Politecnico di Torino

MSc Territorial, Urban, Environmental and Landscape Planning

Master's Research Thesis

Assessing Urban Resilience in the Vulnerable Communities: The Repercussions of the COVID-19 Pandemic

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December 2022

POLITECNICO DI TORINO

Interuniversity Department of Regional and Urban Studies and Planning (DIST)

MSc Territorial, Urban, Environmental and Landscape Planning

Curriculum: Planning for the Global Urban Agenda

MASTER'S DEGREE THESIS

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Research Period	March 2022 – September 2022

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".

This research thesis was presented in the EURAC Research 4th international conference on Sustainable Planning for Cities and Regions 2022 held in Bolzano, Italy in July 2022

To My Family,

Acknowledgments

I would like to start by thanking my supervisor Professor Dr. Patrizia Lombardi, for giving me the opportunity to contribute to the Post Un-lock research project. This time doing this work has been completely formative and enriching. I have acquired skills and knowledge I know are going to be fundamental not only for my professional career but for life in general.

Secondly, I would like to thank my co-supervisor Dr. Sara Torabi Moghadam, who patiently guided me step by step through this process and encouraged me to learn as much as I can from this challenge. Without her I would not have been able to fulfill this task.

They both are remarkable, inspiring women with a lot of passion and discipline for what they do and have become role models for their dedication to their work and care for their students. As a professional architect and urban planner, I respect them immensely and look up to their achievements, and as a woman, they inspire me to never give up.

Finally, I want to thank my family for always being my motor and support system. They have always motivated me to be the best version of myself and to follow my dreams no matter how big or small they are. They have believed in me even when I have found it difficult to believe in myself. I owe them everything that I am and everything I will become. You have taught me to be a caring, strong, independent woman and everything that I do, I do with all of you in my heart.

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Preface

This research thesis starts from the desire to shape a research work that can be challenging and enrich my knowledge in urban planning, but also a work that responds consistently with my ideas and beliefs as a professional architect and planner. To understand the COVID-19 pandemic as an element of high relevance in human history is an accurate vision to change the way we see and plan cities, therefore, to carry out research having as central core the learnings brought by the sanitary emergency nowadays is crucial to talk about topics like sustainability, resilience, equity, etc. On the other hand, the decision to direct this work to have a more social focus starts from the concern to the communities that, even before the pandemic started, the world witnessed to struggle the most to access to proper life opportunities. The role of urban planners essentially consists of designing territories that are inclusive, safe, and healthy for everybody enhancing harmony and synergy among all its parts.

The pandemic has unmasked several social disparities that become an issue to cities to achieve resilience and sustainability. With the lockdown measures that gave way to a serious economic recession, many communities around the world saw themselves in a complicated position of being uncertain on how they were going to be able to provide for them and their families. Words like proximity, welfare, physical and mental health became important, and people started to realize that for them to be able to adjust to unexpected changes simple personal efforts and means were not going to be enough. There are things provided by the environment, and when these things lack, to achieve urban resilience and guarantee the wellbeing of everybody becomes a challenge.

This work also explores some European cities that have dedicated their efforts on urban resilience and sustainability and when facing the pandemic, showed to have a better, more accurate response to the pandemic.

This research thesis seeks to redefine the concepts of urban resilience and urban health by providing a methodology that is applicable and replicable allowing to evaluate territories as deep as possible while at the same time enhance social engagement in order to propose solutions that respond consistently to the territories and communities that live in them.

Abstract (EN)

Keywords: COVID-19, Vulnerable Communities, Urban Resilience, Territorial Planning Model.

The global urbanization process has been a source of territorial vulnerabilities that constantly challenge the efforts to achieve inclusive, safe, and sustainable cities. It has been discussed that these vulnerabilities in dealing with the COVID-19 pandemic, have accelerated the virus's spread and the impact of the pandemic. Later, unmasking and magnifying social, economic, and health disparities in cities all around the world. Common measures to mitigate the contagion like social distancing, and strict confinement have shown to be more catastrophic in marginalized urban areas. Particularly, in the communities living in environments that face high inequality and low fulfillment of human rights.

This work is part of the Post Un-Lock research project led by the Inter-university Department of Regional and Urban Studies and Planning (DIST), along with the Responsible Risk Resilience Center (R3C) and the Medical Statistics and Epidemiology Department of the University of Turin. This research seeks to execute a comprehensive analysis and assessment of the negative impacts brought by the COVID-19 pandemic on vulnerable communities, and further propose new territorial solutions that work towards the achievement of the sustainability agenda.

The impact assessment is based on the evaluation of post-COVID indicators at the neighborhood level in the city of Turin. These indicators were defined within the Post Un-Lock project through a validation process with stakeholders focusing on the necessities and relevant issues to be considered in a post-pandemic scenario. Furthermore, this evaluation sought to enhance social engagement in the decision-making processes through the implementation of innovative participatory tools in the assessment stage. The outcome is expected to be a set of indicators evaluated in within an Italian case study, hand in hand with the respectively spatial solutions supported by a social participatory approach. In the end, these results are expected to be included in a replicable territorial planning model that reinforces urban resilience and focuses on the eradication of social disparities.

Abstract (IT)

Parole Chiave: COVID-19, Comunità vulnerabili, Resilienza urbana, Modello di pianificazione territoriale.

Il processo di urbanizzazione globale è stato una fonte di vulnerabilità territoriali che sfidano costantemente gli sforzi per raggiungere città inclusive, sicure e sostenibili. È stato discusso che queste vulnerabilità nella gestione della pandemia COVID-19, hanno accelerato la diffusione del virus e l'impatto della pandemia. In seguito, smascherando e amplificando le disparità sociali, economiche e sanitarie nelle città di tutto il mondo. Le misure comuni per mitigare il contagio come l'allontanamento sociale e il confinamento rigoroso si sono dimostrati più catastrofici nelle aree urbane emarginate. In particolare, nelle comunità che vivono in ambienti che affrontano alte disuguaglianze e bassa realizzazione dei diritti umani.

Il presente lavoro fa parte del progetto di ricerca Post un-lock guidato 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 di Torino. Questa ricerca cerca di eseguire un'analisi e una valutazione complete degli impatti negativi portati dalla pandemia COVID-19 sulle comunità vulnerabili e di proporre ulteriori nuove soluzioni territoriali che operino verso il raggiungimento dell'agenda di sostenibilità.

La valutazione d'impatto si basa sulla valutazione degli indicatori post-COVID a livello di quartiere della città di Torino. Questi indicatori sono stati definiti nell'ambito del progetto Post un-lock attraverso un processo di convalida con le parti interessate che si sono concentrate sulle necessità e sulle questioni pertinenti da considerare in uno scenario post-pandemico. Inoltre, questa valutazione ha cercato di migliorare l'impegno sociale nei processi decisionali attraverso l'implementazione di strumenti partecipativi innovativi nella fase di valutazione. Il risultato dovrebbe essere un insieme di indicatori valutati nel l'ambito di un caso di studio italiano, di pari passo con le rispettive soluzioni spaziali supportate da un approccio partecipativo sociale. Alla fine, questi risultati dovrebbero essere inclusi in un modello di pianificazione territoriale replicabile che rafforzi la resilienza urbana e si concentri sull'eliminazione delle disparità sociali.

List of Acronyms

D Damage

DIST Inter-university Department of Regional and Urban Studies and Planning

EIA Environmental Impact Assessment

GIS Geographic information system

KPI Key Performance Indicators

LRU Local Resilience Units

MOLOC Morphologies Low Carbon

R3C Responsible Risk Resilience Center

SDGs Sustainable Development Goals

SFDRR Sendai Framework for Disaster Risk Reduction

UN United Nations

WHO World Health Organization

UIA Urban Innovative Actions

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List of Spatialized KPI's

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KPI 11: Availability and Capacity of Basic Public Services

KPI 12: Number of Persons Living in the Same Household

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KPI 14: Accessibility to Information and Communication Technologies (ICTs)

KPI 15: Educational Level of the Population

KPI 16: Availability & Proximity to Urban Public Institutions

KPI 17: Social Marginalization

Chapter 1

Introduction

1.1 Problem Statement.

Background

In recent years, the rapid growth in human activities has become the main driver for the consolidation of big-sized, highly densely populated cities all around the world. These accelerated global urbanization processes have signified the acceleration of paradigm shifts regarding the conception of territories and urban dynamics. The relationship between the local and global, the appearance of new models of inequality, new cross-scale interactions that have transformed the dynamics of proximity, the decoupling of ecological processes, health, and place, among others. Belong to the many transformations attributed to the prompt expansion of cities that have resulted in the consolidation of new major global vulnerabilities challenging the efforts to achieve inclusive, safe, and sustainable cities, giving rise to disparities and dysfunctionalities at the economic, political, social, cultural, and environmental levels, fundamentally threatening urban life.

In 2019, the world found itself in the position to face a global health emergency: The COVID-19 Pandemic, a respiratory virus that propagated in an unexpected speed. The elevated contagious rate, as well as the preoccupying rising mortality numbers, challenged the health systems exposing the unpreparedness of hospitals and professionals to face such a crisis as well as the high vulnerability of cities to external shocks. Citizens from all over the world were bound to remain indeterminately under lockdown to halt the spread of the virus as a crucial measure implemented by every state under the recommendation of global institutions like the World Health Organization (WHO) to encourage collaboration and guarantee a holistic response to the pandemic. This large-scale disease transmission crisis brought several health, economic, political, educational, and societal consequences felt by communities globally, specially, those who live in poor, fragile and conflict circumstances.

This work will focus on the vulnerable communities, who are the ones that have shown to have experienced the biggest impact with the COVID-19 pandemic having unmasked

several social, economic and health disparities at a global scale. Contemporary cities now feature a range of new models of inequalities, and when any type of disaster occurs, these patterns channel the most damage towards the most marginalized and unequal groups in the city. These places are usually characterized by having the most deprived infrastructure, daily life is carried out in risk conditions, and denied the most recent technological and health guarantees. Disasters have a wide range of effects on place and space, but in contemporary cities the discrimination of race, class, gender, family structure, language, migrant status, health disabilities and income heavily stratify space within the city's configuration.

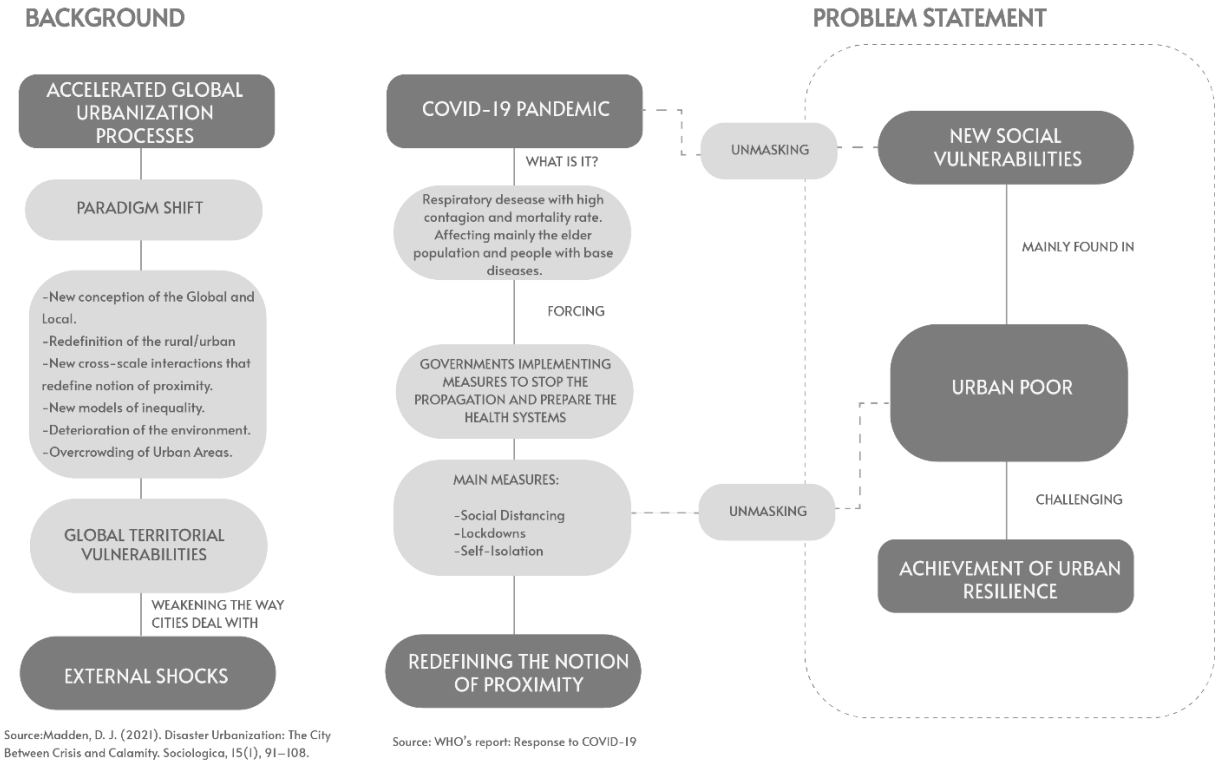


Figure 1: Background Problem Statement. Source: Author.

International organizations as The United Nations have highly empathized on how the pandemic has unmasked social, economic, and health disparities at a global scale: "The pandemic has underscored how humankind is inextricably connected and revealed multifaceted inequalities—with some who have access to care, services, and opportunities, and some who are left behind. National authorities and communities across the world have

struggled to respond to the crisis and to secure a sustainable and resilient recovery" (UN,2021). Additionally, the health global emergency has uncovered the issue of the inefficient role of public policies, especially in developing countries, in assessing local socioeconomic matters as they have been considered in isolation with broader social consequences, negatively impacting the delivery of global guidelines and agendas as the Agenda 2030 for the Sustainable Development Goals (SDGs), as well as The Sendai Framework of Disaster Risk Reduction (SFDRR), that aim at a more sustainable and resilient scenario for cities.

This sanitary emergency represents a wake-up call for everybody in order to think about how cities have been rapidly and uncontrollably growing, to a point in which well-being and safety are being challenged and left aside day by day. Social disparities and inequalities are an example of neglecting and inefficient decision-making processes resulting in disconnected policies with a limited scope of the context and little vision of the future ahead.

The COVID-19 pandemic shows us nothing by the vital importance of planning our cities based on the concept of resilience in order to guarantee the capacity of all urban systems, communities, individuals, organizations, and businesses to recover, maintain their function, and develop in the repercussions of a crisis or disaster, especially, the most vulnerable communities, who are the ones with the biggest need for help as well as the ones that challenge the most the achievement of urban resilience.

1.2 Post Un-Lock Project: From Territorial Vulnerabilities to Local Resilience.

The Post Un-Lock Research is established in the frame of the call for the co-financing of research project 2020 led by the Inter-university Department of Regional and Urban Studies and Planning (DIST), along with the Responsible Risk Resilience Center (R3C) and the Medical Statistics and Epidemiology Department of the University of Turin, with the aim to define a new territorial scenario for the year 2030, taking into account the management of the post-sanitary emergency phase of the COVID-19.

The rapid spread and diffusion of the COVID-19 virus all around the globe brought an important change in the daily life of people, leading us to face an unknown situation with an unspecified duration, unmasking not only how unprepared cities were to face a global disaster, but also all the territorial vulnerabilities that the new urbanization processes have brought. Under these circumstances, the Post Un-Lock project seeks to redefine the concept of urban resilience and propose a new territorial framework by providing a multidisciplinary analysis methodology and territorial approach to risk, carrying out interdisciplinary knowledge systems, and motivating climate change governance processes, based on the study and analysis of local vulnerabilities and the definition of adaptation strategies.

Taking into consideration the 2030 Agenda for Sustainable Development, all UN member states in 2015, agreed on a 15-year plan to achieve the 17 Sustainable Development Goals as a universal call to action to end poverty, protect the planet and improve the quality of life and prospects of everyone, everywhere. Under this framework, the Post Un-Lock project centers on Goal 11 which aims to "Make cities inclusive, safe, resilient and sustainable.", with a particular focus on the Sub-objective 11b that brings attention to the importance of increasing the number of cities and human settlements adopting and implementing integrated policies and plans that work towards inclusion, resource efficiency, mitigation and adaptation to climate change and resilience to disasters, lined up with the efforts

stressed in the Sendai Framework for Disaster Risk Reduction (SFDRR) also implemented in 2015.

Naturally, the COVID-19 pandemic signified a moment in which cities saw themselves in the need to redirect their efforts into the sanitary emergency by looking for short-term solutions to strengthen the health system as well as provide aid to the people who got financially impacted by the economic repercussions of the lockdown. Furthermore, the effects on the pandemic did also affect the ongoing plan for the achievement of the SDGs questioning the fulfillment of the strategies and plans to be carried out in the foreseen time. However, it is important to say that this global event helped us to make a stop in the way and evaluate how the goals and guidelines can be transformed to assess in a more complete way, and now taking into account the outcomes and management of a global disaster like COVID-19, urban sustainability and resilience.

Having The United Nations an important role in the assessment of the pandemic, the 2020 COVID-19 Response Report meant a significant work to include the pandemic repercussions and future implications. For Goal 11, it was stressed that the impact of COVID-19 will be most catastrophic in poor and densely populated urban areas, especially for the one billion people living in informal settlements and slums worldwide as well as for refugees, internally displaced people, and migrants.

On the other hand, the Sendai Framework for Disaster Risk Reduction (2015-2030) is a bold agreement that aims to significantly reduce disaster risk and losses in lives, livelihoods, and health, as well as in the economic, physical, social, cultural, and environmental assets of individuals, businesses, communities, and countries. It aims at the prevention of new and existing disaster risks based on the implementation of integrated and inclusive measures that prevent and reduce hazards (Technological, Biological, and Environmental) exposure and vulnerability to disasters as well as increase the preparedness for response and recovery, fostering and enhancing resilience.

Over the last years, progress has been made in order to detect, assess, and prevent disaster risks significantly reducing losses and damage, however, the framework emphasizes the vital importance of focusing more on losses in lives, livelihoods, and health as well as in the economic, physical, social, cultural and environmental assets of people, business, communities, and countries for the planning horizon of 2030.

Being cities from all around the globe, the first scenario to deal with the impacts and outcomes of disasters and crises like the COVID-19 pandemic, it is crucial to first analyze how the system faces and absorbs the outcomes of unknown situations to be able to strengthen the reaction capacity and foresee and prevent the most damage possible. The Post Un-Lock project seeks to propose and introduce a new model of territorial planning and organization called the Local Resilient Units (LRU) as a territorial, adaptive place-based strategy in an effort to support a transformative governance approach and support institutions worldwide in the pursuit of urban resilience.

To sum up, this project seeks for the proposal of new ideas to achieve urban sustainability and resilience based on the lessons of the sanitary emergency, establishing a huge responsibility to urban planners as well as policymakers and decision-makers looking for the transformation of urban life aiming at assessing the biggest challenges that the urban life faces today: The mitigation of environmental threats, stabilizing resource consumption, social inequality, and an efficient and transparent territorial governance.

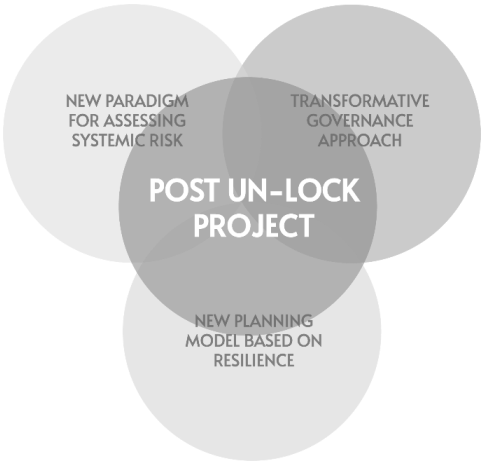


Figure 2: Objectives of the Post Un-Lock Project. Source: Author.

1.3 Research Question.

The assessment and protection of vulnerable communities in the situation of a crisis or disaster is an issue that any disaster risk management should address. Countries and international organizations define vulnerable groups according to precrisis social, economic, and cultural factors, but they do not take into account that these same factors usually enhance inequality, exclusion, social disparities and lack of access to and control over resources. Moreover, it is important to embrace and intersectional perspective regarding the differentials and fluidity of the composition between groups, in terms of vulnerability and resilience, challenging the diffuse tendency in public policy to statistically categorize groups in terms to vulnerabilities or hazards.

The latest sanitary emergency showed us the unpreparedness of countries and health systems to face an unprecedented crisis like COVID-19. The pandemic and the implemented measures to stop the propagation impacted urban life, changing habits and behaviors, and unmasking several social disparities as well as vulnerabilities questioning the capacity of these groups to manage and absorb the impact and therefore their survival and wellbeing.

The discussed above opens the question of the role of urban planning to manage current and future crises. Now more than ever the world needs to transform and solidify the term of Urban Resilience as a vital tool for cities to absorb any type of to prevent the less losses possible and to easily get back to normality and on track the pursue of sustainable development.

Following this order of ideas, the main research question remains: How to assess and manage these social inequalities that suffered the vulnerable in order to achieve urban resilience in the post-pandemic context?

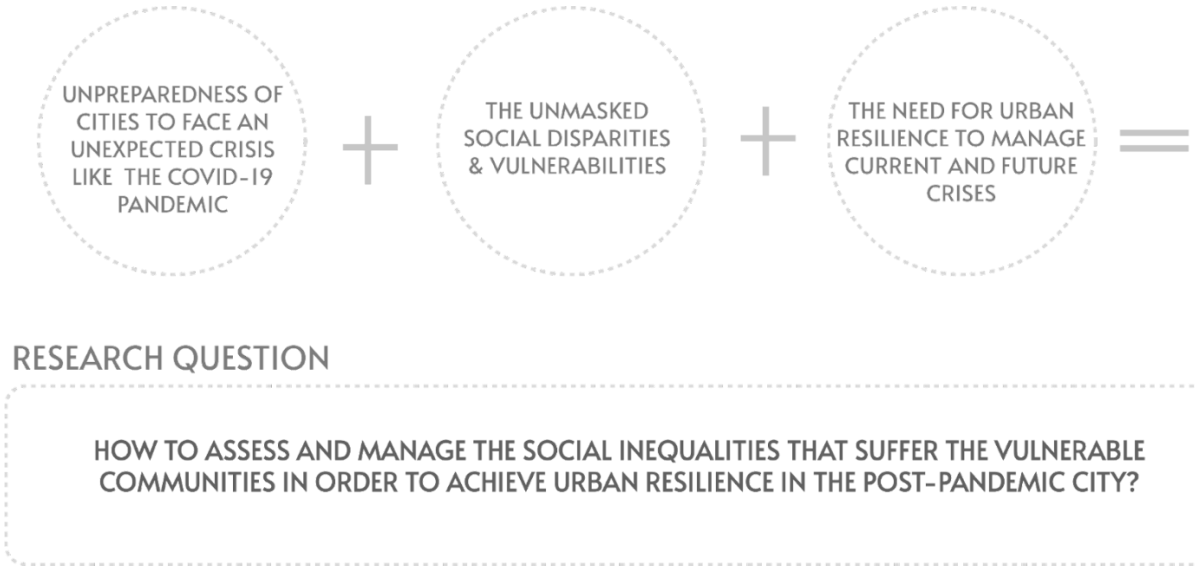


Figure 3: Research Question. Source: Author.

1.4 Research Objective.

This research thesis contributes to the wider work of the Post Un-Lock project proposed by This work is part of the Post Un-Lock research project led by the Inter-university Department of Regional and Urban Studies and Planning (DIST), along with the Responsible Risk Resilience Center (R3C) and the Medical Statistics and Epidemiology Department of the University of Turin, with the purpose to act from the role of urban planning and territorial governance towards the rethinking of modern cities seeking for more sustainable, equal, and resilient urban environments.

Historically, epidemics and health emergencies have been detonators of urban transformation and city ordering. The COVID-19 pandemic not being the exception, has come to reevaluate how cities all around the world have been organized, planned, and lived. Social distancing, quarantine, and lockdowns have been the main measures implemented to stop the spread of the virus setting up the implication of a new normality and redefining the notion of proximity. In addition to the above, attention needs to also be given to communities that have been struggling with social and economic disparities, and

that consequently, with the arrival of the sanitary emergency, have been the ones who suffer the most damage.

The role of urban planning and territorial governance in this health emergency relies on shaping new territorial models and strategies seeking to assess the new forms of inhabiting space considering the changes COVID-19 brought in order not only to face the social, economic, cultural, and health challenges of the pandemic, but to prepare cities to deal with future crises and disasters anticipating the least damage and losses possible. This implies the assessment of vulnerabilities that lead to social disparities and inequalities to then, propose relevant place-based solutions to narrow the social gap and provide the vulnerable communities with access to resources and opportunities and guarantee a standard quality of life for everybody.

The research objective is born from the need to focus on the repercussions that the health emergency brought to the vulnerable communities and the importance of proposing solutions and sustainable strategies, as they hold a significant role in the definition and achievement of urban resilience. This communities, day after day, face the different challenges that modern urbanism has stressed in our societies, fronting lack of accessibility to basic living resources, poor infrastructure systems, low economic capacities, social and cultural discrimination, among others. With the arrival of the pandemic, these vulnerabilities were magnified putting these populations in the uncomfortable and unfair position to abide the COVID-19 propagation measures risking their everyday livelihood. Taking into account the above mentioned, the main objective of this research thesis is expressed as follows:

Main Objective: To analyze and assess the impact of the COVID-19 pandemic on vulnerable communities focusing on the evaluation of Key Performance Indicators at the district level in the city of Turin to then, propose a set of place-based territorial solutions that will be validated through the implementation of an innovative participatory approach.

