the key trends in urbanization likely to unfold over the coming years is crucial to the implementation of the 2030 Agenda for Sustainable Development, namely by defining sustainable urbanization approaches. In an unexpected way, that analysis is now crucial to prepare health care systems to face future challenging crisis as the one the world is still suffering for.

4. The Covid-19 pandemic

The coronavirus Covid-19 pandemic is the defining global health crisis of our time and the greatest challenge we have faced since World War II. Since its emergence in Asia late last year (2019), the virus has spread to every continent except Antarctica. Countries have raced to slow the spread of the virus by testing and treating patients, carrying out contact tracing, limiting travel, quarantining citizens, and cancelling large gatherings such as sporting events, concerts, and schools. The pandemic is moving like a wave, one that may yet crash on those least able to cope. Covid-19 is much more than a health crisis.

By stressing every one of the countries it touches, it has the potential to create devastating social, economic and political crises that will leave deep scars. Every day, people are losing jobs and income, with no way of knowing when normality will return. Small island nations, heavily dependent on tourism, have empty hotels and deserted beaches. The International Labour Organization estimates that 195 million jobs could be lost (UNDP, 2020).

That is a brief, but dramatic description made by International Institutions of the Covid-19 pandemic. More than 413,000 deaths have been registered so far (WHO, 13th June 2020), but the pandemic is not yet finished and many Countries are still facing growing challenges. From an ethical point of view, we cannot accept hundreds of thousands deaths. From the economic perspective, job losses and financial crisis result in further deaths and suffering. Therefore, we are forced to rethink the whole organization of our (urban) life, to defend ourselves from largely unknown threats, as probably the last will be one among others in the near future. If the variation by age groups is quite clear (in Fig.4, we can observe the average distribution in Italy), the evidence about the geographical spread of the virus is still very poor and so it is the (possible) correlation with urban environments.

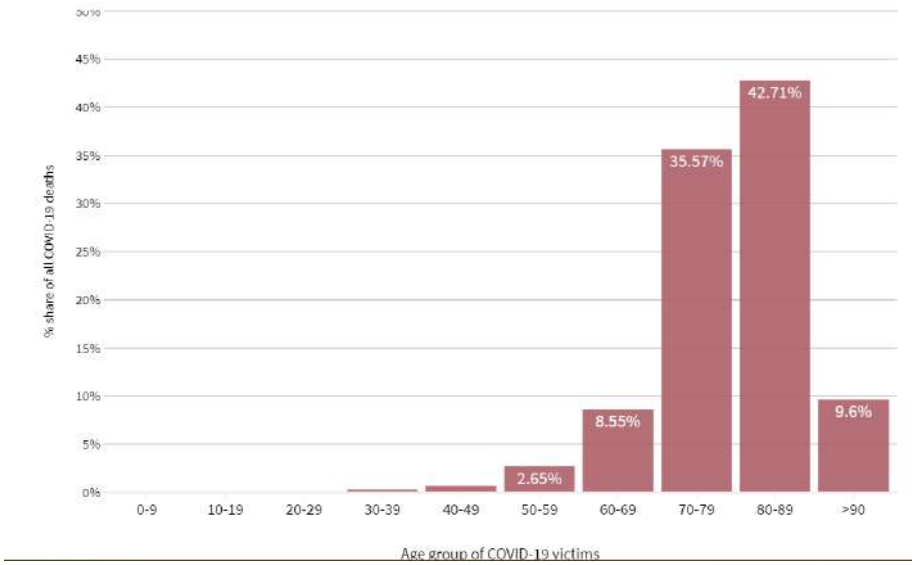

Fig.4 Covid-19 deaths by age groups (Source: https://www.euronews.com/2020/06/10/covid-19-coronavirus-breakdown-of-deaths-and-infections-worldwide, 2020). Study based on 1,625 deaths

5. The effect of average population density on the spread of the virus

What probably will have to be assessed in depth is the effect of population density on the spread of contamination. The figures describing the rapid and massive wave of infections recorded in Region Lombardy are in some way related to the high density of population and economic activities (as shown by an Italian study of some experts, coordinated by G Senna, from the Italian Society of Allergology, Asthma and Clinical Immunology-SIAAIC; paper under embargo). Data show that the infection rate is significantly different. At the basis of discrepancies there is probably a different density of population: where many people live nearby, the virus can circulate much more and the infections grow. In Tab.1 we may observe the distribution of positive cases, the deaths, the average population and their ratios.

We know that both positive cases and deaths are approximated figures. The positive cases depend on the number of coronavirus swabs, while the deaths may not be diagnosed as covid-deaths, due to other diseases or fragilities. Several documents state that the number of positive cases could be much higher, as well as the death toll. Anyway, we will elaborate official available data at 13th June 2020.

