POLITECNICO DI TORINO

MSc TERRITORIAL, URBAN, ENVIRONMENTAL AND LANDSCAPE PLANNING
Curriculum: Planning the City and the Territory

MASTER'S DEGREE THESIS

INHABITING PROXIMITY.
New urban paradigms for post-pandemic cities

Supervisor
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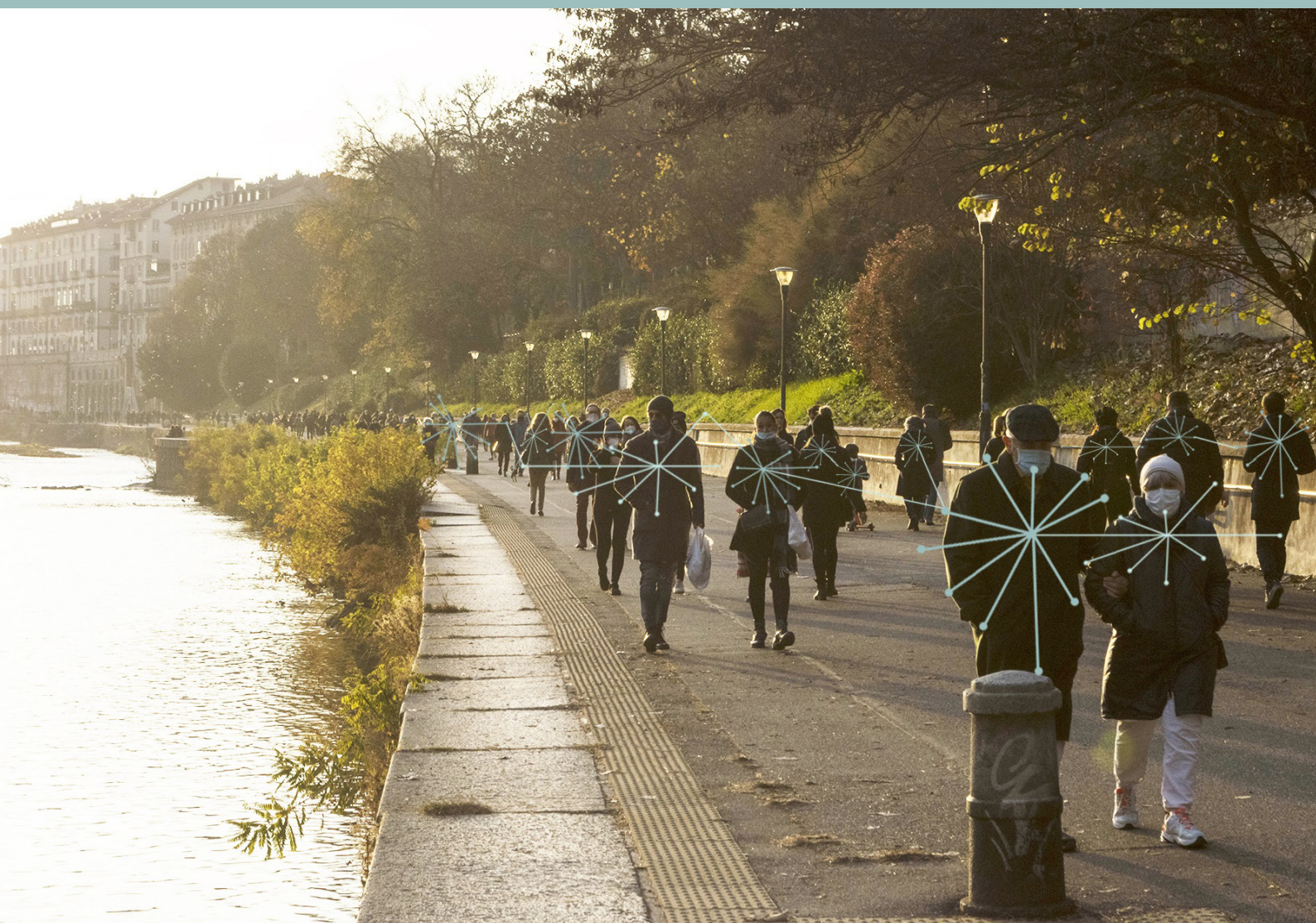
July 2021



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Title	INHABITING PROXIMITY. New urban paradigms for post-pandemic cities
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This research is part of the call for co-financing of the Post Un-lock research project launched by the Interuniversity Department of Sciences, Project and Territorial Policies (DIST) in collaboration with the Risk Responsible Resilience Center (R3C) and the Medical Statistics and Epidemiology Department of the University of Turin. The Project launched in 2020 is entitled "Post Un-lock. From territorial vulnerability to local resilience".

POLITECNICO DI TORINO
UNIVERSITÀ DEGLI STUDI DI TORINO
Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio
R3C Responsible Risk Resilience Centre

The Master Thesis' results has been presented at the 31st European Conference on Operational Research - EURO Athens 2021 on July.

EN

The methodology of Post-Covid indicators analysis presented in this research work has responded to the Call for papers *"The use of data in the decision-making processes in light of the Covid-19 pandemic"* promoted by "Il Piemonte delle Autonomie" in 2021. The paper presented, in the final acceptance and publication phase, has been entitled *"Inhabiting proximity: Post-Covid indicators and scenarios for post-pandemic cities redesign on a neighborhood scale"*. The results will flow into the quarterly journal of Administration Sciences "Il Piemonte delle Autonomie".

ITA

La metodologia di analisi degli indicatori Post-Covid presentata in questo lavoro di ricerca ha risposto alla Call for papers *"L'uso dei dati nei processi decisionali alla luce della pandemia di Covid-19" promossa dal "Piemonte delle Autonomie"* nel 2021. Il paper presentato, in fase di accettazione finale e pubblicazione, è stato intitolato "Abitare la prossimità: indicatori e scenari post-Covid per la riprogettazione delle città post-pandemiche alla scala del quartiere". I risultati confluiranno nella rivista trimestrale di Scienze dell'Amministrazione "Il Piemonte delle Autonomie".

To Gabriella,

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INDEX

PART I – THE VALUE OF PROXIMITY

PART II – MEASURING PROXIMITY THROUGH INDICATORS

PART III – FUTURE EVOLUTIONS

PREFACE

This thesis starts from the need, at the end of this study path, to conduct a research work that could be a source of stimulus for me and that could enrich my knowledge in the field of urban planning. The desire to conduct research work, choosing this thesis mode among those proposed, allowed me to systematize the numerous knowledge gained during these years thanks to the precious teachings acquired by professors assigned to my chosen MSc course. The decision to deal with the issue of post-pandemic cities derives from having begun my research in the middle of the pandemic period, leading me to ask myself what contribution my role as an urban planner could contribute to the cities of tomorrow. When choosing the subject of this thesis, I felt the need to be for my generation, a bearer of knowledge and design solutions that could enrich and be solutions for the future development of cities.

This pandemic crisis has offered a new perspective on the limits of the development of the "urban" world which have declined in the last sixty years. Isolation has affected the collective memory with unprecedented scenarios: empty cities, silent streets, deserted parks and leisure places. It has forced us to reflect on the very meaning of "what it means" and “what's the use” of a city. On the one hand, an interconnection node for a global society, an engine of culture, growth and wealth, a place of exchange, consumption and investment. On the other hand, a deeply divisive and unjust place, a world of slaves of the informal and gig economy, a source of enormous inequality between those who have a balcony and those who don't, those who have a private garden and those who only have a few square meters to live and work in (Favarelli, 2021)

The theme of proximity has been a widely shared and discussed subject over the years through various experiments in different cities such as: the 15 minute city in Paris, the 20 minute neighborhood in Portland and the Superblocks model of Barcelona, but this theme has never been seen as a key to the redesign of post-pandemic cities.

This work seeks to fully understand the wording "near one's home" that has characterized the different phases of lockdown, understanding how the issue of proximity and the new role of the pedestrian must become the focus of future post-urban pandemic planning. In conclusion, this work moves from the need to expand the literary review developed on the subject over the years, to a different interpretation given by the new and essential relationship that must exist between the city and urban health, in order to make the cities their own public health generators.

ABSTRACT – EN

Cities around the world have faced the impact and spread of the Covid-19 pandemic with unprecedented speed as a result of our hyper-connected society. As history teaches us, epidemics plague society by way of the vulnerabilities that humans create through their relationships with the environment, with other species and with each other. The ongoing pandemic is a strong reminder that urbanization has changed the way that people and communities live, work and interact. It is therefore even more necessary than in the past, to adopt a multidisciplinary approach to developing systemic operational skills capable of dealing with complex issues within cities.

This research is part of the call for co-financing of the Post Un-lock research project launched at the end of 2020 by the Interuniversity Department of Territorial Sciences, Project and Policies (DIST), in collaboration with the Risk Responsible Research Center Resilience Center (R3C) and the Medical Statistics and Epidemiology Department of the University of Turin.

This work has shown how many measures adopted during the emergency have now become part of daily life, changing habits and behaviors. The lesson of the pandemic is that people's health is connected and dependent on the health of the planet, and cities are at the center of their relationship. Starting from the research question with the relative setting of the research limits, limits beyond which we have not investigated as they are external to the point of view of the territorial planner, within all the chapters we asked ourselves how to redesign the concept of public health in relation to the built environment.

The objective of the research starts from the need to identify a selection of Post-Covid indicators by providing an analysis methodology suitable for the creation of one's own final set with relative identification of the specific KPIs of the project, replicable in all urban contexts, on which to base the analysis of the local sustainability level, especially on the scale of the neighbourhood.

The proposed methodological framework, developed in two phases: (1) selection of indicators and (2) baseline scenario, has set itself the desire to investigate the correlations existing between the urban environment and level of proximity of the cities. Based on the evaluation of the Key Performance Indicators (KPI), selected in the face of numerous comparisons with the stakeholders internal and external to the project, it was possible to analyze the Baseline Scenario of proximity to the neighbourhood scale for the city of Turin. It highlights weak points and priority areas on which to act, experiments with the theme of "living in proximity" as an urban response to the pandemic.

Measuring, evaluating and spatially visualizing the impact are the keys to the proposed evaluation process.

Keywords: *Covid-19, transformative resilience, territorial vulnerability, local level, urban health, agenda 2030, SDG 11, Post-Covid indicators, proximity.*

ABSTRACT – ITA

Le città di tutto il mondo hanno affrontato l'impatto e la diffusione della pandemia da Covid-19 con una velocità senza precedenti, causa della nostra società iperconnessa. Come la storia ci insegna, le epidemie affliggono la società attraverso le vulnerabilità che gli esseri umani creano attraverso le loro relazioni con l'ambiente, con altre specie e tra loro. La pandemia in corso è un forte promemoria del fatto che l'urbanizzazione ha cambiato il modo in cui le persone e le comunità vivono, lavorano ed interagiscono, ed è quindi ancora più necessario che in passato adottare un approccio multidisciplinare allo sviluppo di competenze operative sistemiche in grado di affrontare problematiche complesse all'interno delle città.

La presente ricerca si colloca nell'ambito del bando per il cofinanziamento del progetto di ricerca Post Un-lock avviato alla fine del 2020 dal Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio (DIST), in collaborazione con il Centro di ricerca Risk Responsible Resilience Center (R3C) ed il Dipartimento Medical Statistics and Epidemiology dell'Università degli studi di Torino.

Il presente lavoro ha mostrato come molte misure adottate durante l'emergenza siano ormai entrate a far parte della vita quotidiana, modificando abitudini e comportamenti. La lezione della pandemia è che la salute delle persone è connessa e dipendente dalla salute del pianeta, e le città sono al centro della loro relazione. Partendo dalla domanda di ricerca con la relativa fissazione dei limiti di ricerca, limiti oltre i quali non si ha indagato in quanto esterni al punto di vista del pianificatore territoriale, all'interno di tutti i capitoli ci si è interrogati su come poter ridisegnare il concetto di salute pubblica in relazione all'ambiente costruito.

L'obiettivo della ricerca parte dalla necessità di individuare una selezione di indicatori Post-Covid fornendo una metodologia di analisi atta alla creazione di un proprio set finale con relativa individuazione dei KPI specifici del progetto, replicabile in tutti i contesti urbani, sul quale basare le analisi del livello di sostenibilità locale, in particolar modo alla scala del quartiere.

Il quadro metodologico proposto, sviluppato in due fasi: (1) Selezione degli indicatori e (2) Scenario di base, si è posto la volontà di indagare le correlazioni esistenti tra l'ambiente urbano ed il livello di prossimità delle città. Sulla base della valutazione dei Key Performance Indicators (KPI), selezionati a fronte di numerosi confronti avvenuti con gli Stakeholders interni ed esterni al progetto è stato possibile analizzare lo scenario di base della prossimità alla scala di quartiere per la Città di Torino, evidenziando punti deboli e aree prioritarie su cui agire, sperimentando il tema "Abitare la prossimità" come risposta urbana alla pandemia.

Misurare, valutare e visualizzare spazialmente l'impatto sono le chiavi del processo di valutazione proposto.

Parole chiave: *Covid-19, Resilienza trasformativa, Vulnerabilità territoriale, Livello locale, Salute urbana, Agenda 2030, SDG 11, Indicatori post-Covid, Prossimità.*

LIST OF ACRONYMS

CDC	Centers for Disease Control
CESBA MED	Sustainable MED Cities
D	Damage
DIST	Inter-university Department of Regional and Urban Studies and Planning
E	Exposure
EIA	Environmental Impact Assessment
ETI	Chair Entrepreneurship Territory Innovation
GDP	Gross domestic product
GIS	Geographic information system
HIA	Health Impact Assessment
HIV	Human Immunodeficiency Virus
HQSL	Hight Quality of Social Life Index
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
KPI	Key Performance Indicators
LRU	Local Resilience Units
MOLOC	MOrphologies Low Carbon
PMU	Urban Mobility Plan
R3C	Responsible Risk Resilience Center
SARS	Severe Acute Respiratory Syndrome
SEA	Strategic Environmental Assessment
SDGs	Sustainable Development Goals
SES	Social-Ecological Systems
SFDRR	Sendai Framework for Disaster Risk Reduction
SNA	Social Network Analysis
UN	United Nations
V	Vulnerability
WHO	World Health Organization

LIST OF FIGURES

LIST OF TABLES

LIST OF THE SPATIALIZED KPIs

KPIs DATASHEETS

PART I — THE VALUE OF PROXIMITY

CHAPTER I

INTRODUCTION

1.1 PROBLEM STATEMENT

There is growing evidence that **anthropogenic**[1] impacts on ecological systems and the growing human population are now the main driver of planetary change. With the urban population projected to increase over time, leading to a world population of 9.3 billion in 2050 (Chelleri *et al*., 2012) the current **challenge** of global sustainability rests largely on **urbanization processes**. More and more over time, damage and destruction of ecological systems due to human footprint, with the consequent loss of biodiversity and their functions, has led to the destabilization of the network that regulates ecological processes, thus producing imbalances and dysfunctions.

A recent analysis of the Global Assessment Report on Biodiversity and Ecosystem Services[2] by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), has shown how human intervention in recent decades, has been unprecedented in human history. The viral emergency is the carrier of unnatural domination of human species on the rest of life forms, that leads to an upheaval of the planet equilibrium, our "big amniotic bag" (Pirni and Caporale, 2020) that is becoming inhospitable for our same species.

Significant attention should be drawn to the difference between **"development"**, that means the evolution and the modality through which humans contract the viral form, and the consequent **"diffusion"**, its propagation. Human history, as well as that of animals, has been characterized by different epidemics and pandemics over time, think of the plagues of just this century: the Spanish flu (1918-1920), Asiatic flu (1956), Sars (2003) and the current Covid-19 pandemic[3]. The question is, where is the origin of the process that transformed our world-environment into a **"virosphere"?** The origin can be found in the distinction of these two terms.

The majority of viruses that during our history have spread around the world, had an animal origin favorited by the **relationship** between **man-nature**, and defined as zoonoses. On this front, the Anthropogenic era led to the progressive destruction of the natural resources of our planet. Following, global warming and its climatic consequences, the reduction of the forest heritage and with it of the natural habitat of many animal species with the related microorganisms, the progressive reduction of biodiversity, water and land pollution, have arrived over time to increasingly thin the line that divided the space of man from the space of nature, altering its balance. Economic development today causes the intensive urbanization of

[1] The Anthropocene era is a proposed geological epoch dating from the commencement of significant human impact on Earth's geology and ecosystems, including, but not limited to, anthropogenic climate change.

[2] The Global Assessment Report on Biodiversity and Ecosystem Services is a report by the United Nations' Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, on the global state of biodiversity.

[3] The World Health Organization declared the outbreak of Covid-19 a Public Health Emergency of International Concern on 30 January 2020, and a pandemic on 11 March 2020.

territories and urban sprawl phenomena[4], that interrupt ecological corridors, make the balance of ecosystems fragile and shortens the distances between urban humans and wildlife, where there is a reservoir of numerous diseases (Capolongo *et al.*, 2020). Attention is increasing from the public opinion on the delicate **linkages** between **climate change** and **epidemiological crises**, especially considering how the loss of biodiversity, deforestation, pollution and bad nutrition are contributing to the spread and lethality of viruses and pandemics.

On one hand, like all pandemics, also the new Covid-19 pandemic wasn't an accidental event, even casual. Like history teaches us, epidemics afflict society through the vulnerabilities that humans create through their relationships with the environment, with other species and with each other (Pirni and Caporale, 2020). On the other hand, the concept of "diffusion" is different. Once it is clear that the development of the virus is dictated and favored by the increasingly thin line that divides man-nature interactions in space, the virus and its effects run by exploiting the speed and **physical hyper connection** of our system, reaching their propagation in time and space through human-human interactions. Therefore, could it be the interconnection dictated by globalization the main factor of diffusion?

As stated by Joseph Eugene Stiglitz[5], "Viruses, like global warming, do not need a passport to travel around the world, they are global by definition", and this has been the difference from past health emergencies because, on this front, hyper connection and globalization play a significant role in rapid virus diffusion. Having defined the current epidemic SARS-CoV-2[6] as a pandemic, already shows how the spread of propagation is undoubtedly greater than the epidemics of the past. When we want to take a picture of how fast a virus is spreading, we can refer to terms like "endemic outbreak" or "epidemic". It is different when an epidemic becomes a "pandemic". On 11 March 2020, the World Health Organization (WHO) declared the international outbreak of the new coronavirus SARS-CoV-2 infection, a pandemic. This viral spread, in addition to being transmitted from person to person and causing a significant number of deaths, began to spread globally without precedent.

In a generative approach to society and globalization of post-Covid emergency, there is the necessity to not come back into the "first world", the world that proved to be an all too favorable environment for the pandemic spread, showing how this sanitary emergency invites today to reflect on our **actual and future**

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[4] Urban sprawl is the unrestricted growth in many urban areas of housing, commercial development, and roads over large expanses of land, with little concern for urban planning. The term urban sprawl is highly politicized and almost always has negative connotations. It is criticized for causing environmental degradation, intensifying segregation, and undermining the vitality of existing urban areas and is attacked on aesthetic grounds.

[5] Joseph Eugene Stiglitz is an American economist, public policy analyst, and a professor at Columbia University. He is a recipient of the Nobel Memorial Prize in Economic Sciences (2001)

[6] Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the virus that causes coronavirus disease 2019 (COVID-19), the respiratory illness responsible for the COVID-19 pandemic. Colloquially known as simply the coronavirus, it was previously referred to by its provisional name, 2019 novel coronavirus (2019-nCoV), and has also been called human coronavirus 2019 (HCoV-19 or hCoV-19)

development model. For over 70 years economics has been fixated on GDP, or national output, as its primary measure of progress. For the twenty-first century, a far bigger goal is needed, and that goal is encapsulated in the concept of the Doughnut[7] (Kate Raworth, 2017). The great challenge would be to achieve sustainable development without causing further damage to the Earth, to avoid further thinning of the line that separates man from nature.

This model admits the existence of two boundaries: "inner boundary" referring to social relations, and "outer boundary" relating to environmental limits. It is between these two borders that an area extends, which Raworth defines as a **"doughnut-shape"**, within which sustainable development is possible.

Covid-19 is spreading human suffering, destabilizing the global economy and upending the lives of billions of people around the globe. The pandemic is an unprecedented **wake-up call**, laying bare deep inequalities and exposing precisely the failures that are addressed in the 2030 Agenda for Sustainable Development and the Paris Agreement[8] on climate change.

Leveraging this moment of crisis, when usual policies and social norms have been disrupted, bold steps can steer the world back on track towards the Sustainable Development Goals (United Nations, 2015). This is the time for a change, for a profound systemic shift to a more sustainable economy that works for both people and the planet**.**

1.2 POST UN-LOCK PROJECT. "FROM TERRITORIAL VULNERABILITIES TO LOCAL RESILIENCE"

The **research Post-Un-lock** can be found in the frame of the call for the co-financing of research project 2020 led by **DIST** (Inter-university Department of Regional and Urban Studies and Planning), Politecnico di Torino.

In 2019, cities around the world faced the **impact** and **spread** of the **Covid-19** pandemic with **unprecedented speed** having to deal with a new and unknown situation in which possible duration in time and space was unknown. In this context, the Post Un-lock project **goal** is to define a **new territorial scenario**

[7] The Doughnut, or Doughnut economics, proposed by Kate Raworth is a visual framework for sustainable development – shaped like a doughnut or lifebelt – combining the concept of planetary boundaries with the complementary concept of social boundaries. Kate Raworth explains the doughnut economy is based on the premise that "Humanity's 21st century challenge is to meet the needs of all within the means of the planet. In other words, to ensure that no one falls short on life's essentials, while ensuring that collectively we do not overshoot our pressure on Earth's life-supporting systems, on which we fundamentally depend.

[8] The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), on climate change mitigation, adaptation, and finance, signed in 2016.

for the **year 2030**, starting from the management of the post-emergency phase and realize the 2030 Agenda.

With the goal by 2030 of achieving and meeting the **17** Sustainable Development Goals **(SDGs)**[9] adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development which set out a 15-year plan to achieve the goals, the Post Un-lock project is focused on "**Goal 11**: Make cities inclusive, safe, resilient and sustainable". Concerning this SDGs goal "making cities inclusive, safe and resilient human settlements as well as sustainable, recognizing the key role of cities for sustainable development" the **sub-objective 11b**[10] starts from the need to increase the number of cities and human settlements, adopting and implementing i**ntegrated policies** and **plans** towards inclusion, resource efficiency, mitigation and adaptation to climate change, disaster resilience and development implementation, in line with the Sendai Framework for disaster risk reduction 2015-2030[11].

Today, progress is being made in many places, but, overall, actions to meet the SDGs are not yet advancing at the speed or scale required. The year 2021 needs to usher in a decade of ambitious action to deliver these goals by 2030.

To realize the 2030 Agenda for Sustainable Development and its global goals, this research starts with the management of the post-emergency phase to use this situation as an **opportunity** to respond towards more **sustainable models**. Now, we need to turn the **recovery** into a real **opportunity** to take actions for the future. Thanks to Covid-19, unprecedented health, economic and social issues are threatening lives and livelihoods, realizing the result of even more challenging goals.

The links between zoonoses, as in the case of Covid-19 spread, and the environmental issue, as highlighted by the World Health Organization, IUCN is increasingly strong. Epidemics of recent years - Ebola, Sars, Mers, bird flu, swine and HIV - have been of animal origin, but they are also attributable to the changing climatic and environmental conditions underway. For this reason, there is a direct relationship between environmental, climatic, social and economic emergency, as well as health.

In this direction, the research has its roots in the themes "Knowledge of **natural** and **anthropic risk**" and "**Integrated policies** for climate governance ", in which spatial policies for the adaptation of territories must be based on the knowledge for risk management, as defined by the 2015-2030 European Roadmap for the implementation of the Sendai Framework. Regarding the SDG 11b objective, the project will study also

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[9] The SDGs were set in 2015 by the United Nations General Assembly and are intended to be achieved by the year 2030. They are included in a UN Resolution called the 2030 Agenda or what is colloquially known as Agenda 2030

[10] 11b: By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

[11] The Sendai Framework for Disaster Risk Reduction 2015-2030 outlines seven clear targets and four priorities for action to prevent new and reduce existing disaster risks. The Framework was adopted at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, on March 18, 2015.

how to achieve territorial resilience, through the development of interdisciplinary process and innovative knowledge systems as the integration of climate governance processes based on the analysis of **local vulnerabilities**.

The SFDRR aims to improve national and community capacity to cope with the risks of disasters. It emphasizes a global approach, to address **multiple risks** (technological, biological and environmental) that impact on different scales, frequency and intensity, including epidemics and pandemics among biological hazards. Five years after its adoption, understanding of **disaster risk** and its implications for sustainable development is improving over time. The global agreement at the time of its stipulation in 2015 represented **a new paradigm** for understanding and managing systemic risk whereby the prevailing focus on natural hazards was expanded to include human, technological, environmental and biological risks.

Today, disaster risk reduction is among the 10 priorities of the decade of action and, following the current evolutions that have seen cities around the world face the consequences of the health emergency, it is necessary to further implement the SFDRR with a time horizon of 2030.

Cities are on the front line of coping with the pandemic and its lasting impacts. Across the globe, Covid-19 is threatening cities and communities, endangering not only public health but also the economy and the fabric of society. After the pandemic crisis, to manage new possible and further waves and pressures it's very important to understand the system capacity to respond to unknown situation making its internal structure stable and strong. The aim is to support institutions in the challenge of resilience towards new models of "transformative governance". The research introduces and tests also a model of territorial planning and organization: the **Local Resilience Units (LRU)** to promote place-based strategies for adaptation of territories.

In summary, the goal of urban sustainability poses great challenges to urban planners and policymakers; the cross-scale nature of urban interactions places these challenges at the centre of global scale solutions. As discussed here, urban transformation can be positioned around three challenges: reducing resource consumption, integrating social and environmental criteria alongside economic interests in decision-making and mitigating the impacts of and adapting to climate change.

To help cities in this process of transformation a key aim of urban sustainability must be to **reduce potential vulnerabilities**, especially to climate change, and notably in low-income countries where rapid urbanization brings significant threats. Moving from vulnerability to resilience is key to this process. The research is structured into **different work packages**:

WP 1

CONSTRUCTION OF THE KNOWLEDGE FRAMEWORK

Data collection and creation of a virtual database in a GIS system that spatializes and monitors the changes that have occurred over time during the emergency phase in the Metropolitan area of Turin. Systematization of existing digital data and the acquisition of data processed by satellite images.

WP 2

VULNERABILITY ANALYSIS

Measurement of systemic vulnerabilities (environmental, climatic, epidemiological, social, economic) by integrating the "slow-burning" disturbance processes with elements of crisis both linked to natural phenomena, anthropic and epidemiological. Vulnerability analysis must accompany territories to support the management of the emergency phases, up to the definition of policies and programs for the re-opening of urban spaces for their long-term transformation.

WP 3

EXPERIMENTATION ON CASE STUDIES

Starting from the identification and measurement of the indicators the territorial vulnerability of the case study will be calculated, showing the resilience or vulnerability of the system in the event of disasters, sudden threats or external turbulence. The goal is to overcome pure systemic efficiency, based on sustainability policies of recent years, using data and indicators in an aggregate and holistic manner to operationally support public action in the post-emergency phase.

WP 4

DEFINITION OF LOCAL RESILIENCE UNIT MODEL

Identification and experimentation of Local Resilience Units, defined as the minimum system capable of reacting to effects of crises, defined as the optimal areas of co-evolutionary resilience. On one hand, these units will make it possible to structure the post-covid emergency action without having to completely "isolate" urban systems, by acting on minimal cells equipped with all urban essentials functions. On the other hand, they will allow a redesign of spaces.

WP 5

PROJECT MANAGEMENT, DISSEMINATION, COMMUNICATION

The activity will support the entire project and will concern the scientific dissemination of results at national and international level with the support of academic research networks and institutions involved.

1.3 RESEARCH QUESTION

Cities are defined as complex systems formed by coupled social, ecological and economic systems responsible for many of the **unsustainable trends** which push the planet beyond its ecological boundaries. The **different challenges** which the urban world faces: population growth, globalization, climate change and environmental degradation, require in particular more flexibility, adaptability and innovation to foster opportunities for their transformation. However, the high concentration of people and activities in cities make them vulnerable to various stressors such as natural and man-made disasters (Sharifi and Khavarian-Garmsir, 2020). The Covid-19 pandemic wasn't the first viral infection[12] in human history to hit cities, and now more and more various forces such as climate, population growth and globalization, can increase the frequency of pandemics in the future. The need, therefore, arises for preparatory response and adaptation measures.

Part of the history of urbanization is building and managing a way out of infectious diseases, and in this regard, the recent pandemic offers an **unprecedented opportunity** to understand what actions are needed today to minimize impacts and improve urban pandemic resilience (Sharifi and Khavarian-Garmsir, 2020) to build a stronger urban **health system**[13]. The ongoing pandemic is a strong reminder that urbanization has changed the way that people and communities live, work and interact, and it is necessary to make the system and local capacities resilient to prevent the spread of infectious diseases (Capolongo *et al.*, 2020)

[12] The pandemics of the 20th and 21st century in the western world, have been and are mostly transmitted by direct contact with body fluids (AIDS, Ebola) or through respiratory (pandemic influenza, SARS-COV-2, MERS) contact, differently from the past, when oral-fecal (Cholera) or vectorial (Malaria, Plague) routes were predominant. (Capolongo *et al.*, 2020)

[13] The emergence of an epidemic brings forth the need for a new concept of health and wellbeing in relation to the built environment, and beyond. Referring to the Urban Health theories, and considering the healthy urban planning and design strategies like vehicles of primary public health prevention and promotion, the contemporary challenge is promoting the city as a new generator of public health itself

After the latest events, this research work shows the importance of answering one of the **key questions** that must be addressed in this period to contribute to the rethinking of post pandemic cities, reflecting on the importance that, in the period of physical distancing, the presence of a dense network of neighborhood services has represented: **"What value does the issue of proximity assume today in the urban management of the post-pandemic city?"**

Many measures adopted during the emergency, by the Ministry of Health, will become part of daily life, changing habits and behaviors. The lesson of Covid-19 pandemic is that people's health is connected and dependent on the planet's health, and cities are the core of their relationship. Today the secondary question is "How we can **re-design** the **concept of public health** in relation to the built environment and contemporary cities?". It is crucial today to make urban areas more resilient to emergencies, ensuring a first effective response from the territory and health infrastructures to face epidemics and other possible future emergencies of every kind (Capolongo *et al.*, 2020).

To structure the research question, we started with the analysis of the background where the problem is placed. Within this work, the role of the question will be to accompany the reader through the research, by formulating and addressing its final answer. To guide the reader through the text, the research question is represented in a **schematic summary** (Fig.1) that will indicate basic information that led to the formulation of the question itself, referring to the contents presented in the dissertation. For this reason, a **list of relevant research articles** specific to the formulation of the question has been created from the general bibliography.

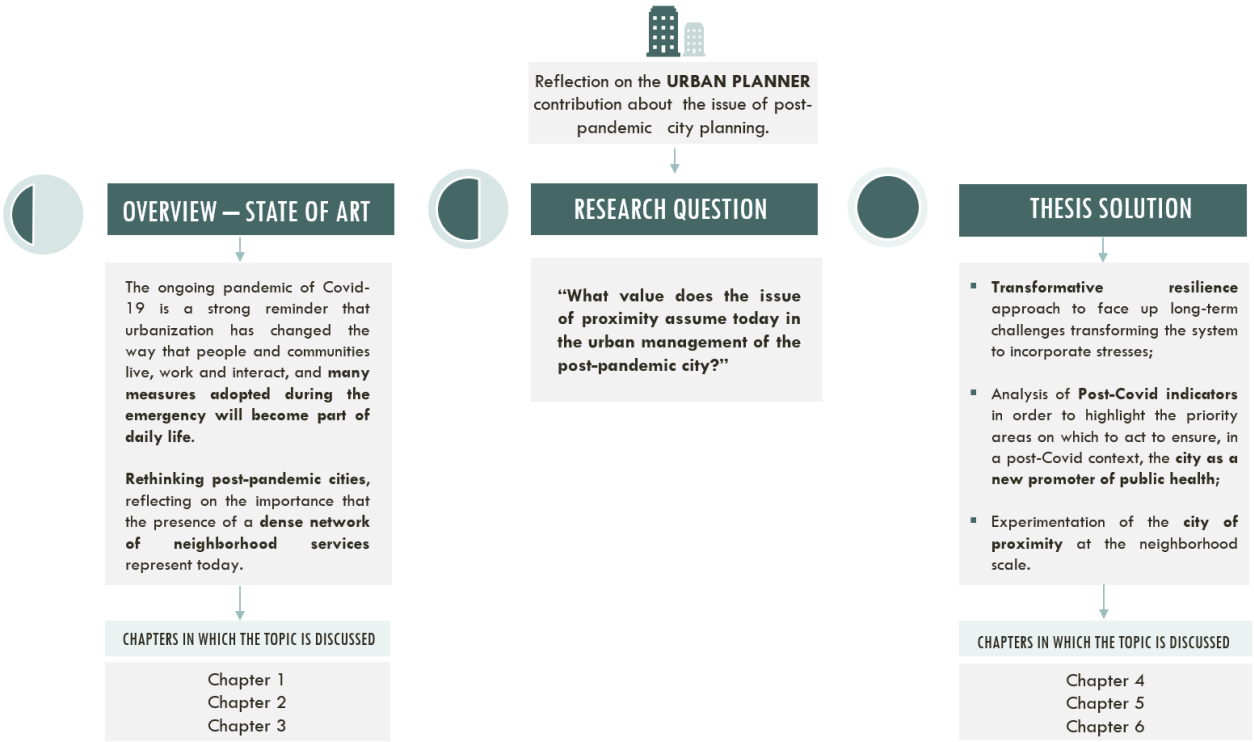


Fig.1 Schematic summary of the research work. Source: Author, 2021

The topic that the thesis discusses turns out to be **very vast**, and for this reason, to better answer and deal with the research question, it is **necessary to identify its limits.** Limits beyond which the work does not investigate, as they are outside the point of view of the territorial planner (Fig.2). The wish to set these research boundaries responds to the desire to make the research as specific and concrete as possible, avoiding dealing with topics that would make it unstable.

Addressing the question of post-Covid city management, the research work aims to treat the topic from the **point of view of the Urban Planner** and urban designer, with its wealth of knowledge and skills without leading to other fields of investigation. For these reasons the research boundaries are the following:

1

This work, has among its objectives, to be as specific as possible starting from the experimentation of the city of proximity in a small piece of the city at the neighborhood level, with the ultimate aim of becoming a pilot project to be encompassing the whole city. For what has been said, the research work is focused at a **local level** through the experimentation of **LRUs**, defined as the minimum system capable of reacting to the effects of the crisis.

2

The development of the viral form is not analyzed, the **focus is put on what happens when the viral form itself enters and spreads within cities**. On this front, the research addresses the issue of the Covid-19 pandemic, analyzing it not from the point of view of its impact on cities, but of how it worked as a wake-up call to address important issues on the urban management of the cities of tomorrow.

3

Concepts of "sustainability" and their 17 SDGs are accepted and for this reason are not covered in detail, focusing in particular on SDGs11 "Make cities and human settlements inclusive, safe, resilient and sustainable" and **under goal 11b "**By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels".

In this way, the research question goal is to understand how important it is for future cities to guarantee a dense network of neighborhood services, and how to realize the design's project of the **city of proximity** as an **urban resilience response** to this situation. In this context, urban resilience is understood as the ability of

the city to ensure public health and transform the system to include impacts into it. As a normative and process-oriented concept, the notion of **transformative resilience** suggests a **forward-looking** and **dynamic perspective** (Chelleri *et al.*, 2012) **Moving from vulnerability to resilience is the key to this process.**

Fig.2 Research boundaries: the urban sphere treated. Source: Author, 2021.

1.4 RESEARCH OBJECTIVES

The research work contribution presented is part of a broader research context belonging to the project previously mentioned "Post-Unlock. From territorial vulnerabilities to local resilience" of the R3C Research Center in Turin and the DIST Department. After months of lockdowns and quarantine, with populations experiencing **'Covid-19 fatigue'** open spaces for recreation and physical activity have become crucial. The problem exposed by the current pandemic is a **perfect scenario** for the urban planner and policymakers for thinking about possible ways to develop cities in a more resilient way **after the sanitary emergency**. This health crisis will result in substantial adjustments in the way we model, administer, live in cities, and our understanding of cities, as dense conglomerates of constant social interactions, could be revised, or rather it should be better handled in future management.

The **research objectives** start from the need to define an ideal-typical scenario of territorial innovation in 2030, starting from **the management of the post-emergency phase experimenting the city of proximity**. This proposal for urban transformation differs from functionalist urban planning and the "**automobile paradigm**" that governs the organization of our territories.

Indeed, our cities have been shaped by infrastructure-based urban planning. Spatial segregation has led to the separation and opposition between time and urban space. Today green spaces, public areas,

squares, the preference for pedestrian traffic over the use of cars will be the key variables for the city of the future.

From an urban point of view, **epidemics have historically left their mark** on our cities and, in particular, cities themselves have reshaped their urban planning system to cope with spread and health risks. Think for example of the case of the plague of 1630 in Florence[14], Naples and Cholera in 1884[15], Philadelphia and the Spanish flu of 1918[16] or, just a few years ago in 2003, the Hong Kong Sars outbreak[17]. In many parts of the world, during the period of physical distance, restricting movement to within a kilometer of their home, or a few meters, has forced residents to find local solutions to meet their daily needs. Cities had to adapt to facilitate social distancing and support preventive measures, thus minimizing the spread of the virus. Against this, there is the need to rethink urban and collective organization to ensure a more sustainable and livable future. On this front, urban planning must include better data management to mitigate the most lethal impacts of future pandemics, but above all, include the new roles like the **health city manager**[18] in the urban management system in order to promote and protect public health needs and collective well-being.