1.5 Proposed Methodology.

To achieve the established research objective, a structured methodology will be carried out based on the analysis, selection, measurement, and evaluation of the impact generated by the COVID-19 pandemic at the local level in the city of Turin, Italy, to then, propose a set of possible solutions focusing on working towards a resilient, sustainable, and equal future of cities and communities. Finally, these solutions will be validated through a participatory approach tool with the purpose to influence and motivate social participation in the decision-making processes of governments worldwide. The following is a step-by-step explanation of how the research thesis will be unfolding:

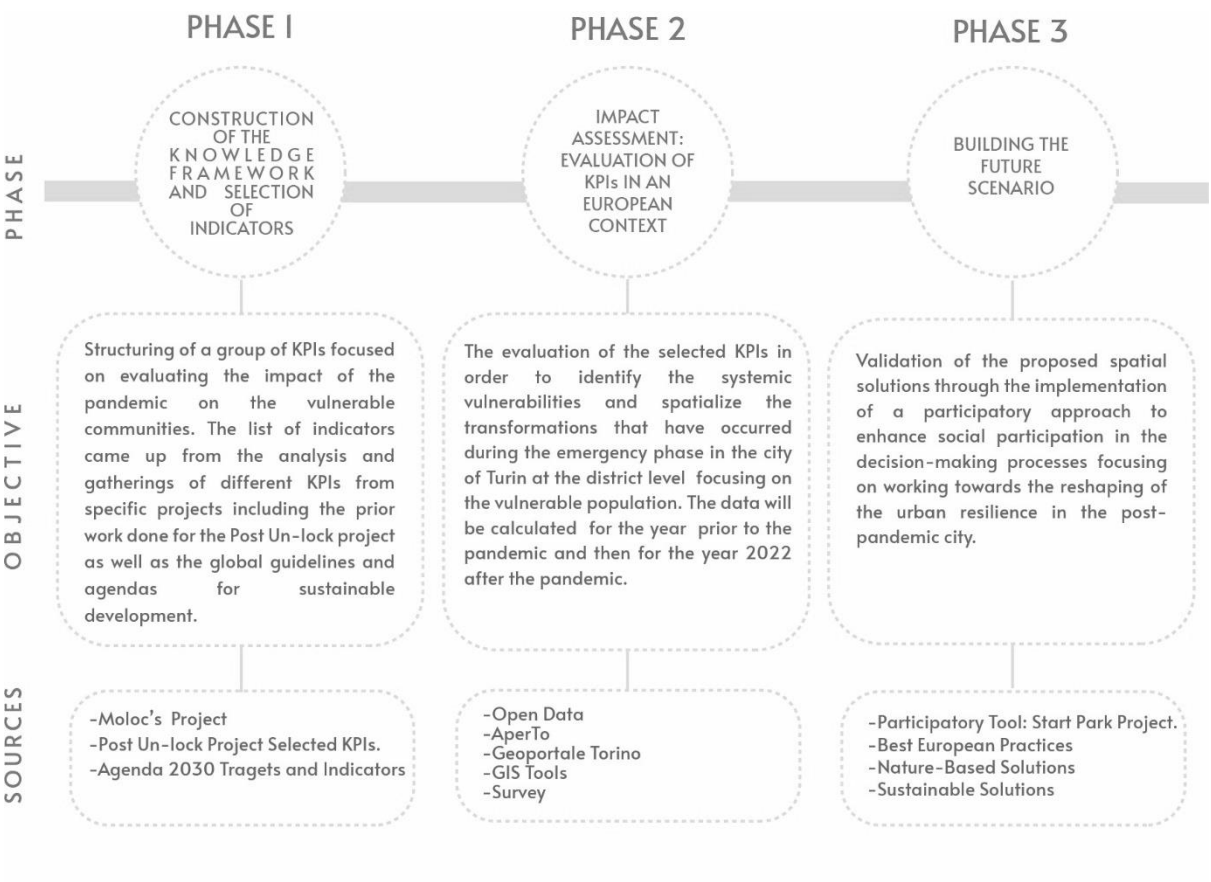


Figure 4: Proposed Methodology. Source: Author

1.6 Expected Results.

Nowadays, we cannot talk about the development of cities without taking into account the repercussions brought by COVID-19 pandemic that have transformed urban life. This work intends to present a current and relevant assessment of the impacts of the emergency in cities from the position of urban planning, focusing on the experience of the vulnerable communities. This will result in the proposal of an accurate methodology to identify territorial vulnerabilities, assess the impact in the case of an events, and propose relevant solutions that seek for urban resilience and sustainability as well as the community is being involved throughout the decision-making process.

This thesis expects to first present a set of post-COVID indicators to assess the impact of the pandemic in the vulnerable communities as the result of the gathering and analysis of different KPIs proposed in previous projects including the Post Un-lock previous selection of indicators. On the other hand, the targets and indicators proposed by the Agenda 2030 with the Sustainable Development Goals were also taken into account as a response to the role and relevance of these global guidelines within the project's framework. This process was carried out with the aim of building the most accurate list of KPIs to effectively assess the repercussions of the health emergency specifically of the urban poor.

As a further result, some spatial solutions, gathered from the analysis of different European strategic scenarios, will be proposed for the specific case study analyzed at the district level in the city of Turin. These solutions will be supported by the execution of a participatory approach as a response of the main objective of the thesis to motivate and amplify the use of this tools as a very important step in the decision-making activities in order to think of accurate strategies that will not only improve the quality of these territories, but also enhance the participation of the community in the sustainable development of their own neighborhoods, districts, cities, but also to strengthen community ties and improve the sense of belonging.

1.7 Thesis Structure.

This research thesis is divided in 5 chapters starting from the Introduction and the Literature Review, which stress the struggle of the most vulnerable communities to deal with the COVID-19 pandemic and the lockdown measures. Then, the methodology explains how to analyze the impact of the pandemic step by step focusing on the calculation of KPIs followed by the implementation of a participatory tool to enhance community engagement. The next chapter is the results applied to a case study in the City of Turin at the district level and finally the last two chapters contain the conclusions of all the work as well as the future developments and the research references.

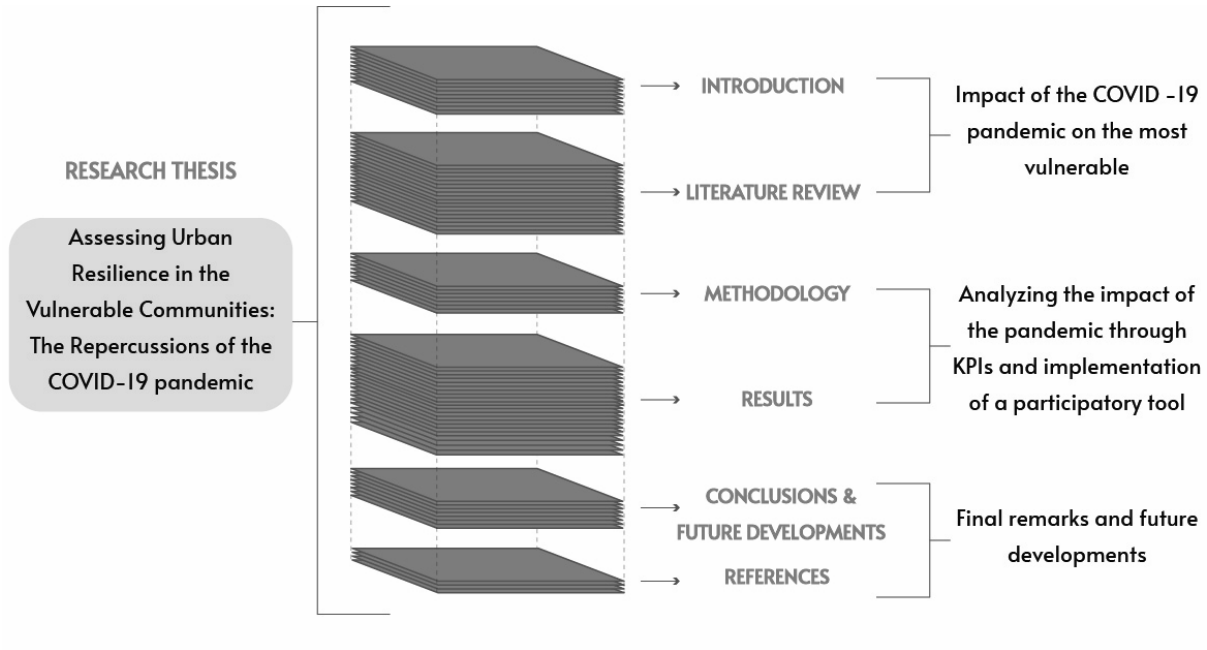


Figure 5: Thesis Structure

Chapter 2
Literature Review & Case Study Analysis

2.1 Theoretical Background.

2.1.1 How COVID-19 has transformed urban life.

Urban and territorial planning have been focusing on how to think cities based on their dynamics. This way of thinking implies all the ways in which a city could be disrupted by new elements and factors, as well as how the infinite number of networks that define the interactions between energy, materials, people, and information generate different levels and scales of complexity. However, this idea of understanding the city as a complex entity full of networks would also imply the capacity to foresee these transformations and disruptions (Batty, 2020). At the beginning of 2020, the world found itself in the unexpected position to face a global health event. The COVID-19 virus, a respiratory disease with an unexpected high contagious and mortality rate, arrived to unmask the unpreparedness of cities to face an emergency like this one. The dynamics of proximity due to global traveling and global supply chains, as well as the high population density in cities, only detonated the spread of the virus in an uncontrollable pace.

As health systems worldwide challenged to provide service to the growing number of infected people in addition to the worryingly number of deaths caused by the virus, governments and health authorities implemented rigorous measures to control the propagation. Meanwhile, citizens from all around the world had to comply a series of strategies like strict quarantine, social distancing, self-isolation changing the way people interact within the city (Dalia Elgheznawy, 2020).

In the short term, the emergency is expected to result in behavioral changes regarding how we interact with and within places as well as the unquestionable impact on urban economies all around the globe. Moreover, mobility and density became key concepts with an

important role in the spatial organization of the city as well as in the notion of urban health (Scott, 2020).

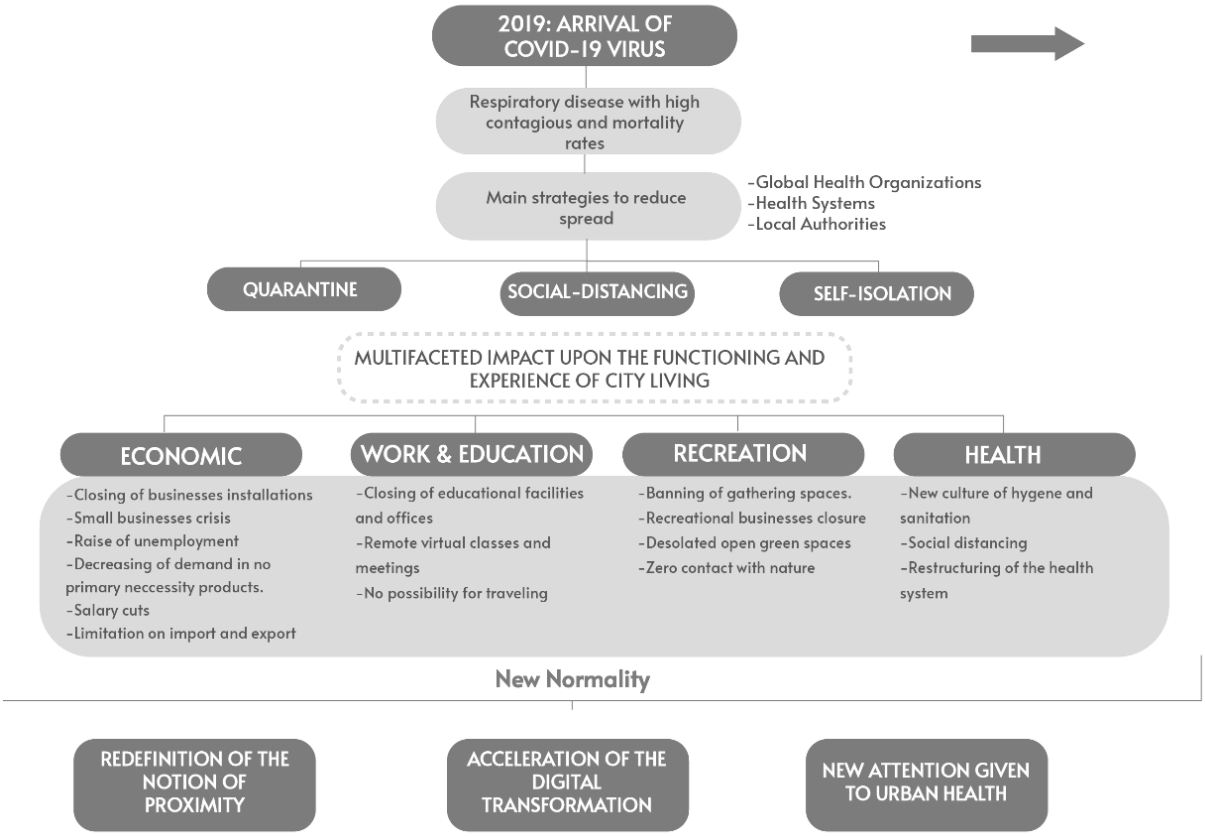


Figure 6: How COVID-19 Affected Urban Life. Source: Author

Historically, cities have pulled people into the system of search for employment, education, and new experiences as places of opportunities. (Lennon, 2021). The relationship between work and home has defined the flows within territories, being work the element influencing people's decisions on where to live, shop and recreate. To be in lockdown for an indeterminate period meant people had to start adjusting their routines to be carried out from their homes. Work and school began to be held online as well as recreational and sporting activities, leaving public spaces and infrastructures together with financial centers

and commercial areas non-functioning as well as the public transport system in disuse, in order to avoid human physical contact and any chance of contagion.

Consequently, the pandemic has conveyed a significant impact on the economy. During lockdown in the United Kingdom, approximately 80% of the social and economic establishments were closed and non-operating (Batty, 2020). Businesses began to go broke while the unemployment rate started to rise, introducing probably the biggest recession since 1709 leaving families and individuals in economic uncertainty.

Mobility and density played an important role in the emergency. During the pandemic, the transportation sector was the one who got affected the most. Unarticulated urban form and uncontrolled development resulting in narrow streets, congested junctions, overcrowded transport infrastructure is nothing by a trigger that spreads the disease (Raj, 2021). With the strict lockdown measures, governments saw themselves in the position to shutdown these facilities as a strategy to prevent social crowding but resulting in leaving millions of citizens that depended on public transportation without a way of mobilizing and therefore, affecting the livelihoods of this segment of the population.

On the other hand, how housing is located and designed also came to the spotlight. With the sanitary measures like quarantine that enhanced activities like telework and online learning, the quality and the right to decent housing has never been more important not only for people to feel more comfortable during these activities but for issues like mental and physical health. However, for people going through inadequate shelter conditions of that are in homeless situation, to comply with these measures became irrelevant if they are not able to access to housing and consequently to basic services to go through the pandemic in a safe, hygienic way.

The pandemic also highlighted the importance of open green spaces not only for physical, but also mental health. Lockdowns and quarantines unmasked the significance to pay attention to this issue as a vital element to also guarantee urban health. Modern cities with

a high population density faced the challenge to access to green areas nearby their homes (Raj, 2021) that are also big enough to respect the minimal social distancing measures. Recreational and sports activities began to be redefined in the daily lives of citizens and public parks and open spaces began to regain their importance in the urban environment.

The current crisis gave full attention to the pre-crisis "normality" in which the world unfolded itself before the virus came along, specifically on spatial and social inequalities across territories. The emergency brought an uneven impact across race, class, gender, age, and geography. It became evident that the present practices of local governments as well as the role of the planning systems left many cities and communities unprepared to cope with any type of crisis (Scott, 2020) having to deal with poorly designed neighborhoods, low access to green open spaces, unpreparedness of health systems forcing people to transform their entire routines to cope with the implemented measures and prioritize health above anything else.

2.1.2 The Digital Gap

One of the major transformations that the COVID -19 pandemic brought to the new normality was the acceleration of the implementation of digital tools and processes.

The digital era started essentially with the arrival of computers in the 1950's. Since this very moment this process has transformed all spheres of life into technology-friendly changing the way we work, study, communicate, shop, and even how people relax and entertain themselves (Tarpey, 2020).

On the other hand, digitalization allows countries to become more competitive and attractive towards citizens and businesses. Cities have played a crucial role in this transition as urbanization has been a major long term trend allowing cities to provide better life conditions, public services and create better scenarios for innovation, flourishment, and growth of businesses, and therefore, economic development. The Digital Single Market is expected to contribute 415 billion euros per year to the economy and create a huge number of new jobs for people. In the Digital World, citizens will have the opportunity to improve the right skills and enhance their chances to apply for good jobs as well as access to better public services that serve and interact better to provide more accountable, user-friendly services. (UIA, 2018). Digitalization has influenced almost all aspects of the economy from production to consumption. As a result, the economy has been transformed from a geographically limited economy to a real global economy, where businesses combine different digital technologies. (Acosta, 2020)

The current health emergency caused by COVID-19 transformed into a serious global and economic issue affecting both developed and developing countries at different levels. Governments from all around the world urgently mobilized in order to implement measures to stop the propagation of the virus. Concerning the new normality, people had to adjust their routines to carry on with their responsibilities and activities, in this process, digital tools like E-learning, teleworking, drones, robots played a leading role in the fight against coronavirus.

However, the pandemic has also exposed the existence of a digital divide among countries and communities. Issues began to emerge as some people struggled to comply with the lockdown measures due to the lack of digital opportunities to mitigate the crisis negative outcome and adapt to the new normality.

In the scenario of social distancing, lockdown and the new normal as consequences of the current COVID-19 pandemic, the digital transformation has been accelerated as one solution to avoid economic collapse. The pandemic forced many jobs to be performed

remotely and pushed companies to rely on digital technologies to address social distancing and adapt to the new normality. Even though digital tools that enable telework and online schooling, the pandemic forced to accelerate this adoption and implementation. As a clear example Restaurants had to rethink their businesses models during quarantine in order to stay afloat. Many traditional restaurants had to launch online delivery services by either implementing digital food delivery platforms, create their own apps or digitally enable resources to connect with customers and receive orders. (Acosta, 2020)

Healthcare systems also saw themselves in the need to quickly adapt for the clinical care delivery system. Hospitals transitioned from in site visits to telehealth focusing on telephone or video consulting, screening processes for COVID-19 were made available on a free - online platform and at-risk patients were sent to drive-through centers for in presence testing to maintain social distance as strict as possible. (Ramsetty & Adams, 2020) However, health professionals noticed that many of the patients were not able to access their online system.

The declined accessibility to information and communication technologies based on different societal and social factors was being exposed at a critical time in a public health crisis and worryingly there were no measures ready to address it.

Telehealth was implemented as a resource to close the health care gap to rural populations as a comfortable measure for people to keep receiving health care service without having to leave their homes, nonetheless, recent authors have raised the concern that technology may actually be widening the gap between groups both nationally and even globally due to recurrent social, economic and political factors. (Ramsetty & Adams, 2020)

Patients often seen in hospitals and free clinics raised concern within the health professionals regarding their physical access to internet services. For instance, the homeless population lacked reliable internet access outside of technology centers at the clinics and

most of the rural patients do not have access to internet in their homes at all. (Ramsetty & Adams, 2020)

On the other hand, access to the internet in many rural areas is non-existent or severely constrained which has been problematic for years, but arguably never has been more worryingly as during the COVID-19 pandemic, when getting online became mandatory for many people. This situation stresses the issue of brain drain of talent, skills, training/development, jobs/telework, lack of access to telemedicine, limitations of distance learning and lack of ability to employ precision agriculture technologies. (Litchifield, Shukla, & Greenfield, 2021)

The OECD (Organization of Economic Cooperation and Development) defines the digital divide is defined as the gap among individuals, households, businesses, and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICT'S) and to their use of the internet for a wide range of activities. This definition not only imply the differences among and within countries, but it also underlines that the digital gap is a multi-faceted concept covering several aspects like the access, use and performance of technology as well as diverse dimensions like the global, regional and social. (Aissaoui, 2020)

Literature and diverse studies have only focused on the digital disparities within a material framework; however, recent authors have distinguished three different types of levels: access divide, use divide and result/performance divide related to ICTs. (Aissaoui, 2020) This means that the improvement on access inequalities is a very needed but not sufficient measure to articulate the digital divide caused by the technological diffusion in society; cognitive skills and specific knowledge are essential for the use of these tools and the exploitation of their content.

The first level refers to the digital gap as the outcome from the inequalities in access to telecommunications such as the gap between nations or groups that have access to

technology and those who do not. In this situation, the liberalization of the telecommunications market is considered predominant in conditioning the digital divide. This level states that categorical inequalities in societies cause unequal distribution of the resources and therefore, access disparities.

The second level focuses on the digital skills of people and how ICTs are used. In recent years, attention has been given for a reconsideration of the digital divide's notion that goes way deeper the restrictive vision that stresses only the problem of physical accessibility. The first levels focus on the inequalities among internet users from the different social groups in the way they access telecommunication technologies while the second level talks about more complex conceptualizations of the divide by stating that the differential possession of digital skills is the most important factor. (Aissaoui, 2020)

This level can also be defined as the cognitive gap between internet users, differentiating those who can effectively search online and those who do not. In this case, efficiency depends on two elements: whether the requested task is performed or not and the time it takes to achieve the said task.

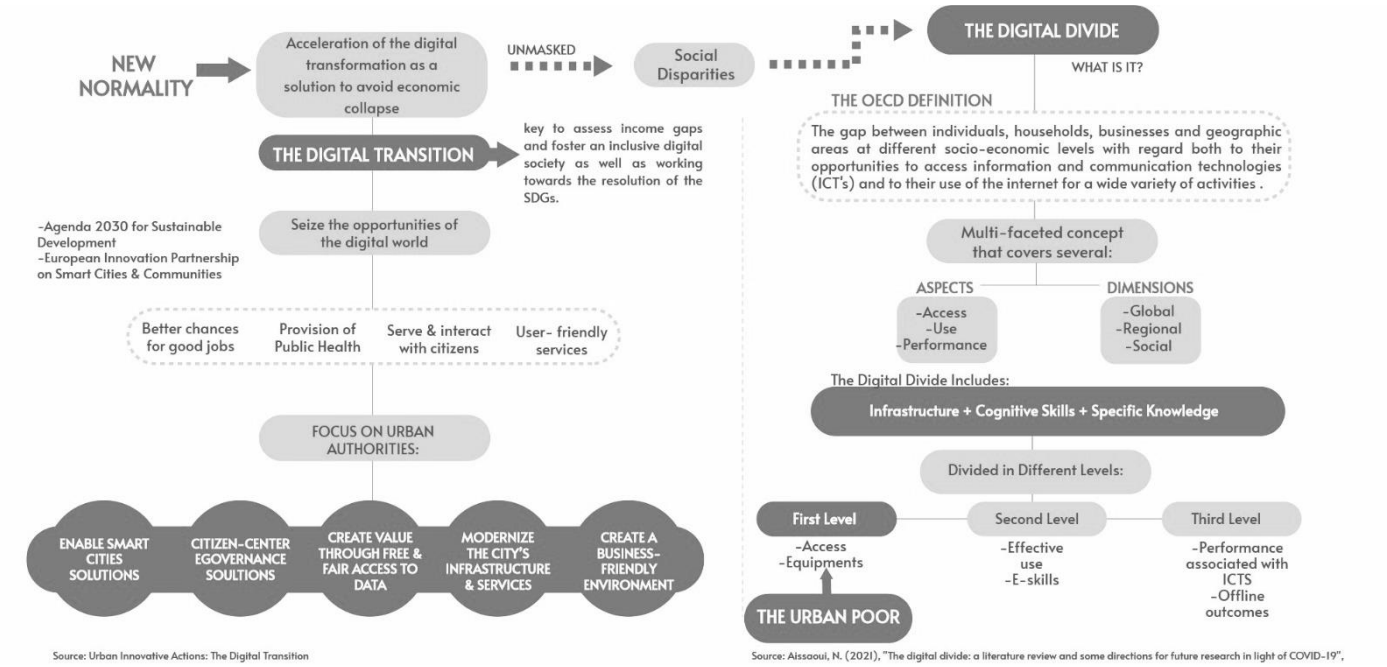
The current crisis has accelerated the need to reduce the existing inequalities and to obtain new effective digital skills. Even though a big part of the problem has been the access to ICTs, the transition to online learning and telework during the lockdowns has revealed the importance of skill in order to be able to use the digital tools. (Aissaoui, 2020)

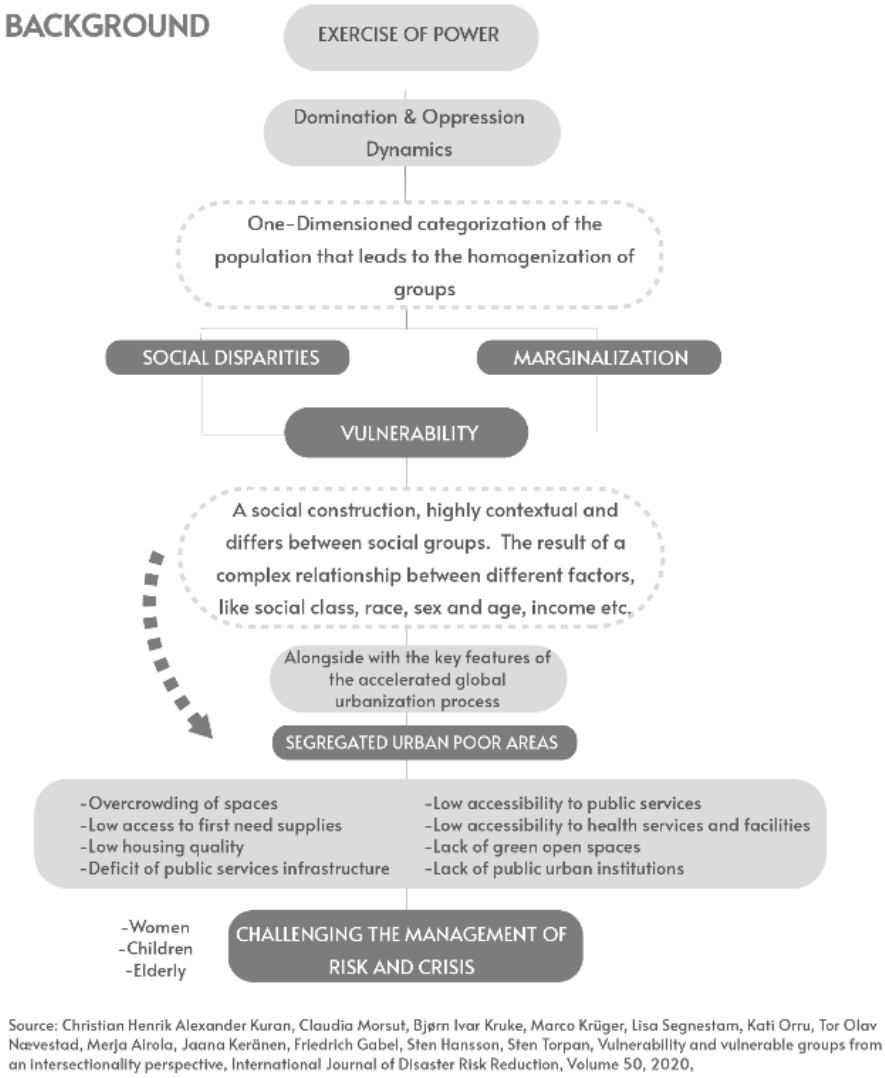
The third and last level refer to the difference in the ability to mobilize digital resource to achieve specific objects. The last means that even if the users have the same level of equipment and digital skills, they may not get the same returns from their internet use, in other words, the offline outcomes are not coherent to the online activity. These disparities can happen with two types of scopes: the first one refers to an aggregate level in which countries and territories diverge from information and communication technologies that contribute to the productivity of the country and therefore, the economic growth. And on the

other hand, in an individual perspective in which inequality expresses itself in terms of skilled and unskilled workers represented in their wage and economical remuneration.

