

Lecture Notes in Networks and Systems 639

Carmelina Bevilacqua
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New Metropolitan Perspectives

Transition with Resilience
for Evolutionary Development



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New Metropolitan Perspectives

Transition with Resilience for Evolutionary
Development

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

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Resilient and Transition Strategies for the Post-pandemic City: A Multi-criteria Analytical Approach for the Case of the Metropolitan City of Reggio Calabria

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Abstract. European cities face the challenges of planning their transition to achieve sustainable and resilient urbanization. However, operationalizing suitable urban strategies toward sustainability appears difficult, especially in the light of rising inequalities and disparities within and among EU cities and regions. Urban regeneration strategies appear to be a possible leveraging mechanism for cities' green and digital transition in the mutated policy context for recovery after the pandemic. In this context, the paper explores how intermediate cities effectively design and implement urban development strategies toward resilience and sustainability in response to the current pressing challenges. The Metropolitan City of Reggio is examined by assessing the city's ability to address context vulnerabilities in current urban development strategies through a multi-criteria analytical approach. Results point out priority factors that affect the case under investigation and should be prioritized in de-fining future development strategies and the potential role of urban regeneration in the city's future development strategies towards resilience sustainability.

Keywords: urban resilience · urban sustainability · urban transition · urban regeneration

1 Introduction

In the 21st century, climate changes, pandemics, and economic fluctuations are just a few of the challenges affecting cities and exposing populations to unpredictable and unforeseen risks [1]. Given the pace of urbanization processes, such challenges became remarkable for cities in scale, scope, and complexity [2, 3]. Cities are then called to deploy policy responses linked to local conditions and provide tools and instruments to achieve sustainable and resilient urbanization [4]. In this direction, the rising uncertainty and complexity, reflected from the global to the urban scale, are demanding new and radical approaches to achieve a transformation to sustainability [5] emphasizing the relevance of the urban dimension [6]. However, despite the efforts towards sustainable urban development in the last decades, socio-economic inequalities and environmental

degradation issues in cities persist [7]. The increase in social, economic, and environmental vulnerabilities pushes adopting resilience thinking in planning [8]. As a result, cities are designing “workable governance instruments to support low carbon energy transition and stimulate urban transition and transformation to achieve sustainable and resilient cities” [9: 410].

In response to the pressing and severe challenges mentioned above, the European Union (EU) has deployed policy and financial efforts to develop transition strategies toward resilience and sustainability for the future of the Union. The Next Generation EU instrument, which makes available unprecedented financial resources for future resilient Europe, has been designed and implemented to foster the recovery phase of the EU [10]. Accordingly, each Member State has shaped a National Plan for Recovery and Resilience to access these resources and facilitate such transition.

Although the policy efforts, global dynamics and natural risks affect cities’ ability to withstand shocks and stress [8]. In a recent contribution, Florida et al. [11] pointed out how, in macro-geographic terms, it is likely difficult that winner-take-all economic geography will be affected by extreme shocks. Hence, the attention should focus on intermediate cities with considerable and untapped economic potential, requiring a more territorially balanced, place-sensitive approach [12]. However, there is a difficulty in planning in response to the increase in urban systems vulnerabilities [8]. One of the worldwide socio-economic development strategies to address this gap is urban regeneration, which is gradually shifting from large-scale urban transformation projects “to address diversity, sustainability, equality and livability in the city” [13: 101].

In this context, the paper explores how intermediate cities address their vulnerabilities in the light of resilience and sustainability goals through their urban development strategies. Given the financial resources available, and the relevance of cities in facilitating the transition, we argue that cities should carefully identify their development priorities, starting from addressing their main vulnerabilities. By following an integrated perspective, urban regeneration offers the chance to implement suitable strategies to increase urban sustainability and foster urban resilience, given its ability to cover the social, economic, and environmental dimensions [14].

In the light of these premises, the paper seeks to answer the following research questions: given the pressing challenges to tackle and the robust response of the EU in terms of policy adaptation and financial resources, are cities effectively designing and implementing resilience-oriented strategies to address their persistent social, economic, and environmental vulnerabilities? Furthermore, which actions such strategies should prioritize to facilitate urban transition toward resilience and sustainability?