This information, together with the effective coordination that city systems can provide, will be crucial in the deployment of essential services. For these reasons, today is fundamental to **measures** and to **evaluate** the impact of the shock for future city resilience development. Mapping and spatial analysis are keys to informative decision-making. The objectives of this thesis are multiple and are expressed as follows:

---

[14] The plague, as reported by CDC (Center for Disease Prevention) is an acute infectious disease caused from the bacillus Yersinia pestis. The Italian Plague of 1629–1631 was a series of outbreaks of bubonic plague that ravaged northern and central Italy. The epidemic spread of plague in Florence during 1630 and progressively extended to the whole city with more than 10,000 victims (Wikipedia 2021).

[15] Cholera, as mentioned by the CDC (Center for Disease Prevention), is an acute diarrheal disease caused by infection of the intestine due to the bacterium Vibrio Cholerae. The case of the spread of cholera in 1884 in the city of Naples constitutes an important case study because after this episode the city was restructured and rebuilt according to new paradigms of urban health (Wikipedia 2021).

[16] Spanish flu is an acute and contagious infectious disease caused by the H1N1 RNA virus. In 1918, an era without flu drugs, antibiotics and mechanical ventilators, an unprecedented disease spread in Philadelphia that gave the world a clear example of the wrong way to handle a pandemic. The pandemic spread across the world from March 1918 to April 1920 with 500 million deaths (Wikipedia 2021).

[17] In 2003 the world was hit by the first pandemic of the 21st century. The 2002–2004 SARS outbreak was an epidemic involving severe acute respiratory syndrome (SARS) caused by severe acute respiratory syndrome coronavirus (SARS-CoV or SARS-CoV-1). In December 2019, SARS-CoV-2, a new strain of coronavirus closely related to the one that causes SARS, was discovered in Wuhan, Hubei, China. This new strain causes COVID-19, a disease which has spread worldwide, leading to an ongoing pandemic (Wikipedia 2021).

[18] The Health City Manager's core curriculum defines the strategic aspects of action to improve health in cities through a holistic approach, with regard to the individual, and a multi-sectoral approach, with regard to health promotion policies within the urban context. The Health City Manager's core curriculum recognizes that the concept of health is an essential element for the well-being of a society, and this concept does not merely refer to physical survival or to the absence of disease, but includes psychological aspects, natural, environmental, climatic and housing conditions, working, economic, social and cultural life (Lenzi *et al.*, 2020) as defined by the World Health Organization (WHO).

1

RETHINKING URBAN RESILIENCE IN A POST-COVID CONTEXT

Resilience is defined within this research as the reactivity of the territorial system to an unexpected event with a long term vision. For this capacity to respond, the system must be able to transform and innovate by incorporating within it the dimension of uncertainty and the threat, caused in this case by the spread of the Covid-19 pandemic, which has seen cities all over the world face its impact and see it spread with unprecedented speed.

2

THE VALUE OF PROXIMITY IN THE POST COVID URBAN MANAGEMENT

The COVID-19 lockdowns have made us aware of the value of proximity and the importance of the neighborhood scale. The crisis is forcing us to rethink many aspects of our current way of life. Referring to the urban health theories deeply debated in recent years, urban planning and design strategies must be seen today as vehicles for primary prevention and promotion of public health.

3

CITIES AS NEW GENERATORS OF INTERNAL URBAN HEALTH

The relationship between public health and city management is a relationship that has been consolidated over the years and has been developed over time with the succession of different infectious diseases. More than in the past, following the latest health emergency, that reached almost all parts of the world with unprecedented speed, we have realized how important it is today to design a model of the city that is in itself a generator of urban health.

4

POST-COVID 19 INDICATORS ANALYSIS

Creation of a new post-covid indicators set, thanks to the literature review, through the analysis of indicators already consolidated within various projects and territorial databases, to experiment the city of proximity as an urban planning pandemic response.

1.5 EXPECTED RESULT

The coronavirus pandemic has triggered **a disaster** with social and economic consequences **on a global scale**. Five years after the adoption of the SFDRR 2015-2030, its implementation is paying off. However, disaster risk reduction and public health are not sufficiently considered in policies and investments across all sectors and has yet to be fully integrated into the implementation of the 2030 Agenda for Sustainable Development. Following the current evolutions that have seen cities around the world face the consequences of the health emergency, there is a need to further implement the SFDRR with a time horizon of 2030.

This research work starts from the desire to analyze, in terms of impact, the signals left by the health emergency **into the city of Turin**, to draw from this experience a new starting point for the realization of the 2030 Agenda.

The expected result is to analyze a completely different situation from studies already conducted previously in the field of urban planning in the last year, demonstrating through the post-Covid indicators analysis the necessity of **rethinking our post-pandemic future cities as a new generators of public health** and create the greatest project, previously mentioned in the research question's paragraph, **experiencing the city of proximity** as a general urban project that starts from its application in a small urban context and then expanded. Based on planning practices, that put proximity at the center of accessibility planning, proximity can also be related to a wider context, not only as an individual tactic for accessing specific everyday life activities, but as important to issues of social inclusion, resident health, quality of life, and urban revitalization (Solá and Vilhelmson, 2018)

The need is to deal with a **new topic**, a hot event in which each of us have found ourselves having to deal with. No urban context had ever been prepared to handle such a wide viral spread. We weren't equipped for all this, but this experience is an excellent scenario to ask ourselves in which direction we would like to continue our development and our city planning. The teaching left behind by Covid-19 demonstrates that it is critical to consider the risk of epidemics and pandemics in multi-hazard risk assessments and vulnerability analyzes, but today more than in the past, it is crucial to understand this possibility in order to

prevent possible new and future waves, and in this context the new figure of the Healthy City Manager in the city planning plays a cardinal role.

What have we learned from this pandemic? What problems in the management of our cities were highlighted during the physical expulsion phase? How can we make the network of neighborhood services, which have played a key role in this pandemic, better distributed throughout the territory?

The spread of the Covid-19 pandemic has shown the opportunity and the **need to change course towards a preventive approach**. This research shows the importance of understanding how important it is today to make the urban system a transformative system capable of changing and innovating in the event of sudden shocks.

Assessing and measuring ongoing sustainable development is the key to analyzing progress, enabling cities to make the right political decisions. In light of the current emergency phase, it is necessary to use monitoring systems with clear and effective indicators, using reference data and goals that successfully **promote long-term** sustainable development plans.

1.6 PROPOSED METHODOLOGY

The research work intends to propose a clear and simple **investigation methodology** that can be **replicated in all urban contexts**, providing an appropriate vocabulary and lexicon aimed at analyzing the territorial response capacity to sudden external stresses in order to experience the **city of proximity** as an urban response to the cities of tomorrow which act as a new generator of public health. For these reasons, the ultimate aim of the research is to develop an evidence-based assessment framework for assessing proximity, in order to analyze the urban environment in relation to accessibility, providing objective results to address policymakers, promoting an alternative bottom-up approach at the local level.

This work, has among its objectives, to be as specific as possible starting from the experimentation of the city of proximity in a small piece of the city, at the **neighborhood level**, with the ultimate aim of becoming a pilot project to be translated at the whole city.

Starting from the literary review, and from the related formulation of the research question, the **methodological framework is structured in 2 phases: (1) Indicators selection, (2) Baseline scenario**, where for each the objectives, the method and the tools are shown in the paragraph 3.1. This study is designed to be read sequentially to gain an understanding of general concepts before working towards a more detailed description of actions and recommendations, as described below.

1.7 THESIS STRUCTURE

This study is designed to be read in sequence to gain an understanding of all general concepts before working towards a more detailed description of actions and recommendations. The present document is the result of an accurate research work that shows the actual challenges which cities face to address their efforts following the sanitary emergency crisis with the aim to realize the 2030 Agenda.

The thesis's structure is organized in 6 different chapters (Fig.3), divided respectively **into 3 thematic sections,** wherein each part explains the intents and the objectives of the research work. This view is structured as follows:

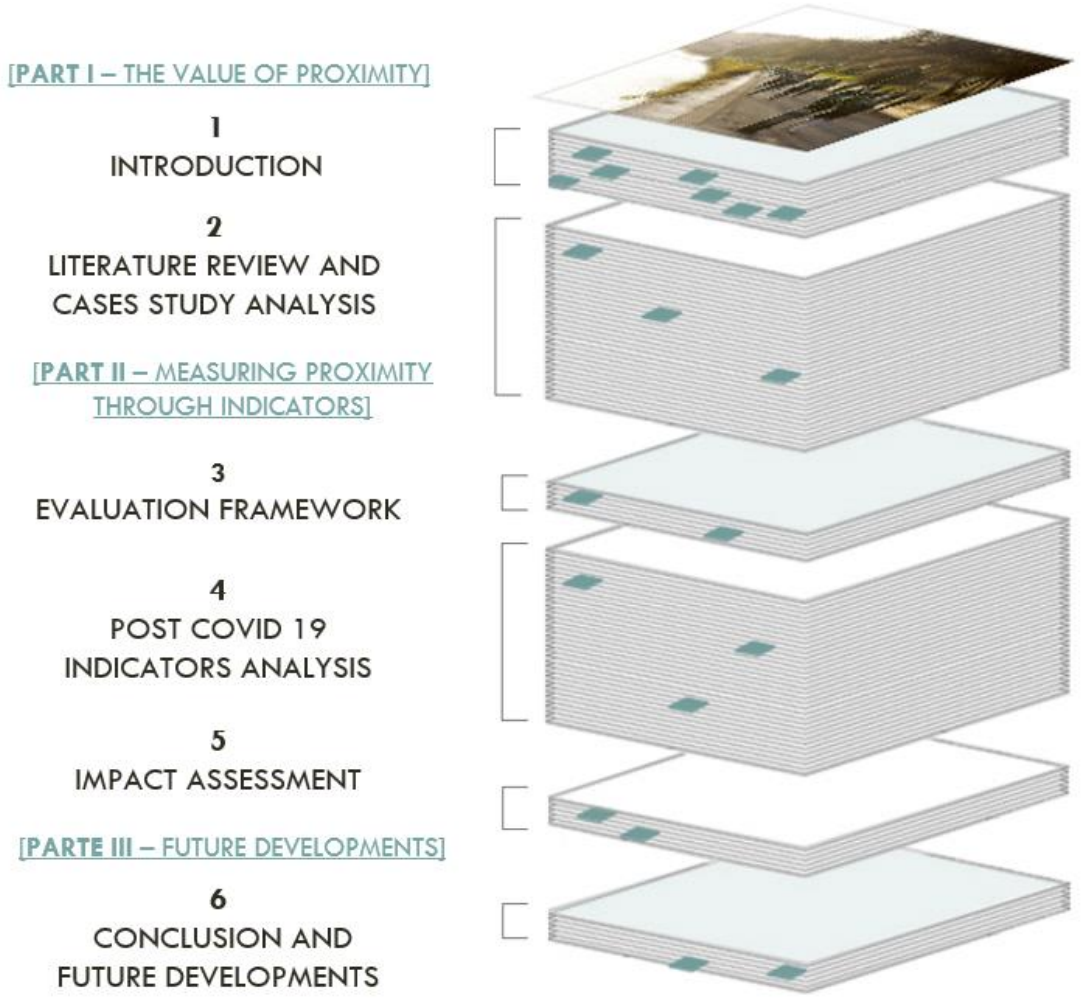


Fig.3 Thesis structure. Source: Author, 2021.

1
INTRODUCTION

The introduction presents the statement of the problem and the motivation that led to the need to address the issue to acquire from this event an opportunity to move towards more sustainable management models of cities, demonstrating how our city can become a new generation of public health itself.

2
LITERATURE REVIEW AND CASES STUDY ANALYSIS

The second chapter represents the real introductory part of the research thesis, in which the management framework begins to be presented within the cities that are listed. The literary review has the task of highlighting, following a careful reading of the studies previously carried out, the need to search for a new topic to be addressed in order not to find itself in the event of a second wave, in a situation of uncertainty. The urban system must now be able to transform and innovate by incorporating within it the dimension of uncertainty and threat. On this front, different cities, which in previous years had already experimented with the concept of "proximity" within their own urban contexts, were analyzed in order to be able to translate some of the teachings of the city of 15/20 minutes as an urban response to the new project of the "city of proximity" in the future post-Covid context.

3
EVALUATION FRAMEWORK

This chapter shows the evaluation framework, a methodological framework previously proposed and tested by the MOLOC project, with the aim of expanding this methodology also in contexts and cities where there are no structured guiding projects behind them. The methodology proposed here, which takes as an example that of MOLOC, aims to present itself as a methodology that can be easily replicated in all contexts, where once the indicators and the case study have been modified, it can be applied in all cities that intend to apply this tool to analyze their own territory. This chapter will introduce the next chapter on spatial analysis and the identification of post-Covid indicators with the identification of the case study, as key to guiding decision making.

4

POST COVID-19 INDICATORS ANALYSIS

This part is the focus of the research work and will detail the logic that has brought about the development and creation of the post-Covid indicators set proposed in this research. This section starts from the need to measure progress towards sustainable development by quantifying the phenomena that constitute it through the use of indicators.

5

IMPACT ASSESSMENT

Chapter five would like to present the final results obtained from the analysis of the post-Covid indicators following their identification in the previous chapter. This chapter will show the methodology of analysis and spatialization of the key indicators of the project (KPI) by proposing for each of them its own calculation and evaluation datasheets. The methodology proposed in chapter 3 will be applied and tested here in the Crocetta neighborhood of the City of Turin, chosen as a pilot case as it is the seat of the Turin Polytechnic. In the last paragraph are also presented the technical sheets of the 9 indicators considered a priority at the municipal scale, but which have not been evaluated in this work, in order to provide all the materials useful for further development of the present research.

6

CONCLUSION AND FUTURE DEVELOPMENTS

In this last chapter the conclusive reflections of the entire research work on the activity carried out and on the final results obtained are reported and verified. The objective of this chapter is to verify the consistency of the results concerning the initial premises, suggesting future developments for the implementation of the city of proximity, and the possible applications of the research as a model that can be replicated in other contexts to support decision making.

CHAPTER II

LITERATURE REVIEW AND CASES STUDY ANALYSIS

The second chapter begins by analyzing the literature written over the years on the subject of study. In light of the topic discussed, a need to develop a thesis that demonstrates the lack of previous analysis of the topic as an event of recent years is recognized. For what has been said, following the identification of the most recent works, the objective will be to broaden the research with new visions in light of the changes taking place. The literary review was dealt with through the logical process as follows (Fig.4):

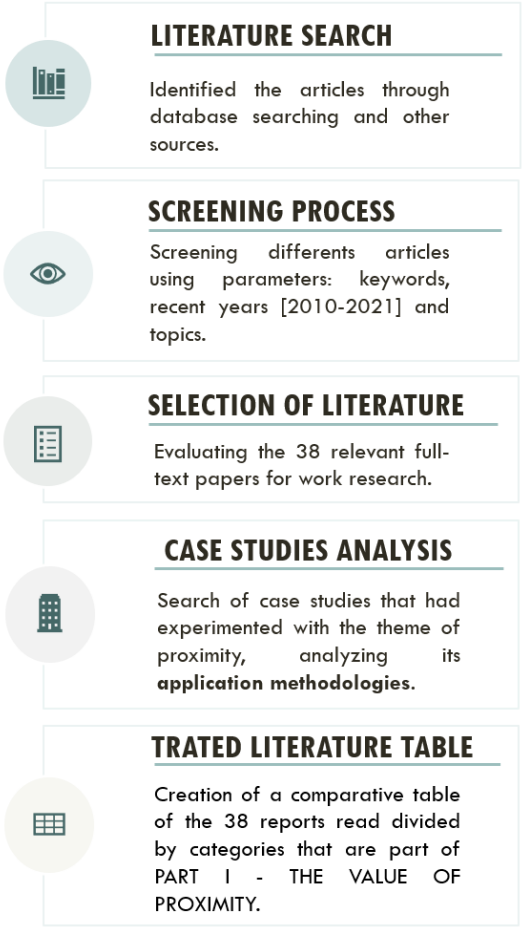


Fig.4 Literature selection process. Source: Author, 2021.

From the selected literature the last step as shown in the diagram above, was the creation of a **literature table**[19] with the aim, through keywords, publication date and topic, to arrive at a more optimal management of the final bibliography of the thesis, allowing the reader to better understand which documents might be the most interesting for research purposes.

[19] The literature tables are attached to the bottom of this research work. Only the bibliographic papers that are part of PART I - THE VALUE OF PROXIMITY of the research work have been included in the tables. The other contributions of the different parts of the research thesis are included in the general bibliography.

2.1 RETHINKING RESILIENCE CITIES IN A POST-COVID19 WORLD

The **concept of resilience** has evolved through various disciplines (Fig.5) from an engineering approach in the 19th century to physics and a social-ecological approach which has found application in many other areas several years later. In the academic field, in recent years, the term resilience has been used to address the concept of shock and rebound mechanisms. Given its multiple uses, the term has become over time a sort of trend, a container word used in many different disciplinary sectors.

In a broader context, resilience is defined as the ability to **adapt and recover** during, but this definition recognizes the **short/medium-term** view. From this perspective, to be more resilient, cities should be able to predict **long-term changes** to create opportunities to adapt to new circumstances or unexpected events (population growth, resource scarcity, climate change, etc.), or even transform to take advantage of a situation in pursuit of sustainability (Chelleri *et al.*, 2012).

Over the past decade, urban scholars and policymakers have increasingly focused on improving resilience in the face of climate change and other urban threats. However, they also drew criticism that urban resilience is a fuzzy term (R3C Research Centre), a kind of **trending word** inserted into speech without giving it the right meaning. By framing urban resilience starting from reactions to shocks through planned transformations of the system, we can ideally retrace the evolution of the concept of resilience in recent years.

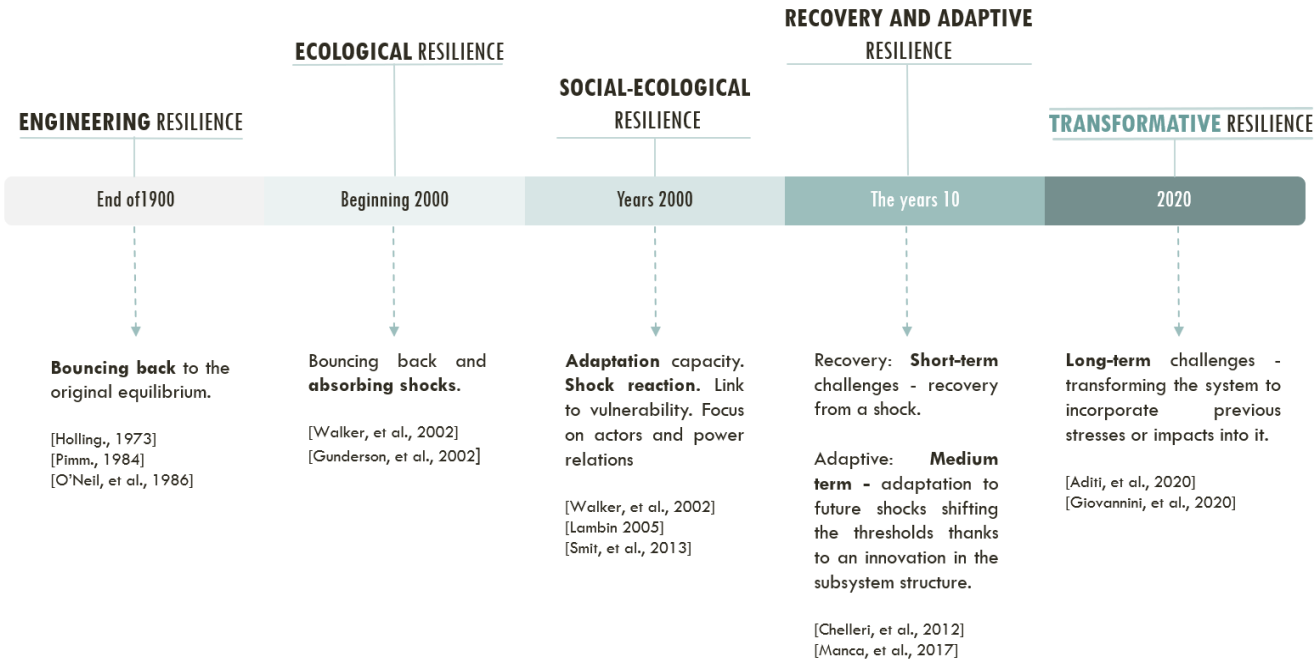


Fig.5 The resilience concept evolutions. Source: Author, 2021.

2.1.1 FROM ADAPTIVE TO TRANSFORMATIVE RESILIENCE APPROACH

Today **t**he **term resilience** is usually summarized and explained as the ability to adapt during a change consequently, it is related to **change factors - time scale** (fast or slow, external or internal) and the **concepts of threshold.** The figure below (Fig.6) shows the differences between resilience relative to **short-term challenges** (recovery from a shock), **medium-term challenges** (preventive adaptation to other future shocks or adaptations that seek to shift thresholds thanks to an innovation in the subsystem structure) and **long-term challenges** (transforming the system to incorporate previous stresses or impacts into the functions of the system).

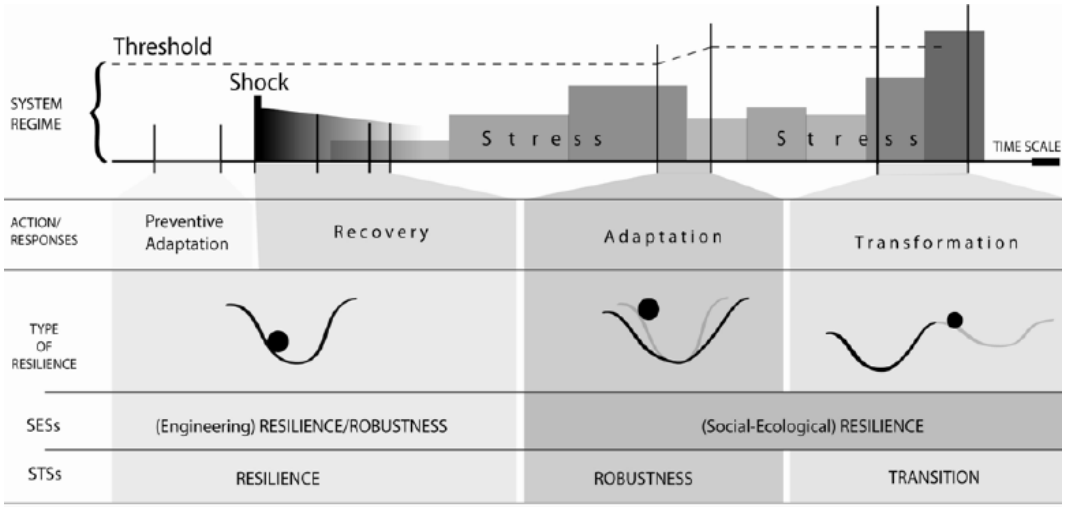


Fig.6 Different actions responding to diverse stresses/impacts and representing different perspective of what we generally referred to as Urban Resilience. Source: Chelleri, L., et al., (2012). "Multidisciplinary perspectives on urban resilience"

On this front, in light of the health emergency, it is necessary to **rethink resilience** in terms of **long-term challenges**. A resilient city should today evaluate, plan and act to prepare for and respond to threats, natural and man-made, sudden and slow/foreseen and unexpected, in order to protect and improve people's lives, ensure development gains and promote positive change.

RESEARCH WORK GLOSSARY

From the literature basing on a compilation of fragmented definitions, the section puts forward a synthetic description of **key terminologies used**, in order to facilitate and improve the debates on this emerging field. This research work expresses the need to refer to precise definitions of the terms "resilience" and "vulnerability" to understand the reactivity of territorials systems to unexpected events. For what has been

said, this work **accepts** the definition of the **term "resilience"** provided by the **R3C Research Centre** which sees resilience as "The ability of cities and regions to face unexpected changes or events, being able in the same way to continue to develop". Under this concept resilience captures the ability of an urban system, and all it is constituent socio-ecological and socio-technical networks across temporal and spatial scales, to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity.

Starting from this definition, following the literary review dissertation, the inevitable need to broaden the concept by inserting the transformative approach of the urban system is recognized. For this reason, we share the need to consider the issue of resilience from a **transformative approach** as expressed in the paper "Multidisciplinary Perspectives on Urban Resilience" (Chelleri *et al.*, 2012). Therefore, we will no longer speak only about the "ability of cities and regions to face changes or unforeseen events, being able in the same way to continue to develop" (R3C Research Centre), but **resilience** as:

"The ability of cities and regions to deal with unexpected events, transforming the system making it capable of incorporating the dimension of uncertainty within it, facing long-term challenges and being able to continue to develop".

As mentioned above, from the point of view of the physical and natural sciences, resilience once implied the ability of a system to absorb disturbance and reorganize itself while essentially maintaining the same function, structure, identity and feedback (R3C Research Centre). In light of what has happened in this period, seen from a spatial perspective, resilience today needs a new approach that requires the system to transform by incorporating impact or stress within it. For this reason, the transformation of the system varies according to the intensity of the phenomenon that affects it, seeing in the urban system the ability to: quickly return to the desired functions and conditions in the face of a disturbance, to adapt to change or to rapidly transform the systems that limit current or future ability to adapt. In this way, experimentation and learning are central to urban resilience management and treating cities as laboratories and innovation hubs are essential to promote transitions to more sustainable and resilient atmospheres.

If, on the one hand, for the definition of the term resilience, one can accept the terminology defined by R3C extended with the concept of the transformation of the post-shock urban system proposed by Chelleri, on the other hand, to evaluate the implications that the spread of the pandemic has led to establishing itself within cities, for the concept of "vulnerability" this thesis proposes its definition.

Addressing the issue of vulnerability assessment, the research work recognizes **vulnerability** as:

"A system's property given by the association between exposure and certain intrinsic properties of the system itself that take into account a given damage" $V = E \times D(x1,x2,\ldots,xn)$

Vulnerability is therefore understood on this front as the predisposition of the exposed elements, in this case, the minimum identified unit areas, or the census sections, to suffer the impact of dangerous events, in this case, an infectious disease (Brunetta and Salata, 2019).

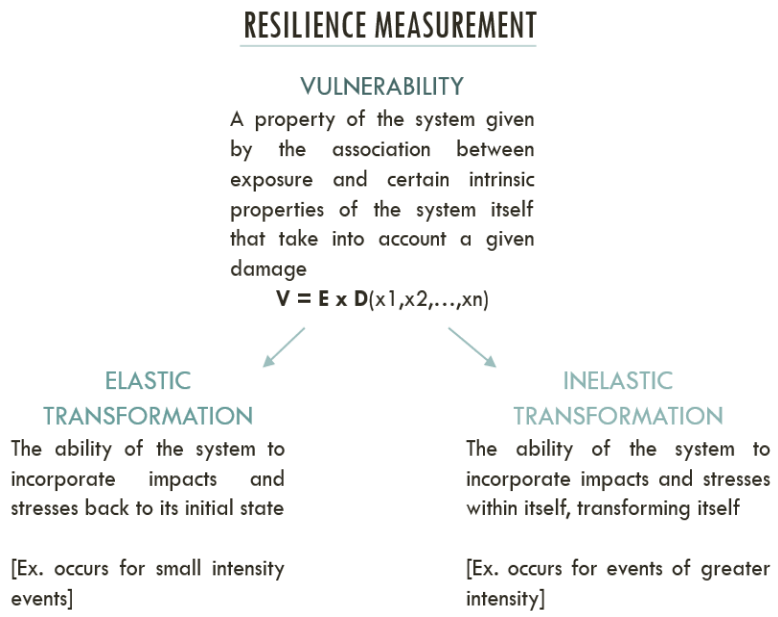


Fig.7 Resilience measurement. Source: Author, 2021.

The concept (Fig.7) starts from the identification of risk as to the probability that an event capable of causing damage will occur, implying the existence of a source of danger and the possibility that it will turn into damage. To assess and manage risks, as in the case of pandemic spread or those related to climate change, it is necessary to identify three fundamental components: **danger, exposure and vulnerability** (Fig.8). The risk exists only if, in a certain territory and in a certain time interval, a source of danger, a vulnerable receiving system and exposure are present at the same time, or where there is possible contact between the danger and the receiver.

A third terminological clarification is related to the term **evaluation**, to be understood here as:

> *"A process of identification and categorization of the relevant elements for a complex system, the city, followed from a hypothetical projection of the potential threats for each element and a consequent assignment of quantifiable value"* (Favarelli, 2021)

The approach to evaluation adopted in this research work, therefore, differs from a classic risk analysis, where rather than focusing on the causes and direct consequences for the object studied, it focuses both on the consequences for the object itself and the primary and secondary consequences for the surrounding

environment. It is about reducing these consequences and improving the ability to manage future incidents to guide the risk management process (Favarelli, 2021).

The ongoing health and climate emergency demonstrate the need to better understand risk factors. It is crucial to start updating the risk reduction strategies by acting on the reduction of territorial vulnerabilities and increasing the transformative capacity of the territories, including the analysis of biological risks as part of multi-risk approaches.

In the discussion on cities, the term to which the most disparate meanings and interpretations have been attributed is "density". On this front, the last definition given in this glossary is that relating to this term. Once it is understood in the ongoing academic and scientific debate that population density is not the factor that has favored or not the spread of the virus in our cities, but on the contrary understood how the Covid-19 pandemic has been more lethal in areas with low densities which did not have access to quality health care, this paper places the issue of density at the center of research on the implementation of proximity. For these reasons, in the present work the theme of density is understood as:

"Residential density is understood as a factor strictly correlated to the term proximity, in order to implement the level of accessibility within our cities. It is possible to design dense cities in which green spaces and public areas are generators of public health"

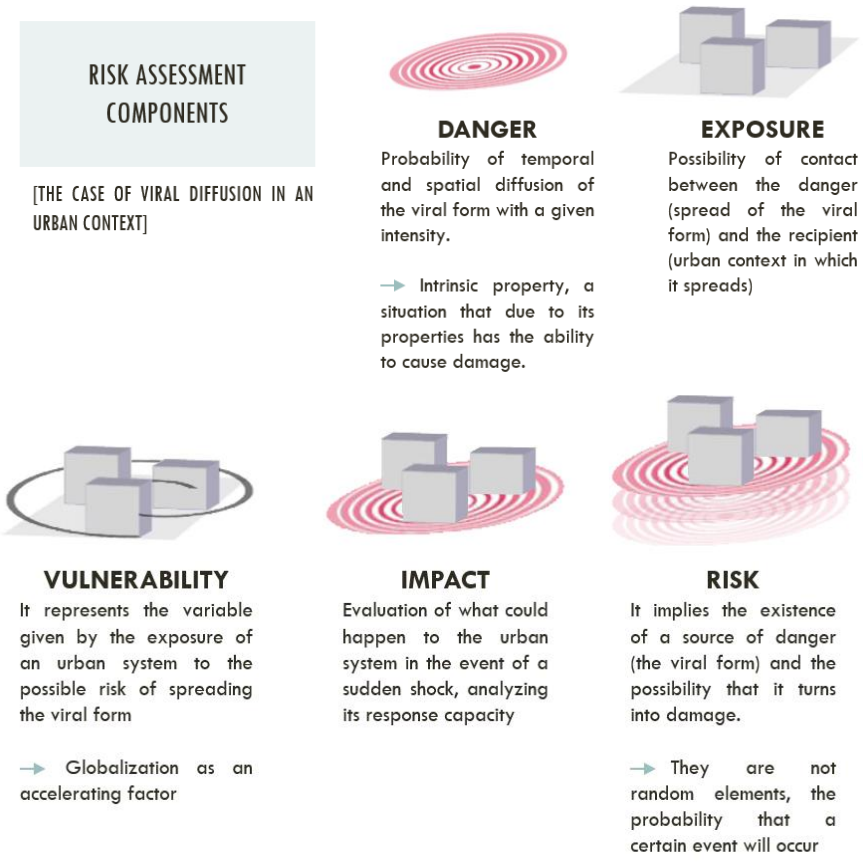


Fig.8 Risk assessment components. Source: Author, 2021.

2.2 CITIES AS A NEW GENERATOR OF URBAN HEALTH

The emergence of a pandemic brings out the need for a **new concept of health and wellbeing** concerning the built environment and beyond. Based on the WHO definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity", a health care system alone is not enough to achieve healthy communities, we need a better environment, and urban planning can no longer ignore the impact it has on the health of its citizens. It determines the urban environment which affects our lifestyle positively or negatively. We need to put people at the center of urban policies. Cities are our habitat and should provide us with the basis for a full and healthy life. The COVID-19 lockdowns have made us aware of the value of proximity and the importance of the neighborhood scale. The crisis is forcing us to rethink many aspects of our current way of life.

Referring to the urban health theories deeply debated in recent years, urban planning and design strategies must be seen today as vehicles for primary prevention and promotion of public health. Five decades of investing in the entrepreneurship of cities to make them more attractive on the global market have left behind the essentials of any habitat: protect and take care of its inhabitants. The planning of habitats that put wellbeing and health at the center requires urban planning that incorporates environmental and social plans. Such holistic urban planning requires new professionals with a cross-disciplinary background: The Health City Manager.

As mentioned several times, the relationship between public health and city management is a relationship that has been consolidated over the years and has been developed over time with the succession of different infectious diseases. More than in the past, following the latest health emergency, that reached almost all parts of the world with unprecedented speed, we have realized how important it is today to design a model of the city that is in itself a generator of urban health.

In the design of cities, the role of urban planners is to select locations, design spaces, and placement services, and on this front, there is ample scientific evidence to indicate these factors have a big impact on health, and almost all urban planning policies and actions have an impact on human health itself.

When it comes to the design of an urban plan, policy or action, health is not always given the space it deserves in the conversation, and to take a proactive approach to health, urban planners and policymakers should use the **Health Impact Assessment**[20] to better understand the impact of various urban factors. However, the urban health analysis is often seen as an inessential add-on activity rather than a key

[20] "Health Impact Assessment is a combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population" (WHO 1999).

preventive measure to improve overall health, but following the latest events, we need to understand that this type of design needs to change to incorporate this aspect into the internal management plans of the city. How to systematically include health in urban planning with a healthy city approach? The goal is to begin **evaluating the potential health effects** of a proposed plan, project or policy, even before they are built or implemented. The decision-making process must be able to integrate this dimension into it, providing practical recommendations to increase positive health effects and minimize negative health effects.

Just as in the planning process the Strategic Environmental Assessment[21] aims to integrate environmental considerations into development plans and programs, in the urban management of the city the plans must take on an assessment of the quality of urban life in terms of public health. This approach aims to make urban planning a new generator and guarantor for urban health.

On this front, taking for example the American model, The Centers for Disease Control and Prevention (CDC)[22] in the United States has proposed an assessment tool called "**Health Impact Assessment (HIA)"** (Fig.9) capable of assessing whether the proposed choices would improve public health.

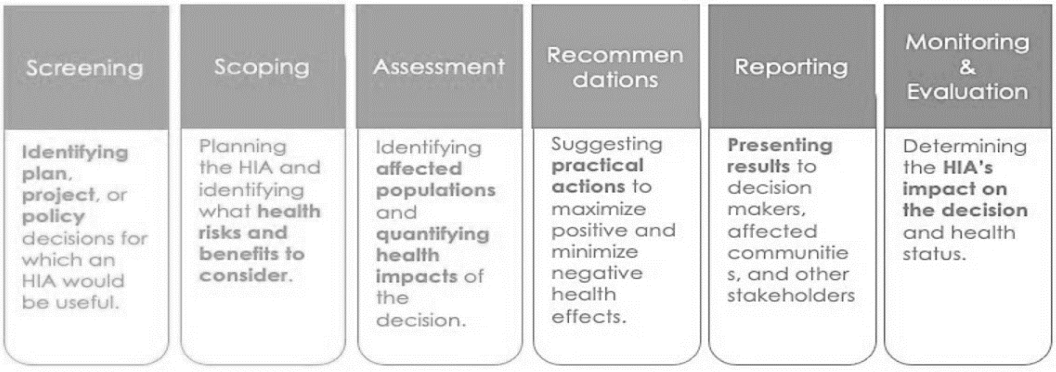


Fig.9 Health Impact Assessment (HIA). Source: Kansas Health Institute

Over the years, the United States has already tried to apply this procedure in Kansas to different urban projects, for examples: in southeast Kansas in 2012 with the HIA "Potential Health Effects of Casino Development", in Wichita "Potential Health Effects of Proposed Public Transit Concepts", in 2014 "Potential Health Effects of Expanding Liquor Licenses to Grocery and Convenience Stores", in 2015 Potential Health Effects of Legalizing Medical Marijuana" (Kansas Health Institute, 2017).

[21] A Strategic Environmental Assessment (SEA) is a systematic process for evaluating the environmental implications of a proposed policy, plan or program and provides means for looking at cumulative effects and appropriately address them at the earliest stage of decision making alongside economic and social considerations. Compared with the Environmental Impact Assessment (EIA), SEA provides recommendations at a strategic level and allows better control over interactions or cumulative effects (Wikipedia., 2021).

[22] The United States Centers for Disease Control and Prevention is the national public health agency of the United States. It is a United States federal agency, under the Department of Health and Human Services and is headquartered in Atlanta, Georgia (Wikipedia., 2021).

Unfortunately, for now, the implications that projects or decisions have on urban health are not a traditional practice in urban planning, although they add a layer of complexity to the planning process. The need is to actively integrate this valuation during urban planning plan decisions.