In a crisis like the COVID-19 pandemic it is of vital importance to assess all three levels of the digital gap as they require different strategies and solutions, and they imply different segments of the population that reflect different levels and types of risks and vulnerabilities in order to comply with the implemented guidelines and adjust to the new normal.

2.1.2 The impact of the pandemic on the most vulnerable communities.





Source: Christian Henrik Alexander Kuran, Claudia Morsut, Bjørn Ivar Kruke, Marco Krüger, Lisa Segnestam, Kati Orru, Tor Olav Nævestad, Merja Airola, Jaana Keränen, Friedrich Gabel, Sten Hansson, Sten Torpan, Vulnerability and vulnerable groups from an intersectionality perspective, International Journal of Disaster Risk Reduction, Volume 50, 2020,

Figure 8: Social Vulnerabilities. Source: Author

The identification and assessment of vulnerable groups in the case of hazards or emergencies is an issue that today more than ever should be of vital relevance in any crisis and disaster risk management. (Kuran, Morsut, & Kruke, 2020) It is of high relevance to take into account that people have different levels of exposure to hazards, risk and vulnerability depending not only on social factors but on economic, geographical, demographic, and cultural factors as well.

Following this order of ideas, Kuran, Morsut and Kruke make a lot of emphasis in the importance of intersectionality to provide a better perspective of vulnerability and vulnerable groups as it represents the result of different and interdependent societal

stratification processes that result in multiple dimensions of marginalization (Kuran, Morsut, & Kruke, 2020).

In a general overview, countries and international organizations have defined vulnerable groups based on precrisis social, economic, and cultural factors and ignore the fact that these same elements usually perpetuate inequality, exclusion, and lack of access to and control over resources.

The intersectional theory stresses principally how the exercise of power, through intersecting domination and oppression, affects individuals who face multiple social inequalities, resulting in multiple sources of marginalization. This approach implies more than just the one-dimensional categorization of people that leads to the homogenization of groups and enhances the integration of different variables like sex, age, ethnicity, disability, immigration status, nationality, physical and mental conditions, among others. Vulnerability is then, a social construction that highly depends on the contexts and differs between social groups. It does not only depend on just one dimensions but is the outcome of complex relationships between different factors (Kuran, Morsut, & Kruke, 2020).

This new way of understanding vulnerability suggests challenging the current tendency in public policy to statistically categorize groups in terms of vulnerabilities to hazards, neglecting the differential and fluidity of the configuration between social groups, in terms not only of vulnerability but also resilience. On the other hand, it also represents a challenge for risk and crisis managers and policy makers to anticipate who might need help most urgently in each situation.

The United Nations has defined vulnerable communities as populations that live in poverty without access to safe housing, water, sanitation, and nutrition and those who are stigmatized, discriminated against, marginalized by society, and even criminalized in law, policy, and practice. These populations may struggle to fulfill their human rights, including

their rights to access health and social services. (UN, 2019) They live in environments of inequality where they are unable to thrive, feel safe and actively participate in all aspects of society.

On the other hand, David Madden, associate professor of sociology and co-director of the Cities Programme at the London School of Economics and Political Sciences, defines the vulnerable communities as the least powerful city dwellers, those who are relegated to the most deprived neighborhoods and buildings, required to labor in the riskiest conditions, and denied the most up-to-date technological and medical protections...space and place are highly stratified by race, class, gender, family structure, language, migration status, and other factors. (Madden, 2021)

For the purpose and objectives of this research thesis and following and intersectional approach, we will take into account the previous definitions in order to refer to vulnerable groups as communities living in environments of high inequality and low fulfillment of human rights where the access and availability of basic living resources are very limited as well as the access to health, social services, and economic guarantees. These populations are usually located in segregated urban areas deprived of technological and infrastructural protection and are usually inhabited by marginal and minority groups. These inequalities turn into vulnerabilities when facing hazards that can potentially cause harm and losses.

The COVID-19 pandemic has unmasked several health inequalities as well as redistributed and reorganized the meaning of risk and vulnerability. The current global urbanization processes imply that now, more than half of the global population is living in cities, this outcome has taken factors density to become a key feature of this urban phenomena. Even though density can become a positive factor regarding the agglomeration of economies as well as easier access to basic services and healthcare as consequence of proper investment in planning infrastructures, density can also have its downsides when it come to contagion and congestion, which are elements more often seen in poor urban areas and informal

settlements. (World Bank Group, 2020)

When density becomes overcrowding, it often increases exposures to diseases as agglomeration and tight physical contact become difficult to avoid, accelerating transmission. This, combined with poor housing conditions and household overcrowding makes shelter, social distancing, and lockdown measures almost impossible to comply with.

According to the World Bank Group, there are several factors that put the urban poor, especially those living in informal settlements at risk for contracting infectious illnesses like COVID-19:

1. Overcrowding conditions
2. Limited access to basic services like water, sanitation, and health services.
3. Reliance on crowded transport services
4. Specific aspects of working in informal sectors: no social protection to fall back on

These are a few of the challenges that face, even before the pandemic, populations and communities that live in urban poor and segregated areas of the territories. With the COVID-19 pandemic, opportunities for containment and treatment of the citizens become very difficult to provide given the issues of reaching and isolating people affected in these areas, leaving them in a state of high vulnerability not being able to access to treatment and correct isolation measures.

The lack of water and sanitation services has set back the efforts to stop the propagation of COVID-19 where hand washing and strict hygiene in general are advised as the primary defense against transmission. Additionally, reliance on crowded transport services rises the risk of contagion as well as the absence of labor regulations and social protections from informal jobs (World Bank Group, 2020).

All of these social disparities result in uneven urban development that leads to concentrated poverty, segregation and environmental racism often followed by gentrification.

Lockdown measures forced citizens to stay for an undetermined period of time in their homes. However, while some people had the possibility to remain comfortably in their hommes, low-income residents who do not have countryside properties or big houses were abided to stay in small and crowded apartments as they are not able to afford larger and safer homes (Cole, et al., 2020).This broadens the social gap by separating the segment of the population who had the freedom to choose where to spend the pandemic in a comfortable, safe spaces and mobilize easy in private vehicles from those who do not have other choice but remain in conditions that even without the pandemic, where characterized by poor health.

The pandemic scenario not only has stressed that structural inequalities result in health inequity but that differences among material wealth and mobility do not only express the level of commodity during lockdown but also the likelihood of people to get sick and die. COVID-19 has unmasked inequitable burdens of morbidity and mortality that depend on social factors. Marginalized populations seem to be more likely to get sick and die due to inequalities because of the health conditions of the environments these communities unfold, in both living and working conditions.

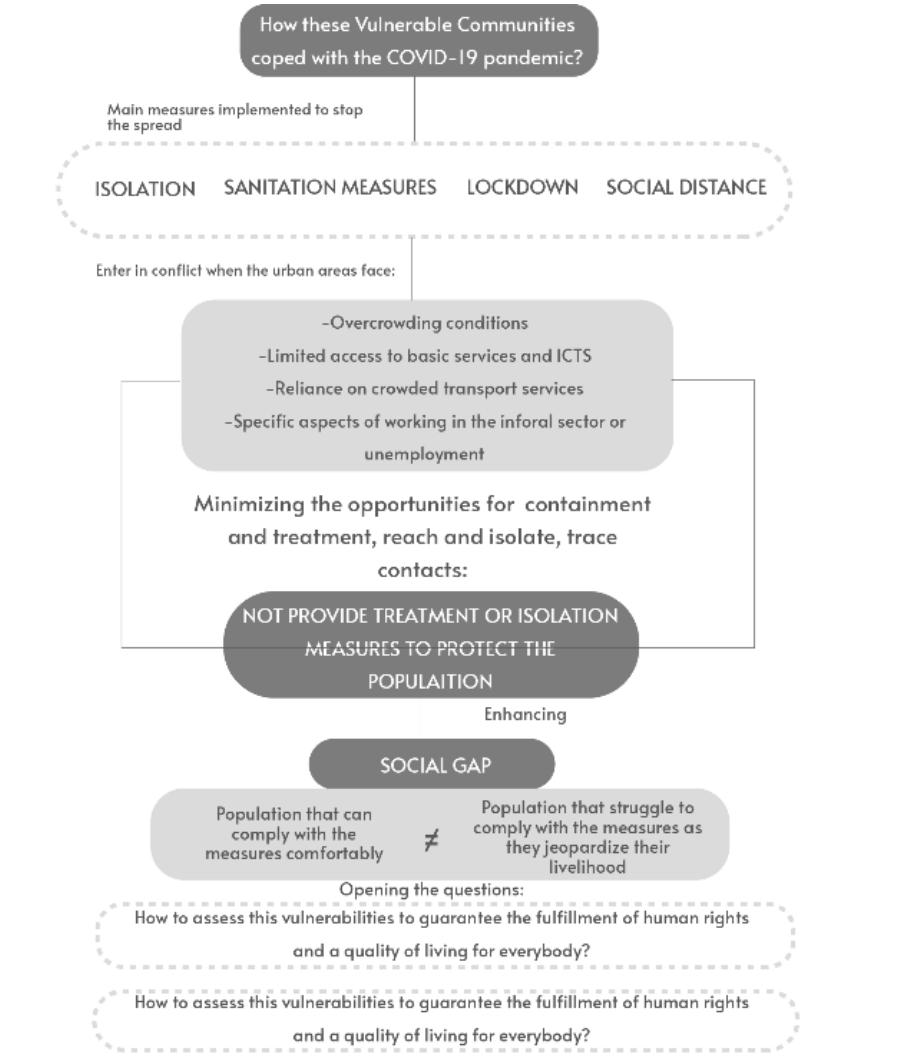
During the pandemic, differences in working conditions and status have led to intense outbreaks of the virus among marginalized social groups including migrant and frontline workers, who usually fill low wage but essential jobs such as sanitation workers, people who work at supermarkets and grocery stores, public transit workers etc.

Poor working conditions usually overlaps with residents long suffering from environmental injustices. For instance, in Chelsea, Boston, patterns of socio-spatial segregation have led

to racial and ethnic inequities during COVID-19. Due to the proximity of the area to a major airport, citizens face high levels of air pollution that have caused the residents several respiratory conditions leading this people to become at-risk patients to suffer from complications from the virus. Consequently, the infection rate in Chelsea is 4 to 5 times higher than the state rate and most infected people belong to Latin American and African American communities who fill frontline jobs. (Cole, et al., 2020)

Lockdown for low-income residents has signified an obstacle to pay rent as they often deal with lost income or unemployment due to the economic decline. On the other hand, less privileged residents struggle to access to health care services and facilities in the area they live facing greater risks when facing a sanitary emergency.

Urban inequalities are also expressed in the lack of accessibility to basic food and essential needs, usually putting people in the position to travel long distances or to rely on urban public institutions for social services, free lunch, childcare and access to internet. With the pandemic, and the delay of early preventive measures, people who relied in these public services were left adrift to meet the needs these places provided. (Cole, et al., 2020)



Source: Helen V. S. Cole, Isabelle Anguelovski, Francesc Baró, Melissa García-Lamarca, Panagiota Kotsila, Carmen Pérez del Pulgar, Galia Shokry & Margarita Triguero-Mas (2020): The COVID-19 pandemic: power and privilege, gentrification, and urban environmental justice in the global north, Cities & Health, DOI: 10.1080/23748834.2020.1785176

Figure 9:COVID-19 & The Vulnerable Communities

2.1.3 The Importance of Urban Resilience After the COVID-19 Pandemic.

Promoting urban resilience in the framework of environmental, socioeconomic, political uncertainty and risk has captured the attention of academics and decision makers across disciplines, sectors, and scales (Meerow, Newell, & Stults, 2015). Now, with the COVID-19

pandemic, resilience has become an important goal for cities, specially, for communities facing the higher level of vulnerability and risk also becoming a highly relevant approach to deal with future climate and health precariousness.

The concept has been defined and used across disciplines and fields; however, it has lacked consistency that has permitted to foster multidisciplinary scientific collaboration (Meerow, Newell, & Stults, 2015) however, this vagueness makes urban resilience difficult to engage with in the practical world and develop a set of replicable indicators in order to be measured.

From the different definitions from different fields and perspectives, four pillars can be identified: Resisting, Recovering, Adapting and Transforming meaning that these concepts can be transformed into a conceptual tool where a resilient urban system will always be evaluated and validated for its capacity to resist, maintain, recover, adapt or transform in the framework of disturbances whose impact tends to create instability in the system's equilibrium (Ribeiro & Goncalves, 2019).

Following the above mentioned and understanding urban resilience as a malleable interdisciplinary word, we will refer to urban resilience as "…*The ability of an urban system - and all its 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."*(Meerow, Newell, & Stults, 2015)

Urban resilience is a concept that empowers community engagement and strategic plans and programs that allow a deeper understanding of risk and hazards as well as strengths and opportunities to overcome social vulnerabilities and problems. It enhances community engagement and social participation approaches from consulting to co-creation. It also expresses an opportunity to create synergies across different programs for climate adaptation, community empowerment and urban regeneration. It is a synthesis framework

that adds to the progressive efforts of territories to become more socially innovative, attractive, and inclusive to its diverse communities (Resilient Europe; URB ACT; European Union, 2016).

Communities are vulnerable to shocks that can compromise their structures and impact their resilience. When we talk about shocks, we refer to sudden events of high impact to the city's structures and dynamics. A resilient city holds the capacities to change into a different state after a disaster while restoring its functions and services. On the other hand, a city that is not resilient has limited capacity to recover and it is also related to factors like high poverty, devastated natural environment, safety conditions, social factors, etc. (Resilient Europe; URB ACT; European Union, 2016)

It is of vital importance for communities to have the ability to self-organize and mobilize their skills in order to source new opportunities and innovate in the aftermath of a disaster. On the other hand, for communities to be resilient, sense of belonging and identity are crucial. A strong cultural identity its often translated into collective honesty. Social resilience is then, the ability of communities to absorb shocks with and within their social infrastructures, adhering to social ties and identities. Moreover, social resilience also implies the solidarity in which a community faces a crisis resulting in a cohesive society. (Resilient Europe; URB ACT; European Union, 2016)

2.1.4 Engaging the Communities: A Participatory Approach.

Nowadays, community engagement has become crucial for the well-functioning of modern democracies. To enhance constructive bonds among communities and institutions is necessary in order to achieve more equitable, sustainable decision-making and improve

the liveability of citizens. To engage the communities means to enable a better understanding of the needs and aspirations of territories and social groups. (Hussey, 2019)

Community engagement has become of vital importance not only as it deepens democracies all around the world but because it builds and sustains cohesive communities leading to improved outcomes that are better informed and truly meet the needs of the community. Moreover, it also enables local governments to promote sustainable decisions prioritizing legitimacy and transparency and it drives social transformation as it enables advocacy, empowering citizens to share their opinions and get involved with the issues and challenges that impact their everyday lives. (Hussey, 2019)

Public participation prioritizes the visibility and understanding of current issues, empowering communities to get involved and have a said over decisions that affect them as well as their neighborhoods, cities, territories. To provide a space for community members to contribute to decision-making results in enabling governments and public organizations to listen and demonstrate the impact of community contribution. (Hussey, 2019)

Design Thinking

Design Thinking, as a participatory approach tool, has risen considerable attention during the last decade as it presents the methodology to solve problems, simple and complicated ones, based on flexibility and resilience. (Mensonen & Hallstrom, 2020)

By engaging people during the development process, its perceived as a tool with the capacity to create new insight based on user needs and resource efficiency. This results in the enhancement of the sense of ownership over the forthcoming solutions and enthusiasm regarding their implementation leading to the easier and better acceptance of decisions by

the end users. (Mensonen & Hallstrom, 2020)

Its popularity and effectiveness also rely on its main attributes that focus on:

-Collaboration
-User-centeredness and Involvement
-Problem-solving
-Iteration and Experimentation

Design Thinking is then, a problem-solving approach that starts with a deep understanding of the needs of the members of a community achieved through studying and interacting with that same community. It allows urban planners to identify key challenges that truly matter for the population, work with the different stakeholders and citizens in order to co-create solutions and possible development paths that can be rapidly tested and iterated by incorporating latest available technology to come up with innovative solutions that address the problems facing the world today. (Mensonen & Hallstrom, 2020)

The process is divided into three main stages: (Talent Garden, 2021)

1.Explorative Stage

Step 1: Immersive Research

The starting point of this participatory tool is to develop immersive research to identify the different urban challenges that have the greatest impact on people's lives in order to address the resources in an efficient, impactful way. To interact with residents and members of a community is an example of an immersive approach to discover the most significant concerns and define problems that need solving.

Step 2: Deeper Dive

Once the challenges have been addressed, to gain a deeper understanding of how these issues impact the population. These studies are possible through available technology such as mobile ethnographies, lifelogging cameras, digital diaries and big data analysis. This analysis results in previously undiscovered insights into new perspectives of the issues that have been identified and how these challenges impact not only residents but also stakeholders.

2.Ideation and Creation of Alternatives (Co-Creation Process)

Step3: Co-Creation Process

After the deep dive to understand the actual needs of the community and its residents, the design thinkers can bring together relevant stakeholders to co-creation initiatives to enable discussion and generate possible solutions.

3.Iterative Testing and Implementation

Step 4: Prototype

A critical element of design thinking is to experiment and prototype with the resulting ideas and concepts before they can be tested in the community. In this step, possible scenarios can be simulated before full scale projects are launched.

Step 5: Test

During testing mode, the stakeholders are asked to give feedback about the prototypes (the solutions) developed but at the same time, it's an opportunity to gather further knowledge about the stakeholders themselves. The results obtained in this stage are often used to redefine problems and to modify and refine prototypes, in a circular process that should finally end with the solution that works well for those users in that context.

Step 6: Implement

This is the stage when finally, the solution becomes real and is launched and tested on the real world. Many designs will never reach this stage. While the design may be outstanding,

perhaps it didn't solve the user's needs in the way you expected. Or perhaps some steps back had to be taken and rework the idea. It is important to mention that the process is not linear.

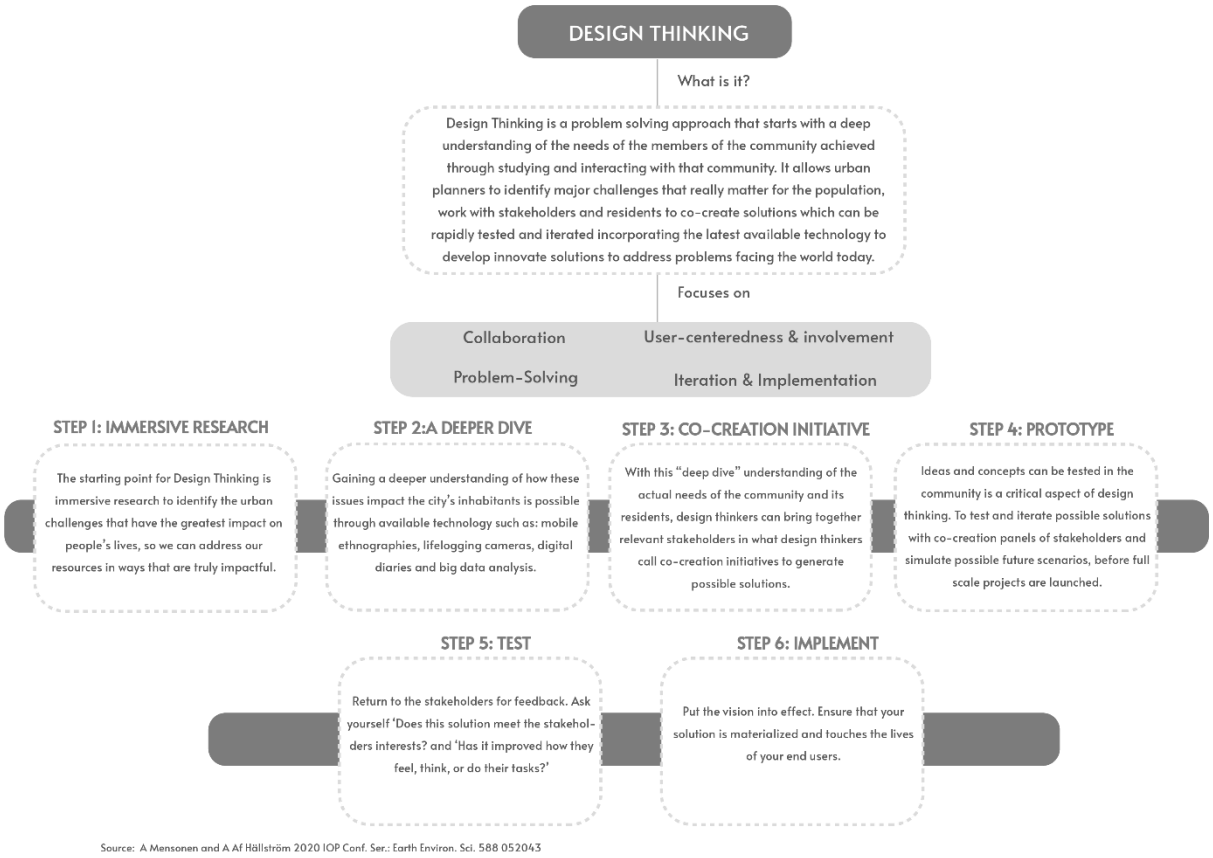


Figure 10: Design Thinking. Source: Author

2.2 Case Study Analysis: How European Cities Assess Social Vulnerabilities.

2.2.1 Helsinki, Finland

In 2017, the city of Helsinki, Finland launched the new City Strategy under the slogan of the most functional city in the world based on offering the best conditions possible for a good urban life for the resident population, businesses, and tourists. (Wahba & Vapaavuori, 2020)

A functional city according to Helsinki's parameters means that governance, as well as service delivery systems work effectively and simultaneously along a range of dimensions and systems, meaning, a city that delivers high-quality public services for all, creates economic opportunities, and enhances community participation and inclusion.

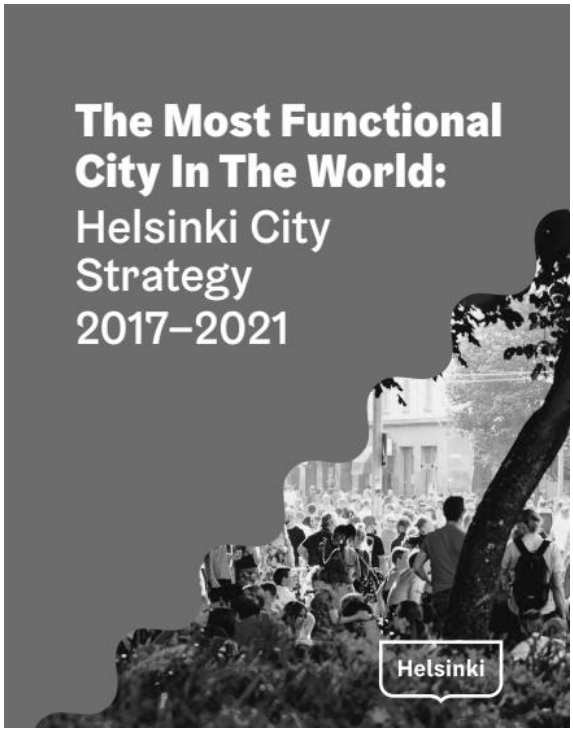


Figure 11: Helsinki City Strategy 2017-2021

Its management approach is based on focusing every decision on functionality, safety and openness leading to a high level of trust between the citizens and local government, which facilitates the ability of the city to lead and operate effectively during time of crisis. (Wahba & Vapaavuori, 2020)

The functional city approach focuses on three main pillars, all of which, during the COVID-19 pandemic, proved essential and critical to assess the crisis. The first pilar corresponds to Smart City, which focuses on the digital transition and how territories and communities can rely more on technology and innovation in order to provide services in a more efficient way. Secondly, Helsinki prioritizes Inclusivity in which community participation is at the center of decision-making. Finally, to motivate a city based on Sustainability constitutes the third pillar to tackle issues like climate change and assess elements like carbon neutrality. (Wahba & Vapaavuori, 2020)

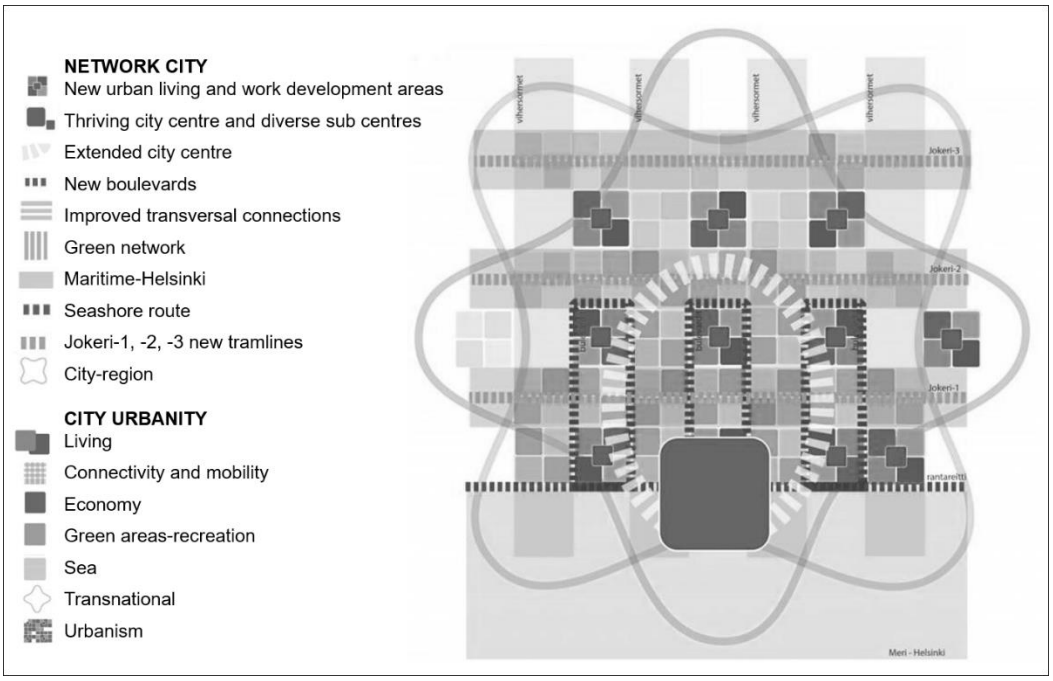


Figure 12: Helsinki Functional City Strategy

Focusing on the second pillar: Inclusivity, Helsinki proposes the following core motives for enhancing stakeholder participation in urban decision-making: (Municipality of Helsinki, Finland, 2017)

1. Legitimacy
2. Accountability
3. Representation
4. Responsibility

5. Transparency

Models of participation in Helsinki:

Traditional:

- Vote in the municipal elections every four years
- Take part in the resident meetings held by the mayor in different neighborhoods four times a year. In the meetings there are also city experts from different fields and the themes vary according to the neighborhood.
- City planning resident events where the current city plans are presented and discussed.