To answer these questions, this contribution explores and describes the case of the Metropolitan City of Reggio Calabria, Italy. It attempts to assess its ability to address context vulnerabilities through the analysis of the development strategies in place and the potential role of urban regeneration in the future development strategies of the city towards resilience and sustainability.

The paper is structured as follows. The following section discusses the connection between urban resilience, transition, and sustainability concepts from the urban planning and governance perspective based on the available literature on these topics. Specifically, it provides a preliminary list of urban resilience definitions, highlights

urban transition management as a point of contact between resilience and sustainability concepts, and the relevance of (urban) planning and urban regeneration to achieve these two ambitious goals. This section also casts light on the policy context in which cities' resilience strategies are being implemented in Italy, namely the National Plan for Recovery and Resilience (PNRR) and the National Operative Programme – Metropolitan Cities. The methodology section presents the overall analytical approach to explore the case study selected, examined through secondary data and on-desk analysis of official documents. First, a multi-criteria analytical approach (adaptation of weighted product model) is applied to detect local context vulnerabilities. Then, the city development strategy is assessed against the vulnerability weight detected, and the Cities Resilience Index has been simulated to assess the resilience performance of the case under investigation against the current urban development strategy. Results point out priority factors that affect the case under investigation and should be prioritized in defining future development strategies to increase the city urban resilience and sustainability.

2 Background

2.1 The Urban Transition Towards Resilience and Sustainability

The recent and interconnected challenges exacerbated by the pandemic push cities to rethink and redesign their future development strategies. Therefore, cities must respond quickly and adapt to the continuous changes promoting urban resilience [4]. Fostering urban resilience in a time of uncertainties and complexity requires transitional processes, which are increasingly gaining emphasis due to the critical importance of local action for sustainability and climate change and the need for cities to take effective and efficient decisions in this direction [15]. Recently, the promotion of urban resilience related to the environmental, socio-economic, and political domains has attracted the attention of scholars and policymakers [16, 17]. A preliminary list of urban resilience definitions sheds light on the adaptive capacity of cities. Leichenko [18], defines *urban resilience* as the “ability of a city or urban system to withstand a wide array of shocks and stresses” outlining the relevance of adaptive capacity. Cities' adaptive capacity varies depending on several factors such as “governance, institutions, cultural habits, technology, wealth, urban planning, and their ability to respond to such challenges” [19: 382]. The level of cities' adaptive capacity is related with urban resilience, which “increases when cities have more adaptive capacity, and decreases when they are more vulnerable” [19: 382]. Meerow et al. [16: 45] define 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 transform systems that limit current or future adaptive capacity”. The latter definition emphasizes a linkage between socio-ecological and socio-technical networks in time and space, shaping urban resilience [16]. Meerow and Newell [3:4]. Have emphasized how leading scholars on resilience argue that the resilience concept “is crucial for achieving sustainability in a world of transformations.” Although urban resilience emerged as related to facing the challenges of natural disasters in the urban environment and climate changes, it can be applied to a more extensive set of sustainability challenges [20]. Such challenges (see Table 1) refer to three distinct resilience

components: the resilience of urban structure and services provided, the resilience of urban metabolism, and the resilience of urban dynamics.

Table 1. Sustainability challenges and related resilience perspective (Source: author's synthesis from [20: 183].

Sustainability Challenges	Principle	Perspective
(urban) Built environment	Rapid urbanization processes call for a safe built environment for population in the face of natural risks and climate changes	Reduction of specific vulnerabilities, especially those experienced by the urban poor living in high-risk areas (p.183)
Urban metabolism	Inefficient and unsustainable resource use both at the city and at the global level	Long-term socio- technical transition toward sustainability (involving technologies, innovation, development patterns of production and consumption chains), along with social, political, and behavioral changes. (p. 183)
Urban dynamics	Globalization has increased inequalities which reflect in cities by affecting vulnerable groups	Short circuit economies as local responses to external stresses the empowerment of vulnerable groups so that they can manage the necessary transition and innovation for sustainability (p.183)