We can no longer plan the city of the 21st century with a ruler, the planning of future cities must manage an ever-growing complexity and bring the pursuit of the common good and, the health and well-being of people back to the center of urbanism.

2.2.1 THE ROLE OF LOCAL RESILIENCE UNITS AS AN URBAN PLANNING PANDEMIC RESPONSE

The research introduces and experiments a model of territorial planning and organization: **Local Resilience Units** aimed at promoting territorial adaptation strategies based on the long term, and in this way the reduction of the risk of disasters at the **local level** requires attention. The need will be to address actions at the local level that can facilitate participatory, multi-sector and multi-stakeholder risk governance and support the integration of disaster risk reduction into policies, programs and tools.

To assess and manage risks, as in the case of pandemic spread or risks related to climate change, according to the paragraph 2.1.1, it is necessary to reduce cities exposure and vulnerability to these potential impacts. Crucial on this front is to analyze the impact assessment of resilience. As urbanization trends continue to increase globally, the significance of **city-level governance** for addressing societal challenges is increasingly recognized.

Evidence reported in the literature indicates that **integrated urban governance strategies** that involve **long-term visioning and pre-event planning** are more conducive to a timely and effective response in cities. **Integrated urban governance** has enabled some European cities to successfully **prevent the spread of the virus** by being able to rapidly detect infected individuals through increased testing and improved surveillance, as well as lockdowns and social distancing actions. In this regard, long-term visioning and appropriate plans for mitigation, absorption, recovery, and adaptation, are key factors determining urban resilience to any disruptive events, including pandemics. These allow cities to learn from past experiences and proactively design strategies to minimize futures shocks.

While top-down management through multilevel governance systems is essential for the coordination of activities at a broader level, the pandemic experience has shown how important it is in the future to take preventive action at the local level and experiment with an urban planning pandemic's response firstly at the smallest level to create after that a general project for the entire city.

The pandemic spread, has revealed **new emerging challenges for the local level**: the need to take preventive, mitigative and recovery actions simultaneously as the disaster evolves; the necessity to pro-actively counter misinformation and stigma while educating communities towards the right actions; and finally, the capability to get communities to realize that they have to take action on their own as the state sometimes lacks the capacity to reach everyone.

With the aim of not treating resilience only in terms of governance but also in terms of evaluation to prevent new possible waves, or to cope with new situations of uncertainty, the research shows the need to introduce the concept of **Local Resilience Units**.

The research introduces and experiments a model of territorial planning and organization: **LRU** aim at promoting territorial adaptation strategies based on long term vision, and in this way at reducing the risk of disasters at a local level. The LRU are defined as the **minimum system** capable of reacting to crises effects, therefore defining optimal areas to promote co-evolutionary resilience. The goal is to better implement the adaptation of territories to better address shocks and support civil, social, economic and environmental innovation for the transition to local resilience models.

In order to expand the assessment of resilience, the integrated approach of the assessment of resilience proposed by the research work is therefore based on LRU: neighborhoods, blocks, parts of cities, census sections. These units, on the one hand, will allow structuring the post-Covid emergency intervention without having to completely "isolate" the urban systems, on the other hand, they will allow a redesign of spaces starting from the concept of living in proximity, a fundamental value for redesigning our cities highlighted by recent events.

Overall, the literature shows that top-down, multi-level governance approaches should be combined with strong, democratic and integrated city-level governance with a bottom-up approach to enable an effective and agile response to cities' problems. Such integrated approaches facilitate the development of appropriate long-term visions and contingency plans, helping to avoid sectoral conflicts and ultimately to maximize the benefits that can be obtained from stakeholder engagement.

2.3 CASE STUDIES ANALYSIS: NEW URBAN PARADIGM OF PROXIMITY IN THE COMPLEX CITY

The need to contain the spread of the SarsCov-2 virus and, at the same time, to restart the economic system has brought the issues of **pedestrianism** and **urban micro mobility** back to the center of the political and scientific debate. The health emergency has brought to light the link between the morphological and functional characteristics of urban contexts and the impacts of public health, opening new scenarios on the

theme of Urban Health, mentioned above in the paragraph 2.2, within the complex phenomena of urbanization that characterize contemporary cities (Balletto *et al.*, 2020).

Urban accessibility represents one of the great challenges of the contemporary city, which is required to adopt sustainable development models, in line with the Agenda 2030 objectives and the SDG 11b, recently confirmed by the health emergency. **Urban accessibility**, **proximity and walkability** are topics closely related to those aiming at a livable, healthy and inclusive city, based on a system of high-quality public spaces and on a dense network of services and infrastructures. However, these principles collide with the fragmentation of many urban contexts, built following vehicular accessibility needs (Balletto *et al.*, 2020).

Where once cities were built around car use and city functions were located within easy reach of a car, the current health emergency has highlighted the **pivotal role of the pedestrian** in the new post-Covid city management, and the question is "What kind of city do we want to live in?". The **new urban paradigm of proximity** in the complex city is to create a city that reduces the need to travel in a certain time and space and thus ensures fairer access at the local level to urban services for a wide range of citizens.

The health crisis is transforming and will transform, the conception of central places in cities. Indeed, architects and urban planners are looking for new visions capable of orienting urban development in the near future. The spread of the epidemic has in fact put the cities to a severe test, highlighting a series of new issues, which can also be overcome through the implementation of innovative strategies to reinvent and readjust our urban context (Balletto *et al.*, 2020). Today more than ever, a future resilient and smart city must be a safe city, ensuring a constant vulnerability analysis and adequacy also in terms of accessibility of services and/or central locations. A mix of features is necessary, able to improve the offer of services and therefore the quality of life, to alleviate traffic congestion in city centers, and consequently pollution, and the reduction of commuting phenomena (Balletto *et al.*, 2020). In this sense, the following paragraphs will present good practices developed in Paris, Portland and Barcelona over the years, that help to understand the methodological approach to the city of proximity that this research thesis would experiment in the Turin context as an urban planning pandemic response.

2.3.1 "THE 15 MINUTE CITY" OF PARIS

The **15 minute city concept** was introduced for the first time by **Carlos Moreno** in **2016.** This concept is derived in part from the historical concepts of proximity and walkability, such as Clarence Perry's[23]

[23] The use of the neighborhood as a structural unit for the development of cities was first introduced in the late 1920s by Clarence Perry. Perry implemented his idea as part of the drafting plan for the metropolitan development of New York, where he proposed a well-ordered hierarchical system of urban amenities starting from the neighborhood unit that formed larger subdivisions, which in turn formed the city.

controversial neighborhood unit and the model Jane Jacobs laid out in The Death and Life of Great American Cities[24], which Moreno cited as inspiration for his modern conception.

In 2016 Carlos Moreno[25] began proposing this concept to **reduce urban carbon emissions** in the city of Paris, **reinventing the city** not as divided into separate zones for life, work and entertainment, but **as mosaics of neighborhoods** where almost all residents' needs can be met within **15 minutes** of their homes on foot, by bicycle or by public transport. Moreno understood how energy transition, with the paradigm shift towards low carbon emissions and renewable sources, is certainly a priority, but how it would have been quite derisory if not accompanied by an ambitious and new urban design of the city (ETI Chair, 2019).

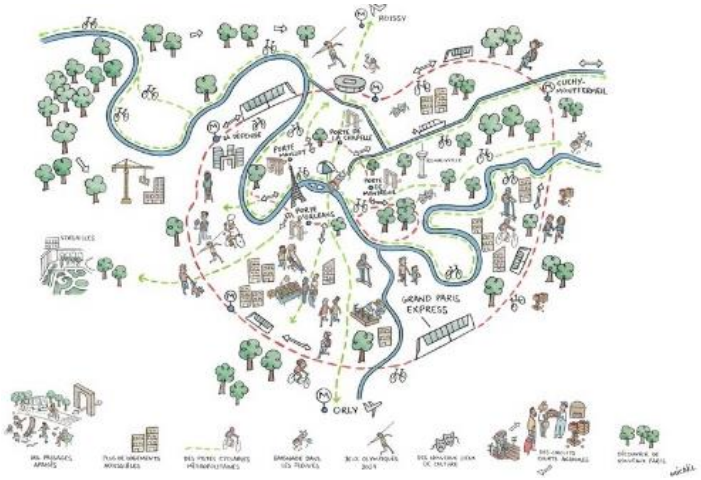


Fig.10 The 15 minute of Paris illustration. Source: Image Paris en Commun

The 15-minute concept (Fig.11) was a proposal for **developing a polycentric city**, where **density was made pleasant**, where **proximity was vibrant** and where **social intensity was real**. His focus was on **time** rather than space, emphasizing the importance of **hyper-proximity** and how ease of access could contribute to the quality of life. The aim was to transform the urban space, which was still highly mono-functional, with the central city and its various specializations, and went towards a **polycentric city**, driven by 4 major components: **proximity**, **diversity**, **density**, **ubiquity** (ETI Chair, 2019). At the heart of Moreno's concept were 6 essential components: working, providing goods, providing assistance, learning, having fun and living.

[24] The book, written in 1961, is a critique of 1950s urban planning policy, which it holds responsible for the decline of many city neighborhoods in the United States. Jane Jacobs' idea that "there must be eyes upon the street, eyes belonging to those we might call the natural proprietors of the street" is in line with the Moreno concept.

[25] Carlos Moreno is a Franco-Colombian scientist and university professor. Paris Mayor Anne Hidalgo introduced the 15-minute city concept during her 2020 re-election campaign and began implementing it during the COVID-19 pandemic. While Carlos Moreno was the first to propose the 15 minute city, later other authors proposed similar but different models within the realm of "time-urbanism" experimenting with them all over the world.

How does the 15 minute city concept work and **how was it developed**?

Designing the 15 minute city means designing the development of the city or territory around the **High Quality of Social Life (HQSL) Index** proposed by Professor Carlo Moreno. When Moreno began her research there wasn't an indicator to compare neighborhoods within the same city, and she proposed the HQSL concept as a demonstrator around the 15 minute city, where the essential functions of the city were accessible within a **15** or **30 minute** buffer zone on a territorial scale using **soft mobility**.

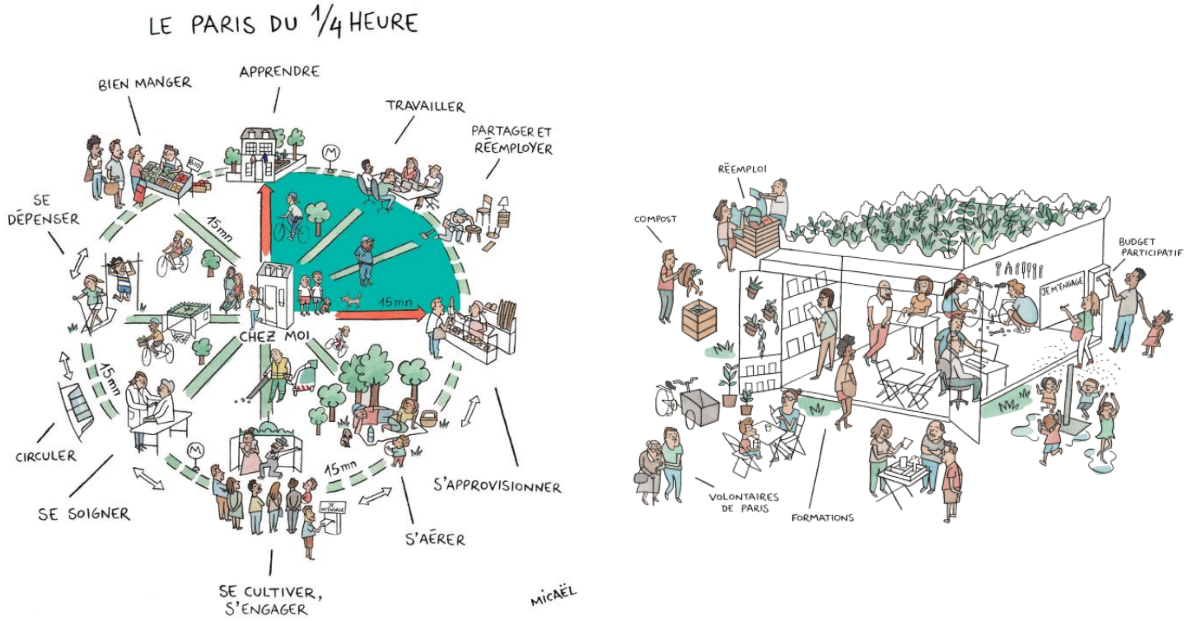


Fig.11The 15 minute of Paris Concept. Source: Image Paris en Commun

To do this, the HQSL **Traceability Matrix** was applied and organized around **the 6 functions of the city** proposed for the city of Paris:

1. Living: housing, energy, environment, facilities, transportation;
2. Working: atmosphere, access, diversification, services;
3. Supplying: eating, non-food purchases, public services;
4. Caring: access to care, prevention, emergency, living environment, well-being, sport, pollution;
5. Learning: access, availability, accessibility, performance, guidance;
6. Enjoying: holidays, culture, entertainment, associations.

with **3 urban states** (well-being, sociability, sustainable planet) (ETI Chair, 2019).

Fig.12 The 6 functions of the 15 minute city. Source: Image Paris en Commun

The approach was to propose a methodology, as well as useful tools to imagine the optimal transformations of a territory based on the High Quality of Social Life Index through the construction of a **digital data aggregation platform** for spatial visualization as a key tool (ETI Chair, 2019). With this methodology, the final goal was to create a model file that could be replicated and implemented in different territories and on multiple scales, building a digital aggregation platform based on a very in-depth exploration of territorial resources enabling the development of tools to imagine the ideal transformations of a territory.

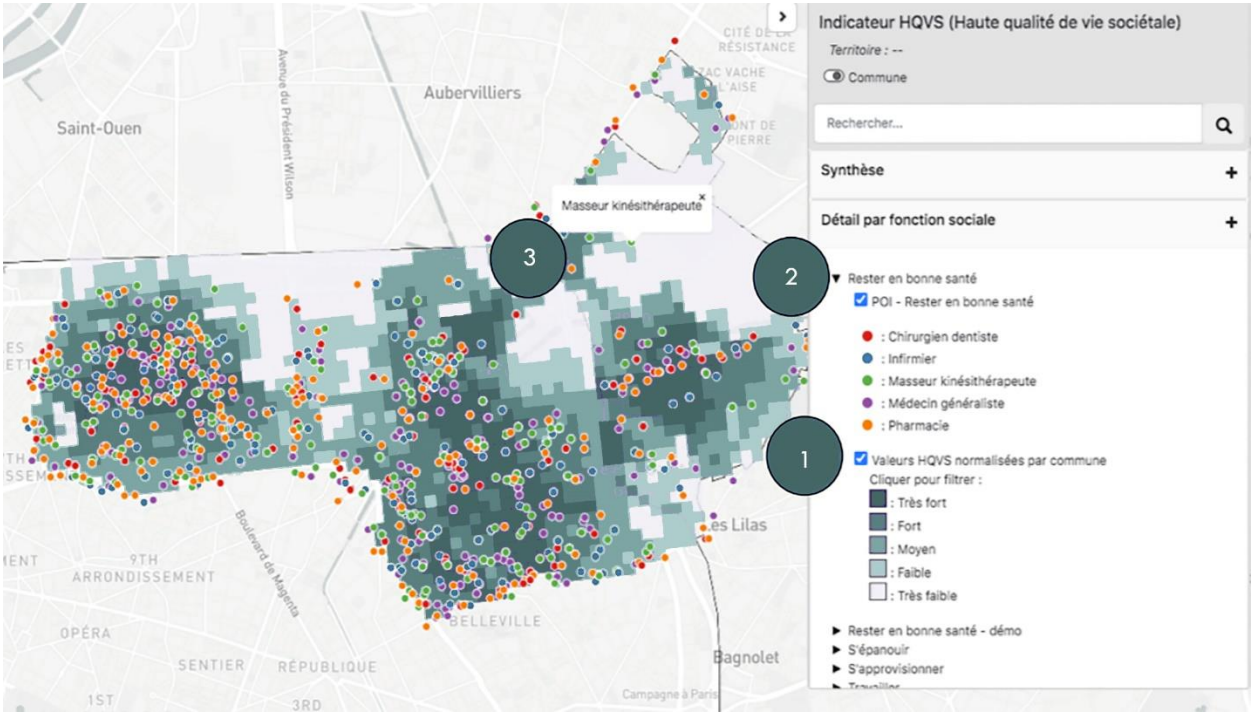


Fig.13 The High Quality of Social Life Index in the digital platform. Source: Image Paris en Commun

A **set of important indicators** were generated, understood as the gears necessary for city planning, to provide a "reading grid" of territorial dynamics, and social functions were also characterized by a set of metadata models and by the interactions between different variables.

The several development phases of the 15 minute city were:

- Visualizing the completeness/incompleteness
- Making a territorial diagnosis
- Assessing assumptions
- Formulating transformation strategies

What **we can learn** from this urban planning approach?

In 2020, the idea of the 15-minute city gained momentum. As more urban dwellers started walking and cycling during the COVID-19 pandemic, cities looked towards economic recovery options that would support the healthy and sustainable ways of life that had been adopted in their communities.

More than in the past, today we need to be creative when we think about our future cities, and imagine, build and change the way we occupy urban space to transform its use, in order to access essential urban social functions. Preserving quality of life requires us to build important and new relationships between two essential components of urban life: **time** and **space**. This means transforming the still highly monofunctional urban space, with the city center and its various specialized areas, into a **polycentric city**, based on four main components: **proximity**, **diversity**, **density and ubiquity**, in order to offer this quality of life within a short time distances, through the 6 essential urban social functions mentioned above.

The different challenges that we can learn from the 15 minute city concept are for example to implement: green street mobility through walking or cycling, more shops close to home, access to multiple services. This is in order to have maximum possibilities to find a way to work close to home in person or digitally, multipurpose locations to transform each purpose into a new multi services area, new important health services in the proximity and care facilities for elderly and fragile people etc.

2.3.1.1 CASE STUDY I - THE PARIS NORTHGATES PROJECT

In 2019, The **Paris Northgates project**, promoted by the ETI chair with Carlos Moreno and work team: GFI, the école de design Nantes Atlantiques and the HETIC School, was the pilot of an exploratory and open approach in which the methodology of the 15 minute city was developed for the **18th and 19th arrondissement of Paris** and part of the communes of **Pantin**, **Aubervilliers** and **Saint-Denis**. The perimeter of the project was chosen for the contrasting territory located at the junction of important transport networks, sources of urban divisions, and also for the opportunities for rebirth. It was a pivotal territory in Paris, at the crossroads of two departments and three municipalities (ETI Chair, 2019).

The Paris Northgates project's goal was to implement the HQSL Matrix designing the 15 minute city for a new part of Paris. The aim was to spatialize the gaps through perimeters which were 15 minutes wide within the city and 30 minutes wide within a sparsely populated territory around **the 6 functions** of the city (living, working, supplying, caring, learning, enjoying) with **3 urban states** (well-being, sociability, sustainable planet) highlighting the essential functions of the city within the Paris Gates area (ETI Chair, 2019).

The project was developed in several phases which are explained below in order to understand the methodology used and draw ideas for the proposal that the research thesis intends to present.

1

UNDERSTANDING THE NEEDS OF THE TERRITORY

In this first phase, to best embody an approach that aims to serve the inhabitants, the Paris Northgates project defines people with social and psychological attributes and characteristics to define **two target groups**: one composed of **users** (Fig.14) and one composed of **actors** at the service of users. These people for the project express qualitative needs allowing to better define each social function in terms of structures and are added to the quantitative needs derived from territorial statistics. The users of the project examined and hypothesized are:

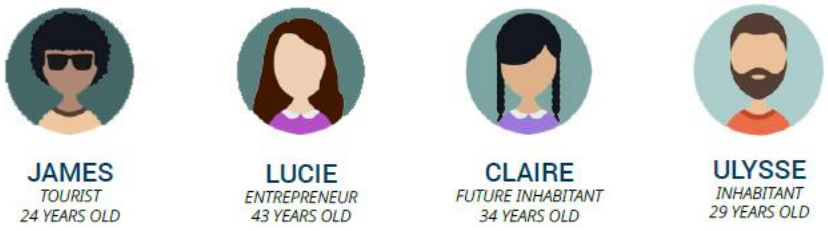


Fig.14 The hypothetical users. Source: White Papers Paris Northgates Project.

2

DATA TO BETTER UNDERSTAND THE TERRITORY

In the second phase the two important steps are: collect quantitative and geographic data

3

UNDERSTANDING THE NEEDS OF PLATFORM USERS

Interviews were conducted with 4 potential 15-minute city observatory users to understand their needs in exercising their functions as city builders. The potential actors (Fig.15) serving the users of the project examined and hypothesized were:

Fig.15 The hypothetical actors. Source: White Papers Paris Northgates Project.

4

DATA COLLECTION PROCESS

The Data Collection process is structured into 4 steps:

1. Collect: in the first step the goal is to aggregate the data sets from various sources and formats;
2. File: define the right ontology to classify all data, and this procedure is based on the HQSL Matrix;
3. Reveal: demonstrate how the importance to develop a digital platform territorializing the 15 minute city;
4. Final project: developing the final tool for the users and actors.

5

INDICATORS SELECTION CHARACTERIZING THE 6 URBAN SOCIAL FUNCTIONS

For the fifth part of the experimentation, a field survey was conducted by a group of HETIC school students to understand the citizens' needs. From these needs, a set of variables was deduced to qualify each of the urban social functions (living, working, supplying, caring, learning, enjoying) (Fig.16).

Social urban function	*Characteristic variables*
Living	*Housing* *High environmental quality housing* *Social housing* *Parks and gardens*
Supplying	*Markets, businesses*
Working	*Number of employees and self-employed workers* *Share of unemployed population* *Public transport nearby: bus, subway, tram*
Caring	*General practitioner* *Swimming pools and sports centers*
Learning	*Preschool, private and public school*
Enjoying	*Media libraries* *Movie theaters* *Cultural centers* *Associations* *Shows* *Coffee shops/restaurants*

Fig.16 Indicators selection characterizing the 6 urban social functions. Source: White Papers Paris Northgates Project.

The project goal is to read the territory in the prism of the equipment on the one hand, and the offer on the other hand. For that reason two main indicators were developed:

- The number of inhabitants 500 meters away from a facility;
- The number of facilities per inhabitant within a 500 meter perimeter.

These two indicators allow us to highlight the territory in such a way that we can move from a decentralized to a centralized view. In particular, this phase has shown how the indicators highlight the fusion of projects, new services and use in existing places in order to ultimately move towards a multi-scale optimization responding to the city of fifteen minutes.

6

SOCIAL QUALITY OF LIFE INDICATOR (COMPOSITE INDEX)

The index of the quality of social life (Fig.17) which takes into account the 6 urban social functions that constitute the 6 parameters, was calculated as follows:

$$Q = aL + bS + cW + dC + eT + fE + G2$$

- *Q : Quality of life in society*
- *L : Living*
- *S : Supplying*
- *W : Working*
- *C : Caring*
- *T : Learning (the T stands for Tutoring, to differentiate it from Living)*
- *E : Enjoying*
- *a, b, c, d, e, f: weighting coefficients*
- *G: a constant allowing the index to be varied from 1 to X (X to be defined)*

Fig.17 The Social Quality of life Index. Source: White Papers Paris Northgates Project.

In order to formulate an index that will thus give a "value" to a neighborhood on the scale of a small neighborhood, several sub-indexes for all social urban functions were created. That approach requires assigning weights and for this step the classical weighting method was chosen.

Example: Enjoying (E) has less weight than the importance of having a home (L), job (W) and supplies (S). Therefore, the sum of the weighting coefficients of (L), (W), and (S) will be considered as equal to the coefficient (E).

7

PLATFORM DEVELOPMENT

The final digital platform (Fig.18) developed is a platform where users can choose the location, view the different social functions of the city on a map in 15 minutes by keyword searching for the service and consequently the possibility to choose the mode of transport: 15 minute walk or 15 minute bike ride. It is therefore a digital platform in which the user can reach any service within 15 minutes of easy mobility.

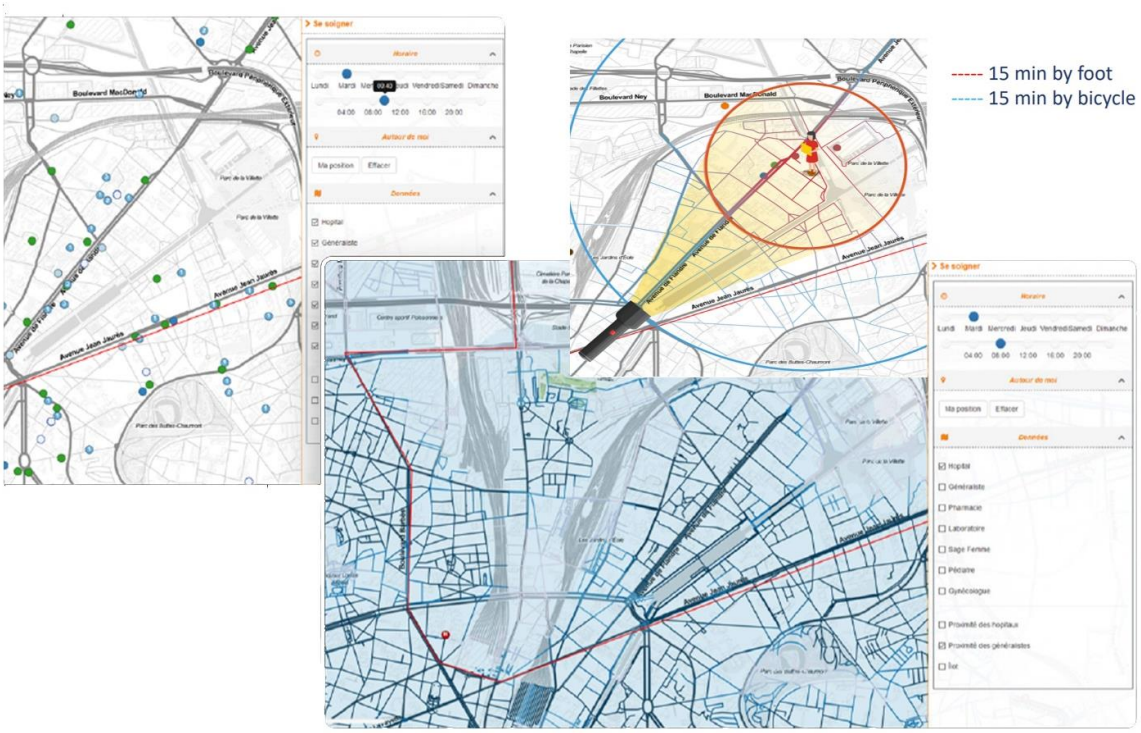


Fig.18 The digital platform. Source: White Papers Paris Northgates Project.

2.3.2 THE "20 MINUTE NEIGHBORHOOD" OF MELBOURNE

In 2017 the **Melbourne Plan 2017–2050** was proposed, a long-term strategy to accommodate the future growth of Melbourne's population (Victoria State Government, 2019). This plan was based on the concept of **20-minute neighborhoods** (Fig.19), a new approach to planning, very similar to the previously mentioned 15-minute city in the paragraph 2.3.1, whose goal was to offer more inclusive, vibrant and healthy neighborhoods.

The Melbourne 20-minute neighborhood principle takes as an example the Portland, Oregon process of "living locally" by giving people the ability to meet most of their daily needs within a 20-minute walk of home, with access to a safe bicycle path and local transport options. In January 2018, the 20-minute

neighborhood pilot program was launched by the Minister of Planning of Melbourne City to **test the experimentation** in 3 different districts: **Croydon South** by the City of Maroondah (that will be presented in this dissertation), **Strathmore** by the Moonee Valley City Council, and **Sunshine West** by City of Brimbank.

How does the 20 minute city concept work and **how was it developed**?

Fig.19 The "20 minute neighborhood" of Melbourne. Source: Victoria State Governament

Human settlements over the centuries have often been compact and walkable. Planners have tried to create models to achieve this through the 'Garden Cities' theory by Ebenezer Howard in the 1890s, the 'Central Place' theory by Christaller and Losch in the 1930s, and now the Melbourne 20-minute neighbourhood principle. These models are all about creating **compact places** where people can access daily needs locally (Victoria State Government, 2019). As mentioned above the 20-min city concept has evolved from Portland's 20-min neighborhood concept, which envisioned a neighborhood where residents were able to access daily activities within twenty minutes, ideally by walking, but alternatively by bike, transit, or even car.

Being very similar in concept to the 15 minutes city the Melbourne Plan has decided however to increase the time to **20 minutes** considered as the **maximum time** for which people are willing to walk to meet their daily needs at the local level. This 20-minute journey represents an **800m walk** from home to a destination. This distance was adopted as a spatial accessibility measure of a walkable neighborhood, but should only

be used as a guide, as there can also be many other factors that influence people's abilities or desire to walk.

What **can we learn** from this urban planning approach?

Never before, in this period in which we are so focused on what is local, does the feeling of being connected and supported seem so important to us. The pandemic situation has brought many things, most of them unexpected and unwanted, but the focus on where we live is at the heart of what has been delivered to us by this introspective moment. Never before have we been forced to immerse ourselves in our communities and lift the veil on what truly constitutes our neighbourhoods. The interconnection between the project of our cities and the happiness of the residents is a story we know well, and it is precisely the focus on health and prosperity that led to the important narrative of the "20-minute neighborhood". As with the 15-minute city, this planning model can be an excellent starting point for rethinking the design of our territories to reassess post-pandemic cities.

2.3.2.1 CASE STUDY II - CROYDON SOUTH PROJECT

Croydon South, in the **Maroondah City Council** area of the eastern suburbs of Melbourne, is a part of the state government's 20-Minute Neighborhood Pilot Program. Croydon South is a 'middle ring' suburb of Melbourne, located approximately 29km east of Melbourne CBD and approximately 4km from Ringwood Metropolitan Activity Centre. Croydon South is characterized by undulating topography, an abundance of open public space which is dominated by impermeable surfaces (State of Victoria, 2019).

The project was developed in three phases which are explained below in order to understand the methodology used and draw ideas for the proposal that the research thesis intends to present for the city of proximity.

1
LIVABILITY SURVEY

The project has enabled a wide range of venues and people taking on a partnership role to support the design and help shape the changes they want see in their neighborhood. The city council of Maroondah has embarked on a series of community support initiatives by establishing a **CrowdSpot** through an **online platform** in order to obtain hyper-local feedback on neighborhood-level issues and understand future priorities. The **"livability survey"** (Fig.20) requested **community feedback** on perceptions of neighborhood livability and **267 surveys** were obtained. The common themes were the need for: affordable housing options, local job opportunities, learning and engagement opportunities, community arts and cultural

programs. The livability survey has reinforced a strong community, and the survey results mapped below are community perspectives on access and satisfaction in South Croydon.

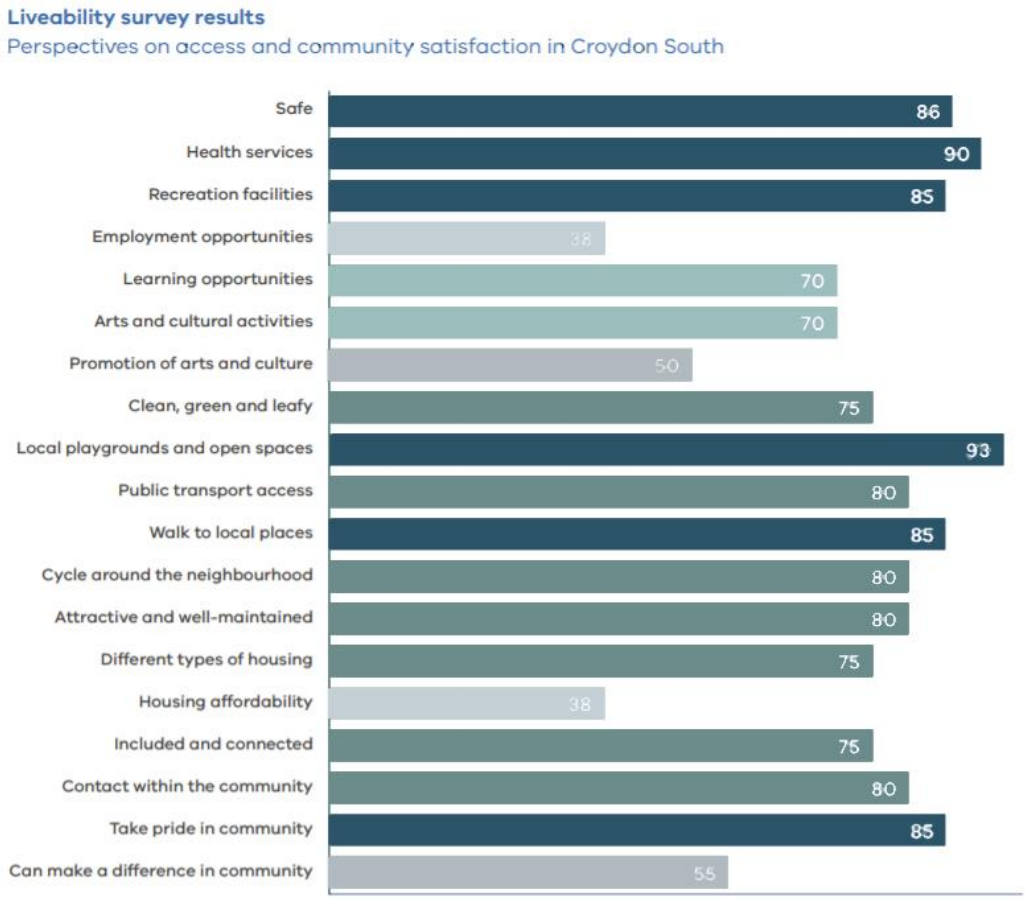


Fig.20 Liveability Survey in Croydon South. Source: Victoria State Governament

2
TECHNICAL ASSESSMENTS

1. **Walkability assessment:** In 2018 Victoria Walks conducted a walkability assessment of Croydon South in order to identify problems relating to pedestrian infrastructure. The assessment provided preliminary recommendations to: construct a pedestrian crossing on Eastfield Road, reduce speed limits around Eastfield Shops, improve wayfinding signage, explore opportunities to naturalize the Tarralla Creek, and install raised zebra crossings at intersections
2. **Movement and Place assessment: the D**epartment of Transport Management Framework for Victoria, recognized the role roads play not only in moving people and goods, but also in contributing to places where people live, work and play, integrating planning and transport in order to support decision

making. This assessment was carried out in Croydon South, where the framework was tested locally for the first time.

3. **Housing development assessment**: For the housing development assessment, data provided information on the number and location of existing dwellings, vacant residential land, and recent residential development across all land in Victoria. Housing stock in Croydon South is characterized by single detached dwellings. While there has been an increase in unit developments in recent years, the area is generally considered low density with 17 dwellings per hectare. Research shows that a minimum housing density of 25 dwellings per hectare is needed to deliver inclusive, vibrant and healthy neighborhoods.
4. **Vegetation and heat vulnerability assessment:** The last assessment concerned vegetation and heat vulnerability assessment including the fundamental role of urban green in order to improve the community resilience to extreme heatwaves. While the vegetation mapping shows moderate to high canopy coverage for most of Croydon South (more than 50%), there are some areas with low canopy coverage (less than 30%). To minimize the heat vulnerability associated with low roof coverage, continuous protection of the existing vegetation is needed. Future investments are also needed to increase support for an urban forest.

3
FUTURE OPPORTUNITIES

The last phase involved the development and testing of the city of 20 minutes to South Croydon. The aim of the pilot project was to **identify opportunities** while maintaining its distinctive features, coming to formulate a series of important actions: be safe accessible and well connected for pedestrians and cyclists to optimize active transport; offer high-quality public spaces and open spaces; provide services and destinations that support local life; facilitate access to quality public transport which connect people to higher-order jobs and services; provide housing/population densities that connect to local services and viable transport; facilitate thriving local economies.

The features were used as the basis for a range of opportunities to improve livability and support people to live locally in Croydon South. The following opportunities reflect the ideas of the community which will be a starting point for a **local approach**, offering a 20 minute neighborhood to Croydon South. These opportunities reflect the community feedback and technical evaluations, supporting the review of the Precinct Structure Plan Guidelines in 2020.

These three methodological steps mentioned in this paragraph for the case study of Croydon South, are to be considered the same also for the experimentation of the 20-minute neighborhood in Strathmore and Sunshine West. Since the methodology is the same for all the case studies, this dissertation has decided to develop the first case study in detail but the approach is to be understood in the same way for the others.

2.3.3 THE "SUPERBLOCKS" MODEL OF BARCELONA

The original plan for the expansion of the city of Barcelona (i.e. Eixample), proposed by the **19th-century** progressive Catalan urban planner **Ildefons Cerdà**, considered the human needs for natural lighting, ventilation, open spaces and greenery, and a transport network that would accommodate enough pedestrians, horse-drawn carriages and public tram lines. Over time, however, the city has seen an increase in levels of air and noise pollution, constantly exceeding the limits of the WHO, causing a great burden on health. In order to recover Cerda's progressive design and remedy the negative effects of climate change underway, the Barcelona Superblock model was proposed as an innovative land use intervention that aimed to **recover space for people** by **reducing motorized transport** and promoting sustainable mobility and active lifestyles (Mueller *et al*., 2019). The particular space management and neighborhood organization promoted by Cerdà has been modified significantly, but his urban vision has been unchanged, and the Superblock model is referenced extensively in its original application (Scudellari, 2017).