The goal is to assess the correlation between the positive cases and the average population density at different scales. If we look at the regional average figures, an explanation to the rapid spread of the virus can be given for Lombardy (see Tab.1), but we do not find any clear correlation between the average population density and the rate of positive cases per inhabitant in other Regions, even in the North of Italy.

For example, it is hard to explain the very high rate of positive cases in Aosta Valley and Trentino/South Tyrol, when looking at the sparse density.

On the other side, Veneto and Liguria show a similar regional average population density, but a quite different rate of positive cases. If we observe figure 5, we may find a partial correlation in Central Italy, where Tuscany, Abruzzo, Umbria and Molise show a similar proportion between population density and positive cases.

Similarly, Veneto and Friuli V.G. follow the same pattern and comparable ratio between positive cases/population versus the regional average population density.

Anyway, we restricted the observation to the North of Italy, assuming that the comparison with the central and southern Regions is not sound, as the pandemic has been confined by the restrictive measures approved by the Government from 8th March 2020 on.

Italian Regions	Population [a]	Regional average population density [b]	Positive cases [c]	Positive case density [c/a] *1,000	Deaths [d]	Deaths / positive cases [d/c]*100
Aosta Valley	125,666	39	1,191	9.5	144	12.1
Lombardy	10,060,574	422	91,414	9.1	16,428	18.0
Piedmont	4,356,406	172	31,029	7.1	4,006	12.9
Trentino S.T	1,072,276	79	7,056	6.6	755	10.7
Liguria	1,550,640	286	9,875	6.4	1,518	15.4
Emilia-R.	4,459,477	199	28,056	6.3	4,199	15.0
Marche	1,525,271	162	6,754	4.4	993	14.7
Veneto	4,905,854	267	19,212	3.9	1,977	10.3
Tuscany	3,729,641	162	10,172	2.7	1,082	10.6
Friuli V.G.	1,215,220	153	3,296	2.7	343	10.4
Abruzzo	1,311,580	121	3,275	2.5	454	13.9
Umbria	882,015	104	1,436	1.6	76	5.3
Molise	305,617	69	439	1.4	23	5.2
Lazio	5,879,082	341	7,941	1.4	806	10.1
Apulia	4,029,053	206	4,515	1.1	532	11.8
Sardinia	1,639,591	68	1,363	0.8	132	9.7
Campania	5,801,692	424	4,608	0.8	430	9.3
Basilicata	562,869	56	401	0.7	27	6.7
Sicily	4,999,891	194	3,456	0.7	279	8.1
Calabria	1,947,131	128	1,162	0.6	97	8.3

Tab.1 Distribution of Covid-19 positive cases and deaths versus population density of Regions at June 13th 2020 (Source: official database Civil Protection Service)

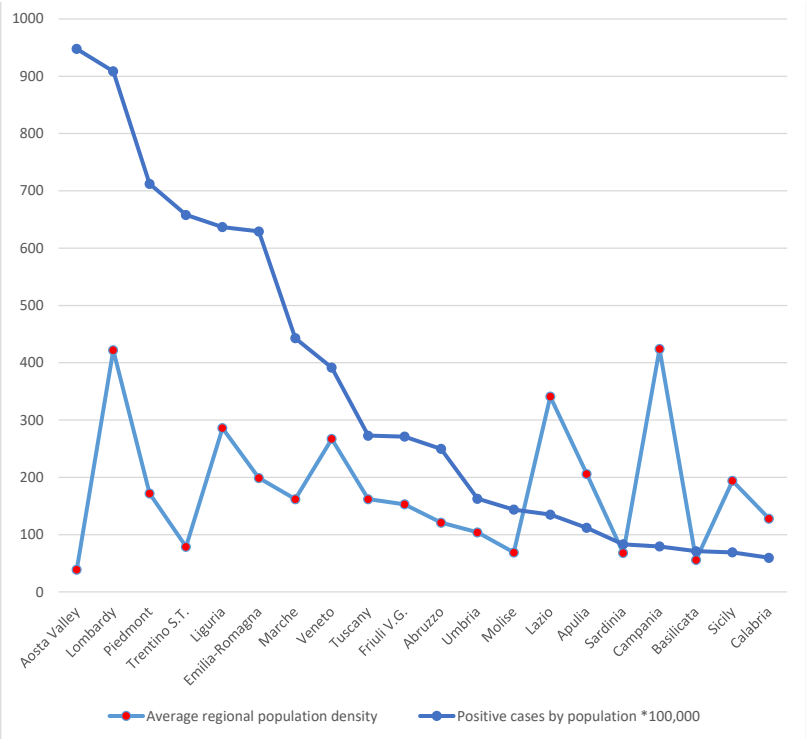

Fig.5 Distribution of Covid-19 positive cases by population (* 100,000) versus regional average population density at June 13th 2020 (Source: official database Civil Protection Service and ISTAT)

Even in that case, the observation must be brought to a more detailed scale, considering a more accurate definition of urban density. The average population density is strongly influenced by the distribution of the population in the diverse geographical regions: mountain, hills and plane and determined by the type of settlement. Therefore, the average figures do not explain the real distribution of population in the urbanised areas.