For Chelleri et al. [20], responding to these challenges requires an integrated framework for the deployment of urban resilience strategies that incorporate sustainability to deal with “cross-scale implications (trade-offs) among systems, capacities, vulnerabilities, and time periods” [20: 183]. Following Chelleri et al. [20], three different approaches related to timescale can be summarized as follows: recovery (short-term), adaptation (medium-term), and transition (long-term). While the first is related to the immediate response to a shock as it could be to a natural disaster, and the second is the adjustment process of the response, the third approach implies a longer-term structural transformation (transitions) [20]. This approach shifts adaptation towards transition through a critical and complex socio-political choice, which happens when the system is close to a dangerous threshold [20] as the phase we are going through after the pandemic. In this perspective, resilience is not conceived as a return to normality but rather as “the ability of complex socio-ecological systems to change, adapt, and, crucially, transform in response to stresses and strains” [21: 302]. This definition provided by Davoudi [21] – which focused on evolutionary resilience – opens the floor to the “transition” concept, which refers to the transition management approach that “tries to empower and mobilize the undercurrent of sustainable development by offering a coherent framework for systemic change” [15]. Specifically, urban transition focuses on “the ability of multiple actors to initiate, accelerate and facilitate transformative processes in cities by scaling, replicating and embedding in local practices and institutions, generating solutions that directly and effectively address sustainability in cities” [3]. The two concepts of urban resilience and urban transition are relevant in understanding and defining the adaptation

and transformation processes that drive urban transformations towards sustainability. Although the literature keeps the two concepts separated, Redman [22] has highlighted how a possible point in common between the two approaches could lie in transition management, as both resilience and sustainability goals need transformative actions and strategies to be reached. Therefore, assessing urban resilience is becoming important for city planners, policymakers, urban transformation experts, and researchers [23], and how to achieve resilience is nowadays the main question to answer. Given the complexity of Cities, planning is crucial to increase their resilience – intended as the ability to be prepared for uncertainty [24]. Urban systems are affected by an increasing number of shocks and stresses that increase their exposure to vulnerabilities and hinder the sustainability of economic and social development [8]. Although the concept of resilience is not relatively new to the planning discourse, urban resilience is encountering difficulty being operationalized in the context of cities [20]. Davoudi [21: 306] emphasizes the relevance of evolutionary resilience for urban planning, given “its rejection of equilibrium, emphasis on inherent uncertainty and discontinuities, and insight into the dynamic interplay of persistence, adaptability, and trans-formability, provides a useful framework for understanding how complex socio-ecological interdependencies work”. From this definition, it is possible to point out two main relevant elements for the resilience and sustainability-oriented planning process: adaptability (or adaptive capacity) and transformation. The first “provides the opportunity for self-organization, which is a process of attraction and repulsion in which the internal organization of a system is not guided or managed by an external source” [8:7]. The second is defined “as the capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable” [8:7]. Some authors [25] argue that the first step to achieving resilience is to reduce the vulnerability of a system. Measuring its vulnerability contributes to defining a prioritization list for developing an urban agenda [25]. Indeed, reducing vulnerability to shocks and focusing on the assets that enable a system or community to maintain its functions and follow its paths is one of the main characteristics of resilience [26]. However, considering the vulnerability concept within the resilience debate can lead to some misinterpretation [25]. In this contribution, we are aware of the overlapping of these two concepts and their conceptual separation [3]. Measuring the vulnerability of an urban system in its components is a preliminary step to assess if the urban development strategies designed and implemented effectively address cities’ vulnerabilities to achieve resilience and sustainability [25]. Indeed, as Eraydin and Tasan-Kok [8] pointed out, planning practice has difficulty elaborating a framework to address the increasing vulnerabilities of urban areas.

2.2 The European and the Italian Response to Foster the Resilient Urban Transition: Urban Regeneration for the Transition

The European Union has responded to the COVID-19 pandemic with unprecedented measures [27]. The long-term budget for the EU programming period 2021–2027 (1.211 BEUR) has been topped up with EUR 806.9 billion of the Next Generation EU (NextGenEU) package as a temporary instrument to power the recovery [28]. The NextGenEU aims to foster the recovery from the pandemic and prepare the Union for a more green, digital, and resilient future [10]. The central pillar of the NextGenEU is the

Recovery and Resilience Facility [27], which aims to “mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions” [27]. The Recovery and Resilience Facility funds are distributed “according to national recovery and resilience plans prepared by each Member State, in cooperation with the European Commission, and in line with an agreed allocation key” [10]. In addition, several existing EU programs will be reinforced by the financial resources made available by this tool. The Cohesion Policy (REACT-EU), the Just Transition Fund, the EU Agricultural Fund for Rural Development, InvestEU, RescEU, and Horizon Europe [10]. Furthermore, the REACT-EU (Recovery Assistance for Cohesion and the Territories of Europe) extends the EU response to the crisis (EUR 55 billion) making available additional funds to the 2014–2020 European Regional Development Fund (ERDF), the European Social Fund (ESF), and the European Fund for aid to Most Deprived (FEAD) [28].