This model, also called **Supermanzana** or **Superilla** in Spanish, was an innovative urban and transport planning strategy that aimed to **reclaim public space** for people (Mueller *et al*., 2019). A total of **503 Superblocks** were proposed from the beginning of the **2000s** for the Municipality of Barcelona by the **Urban Ecology Agency**[26] (BCNEcologia) and its director **Salvator Rueda**[27] in order to renovate the street network. Superblocks were cells that transformed the city into sustainable, compact and connected neighborhoods with mixed land use and a high potential for socialization, but except for some pilot projects, the administration was not able to implement a choral project to the entire city over the years.

The urban transformation implemented in the historic center began in the Barri El Born and was subsequently extended to Barri El Raval, El Gotic and La Barceloneta. The aim of the project was to increase the urban quality of the densest and most touristic neighborhood, encouraging pedestrian traffic and facilitating the use of the city by all types of city users. The second superb project was then developed in 2003 in the Gràcia district as part of the "Pla de Mobilitat del District de Gràcia" (Scudellari, 2017). However, even if, as mentioned before, some projects were not completed and the districts of Gracia and

[26] The *BCNecologia* (Urban Ecology Agency of Barcelona) is a public consortium consisting of the City Council of Barcelona, the Municipal Council and Metropolitan Area of Barcelona and the Barcelona Provincial Council. It applies a systemic approach to the management of cities to encourage a more sustainable model. In order to achieve this, the agency provides sustainable solutions related to mobility, energy, waste management, water management, urban planning, biodiversity and social cohesion. The *Agencia* and in particular its director, Salvador Rueda, have the main role in the implementation of the superblocks because they have been trying to promote the idea of Ecological Urbanism to Barcelona's government since 2000 (Wikipedia., 2021).

[27] Salvador Rueda is the director of the Barcelona Urban Ecology Agency. As director of the Barcelona Urban Ecology Agency since its founding in 2000, he has worked on a number of strategic projects aimed at redirecting cities towards a more sustainable model, including the Superblocks model. He has written several scientific and technical books and articles on the urban environment, as well as other works that disseminate this theme (Wikipedia., 2021).

Ciutat Vella eventually became just a sort of zone 30, the result certainly increased the urban quality considerably. This approach was considered a turning point for the application of sustainable urban solutions and became the first urban program for the implementation of the Superblock model on an urban scale, "Programa Superilles 2011-2015".

The program was realized in parallel with the redaction of some other urban plans, first of all the **Plan de Mobilitat Urbana de Barcelona 2013-2018**, in order to present a comprehensive view of the city and to integrate the pilot projects in a general superblock scheme. In this way, the city council adopted the program with the name **"*Barris a velocitat humana. Programa d'impuls de 5 Superilles Pilot a Barcelona*"** on 28 February **2014**, with the guidelines to realize **5 Superblocks.** The 5 Superblocks included in the first program "Barris a velocitat humana" were: Barri de La Maternitat i Sant Ramon, **District de Les Cortes;** Barri de Sants Montjuic, **District Sants Montjuic;** Barri de la Nova e l'Antigua Esquierra de l'Eixample, **District de l'Eixample;** Barri de Poblenou, **District de Sant Martì**, and **Plaça de les Glòries**.

2.3.3.1 CASE STUDY III – THE APPLICATION MODEL IN BARCELONA

How does the superblocks concept work and **how was it developed**?

The **"Block"** is a unit of small cells and is defined as the part of built space and free spaces representing the minimum unit for determining urban specifications, representing the outdoor space intended for pedestrian accessibility. The **"Superblock"** is the definition of the urban space created by the union of the cells and the space between the different blocks. This interstitial part of the city is composed of public space: mobility networks, infrastructures, service networks, greenery network, a network of basic equipment and services, community social relations, environment, etc (Scudellari, 2017).

Superblocks are territorial units imagined as bigger than one block of the dense Barcelona' urban matrix with a strict grid pattern, but still smaller than a whole neighbourhood. The aim of creating such superblocks is to recover space for the general public, preserve biodiversity in the city, improve sustainable mobility as well as encourage social cohesion and collaboration.

Specifically, the objectives of the "Superblocks" model were: regeneration of public spaces; promotion of biodiversity with urban greenery; social cohesion; the circular economy and integration of governance processes and sustainable mobility.

Large "Superblocks" covering an area of around **400m x 400m** (Fig.21) are created from residential blocks of 150m x 150m. In the Superblocks area, the inland roads provided a local road network accessible

primarily to active transport, i.e. on foot and by bicycle, and secondarily to residential traffic with a **maximum speed of 10-20km/h** (Fig.22).

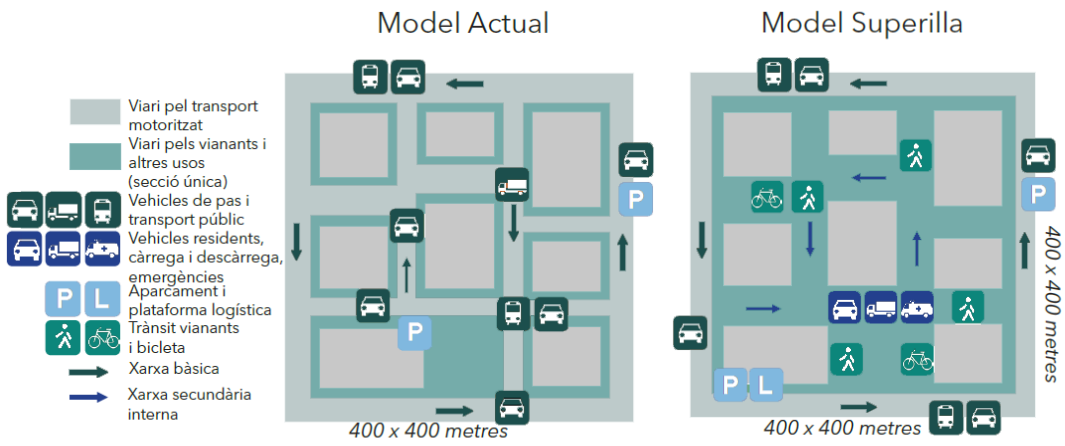


Fig.21 The Superblocks area. Source: Scudellari Jacopo., (2017). "Ecological Urbanism. The Superblock urban model in the case study of Barcelona"

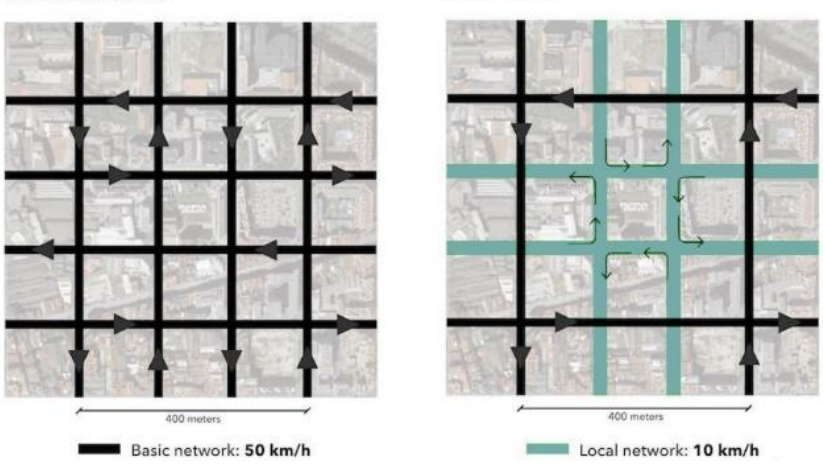


Fig.22 Superblocks roads. Source: Scudellari Jacopo., (2017). "Ecological Urbanism. The Superblock urban model in the case study of Barcelona"

The Superblock was framed by the **basic road network** that connected the city and adapted to traffic at a **maximum speed of 50 km/h.** In addition to hosting cars/motorcycles the basic road network contained **separate cycling and walking infrastructure** and **preferential bus lanes** for rapid transit. For optimal access, bus stops were placed every 4**00m** at the main superblock intersections, in non-grid neighborhoods this distance could vary) and buses ran at high frequency, making public transport an interesting alternative (Mueller *et al.*, 2019). The project does not involve major physical changes, but rather **tactical urbanism**: promoting soft measures that are often low-cost and easy to adapt to, representing a new way of understanding and providing benefits to the city.

In order to achieve the goal of reducing per capita levels of CO2 equivalent emissions by 40% compared to 2005 levels (3.14 GEH / inhabitant) by 2030, the Municipality of Barcelona has introduced a series of

programs and projects, as mentioned above, such as the **Urban Mobility Plan**, linked to the Superblocks program. The Urban Mobility Plan stipulates that the entire city must be organized as a superblock, including also the planning of the mobility network, so that any project carried out in the city develops under this structure.

The program establishes sufficiently flexible functional criteria that can be adapted to the characteristics of each city district, also ensuring the uses and functions envisaged for all types of streets. Some of the analyzes conducted for the pre and post Superblock implementation of the city of Barcelona within the PMU 2013-2018 are proposed below:

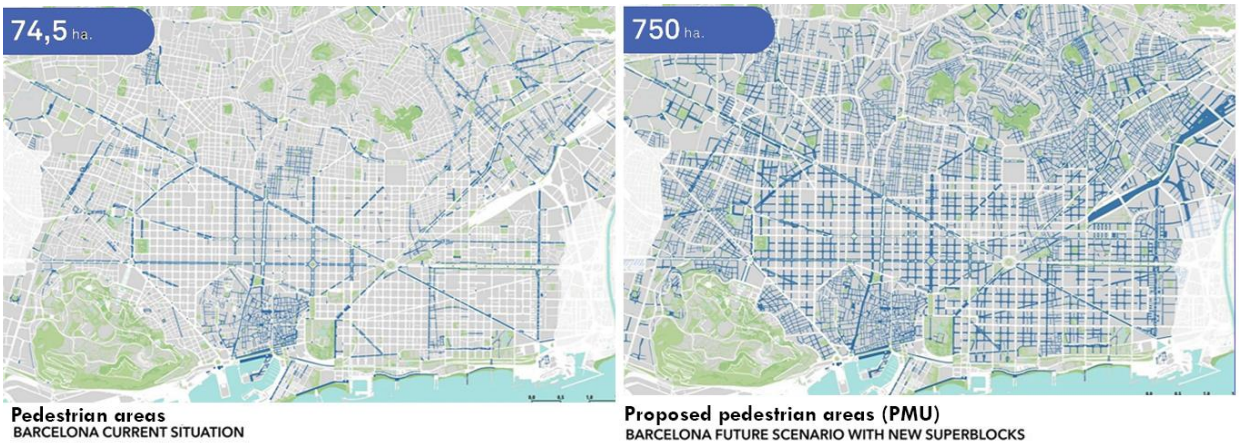


Fig.23 Pedestrian areas in the Superblocks pre and post. Source: Scudellari Jacopo., (2017). "Ecological Urbanism. The Superblock urban model in the case study of Barcelona"

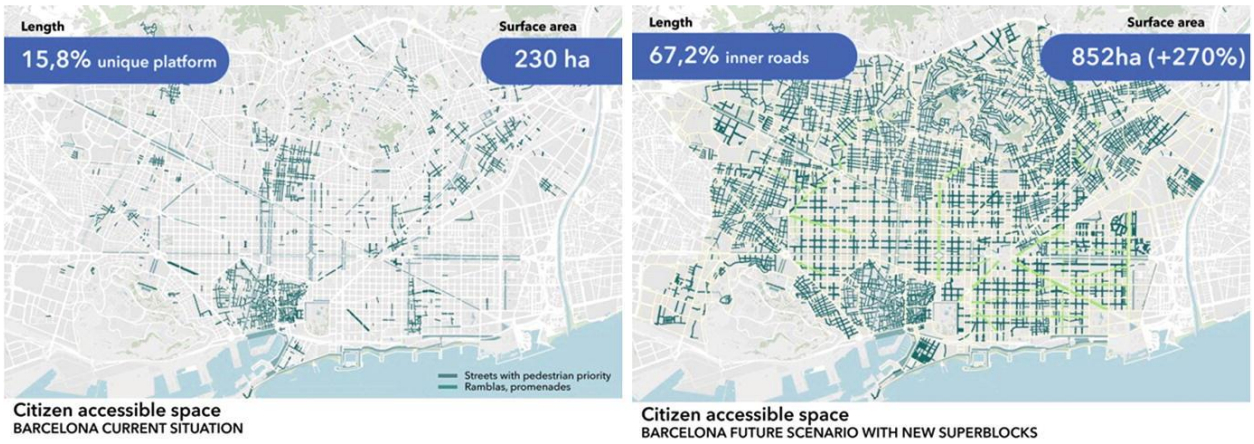


Fig.24 Citizen accessible space in the Sperblocks pre and post. Source: Scudellari Jacopo., (2017). "Ecological Urbanism. The Superblock urban model in the case study of Barcelona"

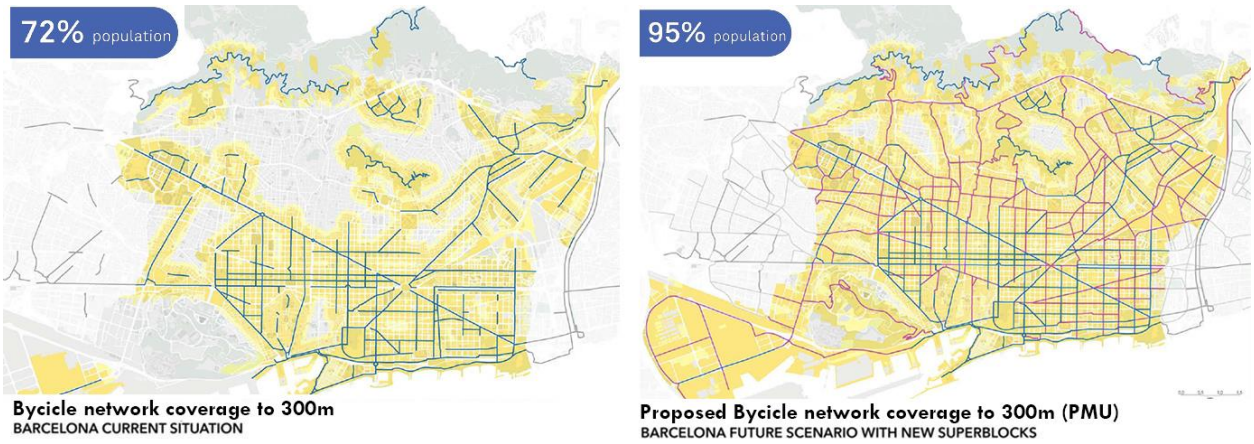


Figura 25 Bycicle network in the Superblocks pre and post. Source: Scudellari Jacopo., (2017). "Ecological Urbanism. The Superblock urban model in the case study of Barcelona"

What **can we learn** from this urban planning approach?

Today's streets need to be redefined as public spaces, as habitable places, as community spaces, as an extension of housing, as a space for games, greenery, history and the local life of neighborhoods. This urban blocks model has given the city back to its citizens by keeping car traffic on the outskirts of each block, creating a quieter and more spacious interior area, ideal for cycling and walking or experimenting with new uses that encourage cohesion social and economic development.

The Superblock concept has caught on in other parts of the world, and the Rueda' model could be used in any city or country, and is far cheaper than building new infrastructure. Superblocks are easier to implement when you start with a neat street grid, as in Barcelona's Eixample district, but there's no reason the basic idea couldn't be adapted to other cities' configurations.

This type of approach to urban planning, like the cases previously proposed in paragraphs 2.3.1 and 2.3.2, demonstrates how important it is in a post-Covid situation to **implement public space** in order to manage new possible and future waves of emergency and redesign a city in the fundamental **role of the pedestrian**, through the new design of the **city of proximity**.

The Superblock project proves that it is not necessary to implement major changes in urban planning or invest in huge infrastructure solutions to improve the lives of citizens. Sometimes small-scale or low-cost actions can induce the same or even better effects. The Superblocks model is a great tool to rethink and change existing urban mobility patterns. At the same time, it has become a model for the total transformation of urban neighborhoods, and superblocks can easily be replicated and modified to suit any other location. Citizen involvement in the whole process is crucial because it is the best way to ensure social acceptance of new lifestyles.

PART II – MEASURING PROXIMITY THROUGH INDICATORS

CHAPTER III

EVALUATION FRAMEWORK

The Covid-19 pandemic has laid bare the system's poor understanding of the nature of risk and interdependencies between different sectors. In light of developments over past years, the challenges we face hinder multidimensional **risk assessments**, including the lack of a clear suitable methodology or terminology for disaster collection and analysis.

Today we need **new methodologies** to understand the risk of the spread of possible health disasters within urban contexts and the relative need to use **new tools** and methodologies for the development of integrated measures that adequately address economic, social, environmental and political aspects. Particularly so in light of the SDGs' Sustainable Development Goals and the implementation of the SFDRR. The Covid-19 pandemic and climate emergency demonstrate the need for transdisciplinary scientific, technological and academic platforms to better understand the underlying risk factors for cities, producing concrete analyzes that show actual data on which to base future actions.

The health emergency has prompted countries to begin updating **disaster risk reduction strategies** to include biological and health risks as part of multi-risk approaches. For these reasons, it is essential today to **measure and evaluate the impact of the shock** on future development of the resilience of the city through a spatial analysis as a key to inform decision making and show priority areas.

The methodological framework proposed in this chapter aims to investigate the **correlations existing between** the **urban environment** and **level of proximity** of cities, understanding how the aspects related to proximity to services have played a fundamental role during the phases of restriction and how this level of accessibility needs to be increased in order to develop more resilient cities locally. The link between urban forms and cities proximity to activities in terms of health benefits has been clearly demonstrated during the years. Several studies have shown that pedestrian behavior and route choice are also influenced by the qualities of urban design.

In these terms, the urban environment plays an important role in fulfilling WHO recommendations during a health emergency, as it could encourage people to be more active in the future thanks to its design features (Rebecchi *et al.*, 2019).

The main categories and conditions of the urban environment that affect health are: **density**, including transport and food environment; **land use mix**, including green spaces and building use; and **urban design**, as regards the aesthetics, safety and cleanliness of the neighborhoods. The strengthening of each of these categories has been linked to an improvement in the well-being of the population or to the promotion of more active behaviors. In this scenario, the role of urban planners and policy-makers becomes essential to (Rebecchi *et al.*, 2019) design the city of proximity for the future.

Starting from the literary review, and from the related formulation of the research question, the **methodological framework is structured in 2 phases**, where for each of the objectives, the method and the tools are shown in the following paragraph.

3.1 METHODOLOGICAL FRAMEWORK IMPLEMENTATION

For what has been said in paragraph 1.6, this research work intends to propose a clear and simple **investigation methodology**, structured in 2 phases that can be **replicated in all urban contexts**. It provides an appropriate vocabulary and lexicon aimed at analyzing the territorial response capacity to sudden external stresses, in order to experience the **city of proximity** as an urban response to the cities of tomorrow which act as a new generator of public health. For these reasons, the ultimate aim of the research is to develop an evidence-based assessment framework for assessing proximity, in order to analyze the urban environment in relation to accessibility, providing objective results to address policymakers, promoting an alternative bottom-up approach at the local level. This work, has among its objectives, to be as specific as possible starting from the experimentation of the city of proximity in a small piece of the city, at the neighborhood scale, with the ultimate aim of becoming a pilot project to be adapted to the whole city.

The research work is structured in 2 phases: (1) Pre-selection (2.) Baseline scenario (Fig.26).

Fig.26 Research work phases. Source: Author, 2021.

This paragraph shows the evaluation framework, a methodological framework previously proposed and tested by the MOLOC project[28], with the aim of expanding this methodology also in contexts and cities where there are no structured guiding projects behind it.

[28] The MOLOC project (MOrphologies Low Carbon), co-funded from Interreg Europe 2014-2020 Programme (interregeurope.eu/moloc), aims to develop a new approach to city construction, combining quality of life and energy efficiency, exploring the brakes that limit the impact of local policies and actions in their ambitions to change current

The decision-making model proposed by the MOLOC project was the starting point in order to rework this methodological framework, which referred to an analysis at the municipal scale, towards an approach capable of analyzing an even smaller scale, that of the neighborhood level. This aims to present itself as a methodology that can be easily replicated in all contexts, where once the indicators and the case study have been modified, it can be applied in all cities that intend to apply this tool to analyze their own territory.

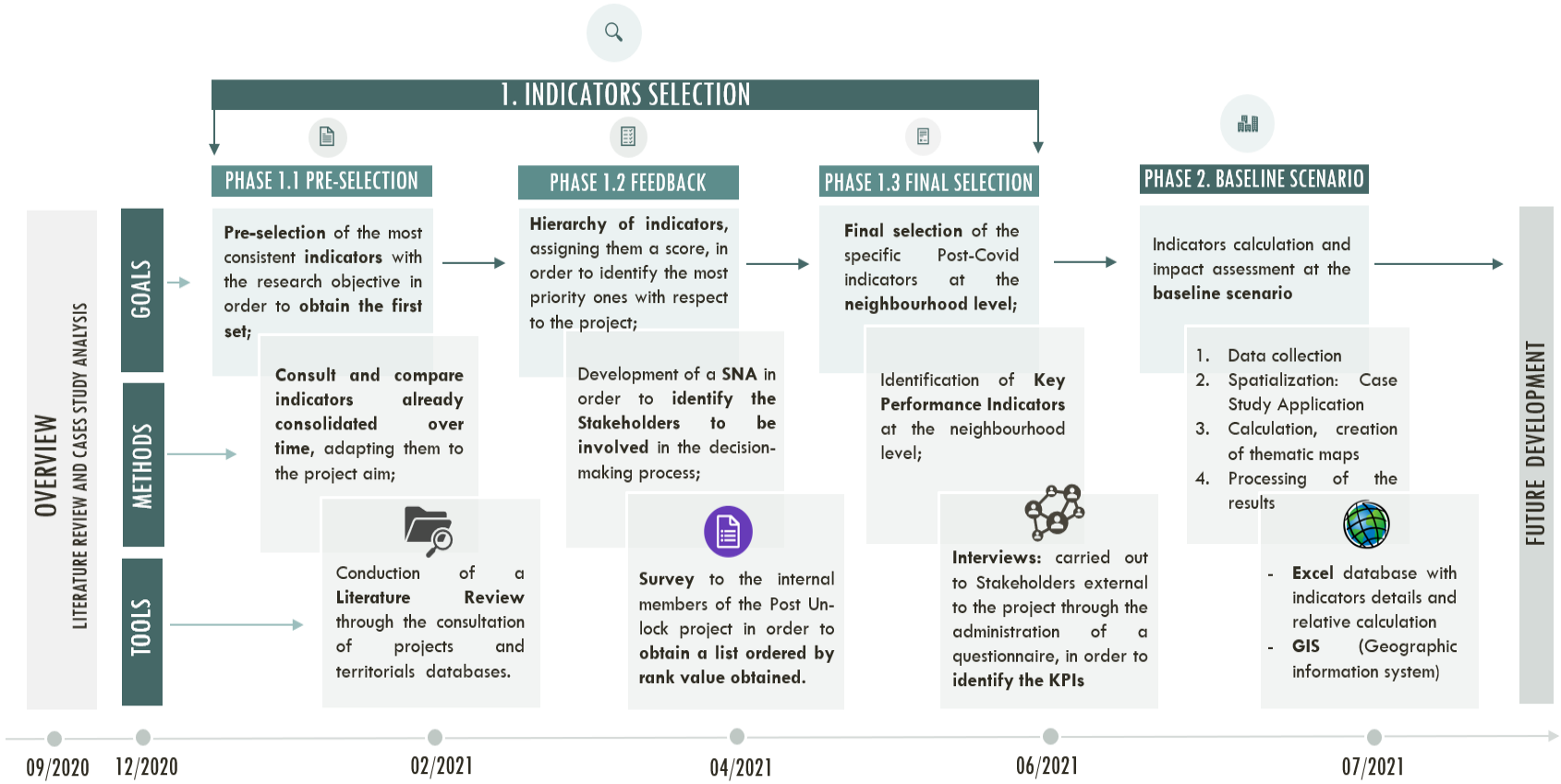
The implementation of the methodological framework intends to select and evaluate the **Key Performance Indicators (KPI)**, selected from already consolidated projects and territorial databases, adapting them to the particularities of the project. KPIs, in general, measure the effectiveness of a proposed project with respect to the achievement of research objectives and their selection process also helps to clarify the success measures of the proposed project.

In general, indicators, and even more so KPIs, should express as precisely as possible to what extent a purpose, objective or standard has been achieved or even exceeded, and this research work intends to use them to provide numerical data and concrete results on the level of proximity of the city under study (Angelakoglou *et al*., 2019).

The impact was assessed using spatial models and geographic information system (GIS) tools to map the phenomena represented by the indicators. Consequently, the method implements a new system based on multi-criteria indicators to support decision-making and to evaluate proximity performance at the local level.

For what has been said, the methodological framework has been structured in 2 phases, and in the diagram below the objectives, the method and the tools that have been used as the analysis method for each phase will be presented (Tab.1):

urban morphologies in light of the sustainability of urban development. Six partners were involved in this project including the City of Turin which developed an action plan for a low carbon strategy, co-designed with local partners. The city has established a local stakeholder group to co-design its action plan through a bottom-up approach, paying attention to the needs of citizens and appropriation by local stakeholders throughout the process .



Tab.1 Work phases – Methodological Framework. Source: Author, 2021.

3.1.1 PHASE 1 - INDICATORS SELECTION

The first phase of the work, which will be described in greater detail in paragraph 4.1, concerned the selection of post-Covid indicators useful for assessing the level of proximity within the City of Turin. As already mentioned previously, in light of current developments, it is essential to produce analyzes that evaluate, monitor and analyze the impacts in numerical terms in order to obtain concrete data on which to base future analyzes. This phase is structured in **3 different steps: Pre-selection, Feedback and Final selection.**

As stated several times, this methodology is also intended to be proposed for those contexts in which there are currently no research projects, as in the case of the **MOLOC project** behind which there was the CESBA MED project with a set of 178 proposed indicators. This research work intends to present itself as the possibility of finding already consolidated indicators within different projects or territorial databases with the ultimate aim of creating a new specific set for the project.

The goal of the Pre-selection and Feedback phase was precisely to **create a preliminary set** of indicators through the literary review that were useful for the purpose of the research. The method was therefore that of reading the indicators proposed by different projects and territorial databases in order to structure a preliminary list first that was submitted through a questionnaire to the internal members of the Post-Unlock project. The details of this phase are explained in greater detail in paragraph 4.1.2, demonstrating how the survey was the useful tool used for the first screening of the proposed indicators.

The third phase Final selection, had the objective of **creating the final set** of indicators for the experimentation of the city of proximity by ranking the results obtained, creating a final list and identify **Key Performance Indicators (KPIs) specific to the neighborhood scale**. More detail of the phase is shown in paragraphs 4.1.3.

3.1.2 PHASE 2 – BASELINE SCENARIO

The formalization of the set of indicators, and the identification of the **Key Performance Indicators (KPIs)** to the neighborhood scale, initiated the first real **operational phase** of the research work: the mapping of databases and information sources at the neighborhood level on the subject of the experiment, the city of proximity as an urban response to the planning and management of post-pandemic cities. The data processing and the drafting of specific thematic maps make it possible to extrapolate the synthetic values of each indicator of the final set, on the basis of which the decision-making model is elaborated and the tool

for assessing territorial performance in terms of proximity is adapted, applied in this first phase to the current state of the City of Turin.

The objective of this phase is to **calculate and spatialize the post-Covid indicators** on the territory of the city of Turin at the neighborhood scale in order to analyze the actual state of proximity in a part of the city. The methodology applied was to make a preliminary collection of data for each indicator chosen in order to spatialize them and place them in the case study. The purpose underlying the measurement of the indicators itself aims for the creation of a Territorial and Environmental Information System of a spatial nature, which allows the visualization and management of data and information through a georeferenced platform (Pignatelli, 2020). A system of this type supports the integration of databases and sources of urban information, offering a spatial model structured according to different layers and georeferenced data.

Furthermore, setting up a system of this kind lays the foundations for a knowledge platform potentially exploitable by the public administration to monitor future developments of the process of sustainable urban planning which this project initiates. The calculation methodology follows a common path for each indicator: Data collection, spatialization on GIS software, calculation of indicators and finally creation of thematic maps and data export (Pignatelli, 2020).

The construction of the scenario was carried out according to a process that involved the results of all the previous phases; first of all by defining a solid and comprehensive cognitive framework of the city of Turin, subsequently associated with other investigation methods (Pignatelli, 2020).

Measuring, evaluating and spatially visualizing the impact are the keys to the proposed evaluation process.

In this phase, having conducted in paragraph 2.3 the analysis of different case studies that over the years had experimented the theme of proximity from different points of view has allowed this research to reduce this knowledge and the different design methods that during the course years had been proposed on the present case study.

3.2 CASE STUDY: LOCAL LEVEL ANALYSIS OF THE CITY OF TURIN

This work, has among its objectives, to be as specific as possible starting from the experimentation of the city of proximity at the neighborhood level, with the ultimate goal of becoming a pilot project for the entire city. The reference City chosen for the purpose of constructing the cognitive framework is the **City of Turin**, within which the Polytechnic of Turin is located. The choice of this context can also be attributable to reasons such as the ease of retrieval of the various materials and datasets, and to knowledge gained as an

"insider" which enabled an understanding of some nuances in the spatial and temporal dynamics that would have been more difficult to obtain in other contexts (Favarelli, 2021).

The Municipality of Turin in the period 2014-2020 was one of the 6 Partners of the MOLOC project in which the DIST Department of the Polytechnic of Turin, taking the opportunity of the **Structural Review of the PRG of the Municipality of Turin**, had decided to offer the administration a decision support tool and the possibility of comparing with other contexts by sharing one's experience to generate good practices. The work of selecting the indicators to be used for the assessment of the performance level of the city of Turin in terms of sustainability and proximity in view of its now approval of the revision of the PRG, was carried out through the application of the methodology presented in the previous paragraph in order to identify a set of indicators that can be measured in a homogeneous way for the entire territory on a municipal and local scale. This research work, showing continuity with the methodology proposed by the previous project, is an additional decision support tool for the administration in view of its now approval of the **Metropolitan Strategic Plan 2021-2023.**

The city of Turin in 2021, saw its approval of the new Metropolitan Strategic Plan 2021-2023 **"Torino Augmented Metropolis"** and this thesis work is shown in full compliance with the **6 axes, 24 strategies and 111 actions proposed.** Axes, strategies and actions, already recall those that are the cardinal principles of sustainable development, declared worldwide in the **UN 2030 Agenda** (the 17 objectives resulting from the Agreement between 193 countries in 2015), and support the Metropolitan City of Turin which, like all other Italian metropolitan cities, is called in the next year to work for the drafting of an **"Agenda for the sustainable development of the city of Turin and its territory".** For what has been said, and in full coherence with the ultimate goal of the new MSP which imagines the Augmented Metropolis as a "90-minute metropolis" made up of many "15-minute cities", this research thesis intends to analyze the proximity level of this case study.

Developing resilience measures in response to today's global challenges is a key issue on a global but also local scale. The society we live in is increasingly interdependent and complex and, consequently, more vulnerable to risks and uncertainties as we have seen with the ongoing health emergency. For the city of Turin, the pandemic acted as a catalyst, and the pandemic period was a way of highlighting all the long-unresolved issues with immediate clarity. From the point of view of resilience and environmental sustainability, cities and their metropolitan areas are by no means static and closed systems, but the different components are in continuous interaction at different levels and scales and for this reason, they can become extremely vulnerable in the face of endogenous and exogenous shocks and stresses. If it is therefore true that urban planning plays a central role in the fight against climate change and in promoting sustainability, it is not the only one facing this challenge; comparison with the surrounding territories and coordination with greater territorial and sectoral planning is fundamental for the definition of winning? and long-term strategies (Comune di Torino, 2020).

CHAPTER IV

POST COVID-19 INDICATORS ANALYSIS

4.1 INDICATORS SELECTION

Chapter 4 represents the **fulcrum** of the research work, which, following a substantial literary review, intends to propose itself as an **operational part** of this work, describing the logic that led to the development and creation of the **post-covid 19 indicators set**.

This section starts from the need to **measure progress towards sustainable development** by quantifying the phenomena that constitute it through the use of precise indicators specific to the research topic, arriving at producing concrete analyzes that numerically show the impacts.

As already mentioned, this work intends to propose a new set of indicators selected from previous projects and territorial databases to propose an investigative methodology that can also be replicated in different contexts. The current post-Covid indicators presented, don't represent indicators that evaluate the changes made within the urban context under study following the spread of the Covid-19 pandemic, but as represented by the title "post-Covid", they represent **useful indicators for the interpretation of the pandemic city** that we want to plan for the future, showing the experimentation of the city of proximity as an urban response. The logical process used for the selection of indicators is shown below:

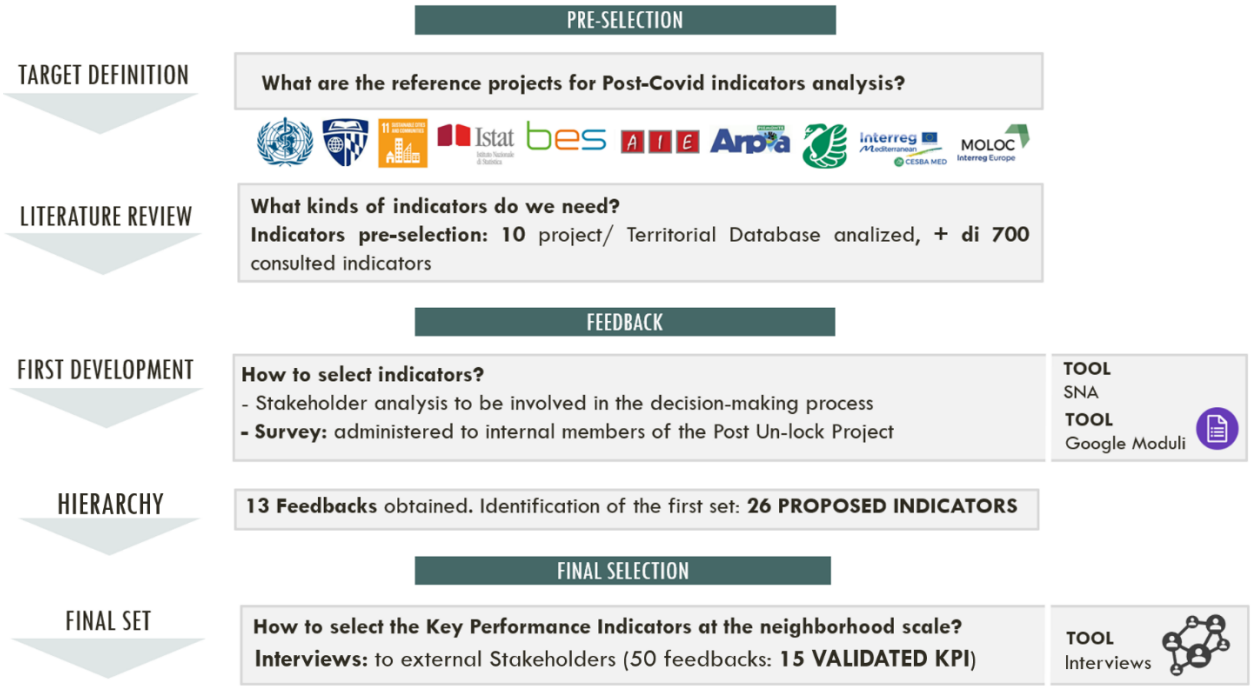


Fig.27 Phase 1 – The logical process of the Indicators selection. Source: Author, 2021.

4.1.1 PRE-SELECTION

4.1.1.1 LITERATURE REVIEW

The pre-selection of the indicators represented the **first step** in the creation **of the new set of indicators** on which to base the analyzes. This phase was supported by a substantial literary review treated on various projects already consolidated over time, which had used internal monitoring indicators, and the consultation of territorial databases. The provenance of the sources used for structuring the first set is shown in the table below, which was ordered by the "geographical level of analysis" to which the indicators referred, from the global level to the urban scale (Tab.2):

	NAME	GEOGRAPHICAL LEVEL	COVERAGE	SOURCES	NUMBER OF INDICATORS	SELECTED INDICATORS
	Global Reference List of 100 Core Health Indicators	Global level	Global	WHO World Health Organization	100 indicators	**2**
	COVID-19 Dashboard Center (CSSE)	Global level	Global	CSSE Center for Systems Science and Engineering	Interactive dashboard	**2**
	UN Habitat - Report on SDG11+	Country level	193 UN Member States	Global monitoring framework goal 11+	SDG 11| 15 indicators, 10 targets	**1**
	ISTAT - SDG Report 2020	Country level	Italy	ISTAT 2020	232 indicators, for 17 Goals	**2**
	BES 2020	Country level	Italy	ISTAT 2020 | BES	152 indicators	**2**
	Italian Association of Epidemiology	Country level	Italy	Italian Association of Epidemiology	5 indicators	**3**
	ARPA	Regional level	Piedmont	ARPA	23 categories, 169 indicators	**3**
	LEGAMBIENTE | Urban ecosystem indicators	Urban scale	Cities	LEGAMBIENTE 2020	18 indicators	**3**
	KPI urban scale | CesbaMED	Urban scale	6 European partners	Interreg EU 2014 - 2020 programme	7 issues, 23 categories, 178 indicators	**3**
	MOLOC project	Urban scale	Cities | Turin	Interreg EU 2014 - 2020 programme	5 issues, 8 indicators	**8**

Tab.2 The origin of the resources used. Source: Author, 2021.