The ratio of positive cases has then been recalculated when considering (see Tab.2):

- the average population density, weighted by the degree of urbanisation, summing only the population living in intermediate density area (towns and suburbs/small urban area), and densely populated area (cities/large urban area);
- the average population density, weighted by three clusters of demographic size: municipalities with less than 5,000, from 5,001 to 250,000 and over 250,001 inhabitants.

The Degree of urbanisation (DEGURBA) is a classification that indicates the character of an area. Based on the share of local population living in urban clusters and in urban centres, it classifies local administrative units level 2 (LAU2) into three types of area: thinly populated area (rural area); intermediate density area (towns and suburbs/small urban area), and densely populated area (cities/large urban area).

The classification of local administrative units (LAU2) in the mentioned areas uses as a criterion the geographical contiguity in combination with the share of local population living in the different type of clusters. In a first step, the typology of clusters starts by classifing grid cells of 1 sq. km to one of the three following clusters, according to their population size and density:

- high-density cluster/urban centre: contiguous grid cells of 1 sq. km with a density of at least 1,500 inhabitants per sq. km and a minimum population of 50,000;
- urban cluster: cluster of contiguous grid cells of 1 sq. km with a density of at least 300 inhabitants per sq. km and a minimum population of 5,000;
- rural grid cell: grid cell outside high-density clusters and urban clusters.

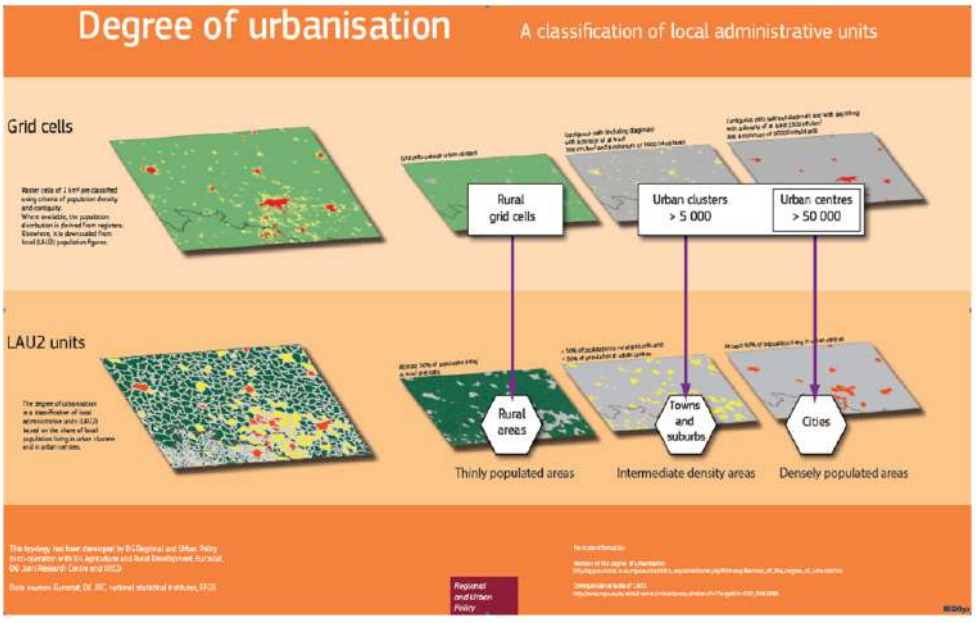

Fig.6 Degree of urbanisation – Grid cells and LAU2 units (Source: EUROSTAT, 2011)

In a second step, local administrative units (LAU2) are then classified to one of three type of areas:

- *densely populated area*: at least 50 % lives in high-density clusters; in addition, each high-density cluster should have at least 75 % of its population in densely-populated LAU2s; this also ensures that all high-

density clusters are represented by at least one densely-populated LAU2, even when this cluster represents less than 50 % of the population of that LAU2;

- *intermediate density area*: less than 50 % of the population lives in rural grid cells and less than 50 % live in high-density clusters;
- *thinly populated area*: more than 50 % of the population lives in rural grid cells.