Digital tools:

- Online platforms where citizens can voice their opinions, participate, and make initiatives to the city authorities.
- Online platform where citizens can leave ideas and observations in a map.
- Online platform where citizens voice their opinion
- Online platforms discussing city planning topics
- The younger people have their own online participatory platform.
- Discussion platforms and channels can be found through social media.
- Online Citizens initiatives related to the city council's scope of responsibilities at least once a year.

Participation and Interaction Model in Helsinki:

Initiated as a part of the reformation of the management system in Helsinki
. It is based on the communal laws of participation regulations, and it aims to better the participatory process and operations to be more citizens initiated by engaging citizens

themselves, organizations, businesses, and other stakeholder groups to interact and participate. The Helsinki city board decided about this participation model in the end of 2017 as part of the new city plan implementation of the functional city for the years 2018-2021.

The model defines the main principles for the participation in Helsinki:

1. Utilization of the know-how and expertise of individuals and communities
2. Enabling of spontaneous activities
3. Creation of equal opportunities for participation.

The new model brings even more means of participation channels include for example:

- Feedback and initiatives,
- Different citizens groups councils like the council for the elderly people or
- Equality committees
- Frameworks for volunteer work
- Possibility to use the public spaces
- Open data policy
- Digital participation channels

Some distinctive features in the model are the regional participation and participatory budget-planning. The regional participation in practice means that each of the city districts or a housing area has a local worker in the form of a city coach assigned to the area whose main field of work is to help citizens to promote initiatives and development proposals They also promote cooperation between the citizens and other communities in the areas.

The participatory budget planning citizens can vote the use of around 4.4 million euros from the city budget on citizens proposals.

Another innovative participation aspect included in the model is the participation game, a board game aimed mainly to the city employees to help them plan and discuss the operations and services and how they could be planned and executed in an even better cooperation with the citizens. (Municipality of Helsinki, Finland, 2017)

2.2.2 Paris, France

The 15-Minute City

The 15-minute city concept is a new urban planning model created in 2016 by Carlos Moreno, a specialist in intelligent control of complex system, as a new people-centered model addressing the ideas and theories stressed by Jane Jacobs. This model was adopted by the city of Paris within the initiative called "Living Smart City" by mayor Anne Hidalgo.

This model stresses that within an urban area, the time spent for people to reach and access the different nodes that offer diverse types of services and activities should be a priority during city planning. Supported by policy implementation, it should be possible for citizens to reach essential urban amenities infrastructure and opportunities comfortably by walking or cycling in a timeframe that does not exceeds the 15 minutes. Following this order of ideas, the demand for the use of private vehicles is discouraged, creating rooms for opportunities to create walkways and bicycle lanes. Therefore, this urban model essentially looks to change urban planning focus on vehicular flows that result in "gridlocked" cities to one that prioritizes liveability and urban health by promoting proximity. (Bibri, Jones, Chabaud, & Moreno, 2022)

According to Moreno, based on the previous concept, in order to structure a number of nodes within a city, these need to follow four key characteristics that are crucial to enhance

urban liveability: (Bibri, Jones, Chabaud, & Moreno, 2022)

1.Proximity
2.Diversity
3.Ubiquitousness
4.Density

Regarding Diversity, the model stresses the importance of accommodating residents from different backgrounds in order to enhance "Cultural Vibrancy" while at the same time guarantee the diversity of urban structures and drive their maximum utilization by ensuring that these structures as well as infrastructures and elements can be used for multiple purposes.

Talking about Density, it is important for cities to focus on having an optimal number of residents as it would facilitate quality resource and service provision, decreasing over-consumption or under-utilization of these same resources.

The Ubiquitousness principle stresses essentially the need to supply for all urban geographies, therefore, to provide urban services, structures, and infrastructures available for everyone at an affordable cost.

The last key dimension is Digitalization, which focuses on the role of digital technologies to influence how cities work resulting in a better delivery of services as well as provide value-producing opportunities. (Bibri, Jones, Chabaud, & Moreno, 2022)

Figure 13: Paris '15 Minute Cityl Scheme

The COVID-19 pandemic has brought the need to rethink how we plan cities and come up with new urban planning concepts. The 15-minute city focuses on promoting social dimensions, urban proximity, and diversity through the motivation of technologies use. This model stresses aspects like social distancing, work from home concepts, reduced travel movements based on enhancing more liveable and human scale cities, responding coherently to the "new normality" dynamics that have been established with the sanitary emergency. (Bibri, Jones, Chabaud, & Moreno, 2022)

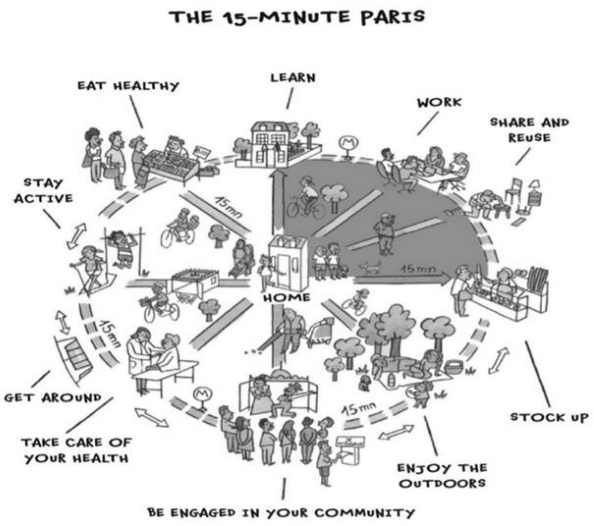


Figure 14: The 15 Minute City Spatial Scheme

2.2.3 London, United Kingdom

City Resilience Strategy

London is known for being a global city with an open economy being also exposed to continuous international, regional, and local change. For the last 15 years, London has focused crucial efforts to develop a world-class multi-agency emergency response infrastructure, leading the city to shape a broad and wider view of what resilience means. (Greater London Authority-City Hall, 2020)

Through the London Resilience Partnership, the city has structured strong emergency plans which have turned vital for the resilience of the city. This partnership reflects the value of resilience throughout all levels of city governance, from community engagement and empowerment in order to drive local resilience, through policymaking based on wellbeing, sustainability and good worth. (Greater London Authority-City Hall, 2020)

Figure 15: London's City Resilience Strategy 2020

In 2020, the city of London launched its first Resilience Strategy for the year 2050. This document consists of the identification of the challenges that the city faces, followed by the presentation of a series of actions that must be taken over time to ensure resilience for residents and the description of specific projects to achieve the action's objective. It is designed to highlight policy activity that already contribute to the building of the resilience and make an analysis to determine where more work should be carried out.

For the development of the city strategy, several challenges likely to affect London were identified. To address shock and stresses is a consistently response to a holistic approach for communities, businesses, and governance to manage risks and vulnerabilities in order to promote long-term resilience. (Greater London Authority-City Hall, 2020)

In this first stage, the aim consisted in looking specifically at the long-term shocks and stresses that are more likely to affect the material wellbeing of the city between now and 2050. This study was developed through discussion with stakeholders, a review of the risk data using 100 Resilient Cities tools and a review of the London Risk Register.

The City Resilience Strategy focuses essentially on the long-term resilience challenges facing London. To manage these types of issues that are likely to impact the city until 2050, a more innovative approach from the traditional risk management approaches was needed. Therefore, three cross-cutting opportunities were identified based on the objectives stressed out in the Preliminary Resilience Assessment, in order to achieve the expected vision for a more resilient city. (Greater London Authority-City Hall, 2020)

These three resilience opportunities are highly interconnected, and they imply a vital synergy between them as each initiative and strategy can link to more than one resilience opportunity and can deliver multiple resilience benefits. On the other hand, each opportunity calls for a multidisciplinary approach in which different disciplines come to

interact in order to came up with the most complete analyses and the most accurate solutions. (Greater London Authority-City Hall, 2020)

To draw the strategy, an analysis of the existing GLA policies that stress resilience in London was made. This provided an overview of the city's resilience status at the current time and gives a scenario of the level of risk London faces.

Then, the document addresses a set of steps that could help the city to tackle these challenges by presenting projects that could be done focusing on building cross-cutting resilience with a number of different partners. These projects collectively contribute to overall city resilience as they focus on different areas (Greater London Authority-City Hall, 2020). Moreover, they have been essentially divided into three branches:

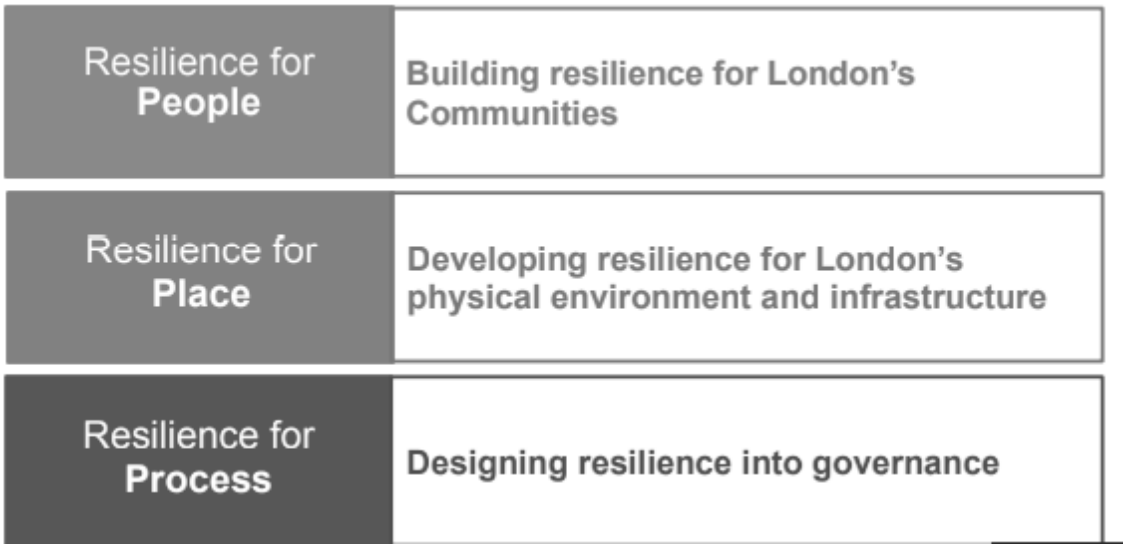


Figure 16: Resilience Opportunities. London's City Strategy

1.People: projects aimed at promoting and supporting community resilience by preparing people for any disruptive event.

-Action 1: Provide first aid education to citizens.
-Action 2: Establish a network of cool spots to help residents deal with high temperatures during heatwaves.
-Action 3: Promote ways of decreasing water wastage.
-Action 4: Mitigate food insecurity by understanding London's food supply and the impacts of a disruption.
-Action 5: Build resilience in communities by developing ways of communicating risk to the public.

Action 6: Use culture and theatre to collectively prepare for emergencies.

2.Place: Projects that develop environmental resilience and resilient infrastructure for citizens.

-Action 1: improve London's underlying water systems to increase water recycling.
-Action 2: Scope the development of a framework for Meanwhile Use in London.
-Action 3: Develop common standards and support for responsible data sharing and joined up data for London.
-Action 4: Improve London's ability to respond to the consequences of a cyber emergency.
-Action 5: Improve the resilience of London's infrastructure systems and prioritize investment using data.
-Action 6: Identify practical steps to achieve ambitions for a sustainable London.
-Action 7: Transform the existing housing stock to prioritize safety.
-Action 8: Understand and promote business adaptation and resilience.

3.Process: Projects that focus on enabling London's systems of territorial governance to continue building resilience.

-Action 1: Develop agile GLA governance to support adaptive, collaborative, inclusive and sustainable policymaking.
-Action 2: Expand the agile city governance model to support and adaptive London-wide approach to city resilience.
-Action 3: Expand city collaboration on counter terrorism preparedness through the CTPN network to keep cities safe.
-Action 4: Integrate London Resilience Partnership risk management process and policy planning for future risks.
-Action 5: Develop a model to understand the cost of disruptions to London and inform policy decision making.
-Action 6: Support data-focused approaches to enable adaptive policymaking in a changing city.
-Action 7: Understand the social impacts of an economy dominated by digital transactions.

Chapter 3
Methodology

3.1 Phase I: Indicators Selection

Figure 17: Phase I Methodology. Source: Author

The COVID-19 pandemic brought considerable attention to the way cities unfold and how the different urban systems interact with each other, unmasking a series of discords between them resulting in social, economic, and environmental vulnerabilities that put at risk communities challenging not only their accessibility to opportunities but also their physical and mental wellbeing. The pandemic has shown that cities lack a clear multidimensional risk assessment methodology that is useful for disaster collection and analysis not only to enhance urban resilience but also to prevent disruptions before they happen.

Today, there are global guidelines created by high level international institutions like the UN and the WHO meant to pilot countries into sustainability, resilience, and equity. However, when in practice, these tools are not enough to prevent as much damage as possible. These guidelines like The Sendai Framework for Disaster Risk Reduction and the Sustainable Development Goals serve as the baseline guide for countries and cities to prepare for crisis, however, they awake the need of a methodology for understanding the risk and hazards of each specifically urban context that can become potential disasters as well as implement integrated measures that efficiently tackle economic, social, environmental, and political spheres as a transdisciplinary approach.

This research thesis follows the investigation methodology previously proposed by the Post Un-Lock Project based on the analysis of the territorial response capacity of cities and communities to sudden external stresses. This methodology aims to develop and evidence-based assessment framework for assessing the impact brought by the COVID-19 pandemic in the vulnerable communities in order to:

- Analyze the urban environment in relation with the accessibility to opportunities and a good quality of life.
- Provide objective results to address policymaker
- Promote a bottom-up approach at the local level

This investigation methodology has as starting point the decision-making model proposed by the MOLOC project based on the structuring of Key Performance Indicators (KPIs) to analyze the different impacts, changes, and dynamics in a territory at the neighborhood level thinking also in presenting a methodology that can be easily replicated in all contexts.

The KPIs 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 project. These Indicators should express as precisely as possible to what extent a purpose, objective or standard has been achieved or even exceeded. The result is a system based on multi-criteria indicators to support decision-making and to evaluate proximity at the local level.

3.1.1 First Selection

This research takes as starting point the work done by Alice Borsari in her contribution to the Post Un-Lock project.

The work done by Alice presented a preliminary set of indicators structured through the

development of three different stages: A pre-selection process, feedback, and then a final selection. The result was a list of 15 post-covid indicators that are relevant to the research question, are scale appropriate for the local level, there is data available and finally its possible to calculate and measure them.

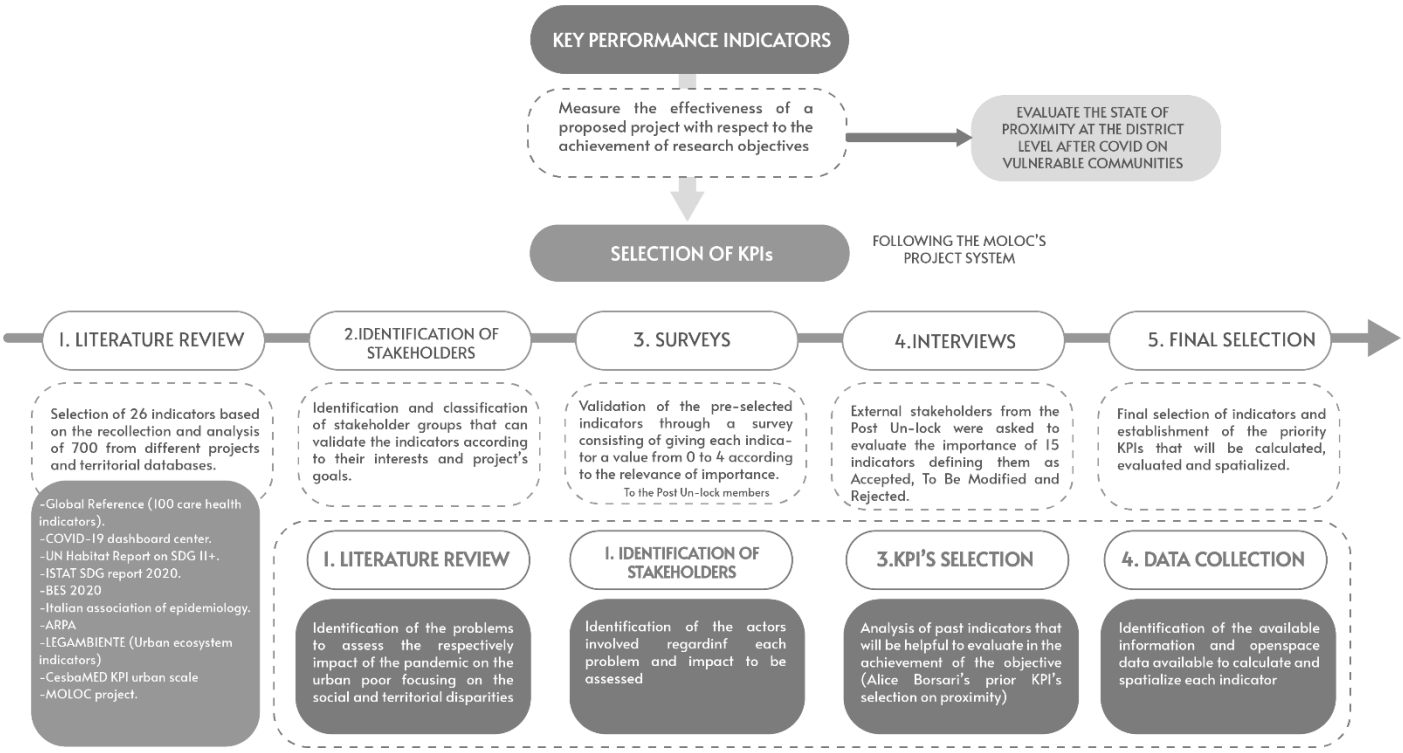


Figure 18: Selection of the KPIs. Source: Author

Previously Post Un-Lock's Final Selection of Indicators:

1. Availability and proximity of services of general interest to residential buildings
2. Incidence of urban greenery on the waterproof surface
3. Availability of urban green spaces
4. Residential population density
5. Mental health indicator
6. Intramodality of the urban transport system
7. Consistency of the network of cycle paths
8. Density of pedestrian traffic areas
9. Time dedicated to mobility

10. Domestic water consumption
11. Waste: production of municipal waste
12. Territorial density index
13. Total average annual consumption of thermal energy for the operation of residential buildings
14. Total average annual consumption of electricity for the operation of residential buildings
15. Greenhouse gas emissions from the energy used for the operation of residential building.

As this research thesis focuses on the assessment of urban resilience in the vulnerable communities and the impact the pandemic had on them, new indicators that focus on this research question need to be structured. Therefore, a similar methodology was followed in order to formulate new indicators that fit better to the aim of this work.

Literature Review

The first step was to carry out a literature review to understand specifically the issues that affected the most the vulnerable communities.
The following table is the recollection of identified problems gathered by extensive research of articles, journals and reports that stress the main struggles that the urban poor had to deal with during the COVID-19 pandemic.

	IDENTIFIED PROBLEM	INDICATOR
1	Overcrowded neighborhoods	Population density
2	Low housing conditions	Physical conditions of the residential units
3	Low residential building area per person	Residential Density
4	Many people living in a same household	Amount of people living in the same household

5	Deficit of basic public services (Water, Electricity, Gas, Heating System, Waste Disposal, Internet)	Availability of basic public services
6	Social marginalization (Ethnicity, Culture and Religion)	Ethnic, cultural, and religious orientation of inhabitants
7	Low income and Unemployment	Average monthly income and unemployment rate
8	High COVID-19 contagion and mortality	Contagion density and mortality rate by age group
9*	Low accessibility to health services and facilities	Accessibility and proximity to public and private health facilities in the area
10	Poor working conditions due to informal jobs	Inhabitants that have informal jobs
11	Proximity to environmental hazards	Proximity to environmental hazards
12*	Low of access to basic food and essential needs	Availability and proximity to basic food and essential needs supplies
13	Closure of urban public institutions	Availability and proximity to urban public institutions
14*	Lack of efficient urban public spaces	Availability of efficient urban public spaces
15*	Low coverage of public transport	Intramodality of the urban transport system
16*	Low proximity of services of general interest	Availability and proximity of services of general interest
17*	Lack of green open spaces	Availability and proximity of green open spaces
18*	Low community involvement in urban planning activities	Community involvement in urban planning activities

Table 1: Identified Problems of the Vulnerable Communities During the Pandemic. Literature Review

Due to time limitations, the survey was not able to be carried out in order to receive feedback from the stakeholders. The pre-selected indicators were chosen based on their potential to

give a complete analysis of the consequences brought by the sanitary emergency specially in communities and territories that face certain types of vulnerabilities and disparities.

After this study, an analysis of what indicators from Alice's work responded consistently and were useful to assess any of the identified problems.

Stakeholders

Having listed the potential KPIs based on the issues identified, the different actors that could have direct or indirect interest were determined. This step is crucial as it signifies the different influences in the decision-making process.

Stakeholders are defined as an individual or group that has an interest in any decision or activity. In order to identify whether an individual or group could be considered a stakeholder or not a series of question are needed to help determine their role within the projects or decisions:

- To whom does the project have legal obligations?
- Who might be positively or negatively affected by the project's decisions or activities?
- Who is likely to express concerns about the decisions and activities of the project?
- Who has been involved in the past when similar concerns needed to be addressed?
- Who can help the project address specific impacts?
- Who can affect the project's ability to meet its responsibilities?
- Who would be disadvantaged if excluded from the engagement?
- Who in the value chain is affected?

After answering these questions, a categorization process needs to be done to clarify the type of interest each stakeholder might have in the project as well as the type of knowledge and support they can provide in the decision-making process.

Stakeholder	Group	Level	Typology	Resource
Name of individual or group	Administrative actors, Support actors, Academic actors, Technical actors.	International, National, Regional, Local	Political interest, General interest, Experts, Special interest, Economic interest	Cognitive, Economic, Political, Legal

Table 2: Categorization of Stakeholders

3.1.2 Final Selection

The final list of post-covid indicators was structured based on two final elements:

- The facility to find complete and updated data in order to calculate it and measure it.
- Its support and level of relevance based on global guidelines like the Sustainable Development Goals.
-

Figure 19: Sustainable Development Goals: 17 Goals. UN

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet,

and ensure that by 2030 all people enjoy peace and prosperity. (United Nations, 2015) The 17 SDGs are integrated—they recognize that action in one area will affect outcomes in others, and that development must balance social, economic, and environmental sustainability. (United Nations, 2015)

Each goal has a determined number of targets and indicators to measure the achievement of each goal. Therefore, for the new selected KPIs focused on the assessment of urban resilience on the vulnerable communities, a similar goal was identified in order to provide a relevant reference and bring support to each Key Performance Indicators.

3.2 Phase 2: Impact assessment

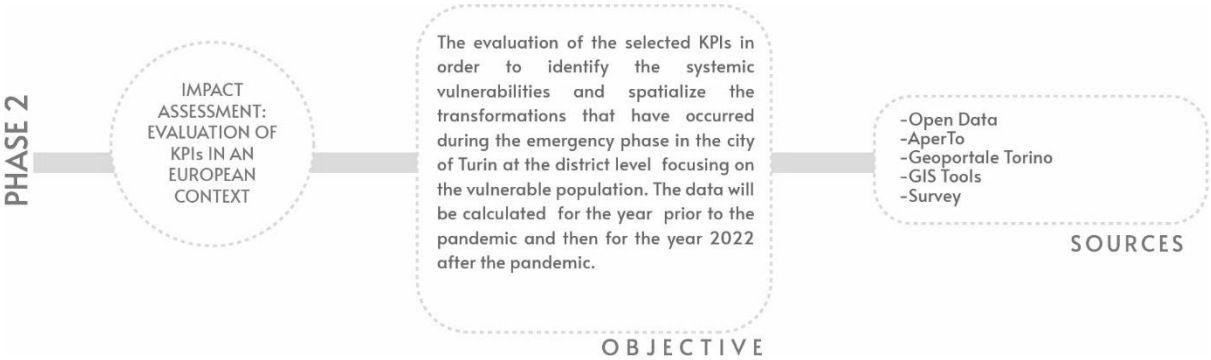


Figure 20: Phase 2 Methodology. Source: Author

3.2.1 Collection of the Data

To calculate and measure the indicators is necessary to carry out a recollection of information that will constitute the data base for the respective analysis.

Information and data at the district level are usually found on municipal territorial databases. While more socio-demographic studies can be found in statistical organizations that develop census in a periodical way an allows to determine the different

changes of the territory and population through time.

On the other hand, there are platforms dedicated to providing access to open data of general urban structures like mobility network, building infrastructure, natural surfaces, etc. To make an analysis at the district level, it is important to have a database in the smallest scale as possible in order to make more detailed analysis and understand territories as realistic as possible. However, this can be a limitation as usually this type of information is not accessible to the public. In this case, geographical platforms of municipalities offer a way to contact them to ask for the needed information depending on the use that will be given to the data.

3.2.1.1 GIS Analysis

For this stage, the data gathered before will be processed in GIS or Geographic Information System. It is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many kinds of data on one map, such as streets, buildings, and vegetation. This allows people to see, analyze, and understand patterns and relationships more easily.

Many different types of information can be compared using GIS. The system can include socio-demographic data, such as population, income, or education level. It can include information about the landscape, such as the location of streams, different kinds of vegetation, and different kinds of soil. It can include information about the sites of factories, farms, and schools, or storm drains, roads, and electric power lines. (National Geographic, 2022)

It allows cross-scale analysis enabling the study and understanding of how different layers interact with one another resulting in a multidimensional approach to understand the territory.

3.2.2 Mapping the Results

GIS software allows to produce visual representations of the information as maps.

The final step of the KPIs calculator is to map the obtained results as a way, not only to clearly show the spatialized analysis made, but to make information easier to understand for everybody.

Each KPI datasheet were divided into different sections to make the calculation of the indicator as clear as possible:

1.Aim: consists of the explanation of the indicator as well as the main result the KPI intends to achieve.

2. Assessment Method:

-Data requirement.