= 29

Starting from the **consultation of more than 700 indicators** contained within the **10 sources** *(Global Reference List of 100 Core Health Indicators; COVID-19 Dashboard Center; UN Habitat; ISTAT 2020; BES 2020; Italian Association of Epidemiology, ARPA, LEGAMBIENTE, CesbaMED; MOLOC)* from which they were drawn, a careful selection was made of those most consistent with the objective of the research and the aims of the project. From the analysis of the indicators already consolidated over time contained within the various sources

represented in the diagram above, a preliminary selection of **29 indicators** was reached. These indicators were interesting for determining which to base the analyzes on in order to understand the **level of sustainability**, resilience and response of the system to sudden events, as in the case of the spread from Covid-19. They could represent key indicators for research from which to draw some considerations for the experimentation of the city of proximity. During the preliminary pre-selection phase, particular attention was paid to:

- The **relevance** of the indicator concerning the topic under study;
- The **scale of investigation**: the local level;
- The presumed **availability of data** (even presumed at this stage);
- The relative **possibility of calculating and measuring** the indicators.

Once the first preliminary list of the 29 post-Covid[29] indicators (Tab.3) has been obtained, useful for assessing the level of sustainability of the city of Turin at the local level, and in particular to be able to understand the level of proximity of the base scenario that the case study presented, the indicators have been inserted in an **Excel table** to represent: (Below is a list of the 29 pre-selected indicators)

1. The name of the proposed indicator;
2. The relative unit of measurement;
3. KPIs specific for the project
4. Reference scale: municipal scale (macro-level), neighborhood scale (micro-level);
5. Data Source;
6. Typology: quantitative or qualitative;
7. Evaluation method;
8. The specifications concerning the project.

[29] The complete list of indicators belonging to each of the 10 consulted projects/databases is available at the following reference links:

1. Global Reference List of 100 Core Health Indicators (https://www.who.int/healthinfo/indicators/2018/en/);
2. COVID-19 Dashboard Center CSSE Center for Systems Science and Engineering (https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6);
3. UN Habitat - Report on SDG11+ (https://unhabitat.org/sites/default/files/download-manager-files/SDG%20Goal%2011%20Monitoring%20Framework.pdf);
4. ISTAT - SDG Report 2020 (https://www.istat.it/it/files//2020/05/SDGs_2020.pdf);
5. BES 2020 (https://www.istat.it/it/files//2021/03/BES_2020.pdf);
6. Italian Association of Epidemiology (https://www.scienzainrete.it/articolo/minimo-set-di-dati-e-indicatori-da-utilizzare-le-decisioni-e-comunicazione/associazione);
7. ARPA (http://www.arpa.piemonte.it/reporting/indicatori-on_line/elenco-completo-indicatori_on-line);
8. LEGAMBIENTE (https://www.legambiente.it/wp-content/uploads/2020/11/Ecosistema-Urbano-2020.pdf);
9. KPI urban scale. CesbaMED (http://www.eihp.hr/wp-content/uploads/2018/05/Prilog_CESBA.pdf);
10. MOLOC (http://www-portale-coto.territorio.csi.it/web/sites/default/files/mediafiles/4.9_quaderno_6-2_relazione_moloc.pdf)

Tab.3 The 29 pre-selected indicators. Source: Author, 2021.

INDICATORS	UNIT OF MEASURE
1. Soil quality	N° (avarage value of the vegetational quality index – NDVI)
2. Intermodality of the urban transport system	N ° of intermodal nodes / Kmq
3. Total average annual consumption of thermal energy for the operation of residential buildings	kWh/m2/year
4. Total average annual consumption of electricity for the operation of residential buildings	kWh/m2/year
5. Greenhouse gas emissions from the energy used for the operation of residential buildings	kg CO2 eq./m2/year
6. Air quality (PM10 concentration in the atmosphere)	µg/m^3/mean year
7. Albedo	%
8. Availability and proximity of services of general interest to residential buildings	N° of services / kmq
9. Territorial density Index	Sf / St (Land area / Territorial surface)
10. Residential density	Resident population / kmq
11. Community involvement in urban planning activities	N° of people involved
12. Relationship between the rate of land use and the growth rate of households	%
13. Incidence of urban greenery on the waterproof surface	mq of urban greenery / mq waterproof surface
14. Deprivation Index	Sum of the standardized indicators representing social and material
15. Time dedicated to mobility	Survey: N° of minutes / 24 h
16. Mental Health Indicator (SF36)	Standardized average scores
17. Accessibility to public and private health facilities in the area	Average time taken to reach at least one facility
18. Availability of hospital and intensive care beds	Total N° of beds / total N° of inhabitants
19. Housing density	Resident population / Territorial surface
20. Domestic water consumption	liters per inhabitant per day
21. Consistency of the network of cycle paths	mq of sup. cycle path / mq land area
22. Density of pedestrian traffic areas	mq of sup. pedestrian / mq land area
23. Waste: production of municipal waste	kg/inhabitant
24. Availability of urban green	mq/inhabitant
25. Contagion density	N° of infected people / N°of inhabitant
26. Incidence of confirmed cases	N° of infected people/ N° of resident population
27. Incidence of contagion by age group	%
28. Residential population density by postcode	N° of resident/km2
29. Concentration of COVID-19 cases by zip code	N° of positive cases/km2

4.1.2 FEEDBACK

4.1.2.1 STAKEHOLDERS ANALYSIS

The growing research interest in **multi-stakeholder analysis** in urban planning reflects a growing recognition that stakeholders can and must influence the decision-making process of urban development projects from their earliest stages (Yang, 2014).

The stakeholders are those individuals or organizations that make the actions able to **influence the decisional outcomes** and that do it because they pursue goals regarding the problem and its possible solution, or regarding their relations with other stakeholders (Dente, 2014). Their involvement in the decision-making process helps to know the existing data available, to determine the relevant objectives and to propose a common strategic vision with respect to the project (Torabi Moghadam, S; Lombardi, 2018).

In this paragraph, the selection of the **identified stakeholders** (Tab.4) will be presented to understand the subjects to be involved in the two different phases contained in paragraphs (4.1.1.2) and (4.1.3.1) to validate the set of indicators.

From a practical point of view, the stakeholder analysis presented below is based on the **identification and classification of the identified stakeholder groups**, i.e. the interested parties who have access and can mobilize resources (**political** resources, **economic** resources, **legal** resources, **cognitive** resources), grouped into different types (**political actors**, **experts**, **special interests and general interests**) (Dente, 2014).

Among the different techniques available to analyze the interested parties and actors, for the purposes of this thesis work, the **Social Network Analysis (SNA)** (Tab.5) approach was chosen, particularly suited to the study of urban and territorial decision-making processes, where the various stakeholders are associated in very dynamic contexts (Yang, 2014).

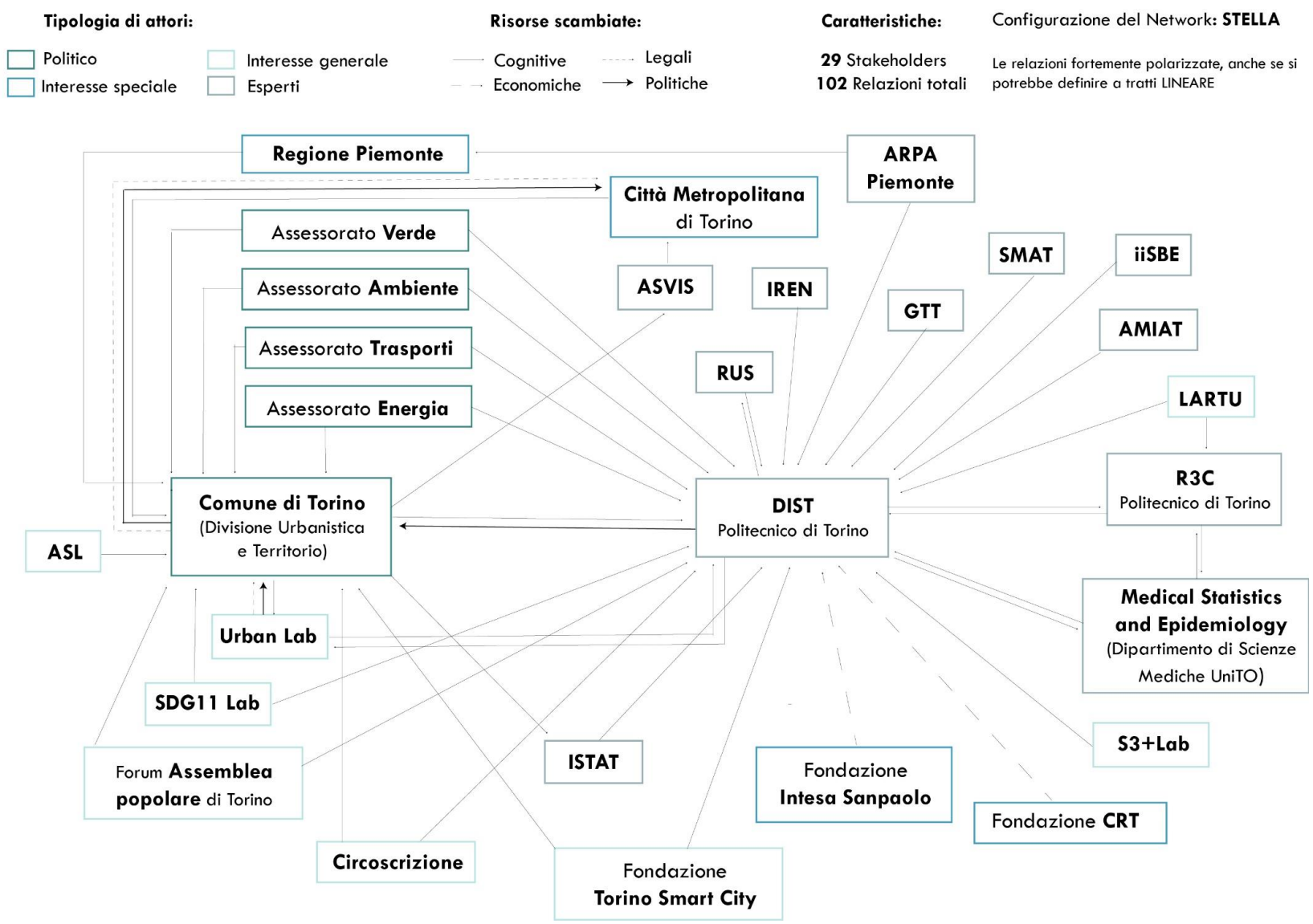
This methodology focuses on the relationships between pairs of stakeholders represented in a dense network of relationships, examining the **size and shape of the decision-making network** that is formed between the parties.

Within the network, the nodes represent the identified stakeholders, while the arrows represent the connections between them, based on the resources they exchange. A total of **29 Stakeholders** are identified, divided into **5 levels of interest** (European, national, provincial, regional, local), who have established **102 forms of relationship**.

The list of Stakeholders identified for the purpose of organizing the subsequent Focus Group is presented below:

STAKEHOLDERS	CLUSTER	LIVELLO	TIPOLOGIA	RISORSE
Regione Piemonte	ATTORI AMMINISTRATIVI	Regionale	Interesse speciale	Cognitive
Fondazione CRT		Regionale	Interesse speciale	Economiche
Fondazione Intesa Sanpaolo		Regionale	Interesse speciale	Economiche
Città Metropolitana di Torino		Provinciale	Interesse speciale	Cognitive
Comune di Torino - Divisione Urbanistica e Territorio		Locale	Politico	Politiche, Legali, Cognitive
Assessorato Verde		Locale	Politico	Cognitive
Assessorato Ambiente		Locale	Politico	Cognitive
Assessorato Trasporti		Locale	Politico	Cognitive
Assessorato Energia		Locale	Politico	Cognitive
Circoscrizione (dell'area di studio scelta)		Locale	Interesse generale	Cognitive
ASL (della Circoscrizione di riferimento)		Locale	Interesse generale	Cognitive
Associazione UrbanLab	ATTORI DI SUPPORTO ALL'ATTIVITA' AMMINISTRATIVA	Locale	Interesse generale	Politiche, Legali, Cognitive
Fondazione Torino Smart City		Locale	Interesse generale	Cognitive
SDG11Lab		Locale	Interesse generale	Cognitive
S3+Lab (Urban Sustainability & Security Laboratory for Social Challenges)		Locale	Interesse generale	Cognitive
RUS - Rete delle Università per lo Sviluppo sostenibile	ATTORI ACCADEMICI	Nazionale	Esperti	Cognitive
DIST (Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio) - Politecnico di Torino		Locale	Esperti	Cognitive
R3C (Risk Responsible Resilience Center) - Politecnico di Torino		Locale	Esperti	Cognitive
Medical Statistics and Epidemiology, Dipartimento di Scienze Mediche - Università degli studi di Torino		Locale	Esperti	Cognitive
LARTU - Politecnico di Torino		Locale	Interesse generale	Cognitive
ASVIS (Alleanza Italiana per lo Sviluppo Sostenibile)	ATTORI DI SUPPORTO ALLA CONOSCENZA TECNICA	Europea	Esperti	Cognitive
ISTAT		Nazionale	Esperti	Cognitive
IREN		Nazionale	Esperti	Cognitive
SMAT		Nazionale	Esperti	Cognitive
Organizzazione iiSBE		Nazionale	Esperti	Cognitive
ARPA Piemonte		Regionale	Esperti	Cognitive
AMIAT		Locale	Esperti	Cognitive
GTT		Locale	Esperti	Cognitive
Forum Assemblea popolare Torino		Locale	Interesse generale	Cognitive

Tab. 4 The Stakeholders Analysis. Source: Author, 2021.



Tab.5 Social Network Analysis - SNA. Source: Authors, 2021.

The relationships identified between the stakeholders are made explicit by the form that the network takes according to the resources that are exchanged. There can be several forms of networks (Fig.28):

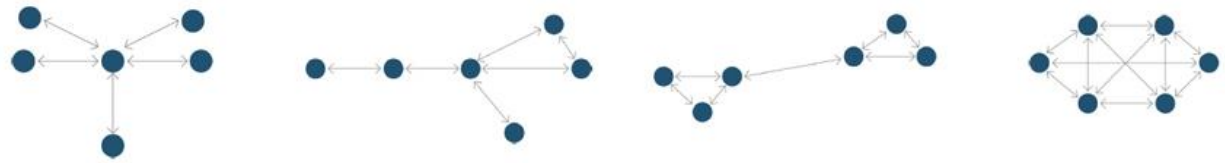


Fig.28 The different type Networks. Source: Yang, R. J. (2014) 'An investigation of stakeholder analysis in urban development projects: Empirical or rationalistic perspectives'

In this specific case, the **morphology is shown in the star part**, since the relationships are strongly polarized, but as a whole, it can be defined **linear** given that few but significant strong relational lines emerge. A relevant characteristic of the network is the density, meaning the intensity of the relations between the actors of a decision-making process.

The density can be **measured through** the calculation of **a specific index** as represented in equation, where D is the density index varying between 0 and 1, n is the number of actors (29 Stakeholders for the present research work) and Ki is the number of relations in each group (102 total relations).

$$D = \frac{\sum K_i}{(n^2 - n)}$$

In the present study, the application of the formula provides a rather **low-density index 0.13**. The complexity of the network is medium-low due to the high complexity of the network, it is weakened by the low density of the system as the development of the process takes place essentially at the local level, involving a large and diversified number of resources.

Finally, it is possible to take into consideration the centrality of the different actors, that is to say, the fact that one or a few actors monopolize the relationships with the participants. The network **centrality index** can be measured as in the equation:

$$C = \frac{k_i}{\sum K_i}$$

where C is the centrality index which varies between 0 and 1 and ki is the number of relations of each actor. On the basis of the numerical results provided by the application of the formula to the decision-making network in question, it is possible to state that the most central actors of the process are the **DIST - Politecnico di Torino (centrality index equal to 0.28)** and **the Municipality of Turin - Urban Planning and Territory Division (centrality index equal to 0.20)** means that they are the administrators of the process (Tab.6)

Tab. 6 The SNA table. Source: Author, 2021.

STAKEHOLDERS	N° DI RELAZIONI	RISULTATO
Regione Piemonte	2	0,02
Fondazione CRT	1	0,01
Fondazione Intesa Sanpaolo	1	0,01
Città Metropolitana di Torino	4	0,04
Comune di Torino - Divisione Urbanistica e Territorio	20	0,20
Assessorato Verde	2	0,02
Assessorato Ambiente	2	0,02
Assessorato Trasporti	2	0,02
Assessorato Energia	2	0,02
Circoscrizione (dell'area di studio scelta)	2	0,02
ASL (della Circoscrizione di riferimento)	1	0,01
Associazione UrbanLab	5	0,05
Fondazione Torino Smart City	2	0,02
SDG11Lab	2	0,02
S3+Lab (Urban Sustainability & Security Laboratory for Social Challenges)	1	0,01
RUS - Rete delle Università per lo Sviluppo sostenibile	2	0,02
DIST (Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio) - Politecnico di Torino	29	0,28
R3C (Risk Responsible Resilience Center) - Politecnico di Torino	4	0,04
Medical Statistics and Epidemiology, Dipartimento di Scienze Mediche - Università degli studi di Torino	4	0,04
LARTU - Politecnico di Torino	1	0,01
ASVIS (Alleanza Italiana per lo Sviluppo Sostenibile)	2	0,02
ISTAT	2	0,02
IREN	1	0,01
SMAT	1	0,01
Organizzazione iiSBE	1	0,01
ARPA Piemonte	2	0,02
AMIAT	1	0,01
GTT	1	0,01
Forum Assemblea popolare Torino	2	0,02
	102	

INDICE DI COMPLESSITA'				
DIMENSIONE DELL'INTERESSE	**TIPOLOGIA DI ATTORI**			
	Politici	Esperti	Interesse generale	Interesse speciale
Europeo		X		
Nazionale		X		
Regionale		X		X
Provinciale				X
Locale	X	X	X	

INDICE DI DENSITA'	0,13

4.1.2.2 SURVEY

The most important phase of the pre-selection of post-Covid indicators, and in particular the real phase that led to their pre-selection compared to the first one was the development phase of the s**urvey. It was** considered the most suitable tool for obtaining important feedback on the 29 indicators for which competence was requested. Since this research is part of the work of the **Post Un-lock research group,** as already mentioned in paragraph 1.2, the developed survey was **administered to the internal expert members** of the project.

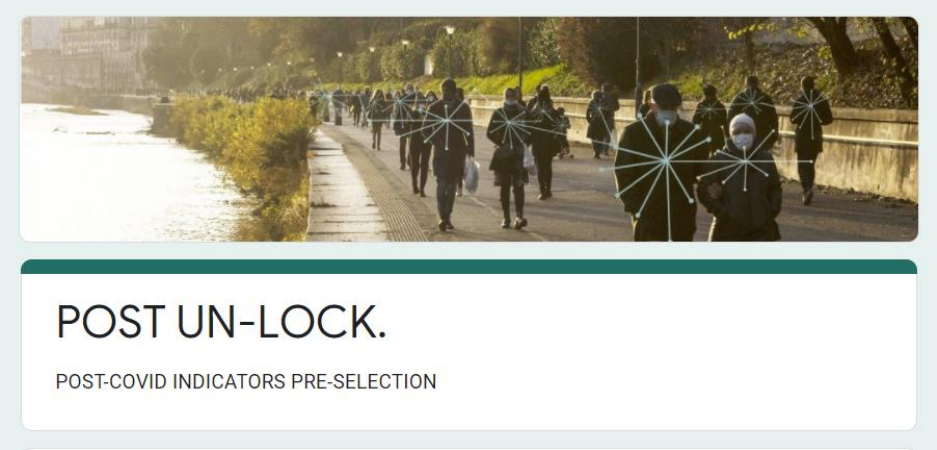


Fig.29. The Survey. Source: Author, 2021.

Link: https://forms.gle/WvT96naPmudydvDn7

The administered survey was carried out on Google modules (Fig.29), and was divided into three sections:

1. **Objective of the survey:** the reason why each participant of the Post Un-lock working group was asked to fill in the survey was explained. In particular, the survey scale was illustrated, that is the "census section" to reflect on the concept of "close to home" that characterized the different phases, in order to remember the survey scale of the research and verify the consistency of the indicator with respect to it;
2. **Personal information:** purely informative section in which each person was asked to write their name and surname and role within the project;
3. **Special section dedicated to feedback to indicators**.

In particular, **the third section** of the survey was used to **give feedback on the first set** of post-Covid indicators proposed. Referring to this section, **29 sub-sections have been created,** representing the 29 post-Covid indicators for which feedback was requested. Each subsection, therefore, represented an indicator, and for each indicator was provided: the **description**, the **unit of measurement** and the project within which this indicator was part of the literary review.

For each of the 29 indicators the following questions were asked:

1. **Evaluation of the usefulness of the proposed indicator with respect to the project by attributing a value from 0 to 4** (0 = not important at all, 1 = not important, 2 = medium important, 3 = important 4 = very important) (Fig.30). This question was fundamental in order to prepare a preliminary ranking of the indicators which, following the feedback from the experts of the project, were more suitable for the research. These results will be shown in the next paragraph.
2. Do you **already have the calculated data**?

3. If not, do you know **where the data can be found**?
4. Notes, space that has been left free to write feedback, advice, notes, etc..

Below is an example of the structuring of question number 1 that was posed for each indicator and the related introductory section within which the indicator itself was presented:

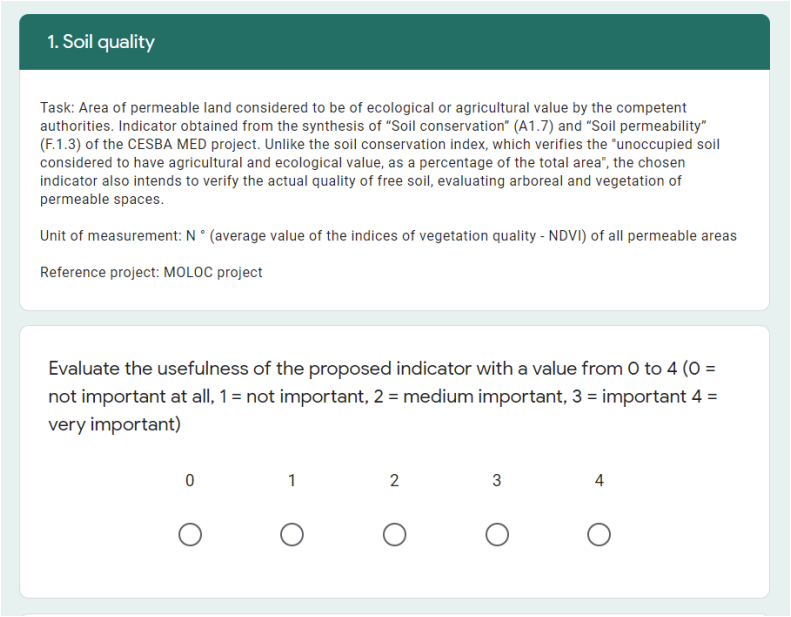


Fig.30 Example of the first Question on the Survey. Source: Author, 2021.

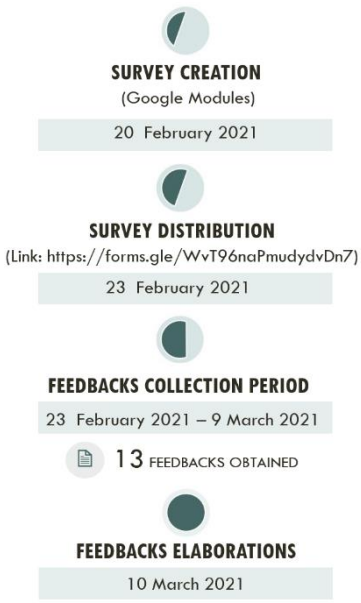


Fig.31 Survey feedbacks collection period. Source: Author, 2021.

The **survey was administered** to the internal members of the Post Un-lock project on **23 February 2021** (Fig.31). 13 members gave their feedback which was **collected in the period between 23 February 2021 and 9 March 2021.** The solicitations obtained were collected inside the "answers" section inside the Google module that was structured. These responses were subsequently processed and allowed for the arrangement of the Excel table of indicators which had been analyzed in the previous phase.

This phase represented an important moment of reflection on the topic in question, especially in the face of the feedback received, numerous indicators among the 29 proposed were modelled, following the expert opinions received, in order to best represent the scale under investigation: the local level. In particular, the **changes made to the indicators following the feedback received were**:

- **Changing the name of the indicator** for greater consistency with the topic under study;
- **Modification of the units of measurement** to better represent the survey scale: the local level;
- **Modification of the description** of the indicator making it as specific as possible for the case study and consistent with the town planning regulations of the city analyzed.

4.1.2.3 HIERARCHY OF RESULTS

The hierarchical phase of the results was obtained thanks to the feedback received following the survey (Tab.7). The analysis and aggregation of the results obtained from question no.1 of the survey in which a value from 0 to 4 was requested for each assignment indicator, made it possible to obtain total scores for each indicator, as a sum of the assigned preferences, in order to obtain a unique rank-ordered by value in descending order of importance. The table below shows the values assigned by each subject for each of the 29 indicators. For the sake of privacy, the names of the subjects who attributed these values were not shown, but anonymously they were numbered from 1 to 13, as the feedback received was 13. In the left column the indicators from 1 to 29 are numbered, and the numbering refers to the list of indicators shown previously, making it easy to find the name of the indicator based on its respective number.

Tab.7 The Hierarchy of results. Source: Author, 2021.

	Evaluation of the usefulness of the proposed indicator with respect to the project by attributing a value from 0 to 4												
INDICATOR N°	Stakeholder 1	Stakeholder 2	Stakeholder 3	Stakeholder 4	Stakeholder 5	Stakeholder 6	Stakeholder 7	Stakeholder 8	Stakeholder 9	Stakeholder 10	Stakeholder 11	Stakeholder 12	Stakeholder 13
1	2	3	1	4	4	3	2	2	2	3	3	4	2
2	4	3	3	3	4	3	2	3	2	3	3	4	3
3	3	3	3	3	3	2	1	3	1	3	3	3	2
4	3	3	2	3	3	2	1	3	2	3	3	3	2
5	4	3	3	4	2	3	1	3	1	3	2	3	1
6	4	3	3	3	4	4	2	4	3	4	3	4	4
7	4	3	2	3	4	3	1	4	1	/	0	2	2
8	4	3	3	3	4	3	4	4	4	4	3	4	4
9	4	3	3	2	3	3	2	4	3	2	0	4	1
10	4	4	2	3	4	3	4	2	3	3	3	4	3
11	4	3	2	3	2	3	4	2	2	4	4	4	2
12	4	3	3	3	3	3	0	4	1	2	0	3	1
13	4	3	3	3	4	3	4	4	4	4	2	4	4
14	4	3	2	3	2	3	2	2	2	3	4	3	1
15	4	3	2	3	3	3	3	3	2	4	2	3	3
16	4	3	2	3	2	3	4	4	3	3	2	4	4
17	4	4	3	3	4	3	3	4	3	2	4	4	3
18	4	4	3	1	4	3	4	4	3	3	4	4	3
19	4	3	2	3	/	3	2	2	3	3	4	4	2
20	4	3	3	3	3	2	2	2	1	3	4	4	0
21	4	3	2	3	4	3	3	2	3	3	4	3	2
22	3	3	3	3	4	3	4	3	4	3	0	4	2
23	4	3	3	3	4	2	1	2	2	3	3	3	1
24	4	3	3	3	4	3	4	4	3	4	2	4	3
25	4	4	4	3	2	4	4	3	4	4	4	4	4
26	4	4	4	3	/	4	4	3	3	4	4	4	3
27	4	4	4	3	3	4	4	3	3	3	4	4	3
28	4	3	3	3	3	4	3	4	3	3	4	4	3
29	4	3	2	4	3	4	3	4	3	3	0	4	3

Of the 29 indicators, as a result of the changes made to the descriptions and units of measurement, the total number of pre-**selected indicators fell to 26,** since in the face of the changes **3 indicators were identical to the others.** The table below shows the results obtained in decreasing order due to the importance attributed to the **26 proposed indicators**:

INDICATORS	UNIT OF MEASURE	TOT
1. Contagion density	N° of infected people / N°of inhabitant	**3,69**
2. Availability and proximity of services of general interest to residential buildings	N° of services / kmq	**3,62**
3. Incidence of urban greenery on the waterproof surface	mq of urban greenery / mq waterproof surface	**3,54**
4. Incidence of contagion by age group	%	**3,54**
5. Air quality (PM10 concentration in the atmosphere)	µg/m³/mean year	**3,46**
6. Accessibility to public and private health facilities in the area	Average time taken to reach at least one facility	**3,38**
7. Availability of hospital and intensive care beds	Total N° of beds / total N° of inhabitants	**3,38**
8. Availability of urban green spaces	mq/inhabitant	**3,38**
9. Residential density	Resident population / kmq	**3,38**
10. Mental Health Indicator (SF36)	Standardized average scores	**3,15**
11. Intermodality of the urban transport system	N ° of intermodal nodes / Kmq	**3,08**
12. Concentration of COVID-19 cases by zip code	N° of positive cases/km2	**3,08**
13. Community involvement in urban planning activities	N° of people involved	**3,00**
14. Consistency of the network of cycle paths	mq of sup. cycle path / mq land area	**3,00**
15. Density of pedestrian traffic areas	mq of sup. pedestrian / mq land area	**3,00**
16. Time dedicated to mobility	Survey: N° of minutes / 24 h	**2,92**
17. Soil quality	N° (avarage value of the vegetational quality index – NDVI)	**2,69**
18. Deprivation Index	Sum of the standardized indicators representing social and material deprivation	**2,62**
19. Domestic water consumption	liters per inhabitant per day	**2,62**
20. Waste: production of municipal waste	kg/inhabitant	**2,62**
21. Territorial density Index	Sf / St (Land area / Territorial surface)	**2,62**
22. Total average annual consumption of thermal energy for the operation of residential buildings	kWh/m2/year	**2,54**
23. Total average annual consumption of electricity for the operation of residential buildings	kWh/m2/year	**2,54**
24. Greenhouse gas emissions from the energy used for the operation of residential buildings	kg CO2 eq./m2/year	**2,54**
25. Albedo	%	**2,42**
26. Relationship between the rate of land use and the growth rate of households	%	**2,31**

Tab. 8 The list of the 26 indicators with relative rank obtained from the Survey. Source: Author, 2021.

From now on, having changed the order of the indicators and having eliminated 3 by repetition, a new numbering will be attributed to them based on the position that the indicators have in the previous table.

The interesting aspect that emerges from the hierarchization of the values obtained for each indicator is the perfect congruence with the theme under study. All **26 indicators** shown in the previous table are indicators that can be calculated at the municipal level for the city of Turin. Starting from these, **15 indicators were calculated on the neighborhood scale**, in order to analyze the city of proximity for the baseline scenario and understand how to increase it. Starting from the list of these 15 indicators, the method of selecting KPIs among these will be explained in the next paragraph.

4.1.3 FINAL SELECTION

4.1.3.1 INTERVIEWS

This paragraph outlines the last step to obtain the final set of post-Covid indicators that can be calculated on the neighborhood scale. For what has been said, the previous phases illustrated in paragraph 4.1.2, represented the validation of the first group identified, reaching the hierarchy in order of importance with respect to the project of the 26 indicators selected on the municipal scale for the city of Turin. The most important step was therefore to understand how many of the 26 optional indicators identified at the municipal scale were the most calculable at the neighborhood scale. **Among these 26, 15 indicators are in fact excellent results for conducting analysis at the neighborhood scale**, the specific scale of the project, therefore able to develop in this phase an adequate methodology to identify the KPIs.

The **tool** used to identify the Key Performance Indicators was the conduct of **interviews with stakeholders external to the Post Un-lock Project** identified during the SNA. For this phase, the identified stakeholders were asked to evaluate the importance of the 15 indicators at the neighborhood scale with respect to the project, defining them as:

1. "Accepted";
2. "To be modified";
3. Rejected"

In the event that the stakeholders replied that the indicator was (b.) or (c.) they were asked to **provide a reason why** in order to fix it in view of future developments.

The interviews were structured in 4 steps:

1. Presentation of the research objectives;

2. Presentation of the 15 indicators on the neighborhood scale;

3. Explanation of the interview expectations;

4. Presentation of the KPI evaluation methods;

5. Explanation of how the information they provided would be used in this thesis work;

Once all the proposed indicators had been evaluated, the next step was then to obtain a brief comparison between interviewees regarding the indicators for which the label to be modified or rejected was assigned, leading to the discussion and motivation for the choice.

Below is a list of the 15 indicators (Tab.9) that were asked to be evaluated, reported in descending order based on the rank obtained for each indicator following the first questionnaire administered to the internal members of the Post Un-lock project. Below is the list:

INDICATORS	UNIT OF MEASURE
1. Availability and proximity of services of general interest to residential buildings	N° of services / Kmq
2. Incidence of urban greenery on the waterproof surface	mq of urban green / mq waterproof surface
3. Availability of urban green spaces	mq / inhabitant
4. Residential population density	N° residents / kmq
5. Mental health indicator (SF36)	Standardized average scores
6. Intermodality of the urban transport system	N° of intermodal nodes / Kmq
7. Consistency of the network of cycle paths	mq of sup. cycle path / mq land area
8. Density of pedestrian traffic areas	mq of sup. pedestrian / mq land area
9. Time dedicated to mobility	Survey: N° of minutes / 24 h
10. Domestic water consumption	liters per inhabitant per day
11. Waste: production of municipal waste	kg / inhabitant
12. Territorial density index	Sf / St (Land area / Territorial surface)
13. Total average annual consumption of thermal energy for the operation of residential buildings	kWh/m2/year
14. Total average annual consumption of electricity for the operation of residential buildings	kWh/m2/year
15. Greenhouse gas emissions from the energy used for the operation of residential buildings	kg CO2 eq./m2/year

Tab. 9 The list of the 15 indicators at the neighborhood scale with relative rank obtained from the Survey. Source: Author, 2021.

For the conduct of the interviews, some were carried out in person or via video calls, which enabled **discussion of the results obtained and the votes attributed.** Other votes were attributed by the external

stakeholders to the Post Un-lock project through the compilation of a second survey, that was created on Google Modules in order to be able to be distributed.

For this phase, the stakeholders who provided their evaluation were **50** in total (Tab.10), thus making the analysis as complete as possible and achieving the desired objective. The provenance of the stakeholders by sector is shown below:

SECTORS
1. **Administrative** (17 Stakeholders)
2. **Innovation** (4 Stakeholders)
3. **Urban Planning** (7 Stakeholders)
4. **Environment** (6 Stakeholders)
5. **Tourism and Culture** (2 Stakeholders)
6. **Economy** (8 Stakeholders)
7. **Human resources** (3 Stakeholders)
8. **Education and training** (3 Stakeholders)

Tab. 10 Stakeholders sector of origin Source: Author, 2021.

As already mentioned, the feedback obtained from the interviews and from the compilation of the questionnaire totaled 50. The results (Fig.32) obtained showed that all 15 indicators proposed on the neighborhood scale, compared to the votes assigned by the stakeholders in this phase, were the specific KPIs for the project thus **confirming the attention that was paid in the previous phase of pre-selection of the indicators**, having proposed extremely specific and priority indicators.

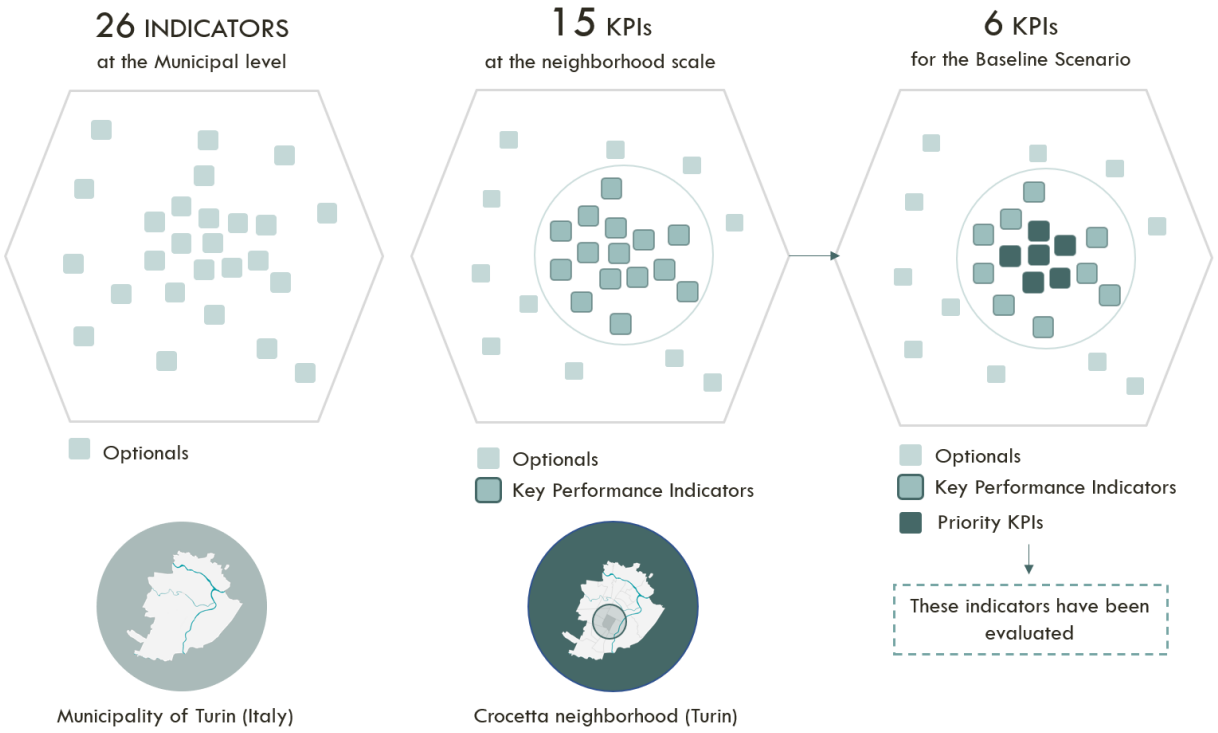


Fig.32 Key Performance Indicators. Source: Author, 2021.