The Italian response to the crisis generated by the pandemic has been set out in the National Recovery and Resilience Plan, which envisages investments and reforms to deploy using the EUR 191.5 billion of the Recovery and Resilience Facility and EUR 30.6 billion being funded through the Complementary Fund [29]. The Plan aims to face both the challenges that emerged after the pandemic and the structural weaknesses of the Italian economic system [29]. The Plan is built on three strategic pillars: digitalization and innovation, ecological transition, and social inclusion [29], which aim to address the economic and social side effects generated by the pandemic and the persisting structural weaknesses of the Italian economy by defining a transition path that will also contribute to reducing territorial, generational and gender gaps [29]. The Plan has been articulated in six missions (see Table 2).

Table 2 shows how the green and digital transition is the main priority of the strategy (Mission one, two, and three absorb most of the budget - BEUR 104). Italian cities can benefit from the National Recovery Plan (PNRR) through the Resilience and Recovery Facility and the React-EU within the NextGenEU stimulus package. The PNRR pays particular attention to rebalancing the inequalities across territories, specifically between the north and south of the country and urban and inner areas. Cities, then, are central elements to drive the envisaged transition, and urban regeneration is gaining relevance as a mechanism to activate it. Social inclusion, energy district, circular economy, and sustainable mobility are only a few specific actions that urban regeneration processes and projects can sustain. Many of the Italian PNRR missions refer explicitly to urban regeneration as a tool to characterize interventions in cities’ urban and peripheral areas to facilitate the transition towards resilience and sustainability. Figure 1 shows the connection between the PNRR and urban regeneration by highlighting the component of each mission in which urban regeneration is mentioned as an implementation tool. It also shows the funds available for each action. Most resources are channeled into the Mission 5 Inclusion and Cohesion (MEUR 87.96) with a specific focus on employment policies (MEUR 38.97) and interventions under the family act (MEUR 30.5). The green transition mission (MEUR 79.7) pays particular attention to the energy efficiency of buildings (MEUR 37.39) and local sustainable mobility (MEUR 18.52). Despite the lower amount of resources (MEUR 18,91), the healthcare mission addresses two critical elements that

Table 2. Italian National Recovery and Recovery Plan (PNRR): Missions, aims and funds [29].

Mission	Aim	Funds (BEUR)
Digitization, Innovation, Competitiveness, Culture	promoting the country's digital transformation, supporting innovation in the production system, and investing in two key sectors for Italy, namely tourism and culture	49.2
Green Revolution and Ecological Transition	improving the sustainability and resilience of the economic system and ensuring a fair and inclusive environmental transition	68.6
Infrastructure for Sustainable Mobility	the development of a modern, sustainable transport infrastructure extended to all areas of the country	31.4
Education and Research	strengthening the education system, digital and technical-scientific skills, research, and technology transfer	31.9
Inclusion and Cohesion	facilitate labor market participation, including through training, strengthen active labor market policies and foster social inclusion	22.4
Health	strengthening local prevention and health services, modernizing, and digitizing the health system and ensuring equal access to care	18.5

emerged during the pandemic outbreak: the digitalization of medicine (MEUR 11.82) and community-based care (MEUR 7.9). The digitalization, innovation, competitiveness, and culture mission highlight important resources to deploy in urban, inland, and marginalized areas by leveraging cultural heritage and tourism funds (MEUR 5.45).