-Data Source

-Assessment methodology

3. Results: The final maps with the respectively table that showcase the numerical results.

3.3 Phase 3: Building the future scenario

Figure 21: Phase 3 Methodology. Source: Author

To enable social participation in decision-making means to enhance more down to earth solutions that truly assess the needs of communities while at the same time motivate sense of appropriation, community contribution and strengthen the relationship between citizens and government. This research thesis proposes the use of a participatory methodology as

a crucial tool to involve citizens in a dynamic way.

3.3.1 The Start Park Methodology

The Start Park is a participatory approach tool created to help communities and public administrations to co-design urban parks based on Nature-based strategies as a response for most cities adaptation and mitigation plan to tackle climate change and protect the environment.

This strategy was born to answer the question on How to engage and encourage people to be aware of climate change and turn it into resilient actions? To put back public space in the hands of citizens creates active communities, transforming space into places for social aggregation and personal and collective well-being. To encourage bottom-up strategies helps to empower the residents and turns them into catalysts of sustainable urban practices.

The tool is essentially a board game, with characters, activity cards and an interactive board with the plan of the site. The purpose is to stimulate and initiate discussion amongst participants, to guide them in the design process while focusing on their necessities and collective needs in order to decide together what type of decisions they consider accurate and how to manage the resources available.

Start Park emerged during the 2017 Climathon held in Florence. An event that hosts international ideas regarding citizen engagement and how to involve citizens in climate actions. It was funded thanks to and European grant under the Designscapes project and represents an innovative citizen-led process aimed at collaborative re-designing underdeveloped with green and blue infrastructure strategies, enabling design thinking methodologies, digital gamification, and STEM- environmental studies.

Two companies were involved in the creation of the Start Park tool: The Codesign Toscana Cultural Association, and the Iridra s.r.l.

Figure 22:Associations that Created Start Park. Source: Start Park

Codesign Toscana is a cultural association and multidisciplinary network of professionals under 35 active in Tuscany since 2017. They main fields of work are:
Design thinking, co-design and service design tools facilitation and support

- Consultancy in innovation management, urban regeneration, environmental sustainability
- Service and UX (user experience) design74
- Ethnography, user research and visual social research
- Management of culture and enhancement of cultural heritage
- Community design and stakeholder engagement, civic imagination, empowerment and

citizenship active

- Drafting of social balance sheets and strategic plans
- Cooperative educational practices and collaborative training for all.

On the other hand, Iridra s.r.l is an engineering company composed of a multidisciplinary group of professionals that focus on the eco-sustainable management of water resources. Their main work focuses on:

- Design and construction management activities for public and private sectors,
- Consultancy and feasibility studies and construction management,
- European projects, community, and national funding programs design,
- Infrastructure management and maintenance,
- Organization of conferences and seminars, teaching, and research about NBS,
- International cooperation projects,
- Territorial planning, design support and technical assistance,
- Environmental impact assessments

This participatory tool proposes a methodology that starts from the understanding of the place, then the co-design workshop as the board game with stakeholders, and finally the presentation of results that end up in a technical proposal as a summary of the discussed strategies.

In terms of the design-thinking process, Start Park relies on the following phases which use different co-design tools

1. Exploration: a site-specific exploration of the context, looking up for opportunities and needs, using observation, interviews, focus groups, and world cafes. The insights from these activities are summarized within cultural probes, personas, and stakeholders' maps.

2. Ideation: co-design workshops take place to generate ideas based on the insights gathered from the exploration part. Used mediation tools in this phase are brainstorming, scenarios, user journey map, and the Start Park game.

3. Test and validate: to collect feedback about the ideas of the previous stages, experience prototyping and service walkthrough tools are used.
4. Converge: the synthesis of a single design solution for the final output of a Start Park is essential for a clear and collaborative technical study of the area. In this phase public voting, debates and open space technology are properly used to collaboratively choose the best developed scenario. The outcome of this phase, with the technical coordination from Iridra spa, is the delivery of a pre-feasibility technical proposal to public administrators and policy makers.

Rules of the game

1. Turn 1 (20 + 10 min) The team of players/co-designers has a first consultation in small groups of two. Each group selects the character they wish to play, empathizing with its needs, the subgroups fill in a small plan of the park with at least: 2 Furnishings cards, 1 Activities card and maximum 2 GBI Punctual cards e 1 GBI Linear card. The players must draw on the small plan gameboard where they would like to put each solution. After the activity in pairs, they must discuss and motivate their choices to the rest of the group, based on the needs of the identified character.

2. Turn 2 (45 min) The group draws a Vision card from the deck. The group will work together on the large Site Plan; the goal is to select together, starting from the small plans

proposed by the subgroups, the GBI cards to create a plan shared by the whole group. For the rating of the project, the scores of the cards selected will have to exceed the following values, according to the chosen difficulty level and stay below the maximum spending scores indicated in the columns of the costs.

3. Turn 3 (1 hour) The group draws the second Vision card. These Vision cards, together with your Super-Goal constitute the goals to strive for during the co-design phase: as a group, they must choose furnishings and activities, taking into account the needs of the characters played. Use the large Plan on which you have already drawn the chosen GBI solutions and draw or write the selected Furniture and Activities cards.

Materials

THE GBI CARDS GBI cards refer to nature-based solutions, the green and blue infrastructures, that are used by designers to adopt sustainable models for the management, collection, and recycling of water in urban contexts, parks and gardens, and the same time enhance biodiversity. These cards will allow the players to design a park that is effectively able to adapt to climate change. Each card is distinguished by 1. A value from 1 to 3 points to rate its effectiveness in adapting to the risks of climate change, 2. A value from 1 to 3 to indicate the costs that need to be sustained to use the card, 3. Three symbols indicating whether it is a Linear, Punctual or Surface solution. If a card is Punctual, it means that it is a solution that the player can imagine in a specific point of the Plan (for example, a tank or an infiltration area); if a card is Linear, it means that it is used to transport the water from one point to another (e.g., a pipe or a channel). A surface card is used for extensive surfaces, like parking lots. Whenever you want to use a Punctual card, the player needs to ask it's how the water can get there; if the point is close to the source of water generated, the Point card can also be played alone; if this is not the case, it is necessary to combine the Point card with a Linear one: the player must think of a recovery scheme, otherwise it will not be possible to transport the water to be recovered from the collection

point to the place where the tip card has been inserted.

FURNITURE CARDS These cards describe possible furnishings for the park that can be designed in more detail during the game to bring the park to life and encourage the construction of an active community around it. Some of these cards are left blank, to stimulate the creativity of the players that can add the furniture they like.

VISION CARDS These cards describe possible visions towards the renovation of the park. What do the players want to realize? What is the objective? What is designed with the Furniture and Activity cards must aim at reaching the Vision cards that the players will have in their hand. The Vision cards might seem a bit vague, so to leave the groups the possibility to decide how to interpret them

ACTIVITY CARDS These cards describe possible activities that can be designed in more detail during the game to bring the park to life and encourage the construction of an active community around it. Some of these cards are left blank, to stimulate the creativity of the players that can add chose the activities as they like. card back view card front view.

CHARACTER CARDS The character cards are only used for simulations of the game, each player must describe a possible character that could design a start park.

THE SITE PLAN GAMEBOARD It is a simplified plan of the green area to be transformed into a Start Park, in small and large format,

Chapter 4
Results

4.1 Phase 1: Indicators Selection

The following list is the result of the final selection of Key Performance Indicators aimed at the analysis of the impact brought by the COVID-19 pandemic focusing on the vulnerable communities.

#	KPI	Unit of Measure
1	Contagion Density	# of new cases/# of people free of the illness
2	Availability and Proximity of Services of General Interest to Residential Buildings	# of services available/ Total area
3	Accessibility to Public and Private Health Facilities	# of health facilities / Total area
4	Availability of Urban Green Spaces	Total green open space area/ Total area
5	Residential Density	# inhabitants/ Total area
6	Intramodality of the Urban Transport System	# Intermodal nodes / Total area
7	Community Involvement in Urban Planning Activities	Qualitative range (low to high)
8	Density of Pedestrian Traffic Areas	# People in the public space/ Total Area
9	Poverty Conditions	# of people living below the international poverty line
10	Physical Conditions of the Housing Units	Qualitative range from low to high
11	Availability and Capacity of Basic Public Services	Capacity of services infrastructure compared to demand
12	Number of Persons Living in the Same Household	Inhabitants /Household
13	Unemployment Rate and Average Monthly Income	# Unemployed residents/ Total Inhabitants
14	Accessibility to Information and Communication Technologies (ICTs)	Proportion of residents with ICT skills
15	Educational Level of the Population	Participation rate of residents in formal and non-formal education and training
16	Availability & Proximity to Urban Public Institutions	Proportion of schools offering basic services by type of service
17	Social Marginalization	Proportion of people living 50% of median living according to race, religion, culture, nationality, sex, gender, age, disabilities.

Table 3: Final KPIs List. Source: Author

Stakeholders

STAKEHOLDER	GROUP	LEVEL	TYPOLOGY	RESOURCE
Piedmont Region	Administrative Actors	Regional	Special interest	Cognitive
CRT Foundation		Regional	Special Interest	Economic
Intesa Sanpaolo Foundation		Regional	Special interest	Economic
Metropolitan City of Turin		Provincial	Special interest	Cognitive
The Municipality of Turin: Urban and Territorial Division		Local	Political	Political, Legal, Cognitive
Green Department		Local	Political	Cognitive
Environmental Department		Local	Political	Cognitive
Transport Department		Local	Political	Cognitive
Energy Department		Local	Political	Cognitive
Health and Social Services Department		Local	Political	Cognitive
Labor Department		Local	Political	Cognitive
Housing Department		Local	Political	Cognitive
District (of the chosen study area)		Local	General Interest	Cognitive
ASL (Of the chosen district)		Local	General Interest	Cognitive
UrbanLab Association	Support Actors to the Administrative Activities	Local	General Interest	Political, Legal, Cognitive
Torino Smart City Foundation		Local	General Interest	Cognitive
SDGI1Lab		Local	General Interest	Cognitive
S3+Lab(Urban Sustainability & Security Laboratory for Social Challenges)		Local	General Interest	Cognitive
RUS (University Network for Sustainable Development)	Academic Actors	National	Experts	Cognitive

DIST (Inter-University of Regional, Urban Studies and Planning) Politecnico di Torino		Local	Experts	Cognitive
R3C (Risk Responsible Resilience Center) Politecnico di Torino		Local	Experts	Cognitive
Medical Statistics and Epidemiology Department of Medical Sciences - University of Torino		Local	Experts	Cognitive
LARTU - Politecnico di Torino		Local	General Interest	Cognitive
ASVIS (Italian Alliance for Sustainable Development)	Support Actors to the Technical Knowledge	European	Experts	Cognitive
ISTAT		National	Experts	Cognitive
IREN		National	Experts	Cognitive
SMAT		National	Experts	Cognitive
iiSBE ORGANIZATION		National	Experts	Cognitive
ARPA Piedmont		Regional	Experts	Cognitive
AMIAT		Local	Experts	Cognitive
GTT		Local	Experts	Cognitive
Popular Assembly Forum Torino		Local	General Interest	Cognitive

Table 4: Stakeholders. Source: Author

4.2 Phase 2: Impact assessment

4.2.1 Collection of the Data

The calculation of post-covid indicators play a high role in the assessment of urban resilience and consequently the redefinition of cities in a post-pandemic scenario. Throughout this research, a set of indicators have been selected based on the previous Post

Un-lock project selected indicators while at the same time targeting the vulnerable communities focusing on the identification of the different issues and challenges stressed by the literature review analyzed as well as the targets and indicators proposed by the United Nation's SDGs that talk about this segment of the population.

After the final list of KPIs was defined, the project entered in a phase of estimating and evaluating with the purpose to search and gather all the basic data and material to carry on with the calculation for each indicator considering that this information needed to be the most updated as possible, complete, and present for the whole municipality, and accurately georeferenced.

This phase represented the one with the biggest limitations, especially regarding data available at the neighborhood level for the city of Turin. The collection of the data resulted in an extensive process where not all the information was found in order to calculate all the indicators. This is mainly due to the availability of the information and resources to the public at more detailed scales as district-neighborhood for privacy reasons.

Following that order of ideas, **seven KPIs** were calculated and spatialized considering the information available as well as their relevance for the analysis for Barriera di Milano. On the other hand, this work also presents some results at the municipal level as its objective is to propose helpful material for future developments on other neighborhoods of Turin or in other municipalities. For the calculated indicators, the data was found in the Geoportale of the city of Turin and complemented with the 2021 edition of the BDTRE30 (Link: https://www.geoportale.piemonte.it/cms/bdtre/modalita-di-pubblicazione-efruizione).

The impact assessment was made using GIS software in order to calculate the KPIs. For each indicator, the sheet is structured in a context description followed by the type of data needed, where was the data found, how is the data used and finally, the steps taken to calculate the indicator and then map the results. For the participatory approach workshop,

the methodology followed was based on the steps stressed by the Start Park project. During the development of the workshop, the contextualization of the study area was provided to the students followed by the explanation of the rules of the game as well as how to use the materials. Then, a specific time was given for the groups to discuss each problem according to the stakeholder roles given and finally the presentation of the results of each group has expressed by each group.

The sheets for the selected KPIs were divided in:
1.Aim: consists of the explanation of the indicator as well as the main result the KPI intends to achieve.
2. Assessment Method:
-Data requirement.
-Data Source
-Assessment methodology

4.2.1.1 KPIs Evaluation at the Neighborhood Level: GIS Analysis

In this section, the development of the methodology previously described will be applied to the study area of Barriera di Milano. This neighborhood belongs to the circumscription number 6, in the northern part of the city. The neighborhood was born in 1853, with the industry belt created to carry out customs control on incoming goods, it separated the countryside from the northern access, which continued as far as the bridge over the Dora River (Aurora district). It was an ancient group of farmhouses, scattered houses, and shops in the northern part of the city.

Location:

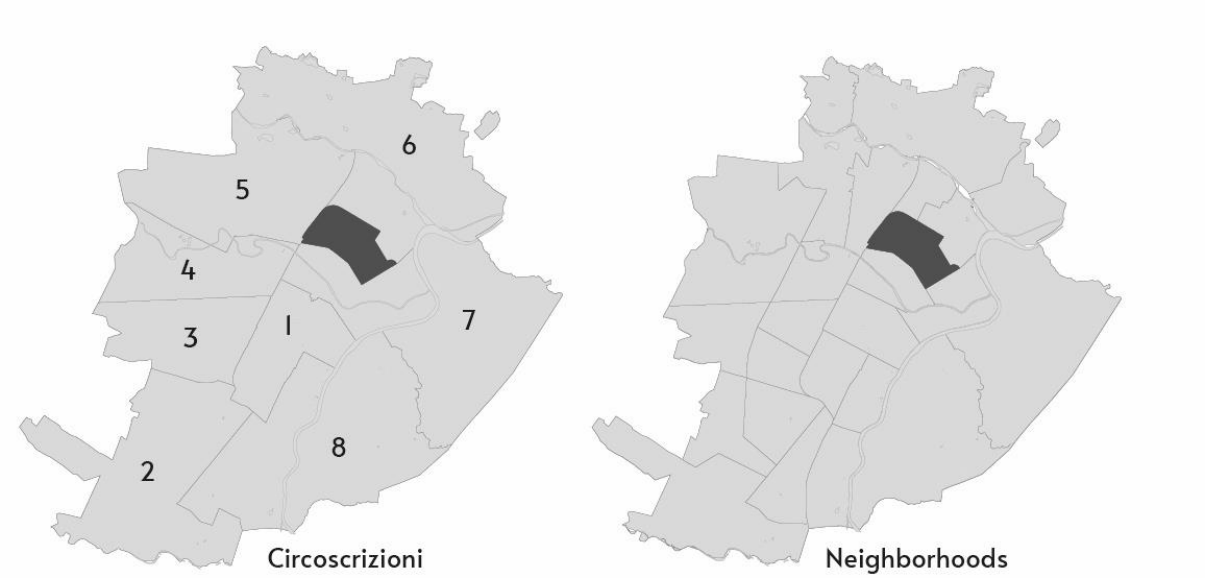


Figure 24: Location of Barriera di Milano in the City of Turin. Source: Author

Barriera di Milano was selected as the study area for this research thesis as it responds consistently with the characteristics stressed previously regarding the vulnerable communities. The neighborhood becomes an interesting area for its high number of residents and residential density as well as its significant foreign population.

Barriera di Milano

Historical Context

The neighborhood was born in 1853, with the first duty belt created to carry out customs control on incoming goods, it separated the countryside from the northern access, which continued as far as the bridge over the Dora River (Aurora district). It was an ancient group of farmhouses, scattered houses, and shops in the northern part of the city. Barriera di Milano started as a zone full of shops and artisans just outside the wall as real estate was cheaper and food and supplies.

Over time the first factories settled in place of the "boite" or the commercial establishments in the area.
In some cases, the shops grew and were transformed into real large factories.
The first example was the Armaments factory, the Ansaldi factory, for small arms, established in 1884. Then, in 1923, it was converted into Fiat Grandi Motori.

Since the early 1900s, the district has acquired industrial and economic importance, as an alternative to the Mirafiori district, in the southern area and headquarters of Fiat.

In the neighborhood, there were various textile industries, tire industries, and many others. Inevitably, all these large industrial plants changed the urban aspect of Barriera di Milano. In a few years, we have gone from an entirely agricultural urban territory to totally industrialized blocks. Today Barriera di Milano is part of District 6 and with an area of about 26 square kilometers, it is, to date, the largest and most populous district of Turin from which the center is approximately 1.5 km away.

Via Valprato is home to the important cultural and social center of the Docks Dora, a structure born as a commercial warehouse and goods storage in 1912 and still today the center of constant architectural and social interest, given the number of nightclubs and clubs that arose during the redevelopment of the neighborhood.
Due to the presence of large establishments, Barriera di Milano became a popular destination for many migrants, in the late nineteenth century and especially in the fifties and sixties of the twentieth century. Consequently, it became the hub of the workers' movement of those years.

Overcrowding, however, led to urban saturation and necessary deindustrialization.
The old factories were converted into structures dedicated to the tertiary sector and commercial activities.

In addition to the tertiary sector, the market sector is still alive today, a legacy of the historic origins of the district. In fact, there are four important local markets open all week: Via Porpora, piazza Crispi, piazza Foroni, and Corso Taranto.

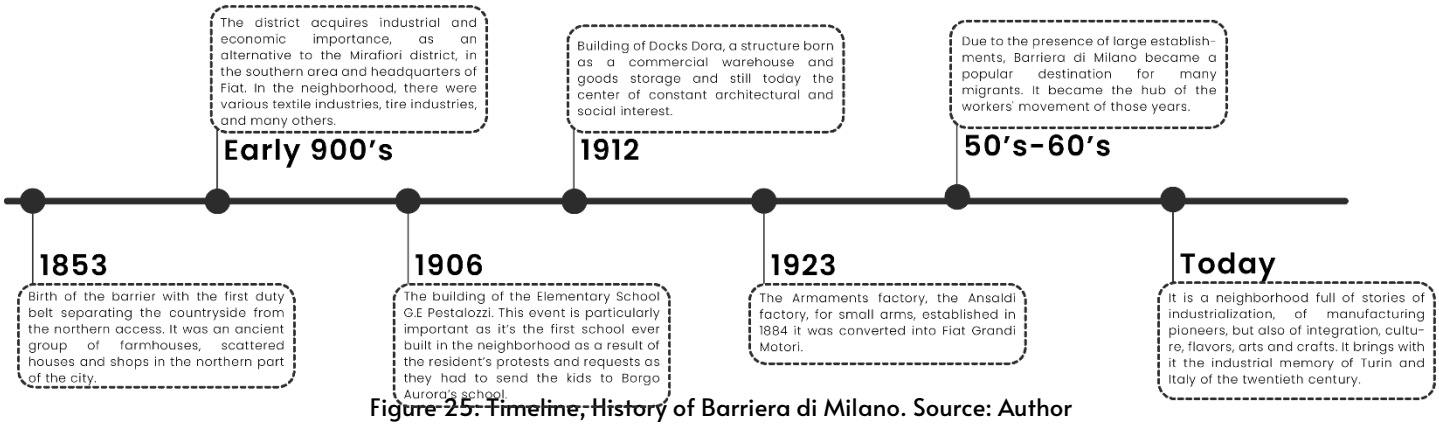


Figure 25: Timeline, History of Barriera di Milano. Source: Author

Today the district looks like a melting pot of ethnic groups and is by far the most representative residential population of the neighborhood, gathering almost half of the total residents. It is a neighborhood full of stories of industrialization, of manufacturing pioneers, but also of integration, culture, flavors, and arts and crafts. It brings with it the industrial memory of Turin and Italy of the twentieth century.

Territorial Analysis.

Socio-Demographic Analysis:

There is a high rate of unemployment, and young people looking for their first jobs represent a challenge for the residents to absorb and adapt to changes and crises. The dependent workers are usually characterized by not having a high level of education and basic professional skills which leads them to look for low-performance jobs. Barriera di Milano is the neighborhood with the highest number of immigrant residents, especially from Morocco, Rumania, Perú, and Nigeria, giving it a rich cultural and ethnic background.

Land-use and activities.

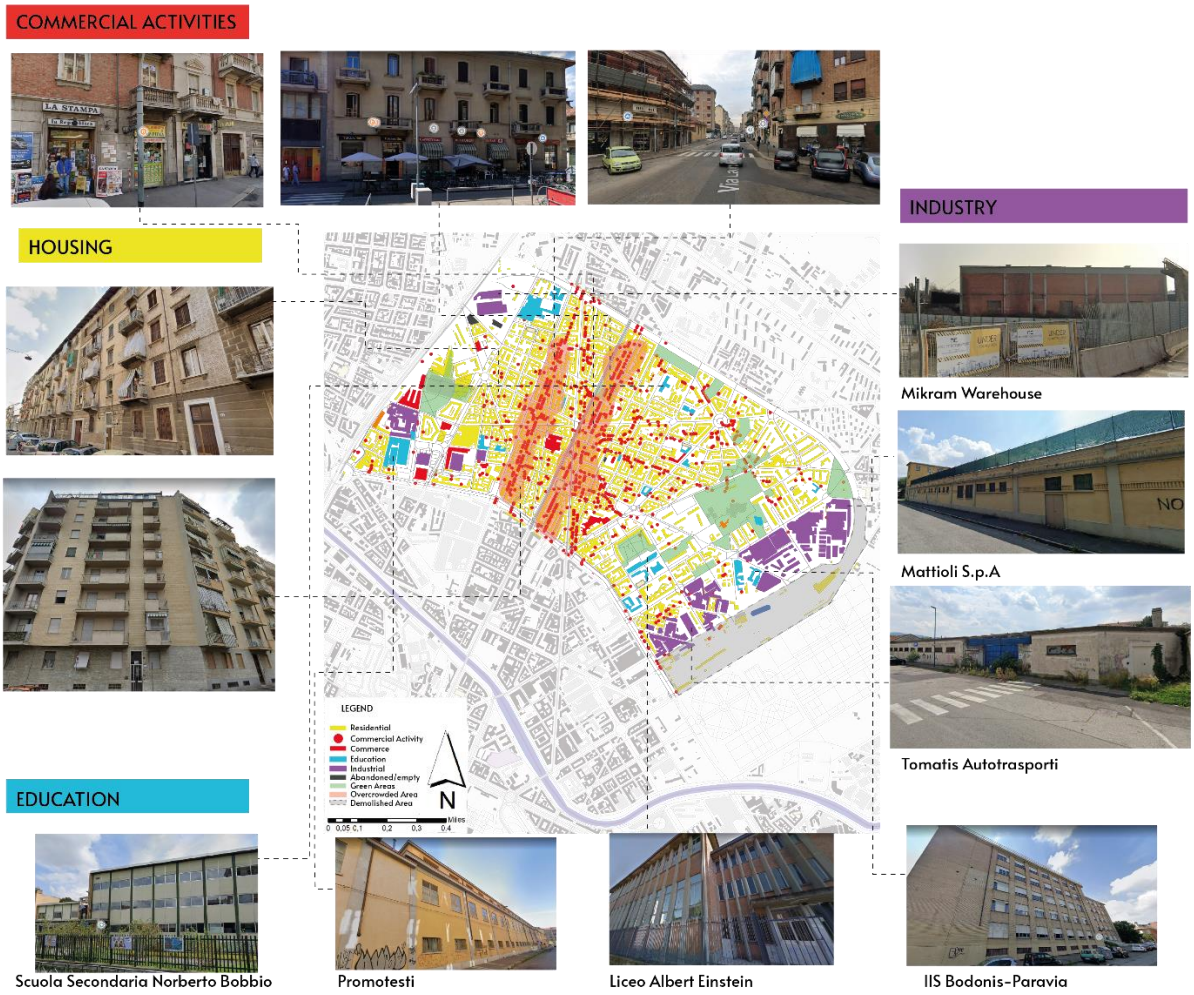


Figure 26: Landuse Analysis Map. Source: Author

This analysis helped us identify some key characteristics of the neighborhood:

- The industrial character of the area has progressively deteriorated the building element of the district.
- There is still a high presence of industrial infrastructure that impact the landscape perception of the neighborhood.
- There are many educational institutions, but with infrastructural problems.
- Commerce activities are mostly concentrated in Corso Giulio Cesare creating overcrowding.

Opportunity: There are around 50 non-profit associations that are acting on Barriera di Milano to help improve the residents' lives and guarantee the fulfillment of human rights.

Environmental structure

- The green areas are mostly located on the periphery of the neighborhood.
- The ones that are most used are the ones with children's activities and facilities.
- Most of them lack any type of activity to invite people to use the space.
- Lacks a bigger relationship with the residential buildings and the green urban areas.
- The area of the existing green spaces is not enough for the number of residents living in the neighborhood.

Mobility

Figure 27: Mobility Map of Barriera di Milano.: Source: Author

Main street: Corso Giulio Cesare

Secondary streets: Corso Palermo, Via Volpiano, Via Luigi Salvatore

- The main bus stops that connect the neighborhood with the rest of the city (Corso Giulio Cesare) are usually overcrowded as there is no other alternative for transportation and

most of the residents do not own a car.

- There are no other alternative mobility options like bicycle lanes, metro, etc.
- In terms of bus lines, there are many bus options that pass through the neighborhood but the only ones that connect with the city center and the main

From a socio-cultural perspective, Barriera di Milano is a borough characterized by a strong social identity and counts about 50 "not for profit" associations engaged for years in the care of the local community.