Although the choice of indicators always involves a subjective evaluation or, in any case, a link to the professional deformation of the discipline that a stakeholder represents; the selection process showed to have implemented a scientific and robust approach and, with the wide participation achieved, brought about a **balanced result inherent to the territorial context under study** (Pignatelli, 2020).

The table below shows the number of **votes obtained for each indicator** proposed in order to demonstrate the final acceptance of the KPIs (Tab.11).

It should also be remembered that with respect to (Tab.11), the order of the indicators has been changed as they are hierarchical, based on the number of votes obtained in this phase.

INDICATORS	ACCEPTED	TO BE MODIFIED	REJECTED	MISSING VOTES
KPI1_Availability of urban green	46	2	1	1
KPI2_Availability and proximity of services of general interest to residential buildings	45	2	-	3
KPI3_Incidence of urban greenery on the waterproof surface	45	1	1	3
KPI4_Intermodality of the urban transport system	44	4	1	1
KPI5_Residential density	43	4	1	2
KPI6_Mental Health Indicator (SF36)	43	5	1	1
KPI7_Consistency of the network of cycle paths	43	6	-	1
KPI8_Time dedicated to mobility	42	3	3	2
KPI9_Territorial density Index	42	4	2	2
KPI10_Total average annual consumption of thermal energy for the operation of residential buildings	42	4	2	2
KPI11_Total average annual consumption of electricity for the operation of residential buildings	42	3	2	3
KP12_Greenhouse gas emissions from the energy used for the operation of residential buildings	42	4	2	2
KPI13_Density of pedestrian traffic areas	41	7	1	1
KPI14_Domestic water consumption	39	5	4	2
KPI15_Waste: production of municipal waste	37	7	3	3

Tab. 11 Assigned votes for the 15 indicators at the neighborhood scale by the 50 Stakeholders outside the project. Source: Author, 2021.

As shown also in the (Fig.32) the present thesis work, **once the final KPIs were selected, proceeded to the calculation and spatialization of the first 6,** providing the **data sheets** for each of them in the following paragraph.

In this work, the following KPIs will therefore be spatialized and calculated:

KPI1_ Availability of urban greenery

KPI2_ Availability and proximity of services of general interest to residential buildings

KPI3_ Incidence of urban greenery on the waterproof surface

KPI4_ Intermodality of the urban transport system

KPI5_ Residential density

KPI6_ Consistency of the network of cycle paths

Despite the priority with respect to the project, the mental health indicator has not been calculated because the current pandemic situation would not allow the calculation of this indicator in such a short time. For this reason, it has not been evaluated for this work but the technical data sheet has been proposed in the next paragraph.

Next chapter five would like to present the final results obtained from the analysis of the post-Covid indicators following their identification in the previous chapter. This chapter will show the methodology of analysis and spatialization of the key indicators of the project (KPI) by proposing for each of them its own calculation and evaluation datasheets. The common measurement methodology for each KPIs in presented in the diagram below (Fig.33), introducing the chapter 5:

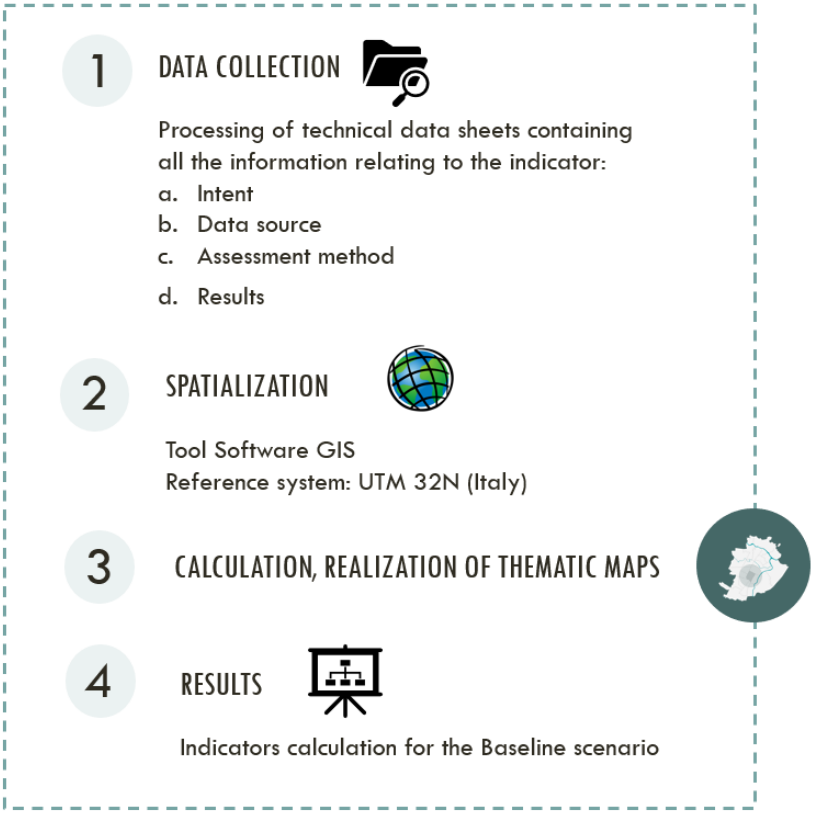


Fig.33 KPI common measure methodology. Source: Author, 2021.

CHAPTER V

IMPACT ASSESSMENT

5.1 SPATIAL DATA COLLECTION

In the previous paragraphs, the importance and priority **role that post-Covid indicators assume today in the redesign of post-pandemic cities** was shown. Throughout this work, the need to implement an extremely accurate selection procedure has been stressed several times to ensure that the indicators belonging to the final set, both the 26 indicators belonging to the municipal scale and the specific KPIs to the neighborhood level identified following the Interviews, could fully represent the characteristics and needs of the case study. Having achieved the limited final number of KPIs, the next phase concerned their mapping and numerical quantification.

The KPI validation and the related calculation methods, units of measurement and tools most suitable for their reading, introduced the project in the next phase: the **operational phase of estimating and evaluating**.

The objective of this phase was to **obtain the basic data and materials for the calculation** of the selected indicators, data that had to be up-to-date, correct, extensible to the entire municipal area and, where feasible, georeferenced as much as possible.

On this front, in particular, referring to the possibility of being able to georeference the data that will be shown in the next paragraph thanks to the use of the GIS tool, a very important aspect was the update of the **2021 edition of the BDTRE**[30] (Link: *https://www.geoportale.piemonte.it/cms/bdtre/modalita-di-pubblicazione-e-fruizione*) which introduced important innovations, both relating to the methods of publication and use, and to the updating of the contents

The present phase of data collection was certainly the phase that showed the greatest limitations and difficulties, especially with reference to the indicators regarding the spread of Covid-19. Among the most encountered limitations:

1. **Data collection:** the process of data collection and construction of updated databases appears to be particularly expensive and time consuming. This is also due to the heterogeneous origin of the data and the time required to contact the different sources and analyze the heterogeneous databases (Pignatelli, M., 2021).
2. **Data privacy and data protection:** various data necessary for measuring indicators, especially those of type pandemic, were not very accessible, sometimes not available except at the aggregate municipal scale for privacy reasons

[30] The Territorial Reference Database of the Bodies (BDTRE) is the geographical database of the Piedmont territory promoted by the Piedmont region, with the contents of a technical cartography, structured according to the "Technical rules for the definition of the content specifications of the geo topographic databases" nationally and primarily aimed at supporting the planning, governance and protection of the territory (Source: https://www.geoportale.piemonte.it/cms/bdtre/bdtre-2)

3. Calculation procedure: given the heterogeneity of the indicators it was necessary to study and develop several calculation procedures, integrating aspects that are also very different from each other (Pignatelli, M., 2021).

For what has been said, **only the specific KPIs** for the project **have been calculated and spatialized**, which will be presented in specific technical data sheets below. It is also recalled that since this research work is a work aimed at obtaining useful material to be able in the future to continue to develop the analyzes also at the municipal scale and not only at the neighborhood scale, within paragraph 5.3 the technical sheets of the indicators that have obtained a higher rank on the municipal scale are provided.

The **technical data sheets** are also provided for the **9 indicators at the municipal level** that demonstrate the characteristics just mentioned. Therefore, the materials would allow extending the experimentation of the proximity city proposed here to the scale of the neighborhood and the entire municipal territory for the entire municipal territory the Municipality of Turin.

In the following paragraph, the spatial analysis and impact assessment are detailed specifically through the use of GIS tools exclusively for the mandatory result indicators and therefore for the KPIs identified as a result of the Interviews. For each KPI, for the following, a technical sheet has been drawn up in which the essential information has been reported: the **contextualization**, the **type of data** that is expressed, **how it is expressed, how it can be read**; in addition, the **methodology and the calculation procedure** were described step by step, as well as the final result (Pignatelli, 2020). For the sake of completeness, an extensive analysis was composed that combines the geographical data returned through graphical representations and tables of alphanumeric quantitative data. The composition of a common type of card was possible by establishing some invariants right from the setting of the calculation to be kept constant for each indicator: the presence of only quantitative indicators, which can be evaluated through alphanumeric data; the retrieval of georeferenced data reworked and representable with GIS technologies.

This was a fundamental aspect characterizing the research; each indicator, having a deep-rooted territorial imprint, has been linked to a reading through the spatial variable, for this reason the introduction of GIS tools has allowed an in-depth analysis (Pignatelli, 2020).

The technical data sheets for each selected KPI have been divided in: **(1) Intent** - explanation of the indicator and its specificity with respect to the project; **(2) Assessment method** structured in:

a. Data requirement

b. Data source

c. Assessment method

and at the end the relative **(3) Results**, cartographies in which the spatialized and calculated indicators are shown.

5.2 KPIs EVALUATIONS AT THE NEIGHBORHOOD LEVEL

Within this paragraph the application of the methodology described in the previous chapters will be shown, experimenting within the **Crocetta neighborhood** of Turin. This district belongs to the district number 1 of the city, located south of the historic city center and historically one of the most prestigious residential areas.

The district is delimited:

1. To the north, from Corso Vittorio Emanuele II (border with the historic center);
2. To the east, from the railway (not following the branch; border with San Salvario);
3. To the south, from Corso Monte Lungo - Corso Lepanto - Corso Bramante (border with Santa Rita and Filadelfia);
4. To the west, from Corso Castelfidardo - Corso Mediterraneo - Largo Orbassano - Corso IV Novembre (border with Cenisia, Borgo San Paolo and Santa Rita).

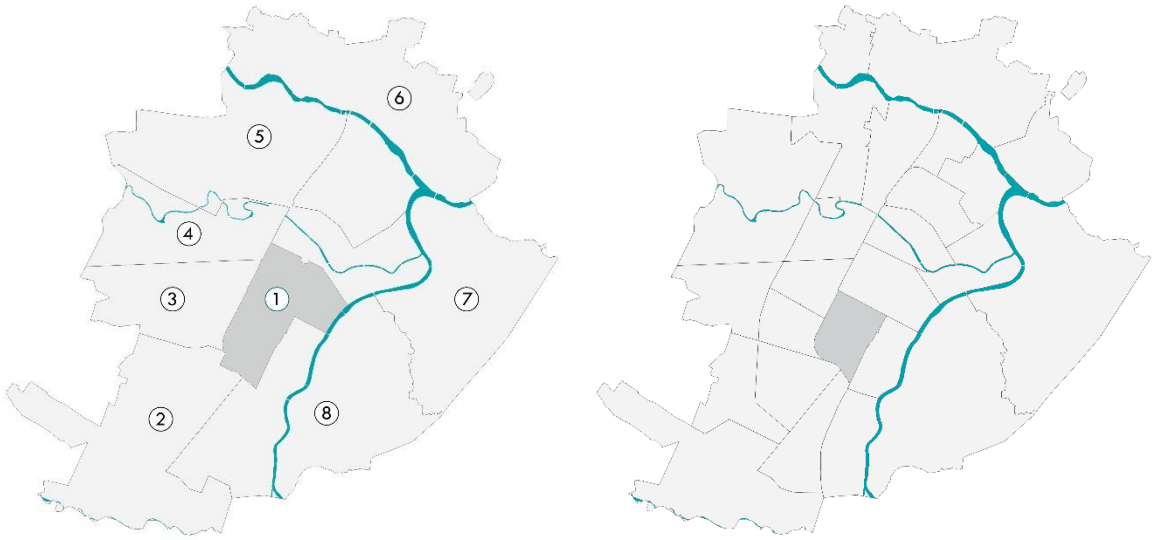


Fig.34 Case study application -The city of Turin: Crocetta neighborhood. Source: Author, 2021.

The choice of this district derives from it being the headquarters district of the **Polytechnic of Turin** since 1950 and from being a very interesting district because, in addition to the aforementioned seat of the Polytechnic of Turin, also located there is the Turin **Porta Nuova Railway Station** and the **Mauritian Hospital**. It is therefore interesting to analyze whether by hosting functions that occupy such a large space, the neighborhood has a good level of accessibility and provision of services within it.

KPI 1

Availability of urban greenery

1. Intent:

Calculation of the per capita extension of square meters of urban greenery available compared to the number of inhabitants present. This indicator makes it possible to highlight how the quality of life in residential areas is linked to the presence of usable green spaces, highlighted in particular by the period of social isolation.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Accepted
Availability of urban greenery	sqm urban green / inhabitant [sq km urban green / inhabitant]	46/50

For the classification of green areas, in the case of the urban context of the city of Turin, in particular in the Crocetta neighborhood, we find ourselves in one of the greenest municipalities in Italy, passing from an urban standard of 3.6 square meters per inhabitant in the seventies to about 22 m2 per inhabitant today (2016 data; source: Istat). The proposed subdivision of the urban green area, is in compliance with: the contents of the Strategic Plan of the Green Infrastructure of the City of Turin (approved by Resolution no. Mech. 2020 02957/46 of 29 December 2020, updated on 24.3.2021); the municipal legislation concerning public green areas consulted (regulations for public and private green areas of the city of Turin. Approved by resolution of City Council of 6 March 2006 (mecc. 2005 10310/046) executive from 20 March 2006. Amended with management resolutions of the City Council of 16 November 2009 (mecc. 2009 03017/046) from 30 November 2009, 12 May 2014 (mecc. 2014 00215/002) executive from 26 May 2014 and 1 October 2018 (mecc. 2018 02234/002) executive from 15 October 2018); and the BDTRE_2021.

1. Data Source

Content	Format	Source
Urban greenery	Shp/geo.zip	geoportale.piemonte.it/cms/bdtre/bdtre-2

For the purposes of the analysis, it was decided to divide the urban green area as follows:

1. Urban greenery:
   Forest cover
   Urban parks
   Neighborhood gardens
   Green along streets
   Green play areas
   Trees

Within the analyzed district, the type of greenery (forest cover and urban parks) does not fall within it, but it was maintained to understand at the municipal level the greenery situation in Turin around the district under study. Furthermore, it was decided to create specific cartography for the analysis of the trees present within the neighborhood under study, relating it to the number of inhabitants present within the area.

Concerning the number of residents in the district, reference was made to the total population registered in the registry as of 31/12/2020, published on the website of the Municipality of Turin (Source: http://www.comune.torino.it/statistica/dati/2020/pdf/A2_Pop_per_Sesso_e_Quartiere.pdf).

2.3 Assessment method

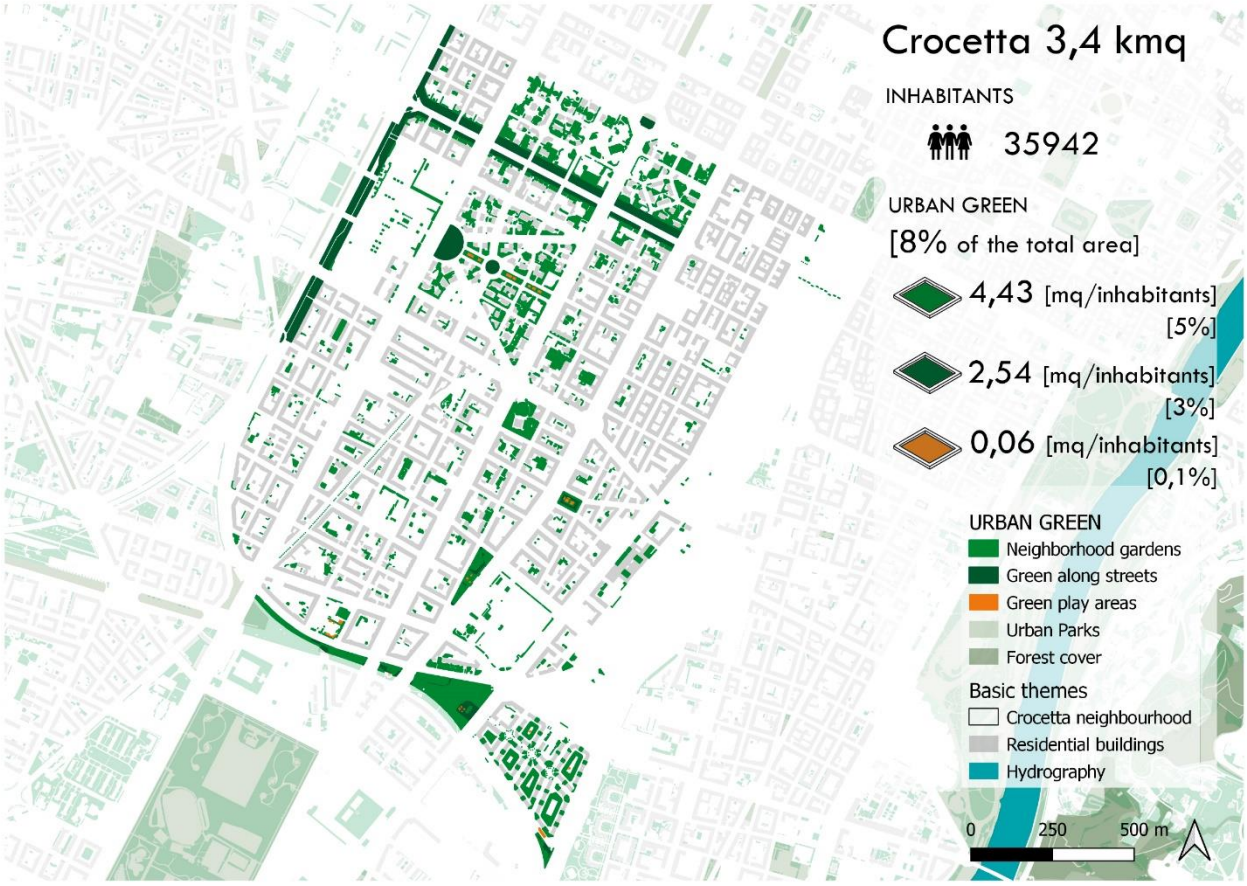
To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
2. Through the "intersect" geoprocessing tool, extrapolation of the data provided by the shapefiles at the municipal level only for the Crocetta neighborhood;
3. Classification of the urban greenery: Extrapolation from the downloaded shapefiles of the types of urban greenery to be analyzed;
4. Analyze the occupied sq km by urban green areas;
5. Analyze the total number of inhabitants;
6. Calculation of the availability of urban greenery in the Crocetta neighbourhood [mq/inhabitants];
7. Analysis of the number of trees in the neighborhood under study;
8. Ratio of the number of trees present in a square kilometer and the number of trees available per inhabitant.

3. Results:

KPI

Availability of urban green

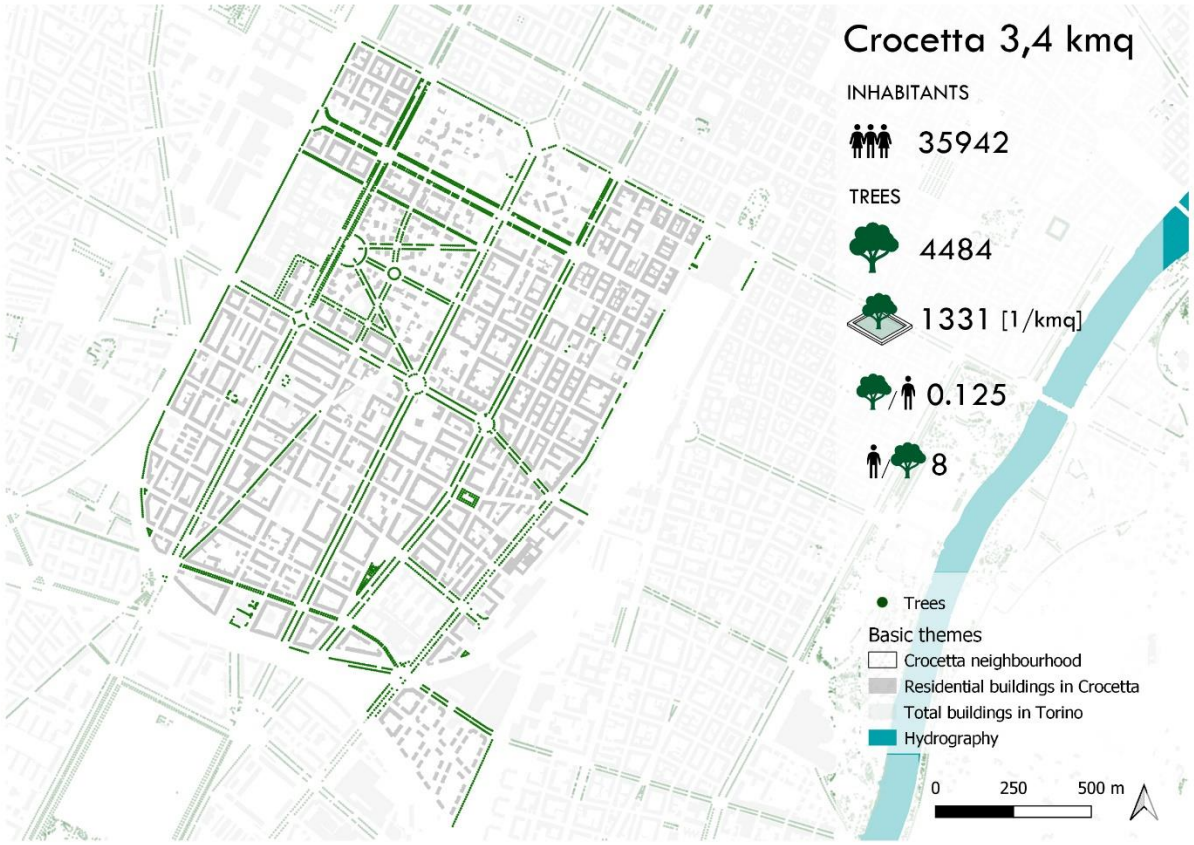


URBAN GREEN	Occupied area [kmq]	Crocetta neighborhood area [kmq]	%
Neighborhood gardens	0.1595		5%
Green along streets	0.0914	3.37	3%
Green play areas	0.0023		0.1%
TOT	**0.2532**		**8%**

AVABILITY OF URBAN GREEN [mq/inhabitants]	Occupied area [mq]	N° inhabitants
Neighborhood gardens per inhabitants	4.4377	
Green along streets per inhabitants	2.5430	35942
Green play areas per inhabitants	0.0640	
TOT	**7.0447**	

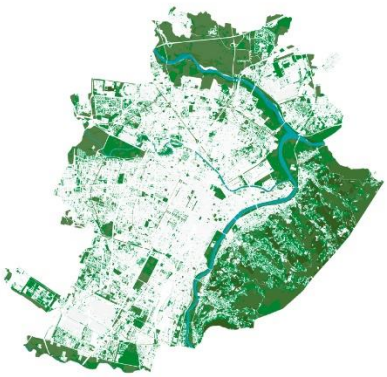
KPI

Availability of urban green (Trees avability)



N° inhabitants	N° of Trees	Density of trees [1/kmq]	Tree per inhabitants [-]	Inhabitants per tree [-]
35942	4484	1331	0.125	8.0

Urban green in the city of Turin



The trees in the city of Turin

KPI 2

Availability and proximity of services of general interest to residential buildings

1. Intent:

The density of services of general interest present (retail, wholesale, health and education facilities) distributed in the Crocetta district. An indicator that allows both an analysis of the number of services present in the district and the number of residential buildings served in an estimated accessibility buffer. This indicator makes it possible to analyze the availability of the "near home" services that characterized the different phases of the lockdown and allows us to understand the priority areas on which to act in order to relocate or implement the services on a neighborhood scale.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Accepted
Availability and proximity of services of general interest to residential buildings	N° of services / sq. Km	45/60

In order to calculate the indicator, it is important to divide the services in Crocetta into different categories: retail, wholesale, health facilities and school facilities. Furthermore, according to the type of function it is necessary to divide the service from residential buildings by distance level in order to better weigh the level of proximity. Three different buffers are established starting from the location of each service taken into account, consideration of 800sqm (10') respectively for services with greater catchment area such as for example hospitals and high schools; while the buffers of 500sqm (5') and 300sqm (3') are assigned respectively to the main basic services presence of which is necessary at the neighborhood scale.

The intention is to provide an overall picture of the state of accessibility of residents to various services in order to identify, consequently, the areas more critical which are excluded from the accessibility zones traced. From the territory point of view, said areas allow us to clearly understand where the planning tool and the future pilot actions for the redesign of post-pandemic cities must act and in what modalities.

The following list shows the subdivision and different distances to be evaluated:

1. Retail:

Food and Beverage_[Buffer 300 sqm]

Specialized commercial establishments_[Buffer 300 sqm]

2. Wholesale:
   Hypermarkets_[Buffer 800 sqm]
   Supermarkets, Discount_[Buffer 800 sqm]

3. Health facilities:
   Pharmacies [300 sqm]
   Consultants, clinics, ASL, and other medical facilities_[500sqm]
   Major hospitals and principals _[Buffer 800 sqm]

4. School facilities:
   Kindergartens_[Buffer 300sqm]
   Primary schools_[Buffer 500sqm]
   Secondary schools_[Buffer 500sqm]
   High schools_[Buffer 800sqm]

2.2 Data Source

Content	Format	Source
Commercial activity (retail, wholesale)	Shp/geo.zip	geoportale.comune.torino.it/geodati/zip/attivita_commerciali_csv.zip
Health facilities	Shp/geo.zip	geoportale.comune.torino.it/geodati/zip/sedi_asl_geo.zip geoportale.comune.torino.it/geodati/zip/ospedali_geo.zip
School facilities	Shp/geo.zip	geoportale.comune.torino.it

2.3 Assessment method

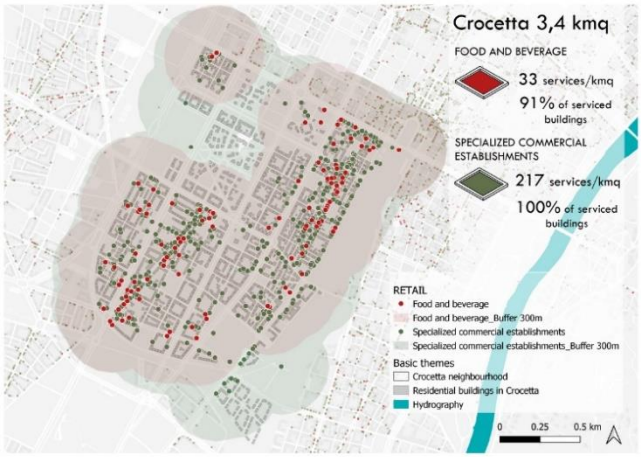
To characterize the indicator's value:

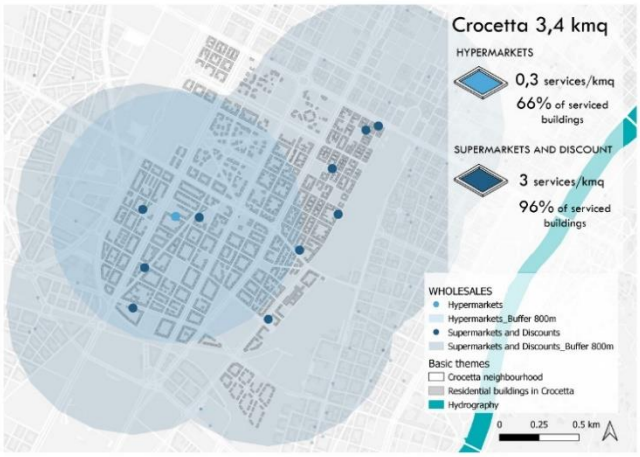
1. Projection of the acquired shapefile data on the GIS Software;
2. Through the "intersect" geoprocessing tool, extrapolation of the data provided by the shapefiles at the municipal level only for the Crocetta neighborhood;
3. Extrapolation from the downloaded shapefiles of the types of services of general interest to be analyzed;
4. Definition of the respective buffers according to the function that the service has (300smq, 500smq, 800smq);
5. Counting of the number of services present for each category within the neighbourhood;
6. Count of the total residential buildings included in each buffer in order to understand the number of buildings supplied;
7. Calculation of the number of services present within the study neighborhood in relation to the square kilometers of the area.

3. Results:

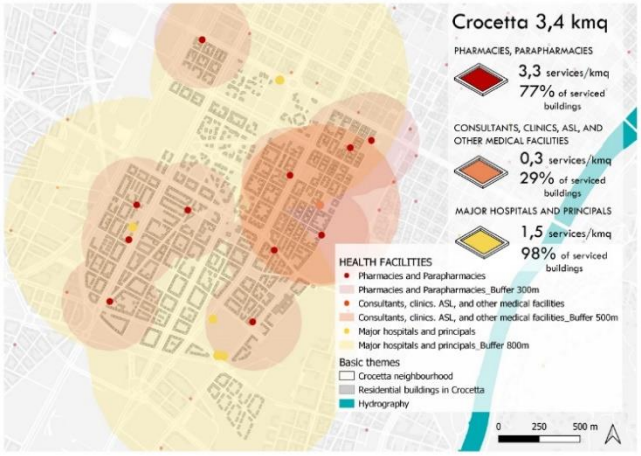
KPI

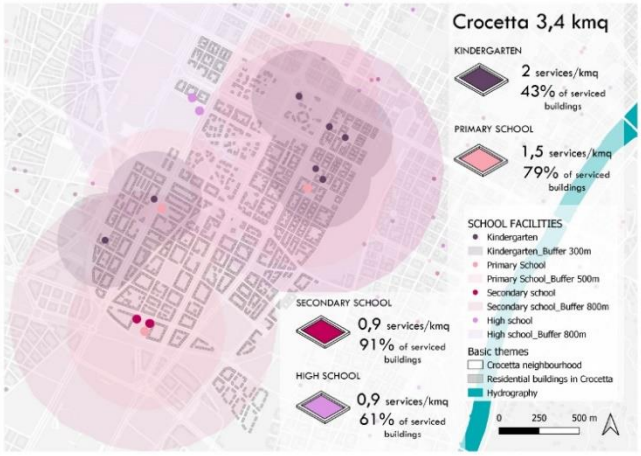
Availability and proximity of services of general interest to residential buildings



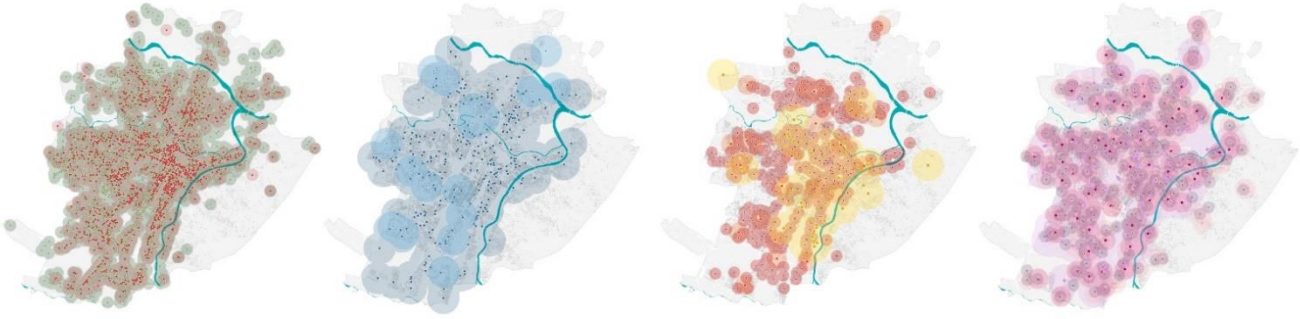


Type of service	Buffer [m]	Serviced residential buildings	Total residential buildings	N° of services	Crocetta neighborhood area [kmq]	N° of services / kmq	% of serviced buildings
RETAIL							
Food and beverage	300 m	1245	1362	112	3.37	33	91%
Specialized commercial establishments	300 m	1360		730		217	100%
WHOLESALES							
Hypermarkets	800 m	902	1362	1	3.37	0.3	66%
Supermarkets and Discounts	800 m	1303		10		3	96%





Type of service	Buffer [m]	Serviced residential buildings	Total residential buildings	N° of services	Crocetta neighborhood area [kmq]	N° of services / kmq	% of serviced buildings
HEALTH FACILITIES							
Pharmacies and Parapharmacies	300 m	1055	1362	11	3.37	3.3	77%
Consultants, clinics. ASL, and other medical facilities	500 m	391		1		0.3	29%
Major hospitals and principals	800 m	1332		5		1.5	98%
SCHOOL FACILITIES							
Kindergarten	300 m	579	1362	7	3.37	2	43%
Primary School	500 m	1082		5		1.5	79%
Secondary school	500 m	1242		3		0.9	91%
High school	800 m	825		3		0.9	61%



KPI 3

Incidence of urban greenery on a waterproof surface

1. Intent:

Ratio between the number of square meters of urban greenery present in relation to the waterproof surface of the area. This indicator verifies the consistency of the green areas present as an important environmental factor that positively affects the mitigation of pressures and quality of life of citizens.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Accepted
Incidence of urban greenery on the waterproof surface	sqm of urban green / sqm waterproof surface [sq km of urban green / sq km waterproof surface]	45/50

In order to calculate the ratio between the number of square meters of urban greenery present in relation to the waterproof surface of the area under study, it is important to divide the different types of urban greenery present within the Crocetta neighborhood. This subdivision is in compliance with: the contents of the Strategic Plan of the Green Infrastructure of the City of Turin (Approved by Resolution no. Mech. 2020 02957/46 of 29 December 2020, updated on 24.3.2021); the municipal legislation concerning public green areas consulted (Regulations for public and private green areas of the city of Turin. Approved by resolution of City Council of 6 March 2006 (mecc. 2005 10310/046) executive from 20 March 2006. Amended with management resolutions of the City Council of 16 November 2009 (mecc. 2009 03017/046) from 30 November 2009, 12 May 2014 (mecc. 2014 00215/002) executive from 26 May 2014 and 1 October 2018 (mecc. 2018 02234/002) executive from 15 October 2018); and the BDTRE_2021.

Representing this indicator of the incidence between the resulting impermeable surface within the neighborhood and the internal green areas, it was decided to divide these categories to provide greater detail on the use of the spaces. The following list shows the subdivision:

1. Waterproof surface:
   - Buildings
   - Railways and tram rails
   - Cycle viability
   - Pedestrian traffic and sidewalks

Vehicular viability

2. Urban greenery:

Forest cover
Urban parks
Neighborhood gardens
Green along streets
Green play areas
Trees

Within the analyzed district, the type of greenery (forest cover and urban parks) does not fall within it, but it was maintained to understand at the municipal level the greenery situation in Turin around the district under study. For this indicator, moreover, residential buildings were not analyzed but all the buildings present. Furthermore, the unit of measure of the indicator chosen was the unit of measure in sq.km and not in sq.m, in order to have a result that is as readable as possible.