Urban regeneration mechanisms are receptive to flexibility and change [30] and gain relevance as a response to the global challenges related to socio-ecological and socio-technical dynamics. Such flexibility lies in the public-private partnership and in the support provided by the Mixed-use zoning approach [31], which allows for economic diversity [32] and acts as a catalyst for environmental sustainability [33]. Then, fostering the transition towards resilience and sustainability in cities can be facilitated by the urban regeneration approach. In the Italian case, cities can benefit from the available EU resources by exploiting the programs developed for 2014–2020, specifically the National Operative Programme for Metropolitan Cities [34], as a platform to coordinate the efforts for the transition of metropolitan cities towards sustainability and resilience. The National Operational Programme (NOP) “Metropolitan cities 2014–2020” supports the priorities of the National urban agenda within the framework of the sustainable urban development strategies outlined in the Partnership Agreement for the programming period 2014–2020 [34]. In addition, the Programme is aligned with the European Urban Agenda strategy, which identifies urban areas as crucial to fostering the smart, inclusive, and sustainable growth set out by the Europe 2020 Strategy.

Given this policy framework for the programming period 2021–2027, European cities now have the unique opportunity to re-design their development strategies accordingly

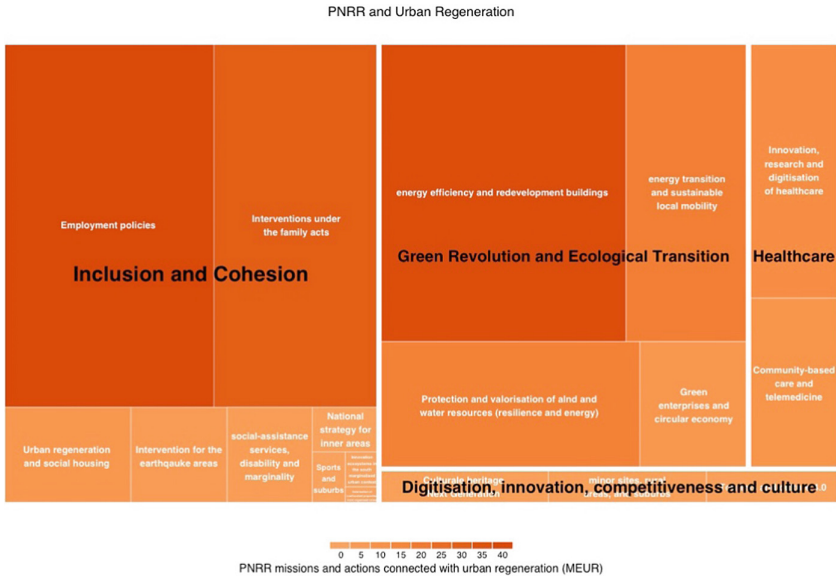


Fig. 1. Italian PNRR: missions and actions connected with urban regeneration.

and foster their resilience and sustainability. Indeed, the adopted Italian Partnership agreement has confirmed the PON METRO strategy for the programming period 2021–2027, expanding the reference target areas to the metropolitan area administrative context [35]. The PON Metro platform offers the chance to Italian metropolitan cities – and their entire metropolitan areas- to re-organize their urban development strategies built on transition-oriented processes to address climate changes and facilitate the transition toward a circular economy. In this direction, urban regeneration can act as a catalyst for such transition by creating the conditions for a more resilient and sustainable city.

With the rise of the pandemic and the mutated policy scenario, cities can exploit the resources made available by the NextGenEU within the existing plans and programs such as the PNRR and the PON METRO. The first (PNRR) makes available important financial resources for integrated interventions as the National Innovative Programme for housing quality – PINQUA (Programma Innovativo per la qualità dell’abitare), which is aimed at funding urban regeneration projects in Italian Municipalities - or the Integrated Urban Plans (PUI - Piani Urbani Integrati). For the PINQUA, the funded projects target housing issues by increasing public housing options, regenerating the socio-economic context in urban centers, and increasing the accessibility, functionality, and safety of neglected spaces and places often situated in the peripheries of cities. At the same time, the PUI, which rationale follows the new Italian Partnership Agreement for the programming period 2021–2027, extends the areas of intervention from the main municipality area to the metropolitan one. The investment aims to create new citizen services, re-qualify logistic infrastructures, and transform vulnerable territories into smart cities and sustainable realities [29].

The resulting policy framework offers attractive solutions for intermediate cities, triggering urban development patterns towards resilience and sustainability. Cities now have clear development goals (resilience and sustainability), drivers (green and digital transition), financial resources (NextGenEU and React-EU together with the existing instruments), and tools (i.e., PNRR, PON Metro). Given that urban regeneration embraces the social, economic, and environmental dimensions [14, 36], it can act as development framework under which cities can implement this strategy.