Impact Assessment

KPI 2

Availability and Proximity of Services of General Interest

1.Aim

The calculation of the followinig indicator allows us to identify the density of services of general interest that hold a more urgent role in the management of the pandemic, specially for vulnerable communities (Supermarkets, Pharmacies, Schools, Specialized Bussinesses establishments). This KPI allows the analysis of the number of services present in the district as well as the number of residential buildings served in an estimated accessibility buffer based on an Euclidean Distance analysis, This indicator os helpful the availability of services near the homes of the residents that have characterized the phases of the COVID-19 pandemic, specially the most critic stages allowing to understand the priority areas on which to act in order to relocate and implement services that can sustainable supply the neighborhood.

2.Assessment Methodology

- Data Requirement:

Indicator	Unit of Measure	Reference
Availability And Proximity Of Services Of General Interest To Residential Buildings	Number Of Services Available/ Total Neighborhood Area	Post Unlock Selected KPIs

In order to calculate this KPI, the services in Barriera di Milano where divided into different categories: Specialized Commerce, Retail, Health Facilities, School Facilities. According by their type of function and role in the emergency, it is important to divide them from the residential buildings by time categories in order to better understand the level of proximity. The buffer zones were established following the theories stressed in the "15 minutes city" in Paris, different categories were established: 0-5 minutes, 5-10 minutes, 10-15 minutes, 15-20 minutes. The aim of this indicator is to have a better overview of the level of accessibility of residents to diverse services to the, identify if the services available are enough and satisfy the demand of the neighborhood or in the contrary, identify critical zones. This will be the support of new territorial strategies that seek to plan the post-pandemic cities through pilot actions for the redesign of territories considering urban resilience and sustainability of communities.

1.Specialized Commerce

- Food and Beverage

2.Retail

-Hypermarkets

-Supermarkets

3.Health Facilities

-Pharmacies

4. School Facilities

-Kindergardens

-Primary Schools

-Secondary Schools

-High Schools

-Data Source

Content	Format	Source
Specialized Commerce	Shp/geo.zip	geoportale.comune.torino.it/geodati/zip/attivita_commerciali_csv.zip
Retail	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 Facilties	Shp/geo.zip	geoportale.comune.torino.it

- Assessment Method

To calculate the indicator:

1.Projection of the acquired shapefile data on the GIS software.

2.Through the "Clip" geoprocessing tool, the extrapolation of the data provided by the shapefiles at the municipal level only for the Barriera di Milano Neighborhood.

3. Extrapolation of the types of services of general interest to be analyzed acording to the established categories.

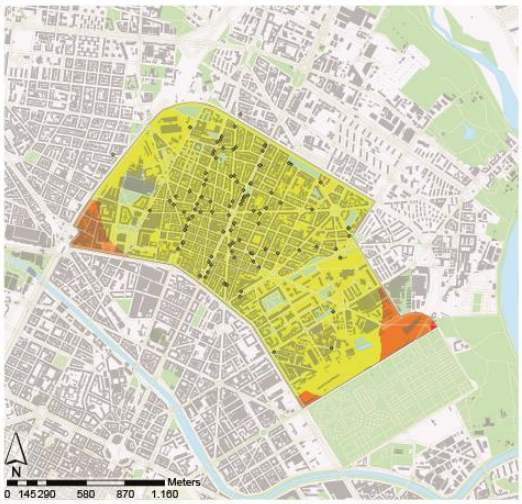
4. Drawing of the buffer zones using " Euclidean Distance" spatial analysis tool.

5. With the "Raster Calculator" tool, transform the buffer zones from distance to time.

6.Counting of the number of services present for each category.

7. Analysis of the accessibility of residential buildings by measuring the distance of each building to each service location using "Extract Multi Values to Points" spatial analysis tool.

- Results

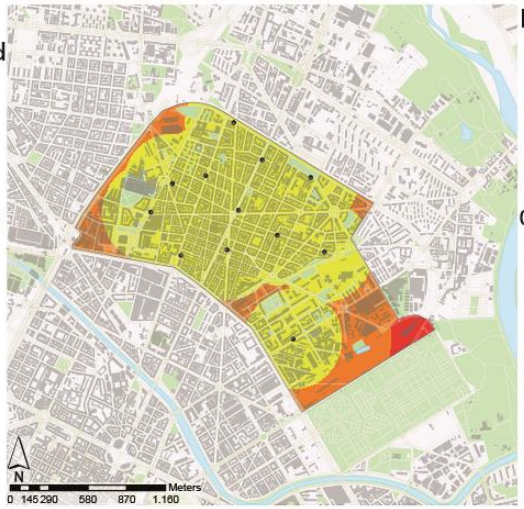


Specialized Businesses: Food & Beverage

0.5 Services/Km2

99.66% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Specialized Businesses
Accessibility & Proximity: Time
<5minutes
<10minutes
<15minutes

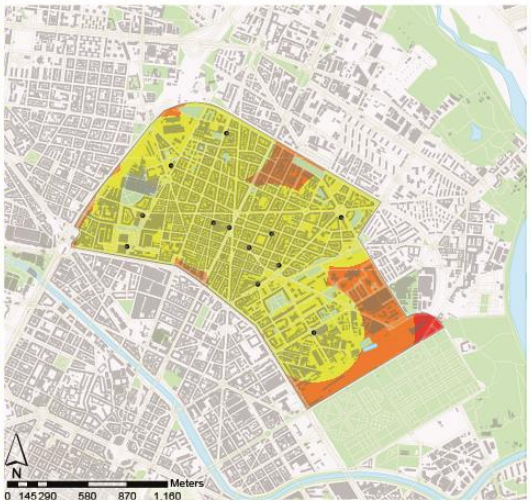


Pharmacies

0.03 Services/Km2

99.97% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Pharmacies
Accessibility & Proximity: Time
<5minutes
<10minutes
<15minutes

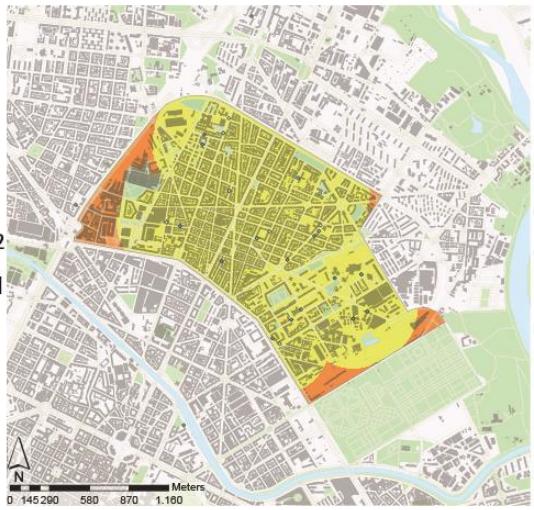


Retail: Supermarkets

0.03 Services/Km2

99.97% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Supermarkets
Accessibility & Proximity: Time
<5minutes
<10minutes
<15minutes



Educational Institutions

0.009 Services/Km2

98.25% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Kindergarden
Primary School
Secondary School
High School
Accessibility & Proximity: Time
<5minutes
<10minutes
<15minutes

Services in Torino:

Type of Service	Buffer (minutes)	Serviced Residential Buildings	Total Residential Buildings	N° of Services	Barriera di Milano Neighborhood Area (sqKm)	N° of services/sqKm	% of Serviced Buildings
Specialized Commerce: Food & Beverage	15	3.471	3.483	1.834	3.133	0,5853814	99,66%
Retail: Supermarkets	15	3.482	3.483	12	3.133	0,0038302	99,97%
Health: Pharmacies	15	3.482	3.483	12	3.133	0,0038302	99,97%
School Facilities: Kindergarden	15	3.422	3.483	9	3.133	0,0028726	98,25%
Primary School	15	3.422	3.483	9	3.133	0,0028726	98,25%
Secondary School	15	3.422	3.483	5	3.133	0,0015959	98,25%
High School	15	2032	3.483	6	3.133	0,0019151	58,34%

KPI 3

Availability and Proximity of Private and Public Health Facilities.

1.Aim

The identification of the health facilities in the area as mayor hospitals and principals as well as consultants, clinics, ASL and other medical facilities. In a post-pandemic scenario, this indicator becomes highly important in order to determine the possibility of residents to easily access medical attention when needed, how far do they have to travel in order to reach the nearest facility and if the services available are enough in order to satisfy the demand of the population.

2.Assessment Methodology

- Data Requirement:

Indicator	Unit of Measure	Reference
Availability and proximity private and public health facilities	Number of health facilities/Total neighborhood area	Post Unlock Selected KPIs

The previous sanitary emergency unmasked the unpreparedness of health systems all around the world. Hospitals saw themselves in the position to transform their protocols and services and citizens saw more clearly the importance of counting with a good health provider and efficient health facilities. The lack of hospitals of clinics nearby the homes of residents puts them in a position of vulnerability in which, if there are not enough facilities to provide attention to all the communities or are not easy to access, people will not be able to receive any type of treatment or help and increase their risk to complications.

The value of this indicator relies on the identification of facilities in order to determine if the population can easily access to medical attention or if on the contrary, there are critical areas in which people are not able to reach any type of facility in a situation of a disease.

Health facilities:

-Major Hospitals

-Principal Hospitals

-Clinics

-ASL

-Consultants

-Data Source

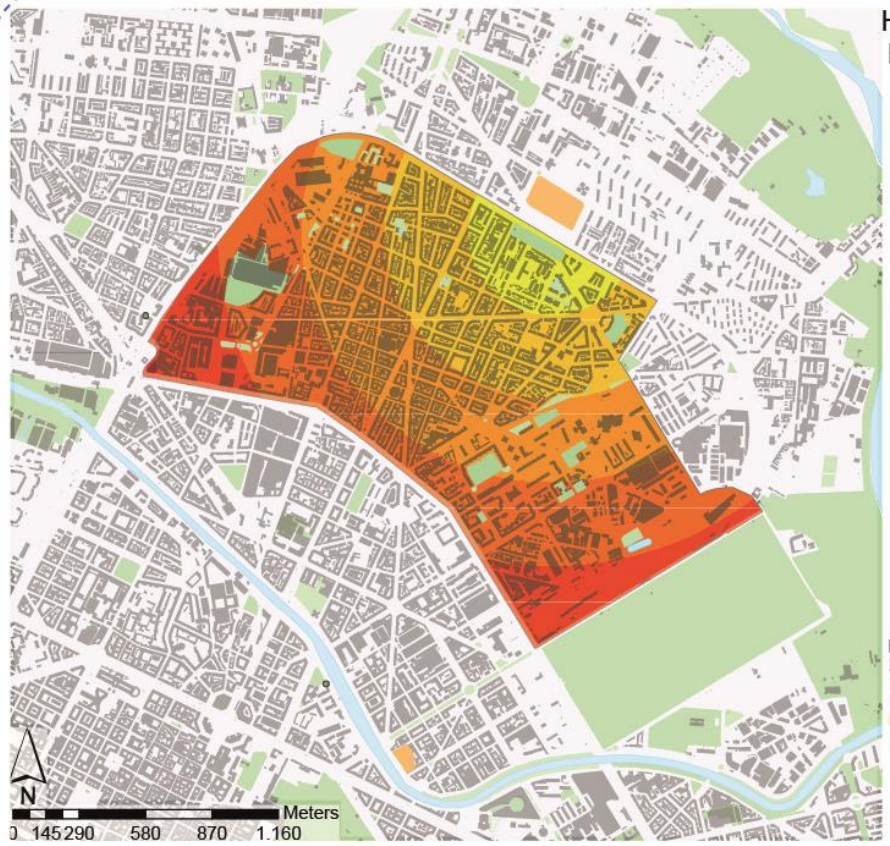
Content	Format	Source
Major Hospitals	Shp/geo.zip	geoportale.comune.torino.it/geodati/zip/ospedali_geo.zip
ASL	Shp/geo.zip	geoportale.comune.torino.it/geodati/zip/sedi_asl_geo,zip

- Assessment Method

To calculate the indicator:

1.Projection of the acquired shapefile data on the GIS software.
2.Through the "Clip" geoprocessing tool, the extrapolation of the data provided by the shapefiles at the municipal level only for the Barriera di Milano Neighborhood.
3. Extrapolation of the hospitals and ASL in the area to be analyzed acording to the established categories.
4. Drawing of the buffer zones using " Euclidean Distance" spatial analysis tool.
5. With the "Raster Calculator" tool, transform the buffer zones from distance to time.
6.Counting of the number of services present for each category.
7. Analysis of the accessibility of residential buildings by measuring the distance of each building to the health facilities using "Extract Multi Values to Points" spatial analysis tool.

- Results



Hospitals & Major Health Facilities

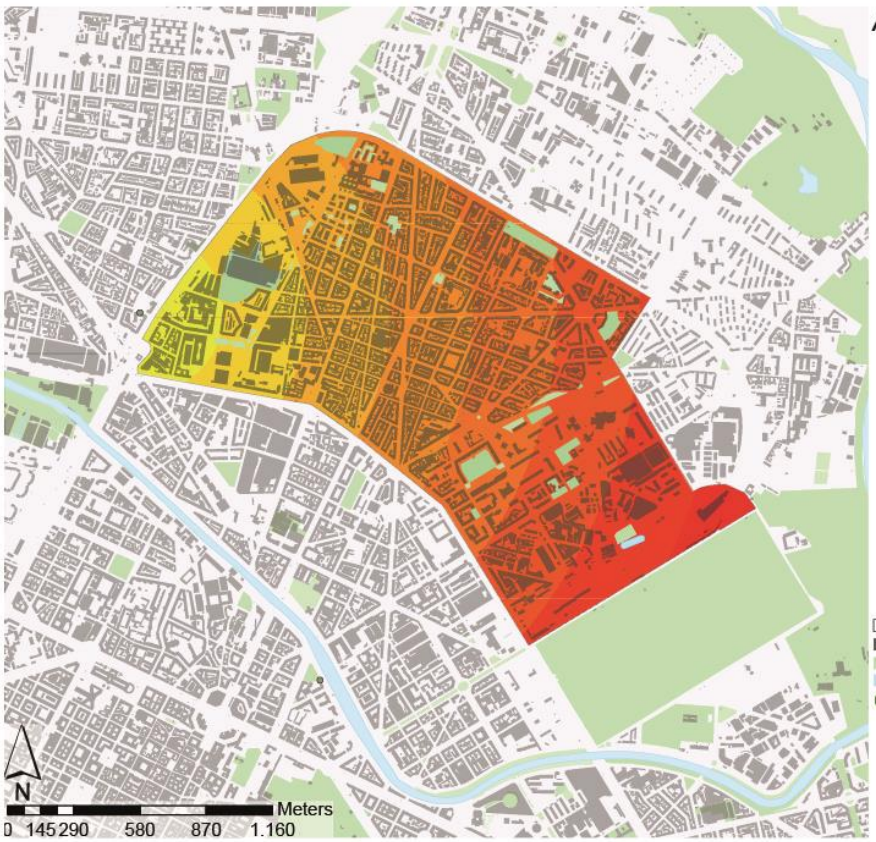
Barriera di Milano:
3.133 Km2

Inhabitants:
47.163

0.319 Services/Km2

79% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Hospitals & Major Health Facilities
Accessibility & Proximity: Time Walking
<5minutes
<10minutes
<15minutes
<20minutes
<25minutes



ASL Headquarters

Barriera di Milano:
3.133 Km2

Inhabitants:
47.163

0.319 Services/Km2

30% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Hospitals & Major Health Facilities
Accessibility & Proximity: Time Walking
<5minutes
<10minutes
<15minutes
<20minutes
<25minutes
<30minutes

Type of Service	Buffer (minutes)	Serviced Residential Buildings	Total Residential Buildings	N° of Services	Barriera di Milano Neighborhood Area (sqKm)	N° of services/sqKm	% of Serviced Buildings
Hospitals & Major Health Facilities	15	2762	3.483	1	3,133	0,319182892	79%
ASL, Clinics, Consultants	15	1051		1		0,319182892	30%

KPI 4

Availability and Proximity of Urban Green Areas

1.Aim

The calculation of the superficial extension of squared meters of urban green areas available in the neighborhood compared to the total number of residents in the area. On the other hand the calculation of proximity makes it possible to understand the viability of residents to access these areas. This indicators is useful in order to highligh the role of urban green spaces in the quality of life of the people, in particular, due to the gained importance in times of social isolation.

2.Assessment Methodology

- Data Requirement:

Indicator	Unit of Measure	Reference
Availability and proximity of urban green areas	Sqm urban green/ inhabitant	Post Unlock Selected KPIs

In order to calculate this KPI, the green areas in Barriera di Milano where categorized following the categories established for the Municipality in the Strategic Plan of the Green Infrastructure(Resolution no. Mech. 2020 02957/46 of 29 December 2020, updated on 24.3.2021); as well as the municipal legislation concerning public gre

en areas consulted (regulations for public and private green areas of the city of Turin. It is important to mention the significant value of the ecological structure of the city as Turin is known as one of the greenest municipalities of the country. Overall, the green spaces correspond to 22 sqm per capita (Istat, 2016). To assess the accessibility and proximity, buffer zones were established following the theories stressed in the "15 minutes city" in Paris, different categories were established: 0-5 minutes, 5-10 minutes, 10-15 minutes, 15-20 minutes.

-Data Source

Content	Format	Source
Urban Greenery	Shp/geo.zip	geoportale.comune.torino.it/cms/bdtre/bdtre-2
Trees	Shp/geo.zip	geoportale.comune.torino.it/alberi

- Assessment Method

To calculate the indicator:

1.Projection of the acquired shapefile data on the GIS software.

2.Through the "Clip" geoprocessing tool, the extrapolation of the data provided by the shapefiles at the municipal level only for the Barriera di Milano Neighborhood.

3. Extrapolation of the types of urban green areas and trees to be analyzed.

4.Analysis of the squared kilometers that each surface occupies in the neighborhood.

5. Analyze the total number of inhabitants.

6. Analyze the availability of urban green areas in Barriera di Milano (sqm/inhabitants).

7.Analyze the number of trees located in the study area.

8. Ratio of the number of trees available per inhabitant.

9. Drawing of the buffer zones using " Euclidean Distance" spatial analysis tool.

10. With the "Raster Calculator" tool, transform the buffer zones from distance to time.

11.Counting of the number of services present for each category.

12. Analysis of the accessibility of residential buildings by measuring the distance of each building to each service location using "Extract Multi Values to Points" spatial analysis tool.

- Results

Green Urban Areas

Barriera di Milano:
3.133 Km2

Inhabitants:
47.163

Park	4,48%
Grass	0,73%
Recreational Ground	0,04%
Allotments	0,36%
Total Green Areas	5,61%

Barriera di Milano
Buildings
Waterbodies
Roads

Green Urban Areas
Park
Grass
Recreational Ground
Allotments

Trees

Number of Trees:
1659

Density of Trees:
529,52 Trees/ Km2

Trees per Inhabitant:
0,035

Inhabitants per Tree:
28.42

Barriera di Milano
Buildings
Waterbodies
Roads
Green Urban Areas
Trees

Green Urban Areas	Occupied Area (Km2)	Barriera di Milano Area (Km2)	%	N°of Inhabitants
Parks	0,1404	3,133	4,48%	47163
Grass Areas	0,023		0,73%	
Recreational Areas	0,0011		0,04%	
Farmland	0,0114		0,36%	
Total	0,1759		5,61%	

N° of Inhabitants	N° of Trees	Density of Trees (1/km2)	Trees per Inhabitant	Inhabitants per Tree
47163	1659	529,524417	0,035176	28,42857

KPI 5

Residential Density

1.Aim

This indicator assesses the relationship between the total number of and the squared kilometers of the study area. This calculation is the foundation to determine if the existing services, health facilities, green urban areas, schools and institutions, transport system, among others, are enough for the amount of people living in the neighborhood or not. On the other hand, to determine the population density can unmask overcrowding situations

that in front of a sanitary emergency like the COVID-19 pandemic, can turn into a vulnerability.

2.Assessment Methodology

- Data Requirement:

Indicator	Unit of Measure	Reference
Residential Population Density	Number of Residents/ Total Neighborhood area	Post Unlock Selected KPIs

-Data Source

Content	Format	Source
Populations_2011	Shp/geo.zip	istat.it/storage/cartografia/basi_territoriali/WGS_84_UTM/2011/R01_11_WGS84.zip

- Assessment Method

To calculate the indicator:

1.Projection of the acquired shapefile data on the GIS software.

2.Through the "Clip" geoprocessing tool, the extrapolation of the data provided by the shapefiles at the municipal level only for the Barriera di Milano Neighborhood.

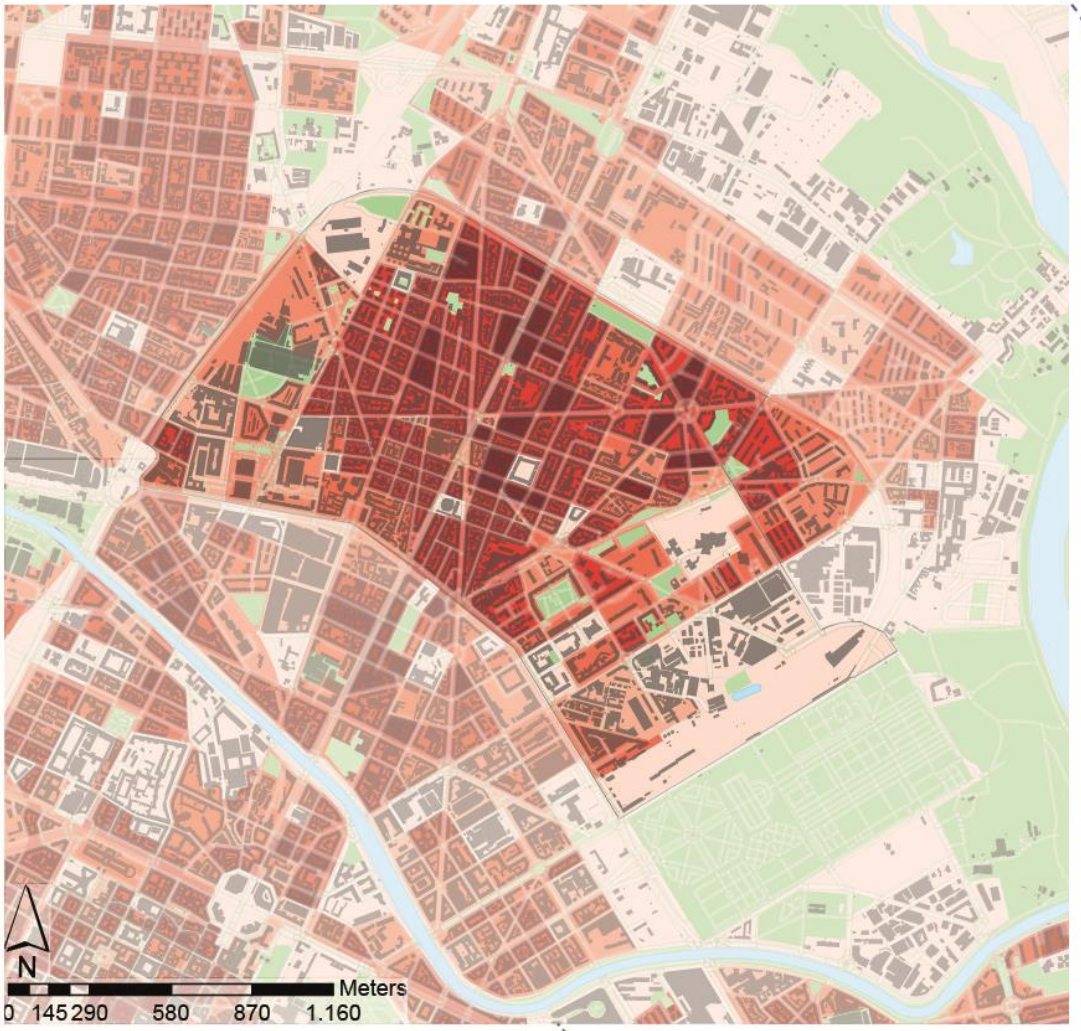
3. Analysis of the 2011 population census carried by ISTAT.

4. Connection between the census sections shapefile of the municipalities and the ISTAT dataset.

5. Create a new field in the attributes table for the area, where the surface in squared kilometers is created. This field relates the residential population by the census sections established by ISTAT.

6. Creation of a new field in the attributes table for the density, where the previous area calculated will be analyzed along with the total number of residents.

- Results

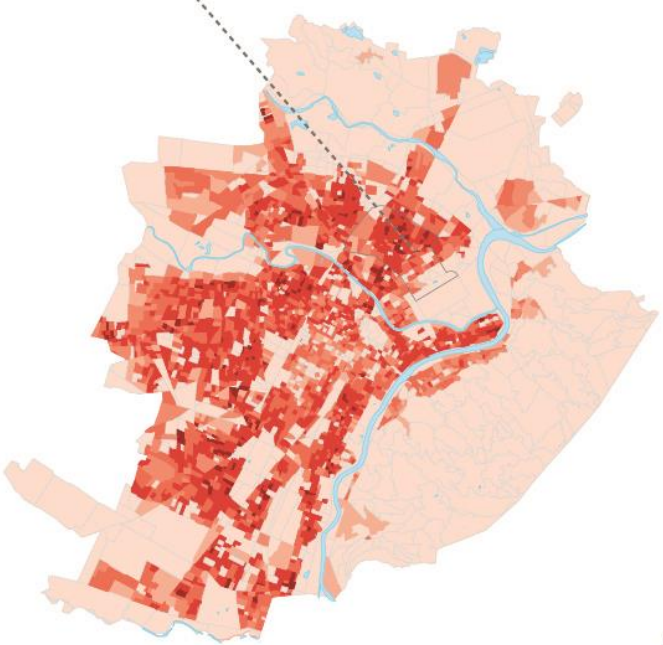


Residential Density

Barriera di Milano:
3.133 Km2

Inhabitants:
47.163

Residential Density:
16.002 Inhabitants/Km2



Barriera di Milano
Buildings
Green Areas
Waterbodies
Roads
Residential Density (Inhabitants/m2)
<2.500
<5.000
<10.000
<20.000
<40.000
<90.000

Residential Density by Neighborhood in the City of Turin:

	Neighborhood	Inhabitants	Area (Km2)	Residential density Inhab/km2
1	Centro	42.313	3,78	11.194
2	San Salvario	35.182	2,46	14.302
3	Crocetta	33.799	3,08	10.974
4	San Paolo	32.771	2,065	15.870
5	Cenisia	36.292	1,471	24.672
6	San Donato	48.635	2,35	20.696
7	Aurora	39.151	2,738	14.299
8	Vanchiglia	29.298	3,734	7.846
9	Nizza Millefonti	27.139	3,51	7.732
10	Mercati Generali	46.176	3,05	15.140
11	Santa Rita	54.462	3,522	15.463
12	Mirafiori Nord	41.414	3,762	11.009
13	Pozzo Strada	54.994	3,23	17.026
14	Parella	46.561	5,47	8.512
15	Le Vallette	39.820	3,64	10.940
16	Madonna di Campagna	41.030	4,89	8.391
17	Borgata Vittoria	39.903	3,8	10.501
18	Barriera di Milano	50.135	3,133	16.002
19	Falchera	25.229	4,31	5.854
20	Regio Parco	28.342	2,97	9.543
21	Madonna del Pilone	14.618	5,846	2.501
22	Borgo Po e Cavoretto	19.926	13,83	1.441
23	Mirafiori Sud	33.816	11,46	2.951

KPI 6

Intermodality of the Urban Transport System

1.Aim

Availability and proximity of intermodal nodes throughout the territory considering the different types of mobility (Urban-regional, sharing alternatives, public transportation, bike infrastructure). To measure the existence of the diverse transport services, its infrastructures as well as the distance to them by foot allows to redefine the perception of proximity in a post-pandemic scenario.