2.2 Data Source

Content	Format	Source
Green area	Shp/geo.zip	geoportale.comune.torino.it geoportale.piemonte.it/cms/bdtre/bdtre-2
Buildings	Shp/geo.zip	geoportale.comune.torino.it
Viability	Shp/geo.zip	geoportale.piemonte.it/cms/bdtre/bdtre-2

2.3 Assessment method

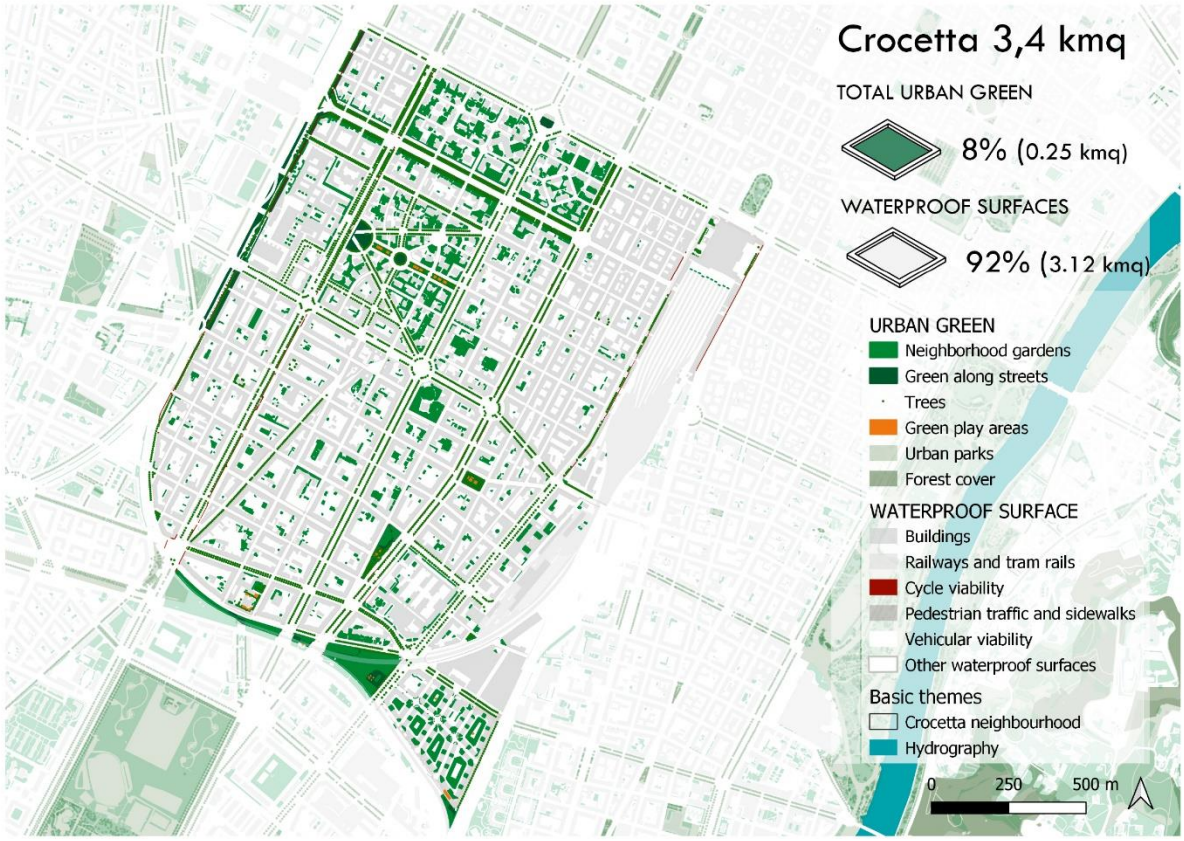
To characterize the indicator's value:

2. Projection of the acquired shapefile data on the GIS Software;
3. Through the "intersect" geoprocessing tool, extrapolation of the data provided by the shapefiles at the municipal level only for the Crocetta neighborhood;
4. Classify the urban greenery and waterproof surfaces: extrapolation from the downloaded shapefiles of the types of urban greenery to be analyzed;
5. Analysis of the square kilometers that each surface (green and waterproof) occupies on the district under study;
6. Analysis of the soil occupied by each type in percentage terms with respect to the sq.km of the area under study;
7. Calculation of the incidence of urban greenery on a waterproof surface

3. Results:

KPI

Incidence of urban greenery on a waterproof surface



Typology	Occupied area [kmq]	Crocetta neighborhood area [kmq]	%
WATERPROOF SURFACE			
Buildings	0.8076		24%
Railways and tram rails	0.1412		4%
Cycle viability	0.0180	3.37	0.5%
Pedestrian traffic and sidewalks	0.1953		6%
Vehicular viability	0.6626		20%
Other waterproof surfaces	1.2921		38%
TOT	**3.1168**		**92%**
URBAN GREEN			
Neighborhood gardens	0.1595		5%
Green along streets	0.0914	3.37	3%
Green play areas	0.0023		0.1%
TOT	**0.2532**		**8%**
[kmq] of urban green / [kmq] of waterproof	**0.08**	**8%**	
[kmq] of waterproof surface / [kmq] of urban green	**12.3**		

KPI 4

Intermodality of the urban transport system

1. Intent:

Density of intermodal nodes distributed throughout the territory (urban and extra-urban TPL stops, bike and car sharing stations, taxi stalls and stalls for the disabled). Indicator able to consider the weighted distance on the basis of the impedances on the paths and the urban physical structure. Fundamental indicator to be able to base the new policies of the "city of proximity" as an urban response to post-pandemic management.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Accepted
Intermodality of the urban transport system	N ° of intermodal nodes / sq. Km	44/50

A good level of intermodality of the urban transport system is guaranteed by the possibility of being able to choose from multiple types of mobility in an area that can be covered in a few minutes on foot. This theme turns out be fundamental in a context that seeks to make itself sustainable, as the typological choice of TPL (local public transport) becomes greater and varied, the use of private vehicles is discouraged more, being the cause of entry into atmosphere of the main climate-altering gases.

Two different analyzes were carried out for this indicator: one concerning the availability of movements and the different modes of transport inside the study area, and the analysis of the external connection of the Crocetta district with the city of Turin. For the external connection, 6 modes of transport within the district were analyzed, mainly including the number of buildings that were served in a radius of distance (300m, 500m, 800m).

The next step was then, starting from the three main modes of transport available to the Crocetta district to cover greater distances within the municipal area (railways, subway, car parks), to analyze the number of transport modes within a maximum of 10 minutes on foot (300m and 500m) allowing modal exchanges. Particular attention was paid to sustainable transport methods such as bike sharing and car sharing.

2.2 Data Source

Content	Format	Source
Type of transport	Shp/geo.zip	geoportale.comune.torino.it geoportale.piemonte.it/cms/bdtre/bdtre-2

The following list shows the subdivision and the different distances to be evaluated in the first map to analyze the intermodality (please note that smaller buffers were taken for this analysis in order to encourage the use of other modes of transport once the interchange point is reached):

1. Railway Station_[Buffer 500 sqm]
2. Underground_[Buffer 300 sqm]
3. Car Parks_[Buffer 300 sqm]

The following list shows the subdivision and the different distances to be evaluated in the second map:

1. Railway Station_[Buffer 800 sqm]
2. Underground_[Buffer 800 sqm]
3. Car sharing_[Buffer 500 sqm]
4. Bike sharing_[Buffer 500 sqm]
5. Car Parks_[Buffer 500 sqm]
6. Bus stations_[Buffer 300 sqm]

2.3 Assessment method

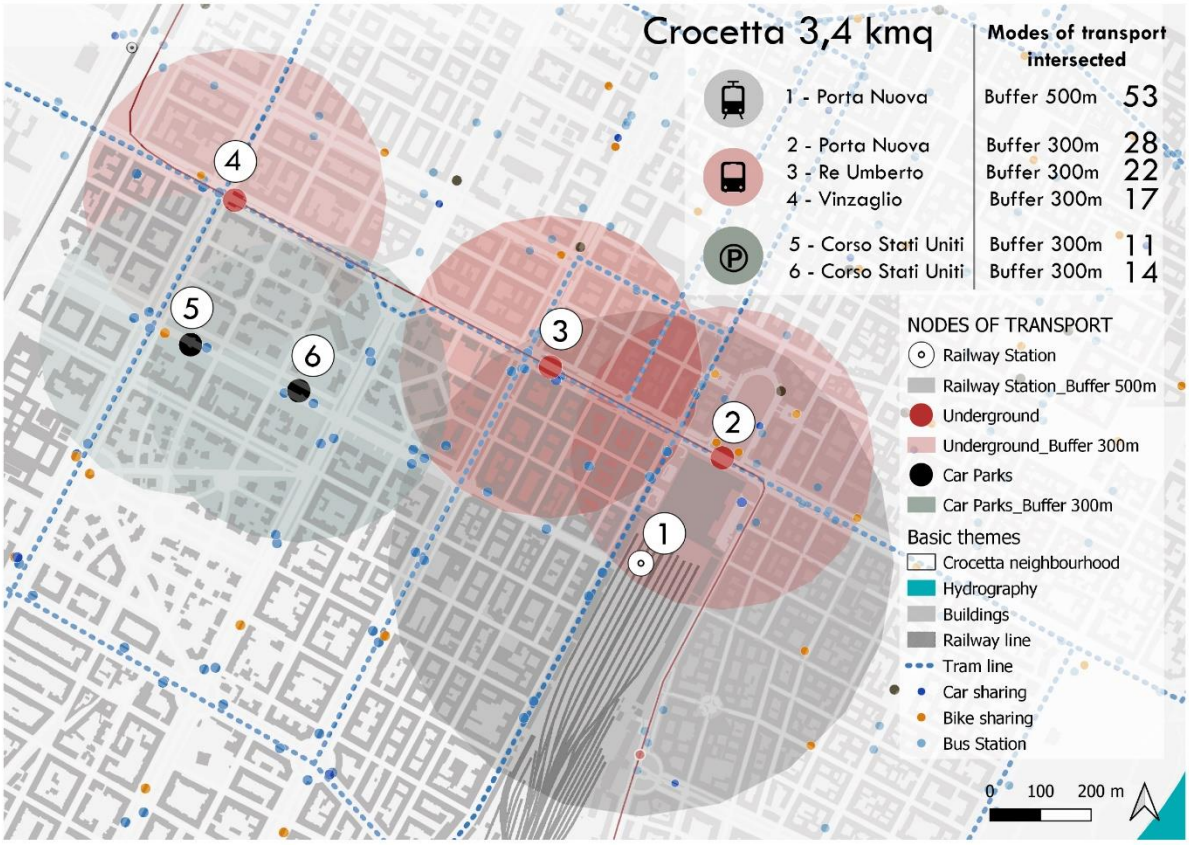
To characterize the indicator's value:

1. Projection of the acquired data on the ArcGIS Software;
2. Through the "intersect" geoprocessing tool, extrapolation of the data provided by the shapefiles at the municipal level only for the Crocetta neighborhood;
3. Analysis of the connection of the district with the rest of the city: definition of the 3 main modes of transport available to the district (railways, underground and car parks in order to be able to reach greater distances within the municipal area and beyond. Definition of buffer with a maximum distance of 10 minutes on foot in order to encourage interchange methods, favoring sustainable means of travel
4. Count of the total elements included in each buffer, divided into the table by transport mode.
5. Count of the number of transport modes intersected by each buffer: from 0 (no typology over
6. at the buffer center of gravity station) to 5 (presence in the buffer of at least one element for each mode of transport considered).
7. Analysis of the internal connection of the neighborhood: Definition of buffers with different distances (300m, 500m, 800m) for the 6 modes of transport present
8. Count of the number of buildings served by each mode of transport analyzed

3. Results:

KPI

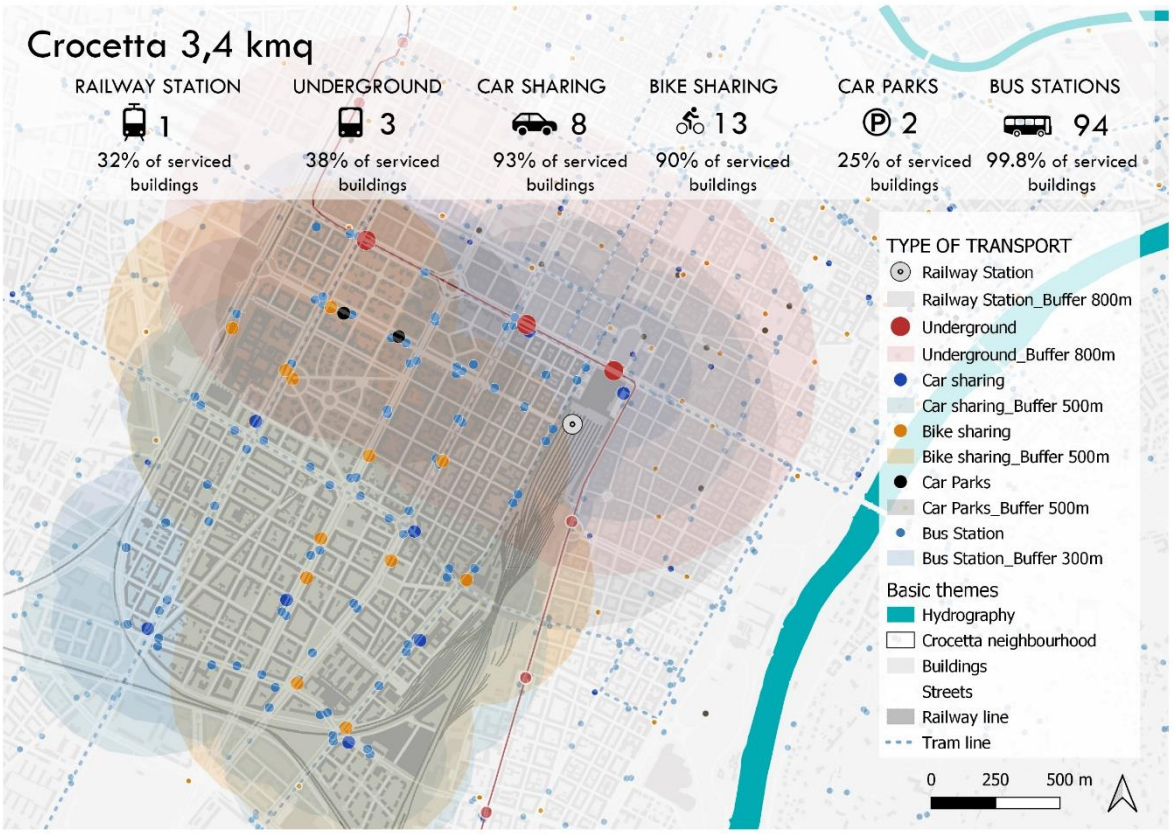
Intermodality of the urban transport system



Type of transport	Intersected modes of transport	Total modes of transport intersected
Railway Station_500m		
1- Porta Nuova	5	53
Underground_300m		
1 - Porta Nuova	5	28
2 - Re Umberto	4	22
3 - Vinzaglio	3	17
Car Parks_300m		
1 - Corso Stati Uniti	4	11
2 - Corso Stati Uniti	2	14

KPI

Intermodality (Analysis of the connections available within the Crocetta neighbourhood)



Analysis of the connections available within the Crocetta neighbourhood

Type of transport	Buffer [m]	Serviced buildings	Total buildings
Railway Station	800 m	528	1658
Underground	800 m	636	
Car sharing	500 m	1536	
Bike sharing	500 m	1493	
Car Parks	500 m	408	
Bus Station	300 m	1654	

N°	Crocetta neighborhood area [kmq]	N° / kmq	% of serviced buildings
1	3.37	0.3	32%
3		0.9	38%
8		2	93%
13		4	90%
2		0.6	25%
94		28	99.8%

KPI 5

Residential population density

1. Intent:

Ratio between the number of residents present in relation to the sq.km of the analyzed area. This indicator, linked to the indicator referring to the availability and proximity of services of general interest located in the neighborhood, allows us to understand how the issue of proximity and the issue of density are linked together. Dense cities are cities that allow greater proximity to services.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Votes
Residential population density	N ° residents / sq. Km	43/50

2.2 Data Source

Content	Format	Source
Populations_2011	istat.it/storage/cartografia/basi_territoriali/ WGS_84_UTM/2011/R01_11_WGS84.zip	geoportale.comune.torino.it www.istat.it/it/archivio/104317

2.3 Assessment method

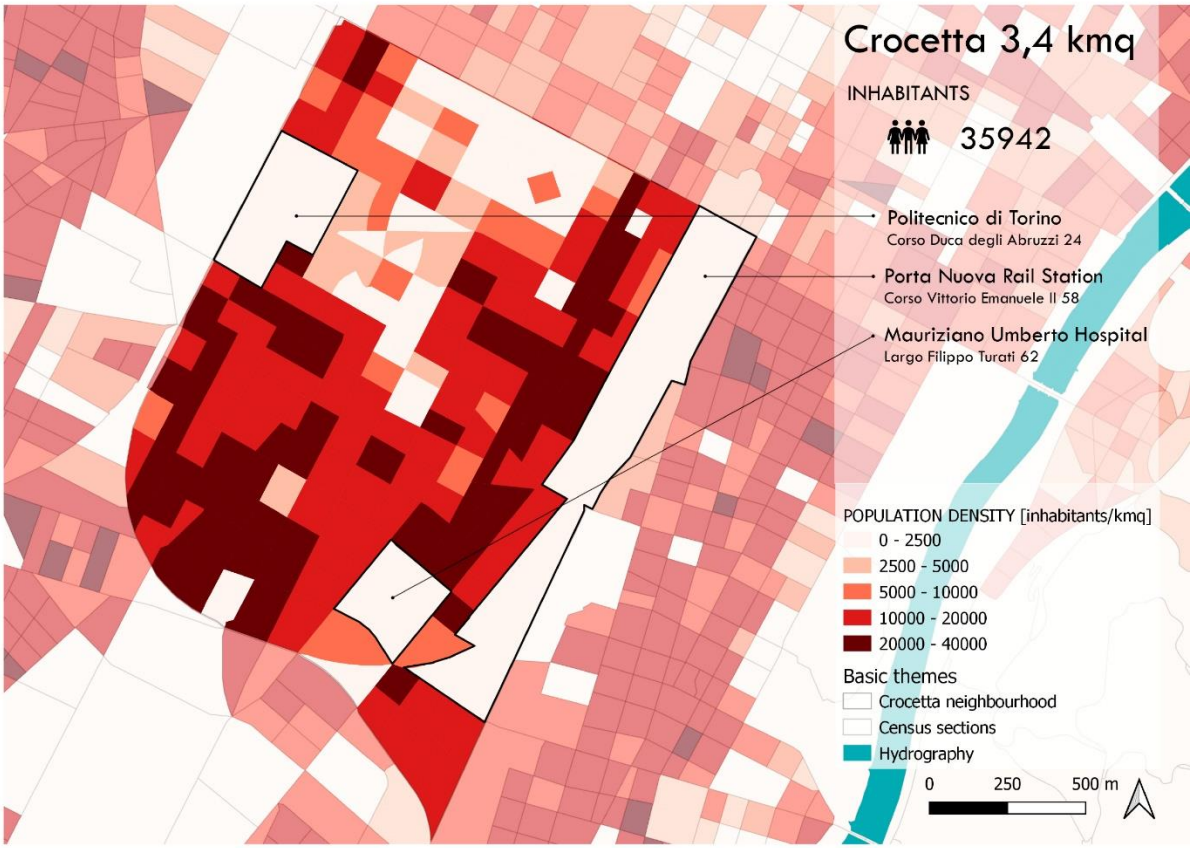
To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
2. Through the "intersect" geoprocessing tool, extrapolation of the data provided by the shapefiles at the municipal level only for the Crocetta neighborhood;
3. Download the 2011 population census from the ISTAT website. Make a connection between the census sections of the municipality and the ISTAT tabular dataset. For each section make a new field named "AREA" where the surface in sq.km is created. This camp is then used as a denominator in the relationship with the resident population total by census section (ISTAT code P1).
4. Use the unit of measure of the indicator to calculate the residential population density

3. Results:

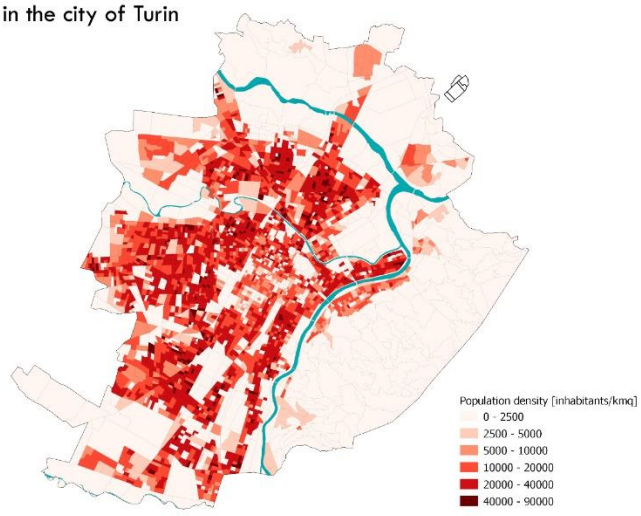
KPI

Residential population density



Population density [N°/kmq]	**10665.282**
Inhabitants [-]	35942
Crocetta neighbourhood [kmq]	3.37

Residential population density in the city of Turin



KPI 6

Mental health indicator

1. Intent:

The COVID-19 pandemic has had a major effect on our lives. Many have faced challenges that have changed their physical and mental well-being. The public health actions taken during this period have, like social distancing, as an adverse effect contributed to increasing the stress, anxiety and level of isolation of people in their homes. Based on the WHO definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity", a health care system alone is not enough to achieve healthy communities, we need a better environment, and urban planning can no longer ignore the impact it has on the health of its citizens. It determines the urban environment which affects our lifestyle positively or negatively. We need to put people at the center of urban policies.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Accepted
Mental health indicator	Standardized average scores	43/50

This difference indicator compared to those previously mentioned and spatialized, needs its development through the conduct of a questionnaire to be administered to the population in order to obtain feedback. In this regard, reference should be made to the survey carried out by the RAND Corporation, a California non-profit research organization that develops solutions to public policy challenges to help make communities around the world safer, healthier and more prosperous. This association has developed what is called a "36-Item short-form Survey Instrument (SF-36)"

2.2 Data Source

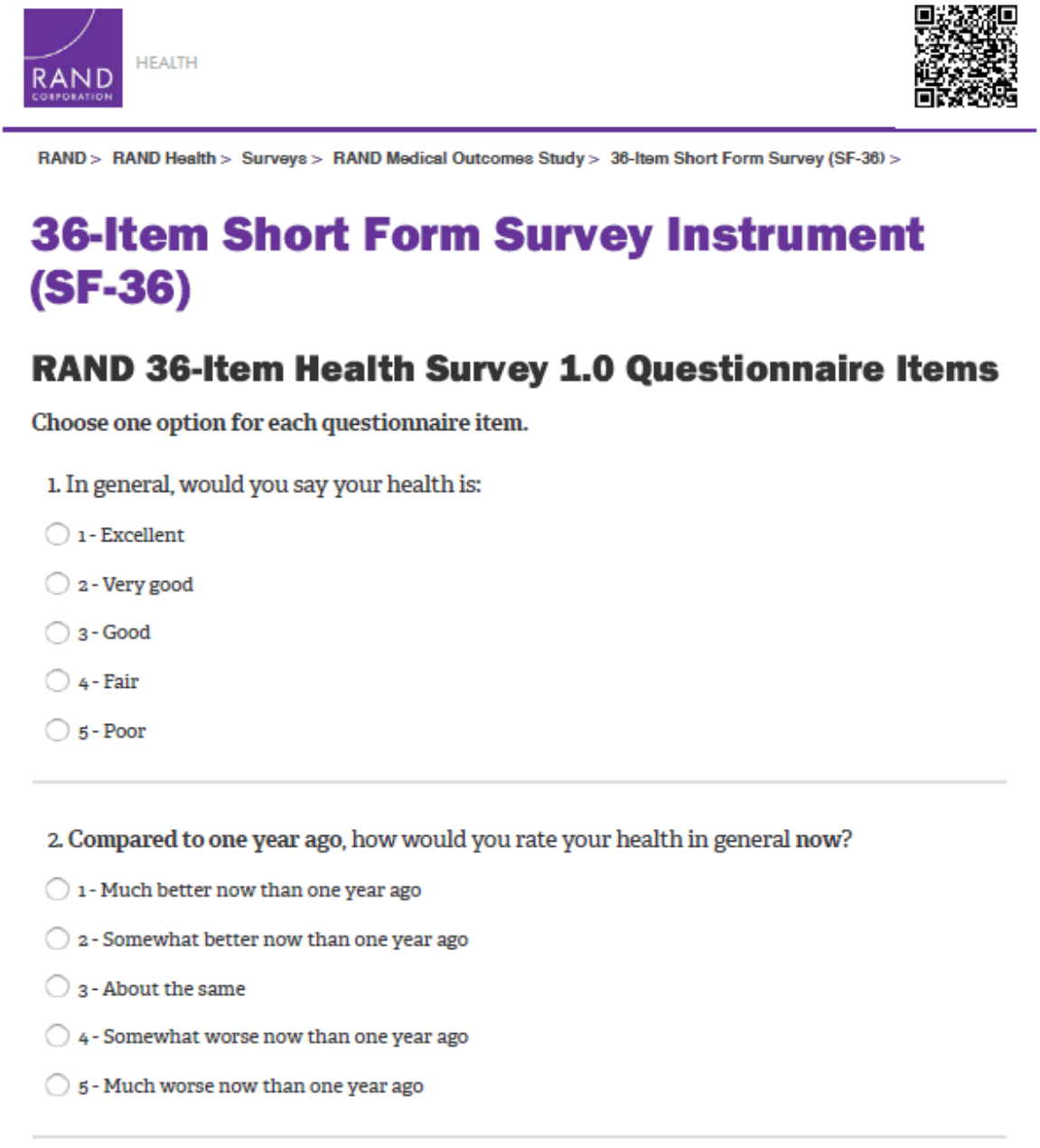
Content	Format	Source
(SF-36) Mental health Index	Survey	rand.org/health care/surveys_tools/mos/36-item-short form/scoring.html

2.3 Assessment method

For its calculation, please refer to this questionnaire (source: https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form/scoring.html) which also shows how the results obtained from the individual scores are analyzed.

In this case, in the present work, this indicator was not developed due to difficulties in finding the sample of the population to be investigated, but the materials useful for its development are provided.

An extract from the survey is shown below:



RAND HEALTH

RAND > RAND Health > Surveys > RAND Medical Outcomes Study > 36-Item Short Form Survey (SF-36) >

36-Item Short Form Survey Instrument (SF-36)

RAND 36-Item Health Survey 1.0 Questionnaire Items

Choose one option for each questionnaire item.

1. In general, would you say your health is:

- 1 - Excellent
- 2 - Very good
- 3 - Good
- 4 - Fair
- 5 - Poor

2. **Compared to one year ago**, how would you rate your health in general **now?**

- 1 - Much better now than one year ago
- 2 - Somewhat better now than one year ago
- 3 - About the same
- 4 - Somewhat worse now than one year ago
- 5 - Much worse now than one year ago

KPI 7

Consistency of the network of cycle paths

1. Intent:

Parameter capable of evaluating the consistency of the sustainable mobility network through the ratio between the square meters of surface used as a cycle path compared to the square meters of the territorial surface available. An important indicator to be able to base the new policies of the "city of proximity" by analyzing both the level of internal connection and the priority areas on which to act in order to develop more sustainable and resilient cities that provide citizens with a travel service which is safe and well connected.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Accepted
Consistency of the network of cycle paths	mq of sup. cycle path / mq land area	43/50

Analysis of the cycle paths present within the study area compared to the presence of bike sharing stations distributed internally.

2.2 Data Source

Content	Format	Source
Cycle paths	Shp/geo.zip	geoportale.comune.torino.it geoportale.piemonte.it/cms/bdtre/bdtre-2
Bike sharing	Shp/geo.zip	http://geoportale.comune.torino.it/geodati/zip/stazioni_bike_sharing_geo.zip

2.3 Assessment method

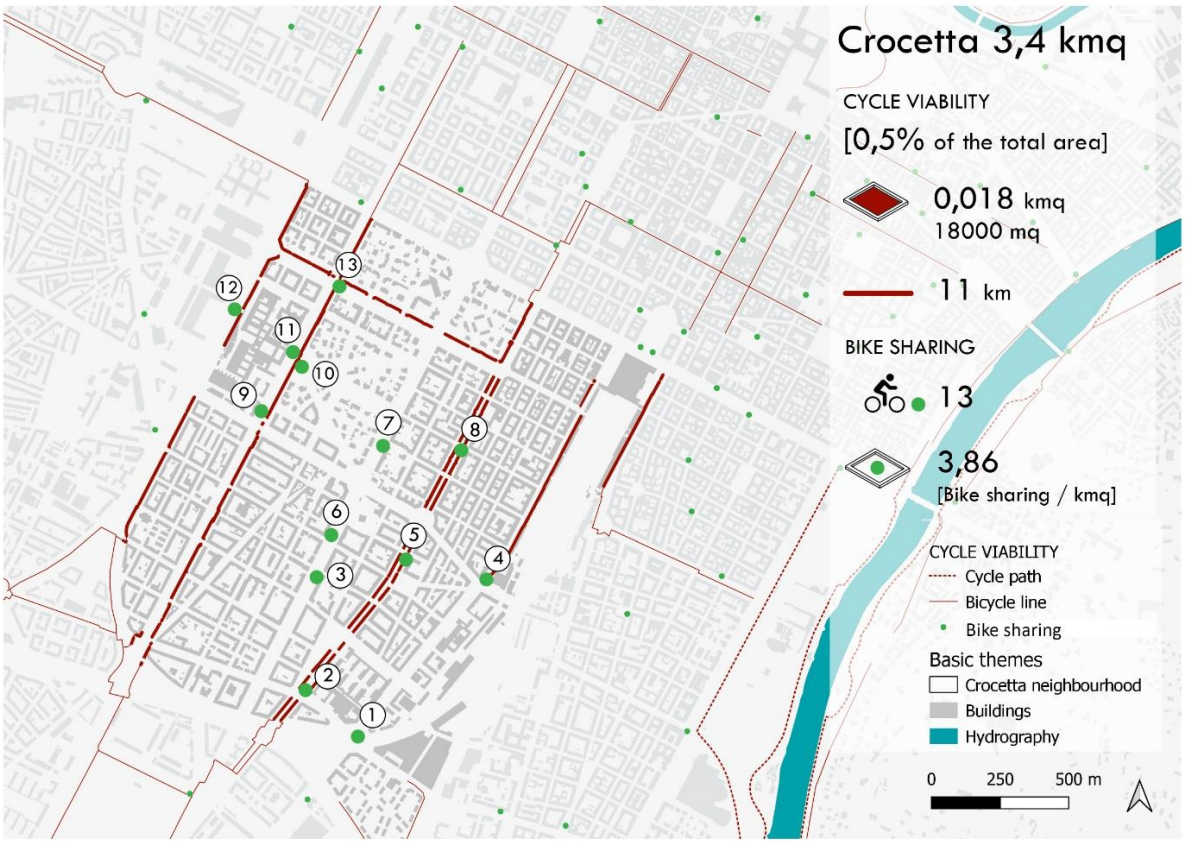
To characterize the indicator's value:

1. Projection of the acquired data on the ArcGIS Software;
2. Through the "intersect" geoprocessing tool, extrapolation of the data provided by the shapefiles at the municipal level only for the Crocetta neighborhood;
3. Ratio between the sq.m of sup. cycle path / sq.m land area

3. Results:

KPI

Consistency of the network of cycle paths



Consistency of the network of cycle paths [mq of sup. cycle path / mq land area]	**0.53%**
Area Crocetta [mq]	3370000
Cycle viability [mq]	18000
Cycle viability [m]	11492
Cycle viability [Km]	11.49
N° Bike sharing / area [kmq]	3.86
Vehicular viability [mq]	662600
Ratio Cycle viability [mq] / Vehicular viability [mq]	0.03
Ratio Vehicular viability [mq] / Cycle viability [mq]	36.81

Bike sharing:

1 - Mauriziano
2 - Mauriziano
3 - Bertola
4 - Sommelier
5 - Re Umberto
6 - Galileo Ferrari
7 - Tribunale
8 - Re Umberto
9 - Politecnico
10 - Politecnico
11 - Politecnico
12 - Politecnico
13 - Castello

As demonstrated in this paragraph, this research work has placed its greatest attention to the development of a survey methodology for the creation of its own set of indicators for the Post Un-lock Project. In order to experiment with the proposed methodology, the pilot district for the analysis of the de facto state was the Crocetta District of the City of Turin.

The choice of this district was certainly favoured by being the main seat of the Polytechnic of Turin, and by being an important district in which there are important functions such as the Turin Porta Nuova railway station, presence of three subway stations and the Mauritian Hospital, one of the main hospitals in the city.

From the spatialization, evaluation and analysis of the current state of the neighbourhood, it emerges that it is certainly one of the most equipped neighbourhoods in terms of services inside. In fact, from the analysis of KPI 2, it emerged that all residential buildings are supplied within a walking distance of about 10/15 minutes from almost all services of general interest. Within the area there is only 1 hypermarket due to it being a central district of the city with a historical matrix containing narrow streets and small services.

From the cross-reading between the availability of services and the number of transport modes present within the district, one immediately notices the great capillarity of the distribution of bus stops, as well as other more rapid forms of transport (subway and train) which allow connection to all parts of the city.

The presence of the Politecnico di Torino within the area, as analyzed by KPI 7, also plays a very important role in the presence of bike-sharing stations which total 13 for the entire district, of which 5 are near the university.

Crocetta being close to the historic centre, the university campus and Valentino Park, as well as the capillarity of the network of cycle paths (11 km for the Crocetta district), was satisfactory even if not perfectly connected, in order to make movement, especially in the vicinity of large crossing axes, safe for cyclists.

Being a central district, the availability of greenery following the analysis of KPIs 1 and 3 is not very high. Only 8% of the total area is covered by green areas (0.25 sq km out of 3.4 available), demonstrating that there is extensive waterproofing of the neighbourhood surface (92%).

5.3 INDICATORS TECHNICAL DATASHEETS AT THE MUNICIPAL LEVEL

Below are shown the **technical sheets for the 9 priority indicators at the municipal scale** (Tab.12) which, being optional results for this work, were not spatialized, but for them the calculation data sheets are provided in the hope that this research work will be taken up again.

As in paragraph 4.2, for each of the 9 indicators proposed, a technical sheet was drawn up in which essential information was reported: the contextualization, the type of data expressed, how it is expressed, how it is read; the methodology and the calculation procedure were also described step by step.

Each form is divided into (1) **Intent** - explanation of the indicator and its specificity with respect to the project; (2) **Evaluation method** structured in:

a. Data requirements

b. Source of data

c. Evaluation method

Indicator	Unit of measure	Rank
1. Contagion density	N° of infected people / N° of inhabitants	**3,69**
2. Availability and proximity of services of general interest to residential buildings	N° of services / sq. Km	**3,62**
3. Incidence of urban greenery on a waterproof surface	sqm of urban green / sqm waterproof surface	**3,54**
4. Incidence of contagion by age group	%	**3,54**
5. Air quality	µg/m³/mean year	**3,46**
6. Accessibility to public and private health facilities in the area	Average time taken to reach at least one facility	**3,38**
7. Availability of hospital and intensive care beds	Total number of beds / total number of inhabitants	**3,38**
8. Availability of urban green	sqm / inhabitant	**3,38**
9. Residential population density	N ° residents / sq. Km	**3,38**

Tab. 12 The 9 priority indicators at the municipal scale. Source: Author, 2021.

1. Contagion density

1. Intent:

Analysis of the infection distribution by comparing the number of people found to be infected with the number of inhabitants present. This indicator enables the analysis of whether the population density has played a major role or not in facilitating the spread of the virus.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Contagion density	N° of infected people / N° of inhabitants	3,69

2.2 Data Source

The indicators relating to the contagion are data that are difficult to find in an official format as they cannot be consulted for privacy reasons and can only be found in aggregate form. The Piedmont region publishes on the page (https://www.regione.piemonte.it/web/covid-19-mappa-dei-contagi-piemonte) a choropleth map with the number of positives per municipality providing an aggregate at the municipal level. The indicator relating to the density of the infection is, therefore, an extremely important indicator in order to understand whether residential density has played a favorable role or not in the spread of the Covid-19 pandemic, but is difficult to read at the municipal level. While analysis at the provincial or regional level provides a more general picture of the current situation.

On December 2020, The Responsible Risk Resilience Centre (R3C), an internal member of the present Post-Unlock project was presented with a research (Source: https://storymaps.arcgis.com/stories/f8eb0d6557ad4d3b884fb8cddb8c1e5e) of results coming from months of analysis on the Covid-19 arrival and evolution patterns in the region of Piedmont. The initiative is part of an effort to open on-going projects to the public and to bring high-quality information to everyone interested in rigorous and accurate data analysis.

In this way, a report, not in official format, was developed by GitHub with the aim of collecting information on the Coronavirus pandemic in Piedmont using data made available by regional public bodies (available at the following link to download data: https://github.com/to-mg/covid-19-piemonte). These values, however, are shown aggregated by province, entire region and ASL, therefore difficult to read at the municipal scale, more interesting at the provincial level instead.

Content	Format	Source
Positive by municipality from the Piedmont Region	dati_aaaa_mm_gg_da_regione_piemonte.csv (1)	to-mg/covid-19-piemonte
Municipalities sorted by positive/1000 inhabitants	comuni_ordinati_per_densita_contagio_2020_mese_giorno.csv	to-mg/covid-19-piemonte
Aggregation of all data into one file	dati_per_tutto_il_periodo_aaaa_mm_gg.csv	to-mg/covid-19-piemonte

2.3 Assessment method

To characterize the indicator's value:

1. Determine the scale of the analysis;
2. Convert the total number of daily positive cases in each municipality regarding the population variable provided by ISTAT census sections;
3. Choose the reference period on which to base the analyzes (for example: convert the daily data to average monthly and weekly data, in order to see the spread pattern of the virus);
4. Projection of the acquired shapefile data on the GIS Software.
5. Convert the relative average data with for example a colour scale by identifying territorial hot and cold points in order to analyze the distribution of the infection (for this part, please refer to the analysis carried out by R3C which explain this technique)
6. Use the unit of measure of the indicator to calculate the density of the infection.

2. Availability and proximity of services of general interest to residential buildings

1. Intent:

Density of services of general interest present (retail trade, wholesale trade, health facilities, school facilities) distributed throughout the territory. This indicator makes it possible to analyze the availability of services "near one's home" which has characterized the different lockdown phases.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Availability and proximity of services of general interest to residential buildings	N° of services / sq. Km	3,62

In order to calculate the indicator, it is important to divide the services into different categories. Furthermore, according to the type of function it is necessary to divide the service from residential buildings by distance level in order to better weigh the level of proximity. Three different buffers are established starting from the location of each service taken into account, consideration of 800sqm (10') respectively for services with greater catchment area such as for example hospitals and secondary schools; while the buffers of 500sqm (5') and 300sqm (3') are respectively assigned to the main basic services presence of which is necessary at the neighborhood scale.

The intention is to provide an overall picture of the state of accessibility of residents to various services in order to identify, consequently, the areas more critical which are excluded from the accessibility zones traced. From the territory point of view, said areas allow us to clearly understand where the planning tool and the future pilot actions for the redesign of post-pandemic cities must act and in what modalities.