To classify municipalities, the previously identified areas are intersected with municipal borders and the percentage of population of the municipality that falls into each typology of area is calculated.

Using ISTAT (2015) database, we weighted the average density of population living in intermediate density and densely populated municipalities by the corresponding percentage of inhabitants, so obtaining the results of column [b] in Tab.2.

On the other side, if we weight the population density by the amount of people living in the three classes of municipalities (<5,000, from 5,001 to 250,000 and over 250,000 inh.), we obtain the results of column [c] in Tab.2.

Northern Italian Regions	**Population density [a]**	**Weighted (1) pop. density [b]**	**Weighted (2) pop. density [c]**	**Positive case density [from Tab.1]**
Aosta Valley	39	336	462	9,5
Lombardy	422	1313	1517	9,1
Piedmont	172	1195	1630	7,1
Trentino S.T	79	614	137	6,6
Liguria	286	1302	1207	6,4
Emilia-R.	199	525	465	6,3
Veneto	267	551	374	3,9
Friuli V.G.	153	976	317	2,7

Tab.2 Distribution of Covid-19 positive cases and deaths versus population density and degree of urbanisation (data 2014) of Northern Regions at June 13th 2020 (Source: official database Civil Protection Service and ISTAT)

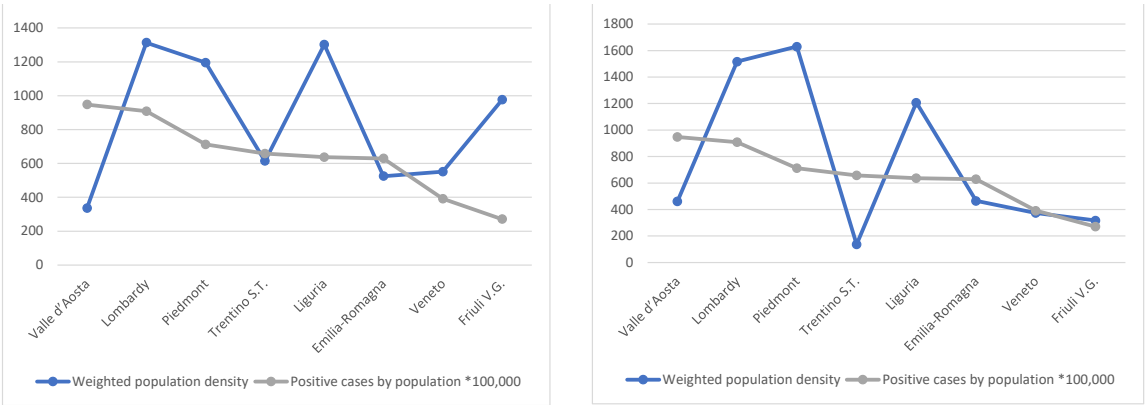

Fig.7 Distribution of Covid-19 positive cases by population (* 100,000) versus weighted regional population density at June 13th 2020 in Northern Italian Regions: 7(a) for the weighted 1 solution; 7(b) for the weighted 2 solution (Source: official database Civil Protection Service and ISTAT)

Through that simple refinement of calculation, we can explain better the high number of positive cases in Lombardy, Piedmont and Liguria. We may also observe that the difference between the average density and the two weighted population densities as calculated and shown in Tab.2 is smallest in Veneto. In other words, the weighted densities (that we postulate are closer to the real distribution of population in the urbanised areas) seem to explain relatively better the distribution of positive cases in Northern Italian Regions.

6. Conclusive remarks

The results are a first attempt to assess the spread of the virus at regional scale in Italy. As stated at the beginning, data approximation has to be considered, as depending very much on the accuracy of medical files and the number and frequency of health surveys. The dynamics of contamination are also obscure to a large extent, so that the spread in central and southern Italy have been much slower and so much smaller are the figures for those Regions. In the northern Regions, namely in Lombardy and Piedmont, we may observe a higher proportionality between the density of positive cases and the population density when a more accurate measure of population density is used. Similarly, that may be observed for Emilia-Romagna, Veneto and Friuli V.G. when the density is weighted by the municipal classes of population.

We may also observe that the difference between the average density and the two weighted population densities as calculated and shown in Tab.2 is smallest in Veneto. That Region is known for having faced the starting of pandemic and then for a better performance in fighting against the spread of the virus. The results here presented partially explain the difference from all other northern Regions (with the exception of Friuli V.G.) also by the smaller urban density.

Therefore, the observation must be brought to a more detailed scale, at the level of single provinces and towns, and even at the scale of single urban quarter, by using local density data.

A new challenge arises for urban density and new needs for public spaces and services.

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