2. Assessment Methodology

-Data Requirement

Indicator	Unit of Measure	Reference
Intermodality of the Urban Transport System	Number of Intermodal Nodes/ Total Neighborhood area (Km2)	Post Unlock Selected KPIs

In order to determine a good level of accessibility and availability of the urban transport systems near the area, a study regarding the time spent by foot to reach each system was carried out. This analysis is relevant in the pursuit of sustainable, resilient, equal cities after the COVID-19 pandemic in a scenario where walkability and accessibility to services becomes relevant for every type of resident while at the same time discourages the use of private vehicles.

Starting from the mapping of six different types of mobility, an analysis was made based on euclidean tools to determine the buffer zones translated to time. Following the theories stated by the Parisian "15 minutes city", the identification of how many residential buildings belong to this buffer zone was made in order to point out if the neighborhood counts with enough transport nodes and infrastructures at a 15 minute walk reach or, on the contrary, identify the critical areas and/or the different systems that do not provide service to

Barriera di Milano.

-Data Source

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

Transport Systems:

Public Transport (GTT)

-Bus/Tram

-Metropolitana

Sharing Services

-Bike-Sharing

-Car-Sharing

Public Mobility Infrastructure

-Cyclepaths

Intercity Mobility Services

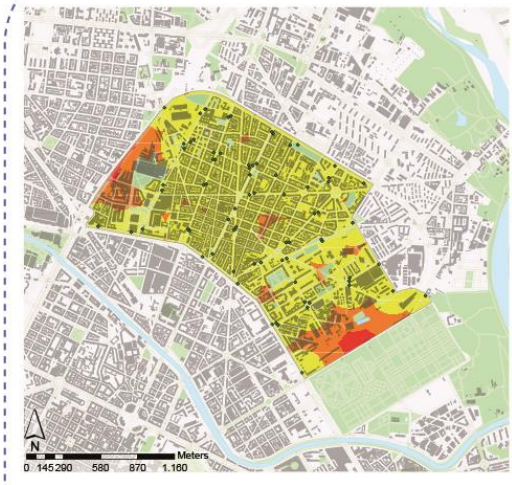
-Train Stations

-Assessment Method

To calculate the indicator:

1.Projection of the acquired shapefile data on the GIS software.
2.Through the "Clip" geoprocessing tool, the extrapolation of the data provided by the shapefiles at the municipal level only for the Barriera di Milano Neighborhood.
3. Extrapolation of the different transport systems in the area to be analyzed acording to the established categories.
4. Drawing of the buffer zones using " Euclidean Distance" spatial analysis tool.
5. With the "Raster Calculator" tool, transform the buffer zones from distance to time.
6.Counting of the number of services present for each category.
7. Analysis of the accessibility of residential buildings by measuring the distance of each building to the health facilities using "Extract Multi Values to Points" spatial analysis tool.

-Results

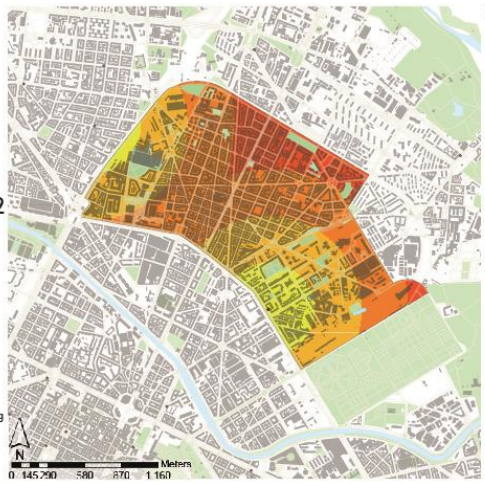


Bus/Tram

23.32Services/Km2

100% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Bus/Tram Stops
Accessibility & Proximity: Time Walking
<5minutes
<10minutes
<15minutes

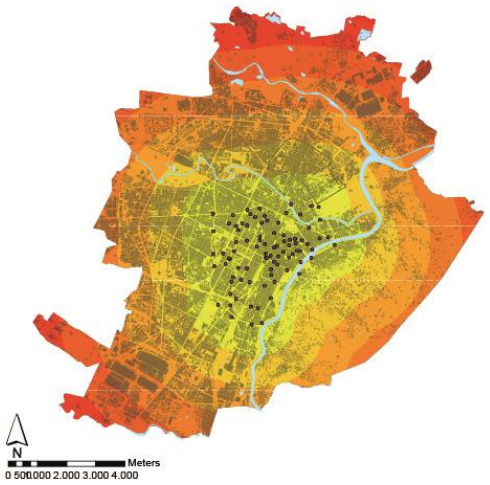


Car-Sharing

0.64Services/Km2

80% Serviced Buildings

Barriera di Milano
Buildings
Green Areas
Waterbodies
Car-Sharing Points
Accessibility & Proximity: Time Walking
<5minutes
<10minutes
<15minutes
<20minutes

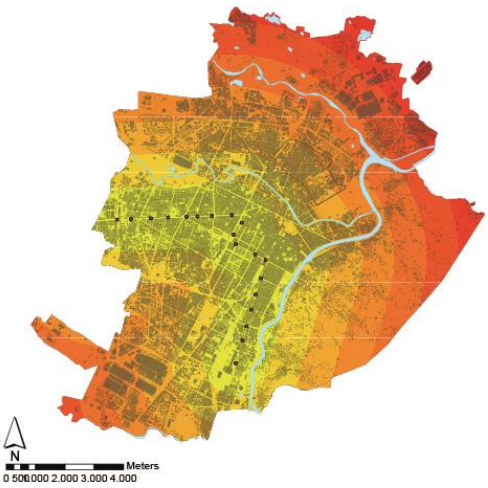


Bike-Sharing

0.64 Services/Km2

17% Serviced Buildings

Barriera di Milano
Buildings
Waterbodies
Bike-Sharing Points
Accessibility & Proximity: Time
<15minutes
<30minutes
<45minutes
<60minutes
<75minutes

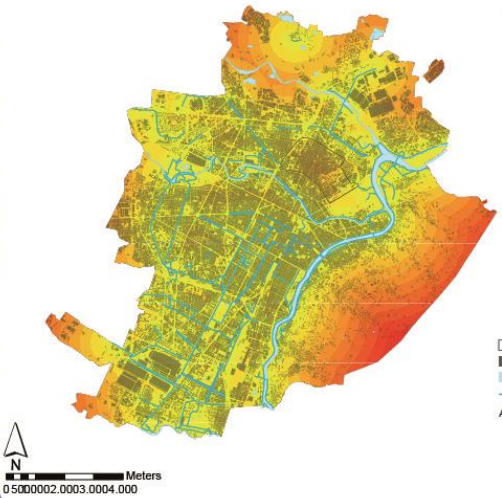


Metropolitana Stations

0 Services/Km2

0% Serviced Buildings

Barriera di Milano
Buildings
Waterbodies
Metro Stations
Accessibility & Proximity: Time
<15minutes
<30minutes
<45minutes
<60minutes
<75minutes

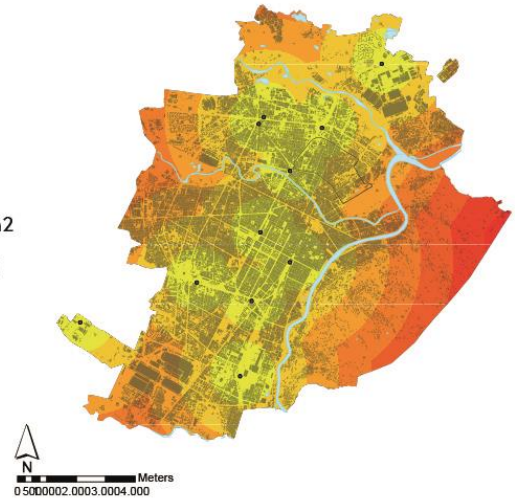


Cyclepaths

1.28 Services/Km2

91% Serviced Buildings

Barriera di Milano
Buildings
Waterbodies
Cycle Paths
Accessibility & Proximity: Time
<15minutes
<30minutes
<45minutes
<60minutes
<75minutes



Train Stations

0.64 Services/Km2

49% Serviced Buildings

Barriera di Milano
Buildings
Waterbodies
Train Stations
Accessibility & Proximity: Time
<15minutes
<30minutes
<45minutes
<60minutes
<75minutes

Type of Transport	Buffer (Minutes)	Serviced Buildings	Total Buildings	N° of Services	Barriera di Milano Neighborhood Area (sqKm)	N° of services/sqKm	% of Serviced Buildings
Bus/Tram Stops	15	3483	3.483	73	3,13	23,32	100%
Car-Sharing Points	15	2785		2		0,64	80%
Bike-Sharing Points	15	604		2		0,64	17%
Metropolitana Stations	15	0		0		0,00	0%
Train Stations	15	1702		2		0,64	49%
Cyclepaths	15	3167		4		1,28	91%

KPI 13

Unemployment Rate & Average Monthly Income

1.Aim

The identification and characterization of the residents capacity to produce economically in order to be able to provide for and afford the basic needs and have a good life quality. To identify the unemployment rate and the monthly income of residents helps to identify the vulnerability of communities to adapt and survive to crises like the previous health emergency in order to guarantee the wellbeing of people.

2. Assessment Methodology

-Data Requirement

Indicator	Unit of Measure	Reference
Unemployment Rate & Average Monthly Income.	N° of unemployed people/ Total N° of inhabitants	UN's SDGs: Goal 8 Decent work and economic growth; Target 8.5; Indicator 8.5.1 & 8.5.2

Low- working conditions and unemployment are often related to poverty, inequality and discrimination. In many contexts, certain groups such as workers with disabilities, women workers, youth, and migrants, among others face particular obstacles in accessing decent work and may be especially vulnerable to abuses (United Nations, 2015). With the COVID-19 pandemic and the economic decline, companies struggled to maintain job positions, increasing unemployment rates all around the world and putting people in the position to struggle financially.

Economic uncertainty becomes an issue for people to face and absorb change in times of a crisis and therefore to be resilient. To enhance job opportunities and decent work conditions for people no matter their race, age, gender, nationality, disability corresponds to an accurate path to work towards the sustainability, resilience and equity of communities and territories.

-Data Source

Content	Format	Source
Unemployed Residents	ISTAT	istat.it/storage/cartografia/basi_territoriali/WGS_84_UTM/2011/R01_11_WGS84.zip

-Assessment Method

To calculate the indicator:

1.Projection of the acquired shapefile data on the GIS software.

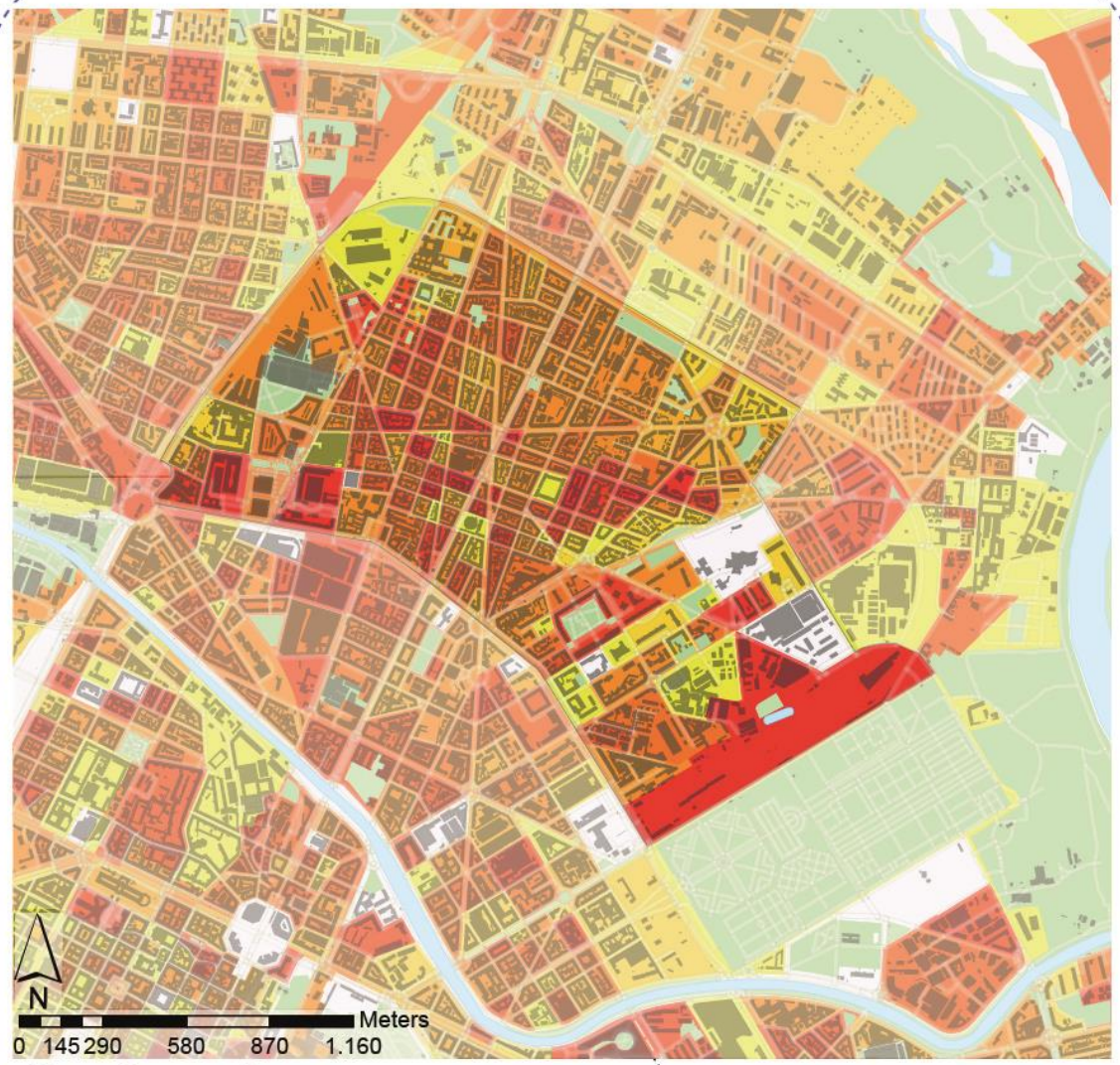
2.Through the "Clip" geoprocessing tool, the extrapolation of the data provided by the shapefiles at the municipal level only for the Barriera di Milano Neighborhood.

3. Analysis of the 2011 population census carried by ISTAT, specially the data on unemployed residents.

4. Connection between the census sections shapefile of the municipalities and the ISTAT dataset.

5. Create a new field in the attributes table , where the number of unemployed residents is divided by the total residential population of every census section.

-Results



Unemployment Rate

Inhabitants:
47.163

Average of Inhabitants per Census Section: 276 Inhabitants
Average of Unemployed Inhabitants per Census Section: 11 Inhabitants

Average Unemployment Rate: 5%

N° of Inhabitants	N° of Unemployed Inhabitants	N° of Census Sections	Average Inhabitants per Census Section	Average Unemployed Inhabitants per Census Section	Average Unemployment Rate per Census Section
47163	2280	208	276	11	5%

KPI 17

Social Marginalization

1.Aim

The identification and characterization of the residents capacity to produce economically in order to be able to provide for and afford the basic needs and have a good life quality. To identify the unemployment rate and the monthly income of residents helps to identify the vulnerability of communities to adapt and survive to crises like the previous health emergency in order to guarantee the wellbeing of people.

2. Assessment Methodology

-Data Requirement

Indicator	Unit of Measure	Reference
Unemployment Rate & Average Monthly Income.	Proportion of people living 50 percent of median living according to race, religion, culture, nationality, sex, gender, age, disabilities.	UN's SDGs: Goal 10 Reduce inequalities; Target 10.2; Indicator 10.2.1.

The COVID-19 crisis has unmasked global income inequality, partly reversing the decline of the previous two decades. Weak recoveries in emerging markets and developing economies are expected to raise between-country inequality. Globally, the absolute

number of refugees in 2021 was the highest on record. (United Nations, 2015)
Marginalized groups were disproportionately impacted by Covid-19 regulations that exposed them to further discrimination and human rights abuses and challenging these groups to cope and comply with the lockdown restrictions (Amnesty International, 2022)

For the following analysis, due to the limitation with the open data available, two variables were studied (Foreign Residents and Unemployment Rate) in order to have an overview at a city and neighborhood scale of the relationships between nationality and income to determine the level of vulnerability within the whole community.

-Data Source

Content	Format	Source
Unemployed Residents	ISTAT	istat.it/storage/cartografia/basi_territoriali/WGS_84_UTM /2011/R01_11_WGS84.zip
Foreign Residents	ISTAT	istat.it/storage/cartografia/basi_territoriali/WGS_84_UTM /2011/R01_11_WGS84.zip

-Assessment Method

To calculate the indicator:

1.Projection of the acquired shapefile data on the GIS software.

2.Through the "Clip" geoprocessing tool, the extrapolation of the data provided by the shapefiles at the municipal level only for the Barriera di Milano Neighborhood.

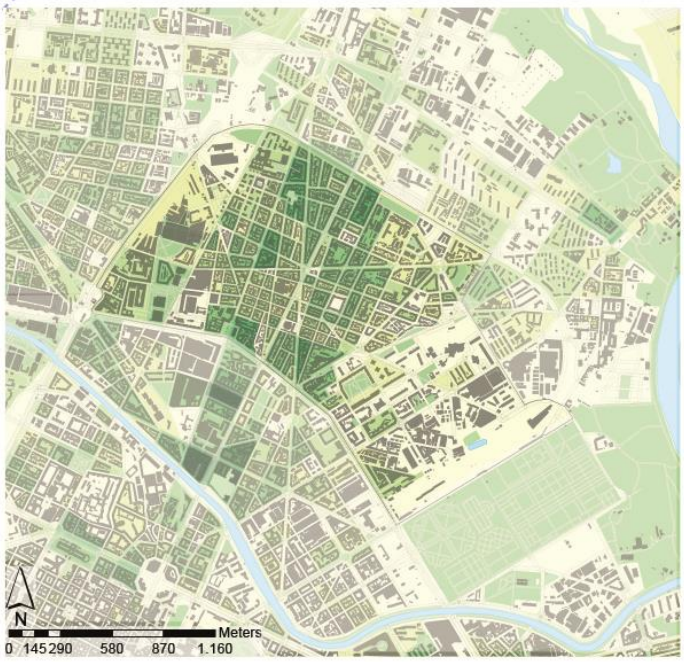
3. Analysis of the 2011 population census carried by ISTAT, specially the data on unemployed residents and foreign residents.

4. Connection between the census sections shapefile of the municipalities and the ISTAT dataset.

5. Create a new field in the attributes table , where the number of unemployed residents is divided by the total residential population of every census section.

6. Identification of the number of foreign residents per census section using the classify categorization in the simbology tool.

-Results



Foreign Residential Population

Foreign Inhabitants: 771

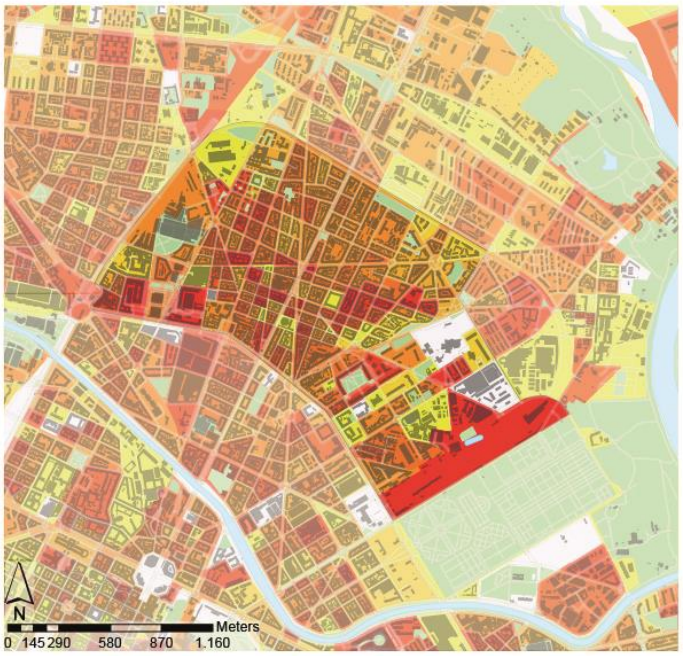
Average of Inhabitants per Census Section: 276 Inhabitants

Average of Foreign Inhabitants per Census Section: 8 Inhabitants

Average Percentage of Foreign Residents : 11%

Barriera di Milano
Buildings
Green Areas
Waterbodies
Roads

Foreign Population (Inhabitants)
<25
<50
<100
<200
<300
<400
<500
<600



Unemployment Rate

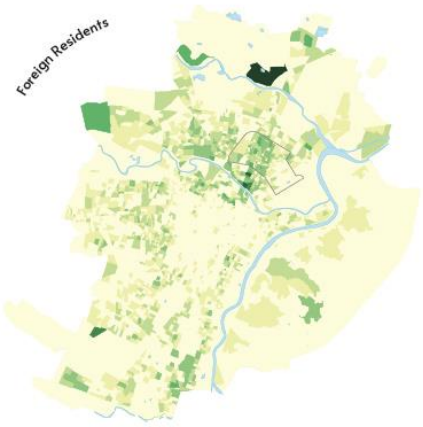
Inhabitants: 47.163

Average of Inhabitants per Census Section: 276 Inhabitants
Average of Unemployed Inhabitants per Census Section: 11 Inhabitants

Average Unemployment Rate: 5%

Barriera di Milano
Buildings
Green Areas
Waterbodies
Roads

Unemployment Rate
<1%
<2%
<3%
<4%
<5%
<6%
<7%
>7%



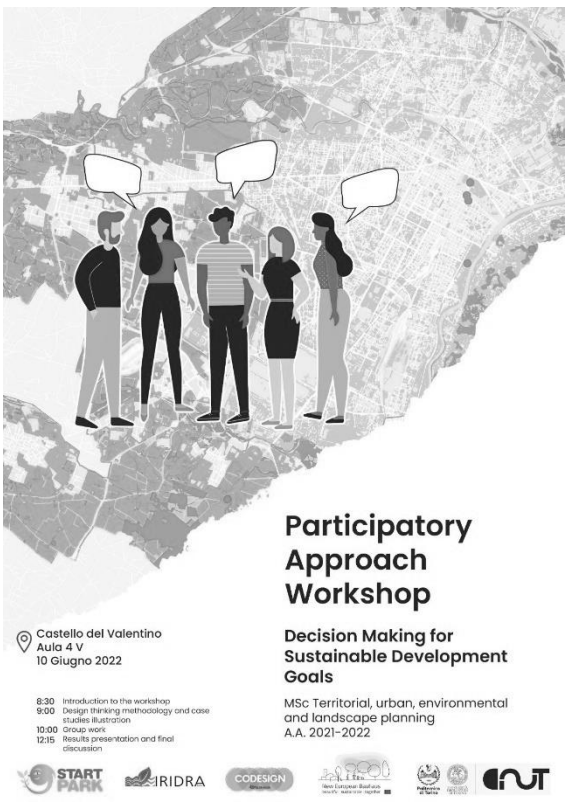
N° of Inhabitants	N° of Foreign Inhabitants	N° of Census Sections	Average Inhabitants per Census Section	Average Unemployed Inhabitants per Census Section	Average Unemployment Rate per Census Section
47163	771	208	276	8	11%

N° of Inhabitants	N° of Unemployed Inhabitants	N° of Census Sections	Average Inhabitants per Census Section	Average Unemployed Inhabitants per Census Section	Average Unemployment Rate per Census Section
47163	2280	208	276	11	5%

4.3 Phase 3: Building the future scenario

4.3.1 Enhancing Social Participation

The social participation tool was simulated and validated through the development of a workshop held in with the students of the Politecnico du Torino. The methodology used was the one structured buy the Start Park project as a participatory game based on the design thinking ideas that seeks to enhance problem discussion among stakeholders and finally motivate spaces of co-design were people came up with some sustainable solutions because of the conversation and dialogue.



4.3.2 Preparing the Material

The Game Board

The board, following the Start Park parameters, is a simplified plan of the site indicating the main features of the study area in order to illustrate the participants with the territory as well as spatialize the discussed and chosen solutions.

During the game, the groups were asked to write, draw, and localize each one of the strategies to be implemented through post-its or directly on the map.

On the bottom part, there is a designated area to put the respectively solution card for each one of the problems.

Figure 28: Board Design. Source: Author

Stakeholder Cards

For the simulation of the workshop a group of stakeholders was selected based on their relevance to the case study and the development of the designated sustainable solutions. In each group a set of cards was distributed for each participant to role play that stakeholder based on its background and interests.

Figure 29: Stakeholder Cards: Boardgame. Source: Author

Stakeholders:

-**The Municipality of Turin**: Urban and Territorial Division: Urban planner of the city of Turin in charge of the creation of development plans for the city and influence the decision-

making processes for the implementation of policies and strategies that work toward a sustainable, equal, resilient future.

-Private Investor: One of the companies that have their warehouses in Barriera di Milano is interested in financing some projects that can enhance the sustainable development of the neighborhood and can transform the landscape of the area to be more attractive.
-Non-Profit Association: President of the ACMOS association that aims to promote and encourage civic participation of young people in their environment, thus contributing to the spread of the values and the practices of active citizenship. The work is based on the active involvement of young people, on the promotion of their cultural and social development, and on non-formal education as a vehicle for social inclusion and respect for differences.

-Elder Resident: A 75-year-old resident who has lived most of his life in the area as he used to work in one of the big factories that were located in the area in the 60s.

-Unemployed Resident: A 40-year-old father head of the family who had to close his family business due to the Pandemic.

-Child Resident: A 9-year-old child that goes to 4th grade in the neighborhood's primary school. During the pandemic, she and her 3 siblings had to stay at home while having online classes.