The following list shows the subdivision and the different distances to be evaluated:

1. Retail:
   Food and Beverage_[Buffer 300 sqm]
   Specialized commercial establishments_[Buffer 300 sqm]

2. Wholesale:
   Hypermarkets_[Buffer 800 sqm]
   Supermarkets, Discount_[Buffer 800 sqm]

3. Health facilities:
   Pharmacies [300 sqm]
   Consultants, clinics, ASL, and other medical facilities_[500sqm]
   Major hospitals and principals _[Buffer 800 sqm]

4. School facilities:
   Kindergartens_[Buffer 300sqm]
   Primary schools_[Buffer 500sqm]
   Secondary schools_[Buffer 500sqm]
   High schools_[Buffer 800sqm]

2.2 Data Source

Content	Format	Source
Commercial activity (retail, wholesale)	Shp/geo.zip	geoportale.comune.torino.it/geodati/zip/attivita_commerciali_csv.zip
Health facilities	Shp/geo.zip	geoportale.comune.torino.it/geodati/zip/sedi_asl_geo.zip geoportale.comune.torino.it/geodati/zip/ospedali_geo.zip
School facilities	Shp/geo.zip	geoportale.comune.torino.it

2.3 Assessment method

To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
2. Definition of the respective buffers according to the function that the service has (300smq, 500smq, 800smq);
3. Count of the total residential buildings included in each buffer;
4. Percentage ratio between residential buildings included in the buffer area and total buildings residential buildings in the Municipality of Turin.

3. Incidence of urban greenery on a waterproof surface

1. Intent:

Ratio between the number of square meters of urban greenery present in relation to the waterproof surface of the area. This indicator verifies the consistency of the green areas present as an important environmental factor that positively affects the mitigation of pressures and the quality of life of citizens.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Incidence of urban greenery on the waterproof surface	sqm of urban green / sqm waterproof surface	3,54

In order to calculate the ratio between the number of square meters of urban green present in relation to the waterproof surface of the area under study, it is important to divide the different types of urban greenery present within the Municipality of Turin. This subdivision is in compliance with: the contents of the Strategic Plan of the Green Infrastructure of the City of Turin (Approved by Resolution no. Mech. 2020 02957/46 of 29 December 2020, updated on 24.3.2021); the municipal legislation concerning public green areas consulted (Regulations for public and private green areas of the city of Turin. Approved by resolution of City Council of 6 March 2006 (mecc. 2005 10310/046) executive from 20 March 2006. Amended with management resolutions of the City Council of 16 November 2009 (mecc. 2009 03017/046) from 30 November 2009, 12 May 2014 (mecc. 2014 00215/002) executive from 26 May 2014 and 1 October 2018 (mecc. 2018 02234/002) executive from 15 October 2018); and the BDTRE_2021.

2.2 Data Source

Content	Format	Source
Forest Cover	Shp/geo.zip	geoportale.piemonte.it/cms/bdtre/bdtre-2
Extensive urban Parks	Shp/geo.zip	geoportale.piemonte.it/cms/bdtre/bdtre-2
Neighborhood gardens	Shp/geo.zip	geoportale.comune.torino.it
Green proximity	Shp/geo.zip	geoportale.comune.torino.it
Waterproof surface (Buildings and roads)	Shp/geo.zip	geoportale.piemonte.it/cms/bdtre/bdtre-2

2.3 Assessment method

To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
2. Classify the urban greenery;
3. Classify waterproof surfaces;
4. Use the unit of measure of the indicator to calculate the consistency of the green areas, so the incidence of urban greenery on a waterproof surface.

4. Incidence of contagion by age group

1. Intent:

Indicator representing the % number of positive cases divided by age groups 0-18, 19-50, 51-70, +75 (subdivision given by the Istituto Superiore di Sanità - ISS). This indicator allows us to highlight the age groups most affected by the viral form.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Incidence of contagion by age group	%	3,54

As in the case of the first indicator, this being also an indicator referring to the Covid-19 spread, there are problems in its calculation. The indicators relating to the contagion are data that are difficult to find in official format as they cannot be consulted for privacy reasons and can only be found in aggregate form. In this way, also for incidence of contagion by age group, a report, not in official format, was developed by GitHub with the aim of collecting information on the Coronavirus pandemic in Piedmont using data made available by regional public bodies (Report available at the following link to download data: https://github.com/to-mg/covid-19-piemonte). These values, however, are shown aggregated by province, entire region and ASL, therefore difficult to read at the municipal scale, more interesting at the provincial level instead.

2.2 Data Source

Content	Format	Source
Aggregation of all data into one file	dati_per_tutto_il_periodo_aaaa_mm_gg.csv	to-mg/covid-19-piemonte
Positive by municipality from the Piedmont Region by age group	dati_aaaa_mm_gg_da_regione_piemonte.csv (1)	to-mg/covid-19-piemonte

2.3 Assessment method

To characterize the indicator's value:

1. Determine the scale of the analysis;
2. Convert the total number of daily positive cases by age groups (0-18, 19-50, 51-70, +75) in each municipality regarding the population variable provided by ISTAT census sections;
3. Projection of the acquired shapefile data on the GIS Software;
4. Convert the relative average data with for example a colour scale by identifying territorial hot and cold points in order to analyze the distribution of the infection (for this part, please refer to the analysis carried out by R3C which explains this technique)
5. Use the unit of measure of the indicator to determine the % of people testing positive divided by age group with respect to the population present for each group

5. Air quality

1. Intent:

This indicator demonstrates the atmospheric concentration of PM10 detected by the monitoring units within the municipality through the average value of the total annual concentration of PM10 expressed in µg / m^3. This indicator makes it possible to evaluate the variation in PM10 levels in the atmosphere compared to previous years, due in particular to having implemented travel reduction policies during the contraction phases (Pignatelli, M., 2020 – MOLOC Project).

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Air quality	µg/m^3/mean year	3,46

Currently, in Piedmont it is possible to consult the Daily Report on PM10 in support of the Operative Protocol Antismog, drawn up by ARPA Piemonte. For the assessment of the level of exposure of the inhabitants to PM10 in the urban area of Turin were used ARPA monitoring data. The limit of these data is that they refer to only 5 control units located on the territory and not to mobile monitoring units and more capillaries. The integration of the data measured by the monitoring network with those estimated through dispersion models allows you to obtain information on air quality levels, with high spatial and temporal detail on the whole territory (Pignatelli, M., 2020 – MOLOC Project).

2.2 Data Source

Content	Format	Source
Atmospheric concentration of PM10 detected by the monitoring units	Shp/geo.zip	geoportale.comune.torino.it

2.3 Assessment method

To characterize the indicator's value:

1. Collection of daily measurements of atmospheric samples in 5 different control units located in the Municipality of Turin;
2. Aggregation of data by calculating the average of the concentrations detected by the various control units;
3. Use the unit of measure of the indicator to calculate the Air quality Index.

6. Accessibility to public and private health facilities in the area

1. Intent:

Evaluation of accessibility in terms of average minutes taken to reach at least one health facility in the area. This indicator makes it possible not so much to analyze the number of structures close to the home, but their accessibility, in order to propose management policies for post-pandemic health structures and their relocation on the territory.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Accessibility to public and private health facilities in the area	Average time taken to reach at least one facility	3,38

Calculation obtained from three different buffers starting from the location of each health and hospital service taken into consideration, a fee of 800sqm (10 ') respectively for services with a greater catchment area such as for hospitals; while the buffers of 500sqm (5 ') and 300sqm (3') are assigned respectively to the main basic services, such as Pharmacies, Consultants and ASL, clinics and other health facilities presence of which is necessary at the neighborhood scale. This subdivision allows us to clearly understand where the planning tool and future pilot actions for the redesign of post-pandemic cities will have to act, and in particular how to manage the city in case of future and hypothetical new waves of emergency to reorganize the city as a new internal health generator. The following list shows the subdivision and the different distances to be evaluated:

1. Health facilities:
   Pharmacies_[Buffer 300 sqm]
   Para pharmacies_[Buffer 300 sqm]
   Consultants and other minor offices_[Buffer 300 sqm]
   ASL_[Buffer 500 sqm]

2. Hospital facilities:
   Emergency_[Buffer 500 sqm]
   Main hospitals_[Buffer 800 sqm]
   Secondary hospitals_[Buffer 800 sqm]

2.2 Data Source

Content	Format	Source
Health facilities	Shp/geo.zip	geoportale.comune.torino.it
Hospital facilities	Shp/geo.zip	geoportale.comune.torino.it

2.3 Assessment method

To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
2. Definition of the respective buffers according to the function that the service has (300smq, 500smq, 800smq);
3. Count of the total residential buildings included in each buffer;
4. Percentage ratio between residential buildings included in the buffer area and total buildings residential buildings in the Municipality of Turin.

7. Availability of hospital and intensive care beds

1. Intent:

Ratio between the total number of beds available, in hospitals and in the intensive care beds, compared to the total number of inhabitants in the area. This indicator is fundamental for the management and resilience of the post-pandemic city in the event of new and possible emergency waves.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Availability of hospital and intensive care beds	Total number of beds / total number of inhabitants	3,38

Calculation of the ratio between the total number of beds available compared to the total number of inhabitants in the area. Within this indicator, it would be interesting to analyze and geolocalize, if possible, also the hubs set up for vaccination for Covid-19 and also the temporary hospitals that were built during the emergency phase.

2.2 Data Source

Content	Format	Source
Hospital care bads	comune.torino.it/opendata/salute/posti_letto_per_stabilimento_ospedaliero_e_disciplina.csv	geoportale.comune.torino.it dati.salute.gov.it/dati/homeDataset.jsp
Hospital Intensive care bads	comune.torino.it/opendata/salute/posti_letto_per_stabilimento_ospedaliero_e_disciplina.csv	http://geoportale.comune.torino.it dati.salute.gov.it/dati/homeDataset.jsp

2.3 Assessment method

To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
2. Analyze the total number of beds;
3. Analyze the total number of inhabitants;
4. Use the unit of measure of the indicator to calculate the availability of hospital and intensive care beds.

8. Availability of urban green

1. Intent:

Calculation of the per capita extension of square meters of urban green available compared to the number of inhabitants present. This indicator makes it possible to highlight how the quality of life in residential fabrics is linked to the presence of usable green spaces, highlighted in particular by the phase of social isolation.

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Availability of urban green	sqm / inhabitant	3,38

For the classification of urban green areas, in the case of the urban context of the City of Turin we find ourselves in one of the greenest municipalities in Italy, passing from an urban standard of 3.6 square meters per inhabitant in the seventies to about 22 m2 per inhabitant today (2016 data; source: Istat). The proposed subdivision of the urban green area, as in the case of the second indicator, is in compliance with: the contents

of the Strategic Plan of the Green Infrastructure of the City of Turin (approved by Resolution no. Mech. 2020 02957/46 of 29 December 2020, updated on 24.3.2021); the municipal legislation concerning public green areas consulted (regulations for public and private green areas of the city of Turin. Approved by resolution of City Council of 6 March 2006 (mecc. 2005 10310/046) executive from 20 March 2006. Amended with management resolutions of the City Council of 16 November 2009 (mecc. 2009 03017/046) from 30 November 2009, 12 May 2014 (mecc. 2014 00215/002) executive from 26 May 2014 and 1 October 2018 (mecc. 2018 02234/002) executive from 15 October 2018); and the BDTRE_2021

2.2. Data Source

Content	Format	Source
Urban green	Shp/geo.zip	geoportale.piemonte.it/cms/bdtre/bdtre-2

2.3 Assessment method

To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
2. Analyze the number of smq of urban green area;
3. Analyze the total number of inhabitants;
4. Use the unit of measure of the indicator to calculate the availability of urban green

9. Residential population density

1. Intent:

Ratio between the number of residents present in relation to the sq km of the analyzed area. This indicator, linked to the indicator referring to the availability and proximity of services of general interest located in the neighborhood, allows us to understand how the issue of proximity and the issue of density are linked together. Dense cities are cities that allow greater proximity to services

2. Assessment methodology

2.1 Data requirement

Indicator	Unit of measure	Rank
Residential population density	N ° residents / sq. Km	3,38

For the analysis of the indicator story, see the 2011 ISTAT census compared to the previous 2001 census (Source: https://www.istat.it/it/).

2.2 Data Source

Content	Format	Source
Populations_2011	istat.it/storage/cartografia/basi_territoriali/ WGS_84_UTM/2011/R01_11_WGS84.zip	geoportale.comune.torino.it www.istat.it/it/archivio/104317

2.3 Assessment method

To characterize the indicator's value:

1. Projection of the acquired shapefile data on the GIS Software;
5. Analyze the number of residents;
6. Analyze the total number of inhabitants;
7. Use the unit of measure of the indicator to calculate the residential population density

PART III – FUTURE EVOLUTIONS

CHAPTER VI

CONCLUSION AND FUTURE DEVELOPMENTS

6.1 KEY FINDINGS

After months of lockdown and quarantine, with populations feeling "fatigue from Covid-19", **open spaces** for recreation and physical activity have **become crucial**. The problem exposed by the current pandemic has been a **perfect scenario to be able to think and propose new possible strategies to develop cities in a more resilient way** after the health emergency. This **health crisis** will bring substantial changes in the way we shape, manage and live in metropolitan areas. Our understanding of cities has certainly changed and this situation has inevitably proved to be an unprecedented wake-up call.

The **various challenges** facing the urban world - population growth, globalization, climate change and environmental degradation - require in particular greater flexibility, adaptability and innovation to foster opportunities for transformation.

The Covid-19 pandemic that has affected city regulations, as seen in the first chapters of this work, was not the first viral infection in human history to hit cities and now more and more different forces such as climate, population growth and globalization may increase the frequency of pandemics in the future. Hence the will of the present research analysis **"Inhabiting Proximity"**, a work that seeks to question the modality of redesigning post-pandemic cities and the role that the urban planner must have in this important challenge.

The substantial literary review conducted, process of selection and choice of indicators, calculation of the latter through their territorialization and assessment of the level of accessibility in the current state of affairs for the Municipality of Turin, has structured a consolidated knowledge base that has enabled an understanding of how to build a sustainable and resilient future. For Turin today that means paying attention to the urban environment, the city's infrastructures, meeting places, proximity trade, accessibility and tangible and intangible connections between neighborhoods.

This research work has highlighted some of the main challenges to which contemporary cities are subjected to, analyzing the problems, opportunities and potential solutions that can be adopted.

Starting from the **research question "What value does the issue of proximity assume today in the urban management of the post-pandemic city?"**, with the relative setting of **research limits**, limits beyond which this work has not investigated as they are extraneous to the point of view of the territorial planner, throughout all the chapters this work **analyzed the proximity level of the case study through the post-Covid indicators.**

This work has shown how many measures adopted during the emergency have now become part of daily life, changing habits and behaviors. The lesson from the Covid-19 pandemic is that **people's health is connected and dependent on the health of the planet**, and cities are at the heart of their relationship. Throughout the work, in addition to the research questions, we also questioned how to redesign the concept of public health in relation to the built environment and contemporary cities.

The emergence of a pandemic brings out the need for a **new concept of health and wellbeing** concerning the built environment and beyond.

The need to contain the spread of the SarsCov-2 virus and, at the same time, to restart the economic system has brought the issues of pedestrianism and urban micro mobility back to the center of the political and scientific debate. The health emergency has brought to light the link between the morphological and functional characteristics of urban contexts and the impacts on public health, opening new scenarios on the theme of Urban Health (Balletto *et al.*, 2020). In the design of cities, the role of urban planners is to select locations, design spaces, and placement services, and on this front, there is ample scientific evidence to indicate these factors have a big impact on health, and almost all urban planning policies and actions have an impact on human health itself.

The **Covid-19 pandemic has exposed the system's lack of understanding of the nature of risk and interdependencies between different sectors.** Through the analysis methodology proposed by this work, it has been demonstrated that there is a need to develop and propose new methodologies to understand the risk of the spread of possible health disasters within urban contexts and the relative need to use new tools and methodologies for the development of integrated measures that adequately address economic, social, environmental and political aspects through the use of evaluation indicators.

The **methodological framework proposed** in this research work has set itself the proclivity to investigate the correlations existing between the urban environment and level of proximity of cities, understanding how the aspects related to proximity to services have played a fundamental role during the phases of restriction and how this level of accessibility needs to be increased in order to develop more resilient cities at the local level. The proposed methodology **structured in 2 phases that can be replicated in all urban contexts** has provided an appropriate vocabulary and lexicon aimed at analyzing the responsiveness of the territory to sudden external stresses, to experience the city of proximity as an urban response to the cities of tomorrow that act as a new public health generator. The ultimate goal of the research was to develop a status-based assessment framework at the neighborhood level to assess proximity, in order to analyze the urban environment in relation to accessibility thus providing objective results.

A city that takes care of and promotes these dimensions in balance is a farsighted city, capable of planning and building its own future by adapting to the unpredictable emerging challenges, because it is capable of sustaining them, regenerating and always re-establishing a new balance. An effective assessment of complexity, differentiated for each territorial system, is necessary in order to develop and implement successful strategies to achieve common objectives. For this reason, multi-criteria analysis tools, analysis of qualitative and quantitative indicators and performance evaluations able to measure the effectiveness of the actions to be implemented before their implementation are becoming increasingly important.

Based on the analysis of the **post-Covid indicators**, in particular the **KPIs**, (Genta *et al.*, 2019) it was possible to analyze the baseline scenario for the city of Turin, highlighting weak points and priority areas on which to act, experimenting with **"living in neighborhood-scale proximity"** as an urban response to the

pandemic. **Measuring, evaluating and spatially visualizing the impact are the keys to the proposed evaluation process.**

For what has been said, below are reported the strengths of the analysis methodology proposed within the research work "Inhabiting proximity. New urban paradigms for post-pandemic cities" (Fig.35):

Fig.35 Key elements of the proposed methodology. Source: Author, 2021.

6.2 LIMITATIONS

Having reached the conclusion of this work, it is important to show the two main limits that the research has encountered during its development phases, in order to show the priority areas on which to act in the event of future and desired implementations of this work.

The limitations encountered and how to overcome them in case of implementation of this work in the future are outlined below in this paragraph:

1. **Availability of Covid-19 data:** From the earliest stages of development, a first major step that was difficult to overcome was that relating to the difficulty in finding data relating to the infection from Covid-19. Since this research is focused on the local scale, in particular on the neighborhood scale in order to be as specific as possible, the data referring to the spread of the contagion have been difficult to find in official format as they cannot be consulted for privacy reasons and are available only in aggregate form. For the present research, all the Covid indicators would have been extremely important indicators to understand the virus spread, but the data available are in aggregate form, therefore difficult to read even at the municipal level. For future developments it would be extremely important that the Piedmontese public bodies release the data relating to the pandemic in an open format, that is: in machine-readable format, with an open license, certified, complete, disaggregated, updated as much as possible and with historical data over time. This would allow academia and beyond to contribute to research by providing high-quality information to all those interested in rigorous and accurate data analysis;

2. **Remote work:** Having drafted this research work during the second phase of narrowing in our country has led to some difficulties. Most of the problems were not encountered in the development of the thesis as much as in the difficulty of organizing the meetings with the Stakeholders. From the early stages of the work it was very important to identify the subjects to involve in the decision process, but unfortunately, the distance and the physical impossibility of organizing workshops, focus groups and meetings has led many times to an extension of processing times. of the results. Greater difficulty on this front was encountered during the organization of the last meeting for the final validation of the set of Post-Covid indicators and the relative voting of the specific KPIs for the project. This phase in fact took longer than expected.

6.3 FUTURE DEVELOPMENTS

As said several times, this thesis work is intended as the experimentation and application of this proposed methodology on a small piece of the city, at the neighborhood level, in order to then become a project design to be applied to the entire municipality.

The following are the main recommendations for future work:

1. **Evaluation and spatialization of the final set:** The present thesis work, having intended to be as specific as possible, has experimented with the methodology proposed only in a small piece of the city, at the neighbourhood level, developing those that in the face of numerous comparisons with stakeholders were the specific KPIs for the project. As previously mentioned, the ultimate goal has always been to then become a project to be applied to the entire municipality by implementing the methodology throughout the municipal area. For this reason, for future evolutions of this work it is advisable to spatialize and evaluate the entire final set of the selected post-Covid indicators in order to obtain a general picture of the situation, but above all to extend and make the methodology proposed in this work a true and tailored pilot project for the entire city of Turin. For what has been said, in Chapter V, the technical sheets have already been presented for the first 9 indicators that have obtained the highest priority on the municipal scale due to the hierarchy of indicators carried out in paragraph 4.1.2. Since these indicators are optional, and also for reasons of time, these indicators have not assessed the results in the proposed state of affairs, but the calculation sheets have been provided for them in the hope that this research work will be resumed and expanded;

2. **Development of future scenarios:** An extremely interesting aspect, which would further enrich the present work, would be that of the development of future scenarios. This phase would allow the comparison before and after the change, thus being able to compare two different time frames. The present work has developed only the baseline scenario for the chosen case study, but in case of future evolutions, it would be important to demonstrate through a new scenario how the redesign of post-pandemic cities should be in function with the promotion of public health and need for a new concept of health and well-being that concerns the built environment and not only for the redesigning of post-pandemic cities. As mentioned several times, the health emergency has highlighted the link between the morphological and functional characteristics of urban contexts and the impacts of public health, opening up new scenarios within the theme of urban health that are very important to address;

On this front it is hoped that this work will provide a basis for future research work based on the analysis of indicators, thus confirming the initial goal set for the expansion of the current literature on the subject.

Furthermore it is hoped that the future scenario will also be developed in the future in order to evaluate the changes and extend the experimentation of the methodology applied to the Crocetta district to the entire municipal area for the City of Turin.

At the end is also hoped that the 50 feedbacks obtained from the evaluation of the KPIs may constitute valuable material for making proposals formally and constitute a further refinement of the set of indicators proposed.

The presented methodology and the materials developed and produced were delivered to a PHD student who will further expand the proposed methodology and apply it to the Colombian case.

eurac research

The methodological research approach developed, thanks to the teaching of Prof. Patrizia Lombardi and Sara Torabi, will continue within a post-graduate internship at Eurach research within the European project "Varcities".

In full continuity with the methodological approach to research field developed in the present work thesis, the tasks that the candidate will perform within the “Varcities project” will be:

a) Analysis of case studies and literature review for the definition of the expected impacts (environmental/economic/social) deriving from the execution of innovative urban transformations based on nature based solutions;
b) Creation of a conceptual grid to link hypothesized impacts and target SDGs on an urban scale;
c) Evaluation of possible Key Performance Indicators and methods for estimating impacts.

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Abastante, F., Brunetta, G., Caldarice, O., Genta, C., Lombardi, P., Pignatelli, M., Salata, S., Torabi Moghadam, S.,	**2020**	Torino, Italy	PRG Torino: Technical proposal for preliminary design. Study documentation - Notebook 6/2 Moloc European Project	Study documentation	Urban scale	Revision of urban planning tools identifying good practices aimed at the development of urban areas in key to sustainability	Low-Carbon, Moloc project, healthy city, energy efficiency, transition, citizen engagement, municipalities, indicators	Develop a new approach to the construction and transformation of cities, associating quality of life and energy efficiency
Aditi, R., Preeti L.J.,	**2020**	New Delhi, India	Observer Research Foundation and Global Policy Journal.	Argumentative	Cities	Rethinking resilience cities between the linkages of pandemic and urban health to mitigate the risks from future health crises.	Covid-19, resilience, urban health, data management, future risk	Demonstrate how Urban planning must include better data management to mitigate the impacts of future pandemics
Alleanza Italiana per lo Sviluppo Sostenibile	**2020**	Rome, Italy	ASviS Report	Investigative	European policy	Policies to tackle the Covid-19 crisis and implement the 2030 Agenda for sustainable development	Covid-19, shock, EU policy, SDGs, Urban Agenda 2030, sustenibility	For each SDGs, demonstrate which are the best guidelines after the covid-19 crises to realize the 2030 Agenda
Balletto, G., Ladu, M., Milesi, A., Borruso, G.	**2020**	Online resource	Sustainability	Study documentation	Urban scale	Urban accessibility and walkability are topics closely related to those aiming at a livable, healthy and inclusive city	Public real estate, disused properties, divestment; urban walkability, urban accessibility, Cagliari, Sardinia, Italy.	Evaluate in the city of Cagliari the 15-minute city model as a city that guarantees more equal access to urban services
Giovannini, E., Benczur, P., Campolongo, F., Cariboni, J., Manca, A.R.	**2020**	Luxembourg	Science for policy Report in Joint Research Center (JRC)	Argumentative	European level	Suggest actions to deal with the covid 19 emergency and bounce forward through adaptation and transformation	Covid-19, resilience, shock, sustenibility, policies, EU	Design policies and interventions for the cities to "bounce forward" toward a better and more sustainable pathway
Gray, E., Jackson, C.,	**2020**	Online resource	Ipsos Global Advisor	Social survey	Global level	Change in world view following climate change and Covid-19	Covid-19, energy, climate change,environmental issues, global warming,	Show through global survey how the world view will change over time following the ongoing disasters
Hamidi, S., Sabouri, S., Ewing, R.,	**2020**	Online resource	Journal of American Planning Association	Research	Cities	COVID-19 as a perfect case study to investigate the relationship between density and spread of contagious infectious diseases.	Covid-19, density, infectious diseases, pandemic, urban sprawl	Demonstrate how connectivity matters more than diffusion density of the Covid-19 pandemic
Urban Cooperation Progr. Caribbean (IUC-LAC)	**2020**	Latin America	IUC-LAC Website	Research laboratory	Europe and Latin America	Analysis of: tourism, public space, mobility, green economy and climate change, in the light covid crisis.	Covid-19, shock, resilience, tourism, public space, mobility, green economy, climate change,	To highlight the results following the research laboratory which involved various figures to address future post covid actions
Pignatelli Maurizia	**2020**	Turin, Italy	Politecnico di Torino -Webthesis	Research thesis	Urban scale	Development of a future scenario in order to facilitate the transition of Turin city towards a sustainable urban system, resilient and low-carbon	Indicators, Moloc project, SDGs, sustenibility, Low carbon, cities, Agenda 2030	Implement a new system approach based on multi-criteria indicators to support decision-making and to evaluate the sustainability performance of cities

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Pirni, A., Caporale, C.,	**2020**	Rome, Italy	Scientific Council of the Cortile dei Gentili - Cnr Edition	Argumentative	Cities	Peoples, communities, and development models after the Covid-19 health crisis	Covid-19, shock, resilience, psychological resilience, health, community, subsidiarity, public ethics, justice	In a generative approach, avoiding the return to the initial situation that made the spread of climate and health problems all too favourable
Raworth, K., Krestyanino-va, O., Eriksson, F., Feibu-sch, L., Sanz, C., Benyus, J., Dwyer, J., et al.	**2020**	Amsterdam, Netherlands	Doughnut Economics Action Lab (DEAL), Biomimicry 3.8, Circle Economy, and C40 Report	Action Lab laboratory	Urban scale	Amsterdam's new vision of respecting the planetary boundaries' makes the city a pioneer of this systemic transformation	Doughnut economics, thriving city, planetary boundaries, Amsterdam, planet, economy	Apply the doughnut economy model to the city of Amsterdam by creating its "self-portrait"
Sharifi, A., Khavarian-Garmsir, A.R.,	**2020**	Online resource	Science of the Total Environment	Research	Cities	Covid-19 pandemic offers an unprecedented opportunity to understand how cities might be affected by pandemics and what actions are needed	Covid-19, pandemics, smart cities, environmental factors, air quality, urban planning	Treat and inform city planners and policy makers of the measures that must be taken to develop more resilient cities
Siragusa A., Vizcaino P., Proietti P., Lavalle C.,	**2020**	Online resource	Joint Research Center (JRC) - SDG Voluntary Local Reviews	Research	Cities	Provide key examples of official and experimental indicators to set up an effecti-ve local SDG monitoring system	SGDs, Agenda 2030, cities, sustenability, indicators	Give examples of indicators collected at local level to facili-tate comparison for local actors with other cities
Alessi, L., Benczur, P., Campolongo, F., Cariboni, J., Manca, A.R., Menyhert, B., Pagano, A.,	**2019**	Luxembourg	Science for policy Report in Joint Research Center (JRC)	Argumentative	European level	Resilience analysis of EU member states to recent financial ed economic crisis	EU, resilience, analysis, adapta-tion, transformation, well-being, financial crisis, economic crisis	Analysis of which countries have had a resistant result, in terms of shock absorption during the post-crisis recovery
Alleanza Italiana per lo Sviluppo Sostenibile	**2019**	Online resource	ASviS Report	Teamwork report	European policy	Identification of precise objectives for each objective and the main sub-objectives of the UN Agenda 2030 referring to urban areas	EU policy, SDGs, Urban, goals, Agenda 2030, sustenibility, framework, social cohesion	Update the performance of the indicators annually related to the objectives contained in the 2030 Urban Agenda
Brunetta, G., Salata, S.,	**2019**	Online resource	Sustainability	Argumentative	Cities	Distinction between "vulnera-bility" exposure to a specific danger, and "resilience" emerges from the characteri-stics of a complex socio-eco-logical and technical system.	Urban resilience, spatial plan-ning, vulnerability, measuring,-mapping, decision-making	Demonstrate how mapping resilience aids the spatial plan-ning decision-making processes to adapt and transform the system.
Brunetta, G., Ceravolo, R., Barbieri, C.A., Borghini, A., de Carlo, F., Mela, A., Beltramo, S., Longhi, A., De Lucia, G., Ferraris, S., Pezzo-li, A., Quagliolo, et al.	**2019**	Online resource	Sustainability	Argumentative	Cities	"Territorial resilience" as emerging concept in able to help the process decision making	Resilience, spatial planning, interdisciplinary, sustenibility, co-evolution, urban, adaptation, transformation	Building a debate international on resilience transformative, around the capacity of a community of adapt to natural disasters
ETI Chair	**2019**	Online resource	White Paper	Teamwork report	Neighborhood	Transform the urban space, which is still highly mono-functional, with the central city and its various specialisa-tions, and go towards a polycentric city	15 minute city, Paris, Northga-tes project, climate change, spatial planning, measuring,-mapping, Urban and Territorial Transitions	Experimentation the 15 minute city in the 18 and 19 arrondis-sement of Paris with the Paris Northgates project promoted by ETI Chair

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Victoria State Government.,	**2019**	Online resource	Victoria State Government website	Argumentative	Neighborhood	The 20-minute neighbourhood is all about 'living locally' giving people the ability to meet most of their daily needs within a 20-minute walk	20-minute neighbourhood, Melbourne, 800m, local level, walkability, urban health, compact mixed-use,	Research shows that 20-minutes is the maximum time people are willing to walk to meet their daily needs locally to promote the city of proximity
Victoria State Government.,	**2019**	Online resource	Victoria State Government website	Argumentative	Neighborhood	Experimentation the 20-minute Croydon South neighborhood in Melbourne by proposing action strategies to implement the proximity	20-minute neighbourhood, Melbourne, 800m, walkability, proximity, Croydon South	The project focused on developing an integrated neighbourhood plan in partnership with the local community.
Coaffee, J., Therrien, M., Chelleri, L., Henstra, D., Aldrich, D.P., Mitchell, C.L., Tsenkova, S., Rigaud, E.,	**2018**	Online resource	Journal of Contingencies and Crisis Management	Argumentative	Cities	Implementation of urban resilience as a challenge politics and the new agenda research for the 21st century	Resilience, 100 Resilient Cities program, risks, climate change, Agenda 2030, SDGs	Prove as in the emerging political speech cities are become a focal point where challenges arise without precedents
Mueller, N., Rojas-Ruedaa, D., Khreis, H., Cirach, M., Andrés, D., Ballester, J., et al.,	**2018**	Online resource	Environment International Journal	Research	Cities	The Superblock model is an innovative urban and transport planning strategy that aims to reclaim public space for people	Barcelona, Superillas, Supermanzana, Superblock model, Cerdà, walkability, public space,	Reclaiming space for people, reducing motorized transport, providing urban greening and mitigating the effects of climate change
United Nations Statistics Division	**2018**	Online resource	E-Handbook on Sustainable Development Goals Indicators	Statistic guidlines	National level	The 2030 Agenda encourages member states to conduct regular reviews of progress at the national and sub-national levels	SGDs, Agenda 2030, cities, sustenability, progress, statistic data	Creation of a manual aimed at national statisticians to monitor the progress made in the implementation of the Sustainable Development Goals
Verma, P., Raghubanshi, A. S	**2018**	Online resource	Ecological Indicators Journal	Research	Cities	Explain how the contextual meaning and understanding of the concept of sustainability differs from country to country	Sustenability, indicators, SDGs, policy, progress, resilience	Identifying major issues faced in the development and implementation of sustainability indicators in an urban context, suggesting remedial recommendations
Kansas Health Institute.,	**2017**	United States	Health Institute webasite	Informing Policy	Cities	To take a proactive approach to health, urban planners and policy makers should use HIA to better understand the impact of urban factors.	Health Impact Assessment (HIA), sustenability, indicators, tool, policy, Health City Manager	The goal is to begin evaluating the potential health effects (HIA) of a proposed plan, project or policy, even before they are built or implemented.
Klopp, J. M., Petretta, L. D.,	**2017**	Online resource	Journal	Research	Cities	The urban sustainable development goal: Indicators, complexity and the politics of measuring cities	Indicators, sustainability, performance, SDGs, cities	Provide an overview of the USDG and explore some of the difficulties around using this goal as a tool for improving cities
Lakoff, Andrew.,	**2017**	Oakland, California	University of California Press	Investigative	Global level	The emergence of each new infectious disease highlights a persistent lack of global institutional preparedness to prevent pandemics	Global Health, pandemics, virus, emergency, shock, crisis, disasters, cities	Propose an engaging analysis of the evolution of the state of emergency response to global health crises.

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Manca, A.R., Benczur, P., Giovannini, E.,	**2017**	Luxembourg	Joint Research Centre (JRC)	Investigative	European level	Building a narrative science towards a society more resilient EU	Resilience, trasformation, digital innovation, progress, demographic change, development policies	Demonstrate how interest in resilience has grown over the last twenty years, in response from shock actual and potential in place
Raworth, Kate.,	**2017**	NY, United States	United States Book	Economic research	Planetary boundaries	Identify the existence of two boundaries: (internal boundary) - social relations and an (external boundary) - relative to environmental boundaries	Economy, development policies, unit growth, planetary boundaries, earth	Change the way of economists, and not only, to respond to the "growth limits" with a view to development sustainable, reconsidered economy organization
Scudellari, Jacopo.,	**2017**	Barcelona, Spain	Politecnico di Torino -Webthesis	Research thesis	Urban scale	The Superblocks model was an innovative urban and transport planning strategy that aimed to reclaim public space for people	Ecological urbanism, The Superblock urban model, sustainable cities, urban scale	Analysis of the urban approach presented by Salvador Rueda in order to present an innovative methodology able to ensure all sustainable urban aspects
Sylkina S.M., Altayeva K.J.	**2017**	Online resource	Central Asian Journal of Social Sciences and Humanities	Research	International	Analysis of international treaties, national ecological legislation, and the role of international organizations	International treaty, global organizations, climate change, climatic system, the framework strategy, energy, implementation, UN, Kyoto protocol	Promote economic development aimed at the growth of people's well-being in combination with social guarantees.
United Nations	**2017**	Online resource	United Nations (Habitat III)	Investigative	Global level	Present a shared vision for a better and more sustainable future in which all people have equal rights and opportunities that cities can offer	New Urban Agenda, cities, sustainability, progress, human right, human settlements	Establish standards and principles for the planning, and development of urban areas along the five main pillars of the New urban agenda
United Nations	**2016**	Online resource	Human Settlements programe (UN-Habitat)	Investigative	Global level	Representing a change in governance with greater participation of local authorities withinSDGs 11	Agenda 2030, SDGs, SDGs11, cities, goals, sustainability, progress,	The implementation, monitoring and reporting of the SDG Goal 11 will enhance the coordination mechanisms of national and local authorities
Chelleri, L., Waters, J.J., Olazabal, M., Minucci, G.,	**2015**	Online resource	Environment and Urbanization	Research	Cities	Anthropogenic impacts on ecological systems and the growing human population now represent planetary changes.	Climate change adaptation, resilience trade-offs, scales, sustainability transition, urban resilience	Increasing interest in exploring how to incorporate approaches around longer-term systemic transformation, incorporating risk mitigation within recovery
United Nations	**2015**	Online resource	United Nation - Knowledge platform	Investigative	Global level	Present the ambitious and transformative vision of the Agenda 2030.	Agenda 2030, SDGs, cities, goals, sustainability, progress,	The Agenda 2030 is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom
Chelleri, L., Kunath, A., Minucci, G., Olazabal, M., Waters, J.J., Yumalogava, L., ,	**2012**	Bilbao, Spain	BC3, Basque Centre for Climate Change	Workshop Report	Cities	Resilience theory provides a long-term perspective and fundamental concepts related to adaptation and transformation.	Transformative resilience, shock, vulnerability, cities, progress, sustainability	Demonstrate how is important the passage by vulnerability to transformative resilience, fundamental for reacting to an unexpected shock

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Chelleri, Lorenzo.,	**2012**	Online resource	URNet Urban Resilience Research Network	Argumentative	Cities	Addressing the issue of resilience which seems to have now become a buzzword in the debates	Resilience city, urban resilince, urban system, cities, progress, sustainability, transition town	Examine the prospects for resilience and their possible application to urban systems
Smith, A., and A. Stirling.,	**2010**	Online resource	Ecology and Society	Argumentative	Cities	The Politics of Social-ecological Resilience and Sustainable Sociotechnical transitions	Governance, social-ecological resilience, scio-technical transitions	Questions over who governs, whose system framings count, and whose sustainability gets prioritized to social-ecological systems research.