2.3 Towards Urban Resilience Sustainability: The Agenda 2030 and the 100 Cities Resilience Framework

The transition towards sustainability was deemed urgent in 2015 when world leaders agreed on adopting an ambitious agenda for fostering human well-being with the Paris Agreement and the sustainable development goals (SDGs) [37]. The Urban Agenda 2030 [38] core is represented by the seventeen Sustainable Development Goals (SDGs) and 169 sub-goals. Among the 17 SDGs, the Urban Agenda [38] has included a specific Goal related to cities, the SDG 11, “Make cities inclusive, safe, resilient, and sustainable”, resulting from the growing emphasis on evidence-based policy, including urban policy [39]. The complexity of the challenges affecting cities requires efforts to increase their learning, adaptation, and transformation across ability sectors and levels [40]. Fostering urban resilience is a significant challenge for cities [41]. Over the past decades, inter-governmental agencies - UN Habitat, UN Office for Disaster Risk Reduction, and the World Bank – have developed tools, indices, and guidelines to support cities in this direction [41]. Recently the Rockefeller Foundation has worked on the urban resilience concept by developing practical tools for its assessment by promoting an international partnership, namely the 100 Resilience Cities network. The approach is based on planning and assessment tools developed by ARUP “to assess relative vulnerabilities and strengths in a city as a basis for developing a resilience strategy [41]. The ARUP approach [42] has two main pillars, the Cities Resilience Framework (CRF) and the Cities Resilience Index (CRI). Both pillars distinguish four essential dimensions: 1) health and well-being; 2) economy and society; 3) infrastructure and environment; 4) leadership and strategy (see Table 3).

Table 3. The Rockefeller Resilience Framework/index [42]

Dimension	Drivers	Actions
Health and Wellbeing	Minimal human vulnerability	The extent to which everyone’s basic needs are met
	Livelihoods and employment	Access to finance, ability to accrue savings, skills training, business support and social welfare
	Safeguard to human life and health	Integrated health facilities and services, and responsive emergency services
Economy and Society	Collective identity & mutual support	Active community engagement, strong social networks, and social interactions

(continued)

Table 3. (continued)

Dimension	Drivers	Actions
	Social stability and security	Law enforcement, fair justice, and prevention of crime corruption
	Finance including contingency fund	Sound management of city finances, diverse revenue streams, and the ability to attract business investments, allocate capital and build emergency funds
Urban Systems and Services	Reduced physical exposure	Understanding of the hazards and risks to which a city is exposed, inform the development of integrated strategies to physically protect the city
	Continuity of critical services	Active management and maintenance of ecosystems, diversity, redundant capacity, maintenance of essential services and contingency planning
	Reliable mobility and communications	Diverse and affordable multi-modal transport systems and ICT networks and contingency planning
Leadership and Strategy	Effective leadership and management	Trusted individuals, multi-stakeholders' consultation, evidence-based decision-making and disaster risk reduction activities
	Empowered stakeholders	Education for all, access to up-to-date information and knowledge to enable people and organizations to action
	Integrated developed planning	Presence of a vision, integrated development strategy, and regularly reviewed plans updated by cross-department groups

The CRF is articulated in three layers: categories, drivers, and qualities [42]. The CRF can help stakeholders develop a shared understanding of resilience or identify the critical gaps where actions and investments are needed [42]. Dimensions contain drivers to reflect the specific characteristics of cities, and each driver contains sub-drivers to identify specific actions (see Fig. 2).

The final layer results in the City Resilience Index (CRI), enabling cities to reach their resilience level [42]. The City Resilience Index (CRI) follows the structure of the City Resilience Framework (Fig. 2): 4 main dimensions corresponding to the four main categories, 12 goals corresponding to the 12 drivers, 52 sub-indicators, and 130–154 variables considered [42]. The relative importance of indicators can depend on the urban context and provide a holistic picture of a city's resilience [42] (Fig. 2). Two main elements emerge from the Rockefeller 100 Cities Resilience framework. The first is the importance of assessing vulnerabilities to determine the resilience ability of a city. The second is the relevance of urban planning in fostering urban resilience strategies.