-Single Mother Resident: A mother of 2 children head of the household who works two part-time jobs in order to be able to pay the bills.

-Immigrant Resident: A Moroccan resident that migrated 4 years ago to Turin with his wife and children looking for better life opportunities.

The Solution Cards

For the gamification process, permission was asked to the Start Park organization to use their designed cards with their natural based solutions proposed. As described before, there are 3 types of solution cards: The GBI Cards, Furniture Cards and Activity Cards. However, as the case study of Barriera di Milano represents an urban approach and a wide range of solutions were needed rather than nature-based solutions, the cards were modified in order to have a larger range of solutions based not only on nature but also sustainability.

- Transport Cards: (GBI Cards)

These cards present different types of mobility solutions with different levels of impact, spatial configuration, and costs. Regarding this last variable, each strategy holds a different construction and maintenance cost ranging from One to Three.

Figure 30:Transport Cards. Source: Author

- Housing Quality Cards

These types of cards have different solutions regarding the improvement of housing conditions. They differ from cost to time of development as well as different involvement of stakeholders and feasibility.

Figure 31: Design of the Housing Quality Cards. Source: Author

- Green Areas Cards

These cards present various solutions that aim to improve the quality of green areas in the neighborhood as well as the number of zones found in the study area. They also vary from scale, price, and term of development.

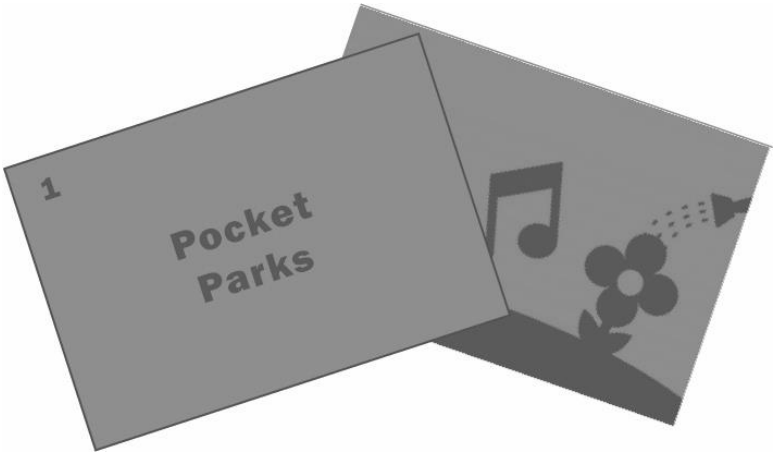


Figure 32: Design of the Green Areas Cards. Source: Author

4.3.3 The Workshop

This workshop was organized as a simulation of a real participatory approach. During a whole class session with the students of the Decision Making for Sustainable Development Goals class with Patrizia Lombardi and Sara Torabi in June 10th 2022. The first part of the session corresponded to the explanation of the participatory processes from a theoretical point of view followed by the presentation of the case study were a general overview of the place and the social dynamics were given to the participants and finally the presentation of the rules of the game as well as how to use the materials and the different roles for each participant.

Figure 33: Workshop Attendants, July 10th, 2022. Source: Author

Presentation of the Case study and Game Rules

After the introduction of the workshop and participatory tools, we proceeded with the contextualization of each study area in order to enlighten the students regarding the

historical, social, economic, cultural background of the study area as well as the strengths and weaknesses of the place. On the other hand, the rules of the game were explained detailed as well as how to use the material properly.

Figure 34: Presentation of the Case Study. Source; Author

Identification of the problems:

For the purpose of the workshop, three problems were selected in order for participants to discuss and find a solution together. It is important to say that these problems were identified as the result as a first territorial analysis made before the calculation of KPIs.

Overcrowded Public Transport System: The high population density of Barriera di Milano challenges the capacity of the public transport resulting in overcrowded buses and trams as well as the stops in the public space. This also happens because of the absence of other alternative transportation methods like the metro, bicycle stations, and infrastructure as well as comfortable sidewalks. In a pandemic scenario, this becomes an issue in order to comply with the implemented measures to stop propagation like social distancing.

Poor Housing Conditions: The private residential buildings, as well as the educational infrastructure, industrial facilities, and heritage buildings have shown a progressively physical deterioration throughout the years. On the other hand, as some industries have moved to the new peripheries in Torino, some buildings and warehouses are now in an abandoned state. This affects not only the landscape value of the neighborhood but also the quality of life of the residents. The living conditions are directly affected by the deterioration state of the buildings defining the quality of the daily life and activities of the inhabitants.

Lack of Green Public areas: The existing public parks in the neighborhood are found on the periphery of the district limiting their accessibility to them from all types of populations. Additionally, the current parks are not enough area compared to the population density and the recommended parameters of green public areas by the World Health Organization (9sqm/inhabitant). On the other hand, most of them lack the infrastructure to invite people to use the park. Moreover, its industrial character limited the construction of squares that hold an important role in the Italian urban life and culture.

Spatialization of the problems:

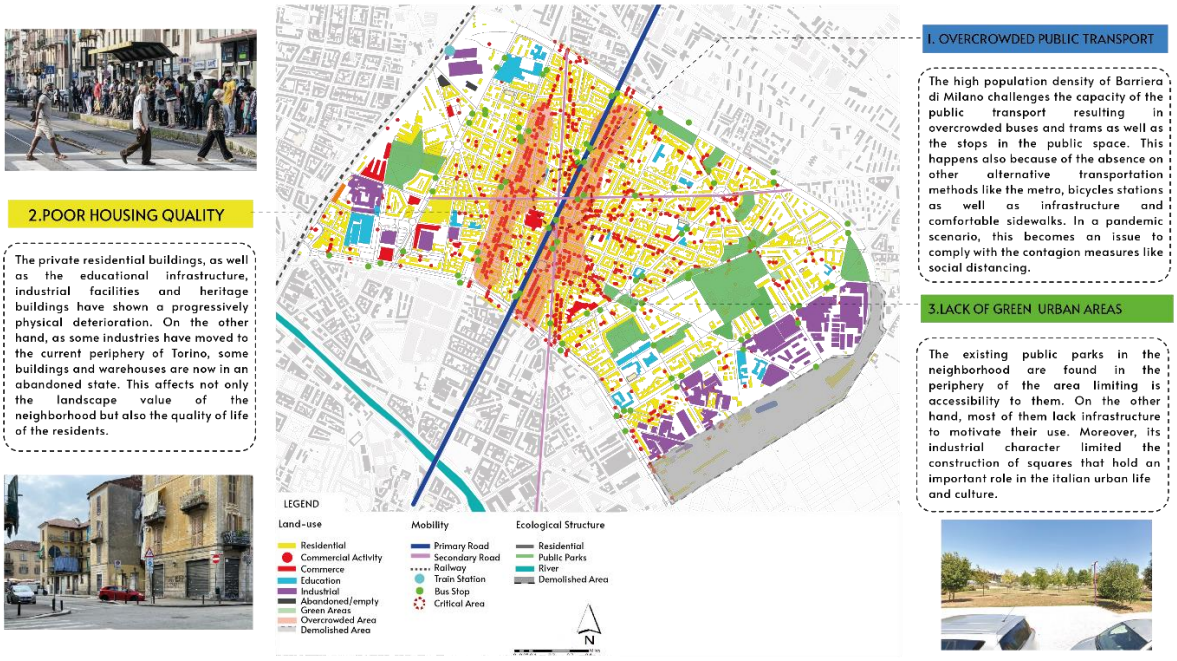


Figure 35: Spatialization of the Identified Problems. Source: Authors

How to play:

Step 0: Set the Ground (10 Minutes)

Each group is assigned to a case study

-Prepare the table. You will have:

. The Site plan with 3 problems

. 4 card desks (stakeholder, GBI, Furniture, Activities)

-Pick a stakeholder card. It represents the stakeholder you will embody during the game.

Step 01: Round 1 (30 Minutes)

Address the first problem by using Transport cards (max 2).

Select where to put each solution and justify your choice with a sticky notes/sketches/note on the board.

Step 02: Round 2 (30 Minutes)

Address the second problem by using the Housing You can use max:

. 2 Housing cards

Select where to put each solution and justify your choice with a sticky notes/sketches/note on the board.

Step 03: Round 3 (30 Minutes)

Address the problem by using the Green Areas. You can use max:

. 2 Activities cards

Select where to put each solution and justify your choice with a sticky notes/sketches/note on the board.

Final Step:

Each group has 10-15 minutes to present their results.

The Co-design Process

Then, the students had time to work in their respective groups. Each member of the group selected a stakeholder card that will determine their position and point or view in order to enrich the conversation and enhance negotiation depending on the interests of each one of them. For each presented problem (three in total) there was a round of discussion among stakeholders.

Figure 36: Discussion of Group 1. Source: Author

Figure 37: The Groups During the Co-Design Process. Source: Author

Groups Presentations

As a final step of the workshop session, each group had 15 minutes to present to the rest of the participants how their discussion went up in their teams and explain which solutions they picked as well as why they selected those strategies.

Figure 38: Groups Presenting Their Results. Source: Author

Group 1

Problem	Chosen Solution	Conclusion
Overcrowded Public Transport	1.Intercity Train 2.Public Bicycle Racks & Bikeways	Bicycle paths are the most sustainable solution in terms of cost-efficiency as well as urban health taking into account the pandemic scenario. The implementation of the train is helpful as its collective, it can be adapted for old/disabled people, and it would be cheaper as it would use existing infrastructure.
Poor Housing Quality	1.Boost Private Sector Investment 2.Housing Retrofitting Grants	Grants encourage people to pay attention to the physical state of the housing units. If the energy efficiency is improved in the houses, the consumption costs will decrease, and the performance and quality of the building will go up generating value. The private sector should be involved in terms of budget as well as increasing the reputation and image of the area.
Lack of Green Urban Areas	1.Pocket Parks 2.Street Trees Canopies	Increase the accessibility for all segments of the population to green-recreational areas without having to move long distances as well as improving the landscape perception and quality of the neighborhood.

Table 5:Workshop: Results of Group 1. Source: Author

Group2

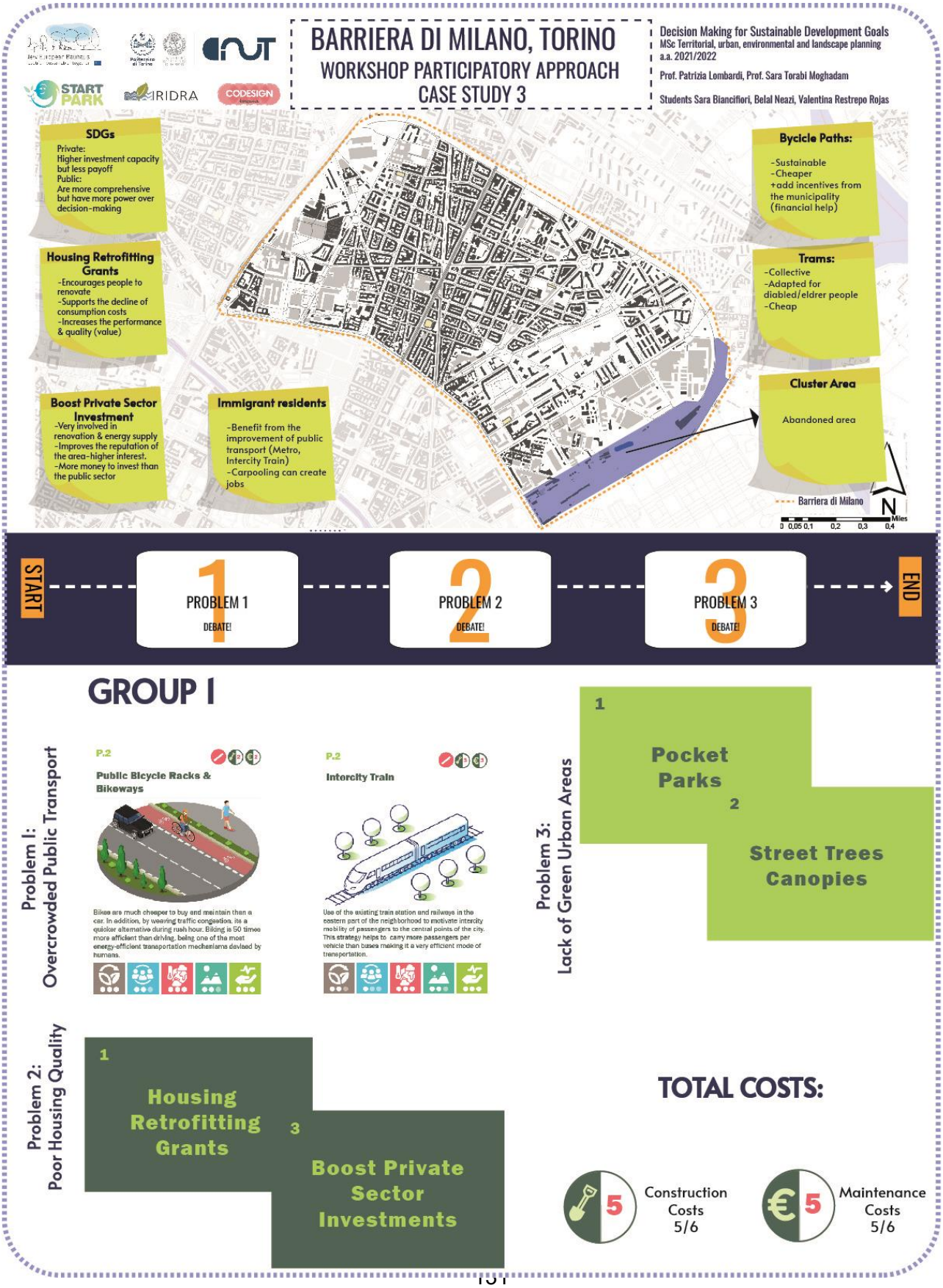
Problem	Chosen Solution	Conclusion
Overcrowded Public	1.Metro Line	The development of the metro line helps not only the connection of

Transport	2.Public Bicycle Racks & Bikeways	the neighborhood but the whole city. it is efficient and has a high capacity for high density neighborhoods. The bicycle paths help to give an alternative option to car and public transport.
Poor Housing Quality	1.Municipal Housing Fund 2.Housing Retrofitting Grants	To give affordable housing for the homeless, poor families in order to guarantee decent living conditions for everybody. From the point of view of the residents, a restoration fund can prioritize the renovation of housing units and improve living conditions.
Lack of Green Urban Areas	1.Pocket Parks 2.Climate Proof Residential Gardens	The pocket parks give accessibility to children and elder people to access green areas. This strategy, as well as the climate- proof residential gardens enhance integration among cultural groups as well as tackle issues as climate change and resource efficiency.

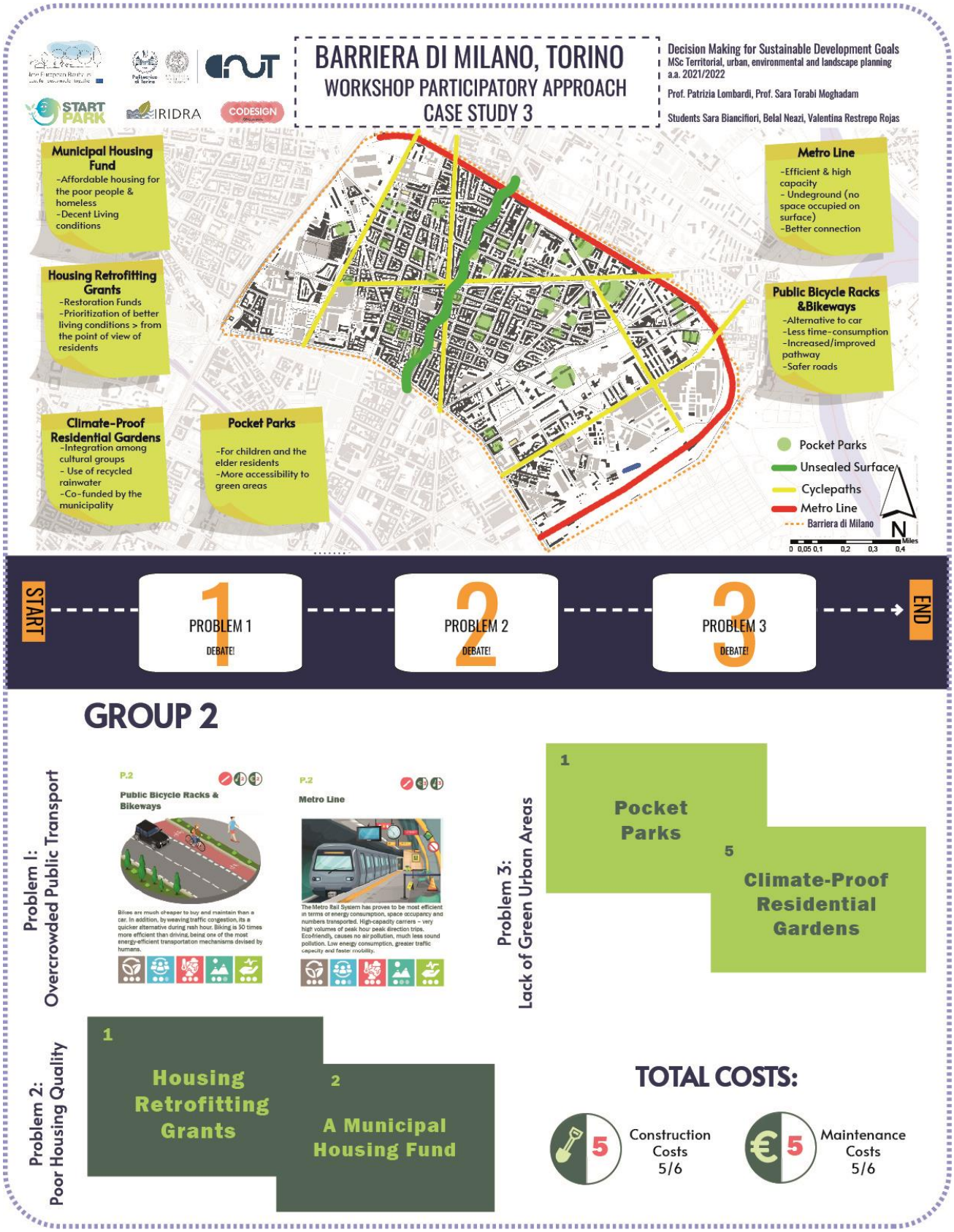
Table 6: Workshop: Results of Group 2. Source: Author

4.3.4 Results

Group 1:



Group 2:


BARRIERA DI MILANO, TORINO
WORKSHOP PARTICIPATORY APPROACH
CASE STUDY 3
Decision Making for Sustainable Development Goals
MSc Territorial, urban, environmental and landscape planning
a.a. 2021/2022
Prof. Patrizia Lombardi, Prof. Sara Torabi Moghadam
Students Sara Biancifiori, Belal Neazi, Valentina Restrepo Rojas
Municipal Housing Fund
-Affordable housing for the poor people & homeless
-Decent Living conditions
Housing Retrofitting Grants
-Restoration Funds
-Prioritization of better living conditions > from the point of view of residents
Climate-Proof Residential Gardens
-Integration among cultural groups
- Use of recycled rainwater
-Co-funded by the municipality
Pocket Parks
-For children and the elder residents
-More accessibility to green areas
Metro Line
-Efficient & high capacity
- Undeground (no space occupied on surface)
-Better connection
Public Bicycle Racks &Bikeways
-Alternative to car
-Less time-consumption
-Increased/improved pathway
-Safer roads
Pocket Parks
Unsealed Surface
Cyclepaths
Metro Line
Barriera di Milano
N
Miles
0 0,05 0,1 0,2 0,3 0,4
START
1 PROBLEM 1 DEBATE!
2 PROBLEM 2 DEBATE!
3 PROBLEM 3 DEBATE!
END
GROUP 2
Problem 1: Overcrowded Public Transport
P.2
Public Bicycle Racks & Bikeways
Bikes are much cheaper to buy and maintain than a car. In addition, by weaving traffic congestion, its a quicker alternative during rash hour. Biking is 30 times more efficient than driving, being one of the most energy-efficient transportation mechanisms devised by humans.
P.2
Metro Line
The Metro Rail System has proves to be most efficient in terms of energy consumption, space occupancy and numbers transported. High-capacity carriers - very high volumes of peak hour peak direction trips. Ecofriendly, causes no air pollution, much less sound pollution. Low energy consumption, greater traffic capacity and faster mobility.
Problem 2: Poor Housing Quality
1 Housing Retrofitting Grants
2 A Municipal Housing Fund
Problem 3: Lack of Green Urban Areas
1 Pocket Parks
5 Climate-Proof Residential Gardens
TOTAL COSTS:
5 Construction Costs 5/6
€ 5 Maintenance Costs 5/6

Chapter 5
Conclusions, Limitations & Future Developments

5.1 Key Findings

The COVID-19 Pandemic has changed how people interact with the city and public space directing the focus of authorities to urban health and resilience. Moreover, it has unmasked not only the unpreparedness of cities to face disasters and crises but also many social disparities that put a great part of the global population in a vulnerable state.

Lockdown and quarantine measures resulting in economic decline have been the most catastrophic in poor and densely populated urban areas, especially, for the communities living in informal settlements and slums, challenging the achievement of urban resilience.

The change and redefinition of proximity has accelerated the digital transition. Lockdown measures made citizens to rely completely on digital technologies almost overnight to try to adjust to the new normality and continue with daily activities. However, this transformation has negatively impacted the people who do not have access to communication technologies leaving this communities behind and vulnerable adrift on how they are going to cope with the measures in order to protect their health, while at the same time maintain their routines from their homes and still count with economic welfare.

It is of vital importance to identify the communities and social groups that might struggle more to absorb any type of damage and be resilient to provide the necessary support as an important step to guarantee security to all citizens regarding their gender, age, disabilities, economic status, nationality etc. Cities need to understand that a crucial element to enhance the development of sustainable, resilient cities is to actually put all the efforts to leave no one behind understanding the city as a whole community.

To achieve this, to follow a methodology based on the evaluation of Key Performance Indicators (KPIS) as a data analysis tool was crucial to identify these communities as well

as the different risk factors that can limit their capacity to adapt to crises and absorb damage to then propose a set of possible solutions to enhance resilience and avoid damage, loses and negative impacts as much as possible during future disasters. To structure a methodology that is applicable, replicable, and sustainable is vital to provide an appropriate vocabulary with the objective to analyze the territory and its response to external shocks that can interrupt social dynamics and jeopardize the wellbeing of the population, especially, the communities exposed to more hazards and that face greater social disparities compared to the rest of the population.

For the case of Barriera di Milano, the proposed methodology was helpful to identify the risk factors that, facing the COVID-19 pandemic, would leave them with a disadvantage compared to the rest of the city to be able to accommodate their routine to the "new normality". The different accessibility analysis helped determine that, in a scenario where public transport cannot be reached due to unavailability or just for social distancing reasons, if people do not count with a private vehicle, services like health facilities, are not easily reached by foot. Moreover, the residential density analysis showed us that the neighborhood is one of the densest in the municipality having a high risk of overcrowding and consequently, harder to comply with the social distancing measures. Nonetheless, the most relevant characteristic in Barriera di Milano is the high cultural backgrounds of the residents. To have a high population of immigrants can result in social marginalization due to their financial struggle and challenge to access to stable, safe jobs.

On the other hand, social participation tools are of vital importance in order to have a broader vision of territories from the social point of view as well as to motivate decision-making as a bottom-up approach to take into account the people's perceptions to propose and enhance sense of belonging and guarantee successful strategies.

The pandemic showed us that nowadays efforts need to be redirected to enhance urban resilience in order to prepare communities and territories to face future disasters and crises,

absorb the damage and guarantee sustainable development, equity and safety for all communities and territories.

By analyzing the Key Performance Indicators, it was possible to understand the basic scenario of the city of Turin, identify weak and critical areas as well as opportunities having as the core of the study the vulnerable communities as a crucial step to promote urban resilience. This, supported by the development of social participation tools as co-creation strategies represent the accurate path to influence decision-making processes to propose solutions that respond to the needs of the community, promotes social appropriation, and enhances sustainability, resilience, and equity.

5.2 Limitations

From the impact assessment, there was the challenge of the data collection regarding not only the COVID-19 information, but also socio-demographic, economic, and territorial information at the local level for the different neighborhoods in the city of Turin, due to privacy reasons. Most of the information found openly to the public is found generally for the country of Italy or by region and municipality. Moreover, the few data available at the neighborhood level, especially the socio-demographic information its not up to date, making it difficult to present a comparison analysis between different time periods (before, during, and after the pandemic) to have a deeper understanding of the impacts brought by the sanitary emergency. Even though the initial idea was to calculate the most KPIs as possible, the ones calculated in this research thesis were chosen considering the amount of information available to the public rather than its importance and relevance in the analysis. Therefore, for future developments, it is important that the Piedmont's public entities to provide the needed data openly in a readable format, with open license, certified, complete, and up to date.

On the other hand, regarding the validation of the participation tool, due to the resources and time limitations, could be implemented only as a simulation workshop with the Politecnico di Torino urban planning students. For future developments, it would be very

enriching to work directly with the community to have an insight on the resident's opinions, needs, and desires.

5.3 Future Developments

As this research thesis is part of the Post Unlock project 2020 led by the Inter-university Department of Regional and Urban Studies and Planning (DIST), along with the Responsible Risk Resilience Center (R3C) and the Medical Statistics and Epidemiology Department of the University of Turin, with the aim to define a new territorial scenario for the year 2030, considering the management of the post-sanitary emergency phase of the COVID-19, the aim is to keep applying the proposed methodology to the remaining neighborhoods in the city of Turin, to construct a project that can then be applied to the entire municipality.

In this work only 7 indicators were evaluated due to lack of data available as well as time, therefore, the first element to keep working on is the evaluation and spatialization of the final set of indicators to have a complete territorial analysis of the neighborhood.

Moreover, this thesis also explores the development and proposal of future scenarios based on a participatory approach. This would be an interesting aspect to keep developing; to understand, after having carried out an extensive analysis of the neighborhood with the evaluation of indicators, possible solutions to tackle the identified issues based on co-creation initiatives that takes into account the communities' best interests while at the same time thinking on strategies that can be easily adaptable, replicable and sustainable for most urban contexts. The structuring of these type of solutions can be a starting point to begin shaping the Local Resilience Unit Model as the expected result of the Post Un-Lock project.

This research thesis provides a basis for future research not only on the evaluation of Key Performance Indicators, but also the use of social participation tools as a crucial tool that supports decision-making. This work sets a starting point to redefine urban resilience after

the COVID-19 pandemic, starting from community engagement thinking on enhancing sustainability, resilience, and equity to all social groups.

Chapter 6
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