Fig. 2. City Resilience Framework (CRF) and City Resilience Index (CRI) [42]

3 Methodology

This section explores how cities effectively design and implement urban development strategies to address their persistent social, economic, and environmental vulnerabilities towards resilience and sustainability. It focuses on the case of the Metropolitan City of Reggio Calabria, one of the 14 Metropolitan Cities included in the Italian PON METRO.

The analytical approach is articulated in three main levels. The first introduces the case in the PON Metro context and program by examining the city PON Metro strategy. The second level focuses on the local context vulnerabilities detection. To assess the context vulnerabilities of the case under investigation, we propose a multi-criteria analytical approach based on the adaptation of the weighted product model - WPM). First, the most recent and available context-based statistical indicators are analyzed to detect local context vulnerabilities and match the city development strategy with the vulnerabilities detected. Second, indicators have been grouped in subthemes and associated with the three main pillars of sustainable development (social, economic, and environmental) [43]. Third, the WPM allows for weighting the vulnerability factors in the case under investigation. Such vulnerabilities have been used to assess the city resilience performance level and framed into the Cities Resilience Index [42] categories. By exploiting the CRI Rapid Resilience Review Toolkit, it has been possible to detect the main drivers for intervention for facilitating the resilience-oriented planning process.

Finally, the vulnerabilities detected, the Resilience drivers, and the PON METRO strategy's actions have been framed in a relational matrix to assess how the city is addressing the vulnerabilities detected.

4 The Case of Reggio Calabria

4.1 Reggio Calabria in the Context of the National Operative Programme: The Strategy

The Metropolitan City of Reggio Calabria is in the southern Calabria region. It is one of the 14 Metropolitan Cities selected by the government to be included in the PON Metro Programme [44]. The case strategy is examined considering the city administration designed and implemented the PON Metro strategy. The Programme “Metropolitan cities 2014 – 2020 aims to support the priorities of the Italian National urban agenda in line with the objectives of the European Urban Agenda, which identifies urban areas “as the key territories to take up the challenges of smart, inclusive, and sustainable growth set in the Europe 2020 Strategy [44]. Within the framework of the sustainable urban development strategies outlined in the Partnership Agreement for the programming period 2014–2020, fourteen Italian metropolitan cities have been identified as eligible for this Pro-gramme [44]: Turin, Milan, Bologna, Venice, Florence, Rome, Bari, Naples, Reggio Calabria, Cagliari, Catania, Messina, and Palermo.

As for the PON Metro Programme, the strategy adopted by the Metropolitan City of Reggio Calabria [44] is articulated in 5 strategic axes: Metropolitan Digital Agenda; Sustainability of public services and mobility; Social Inclusion services; Infra-structures for social inclusion; Technical Assistance. Furthermore, with the REACT-EU funding, three more axes have been added: Green, digital, and resilient recovery; Social, economic, and occupational recovery; and Technical Assistance (Table 4).

Table 4. City of Reggio Calabria refunding of the PON Strategy according to the React-EU resources [44]

Axis	Fund	Funds (MEUR)
1 Digital Agenda	ERDF	16.1
2 Sustainable Mobility	ERDF	36.3
3 Social Inclusion	ESF	24.2
4 Infrastructures for Social inclusion	ERDF	10.2
5 Capacity Building	ERDF	1.2
6 Green, digital, and resilient recovery (REACT-EU)	ERDF	63.2
7 Social, economic, and occupational recovery (REACT-EU)	ESF	4.5
8 Capacity Building (REACT-EU)	ERDF	6.9
Total	ERDF and ESF	162.6

In the initial PON Metro strategy, the City administration has channeled the financial resources into specific projects to be completed by 2023. In this pre-COVID vision, which includes only the axes from one to five, most of the financial resources were allocated for Sustainable mobility (36.3 MEUR) and social inclusion (24.2 MEU).

Table 5 shows a homogenous distribution of ongoing projects at the National level among all the axis of the Programme. On the contrary, most ongoing projects for the City of Reggio Calabria are related to social inclusion (31,91%) and sustainable mobility (29,79%). The actions completed – or still in place – are not related to the re-design of the strategy according to the REACT-EU as the former have been designed b.

Table 5. Number of projects activated by axes in total and for the City of Reggio Calabria [44]

Axis	Ongoing Projects in all Metro cities		Ongoing Projects in Reggio Calabria	
	<i>n</i>	%	<i>n</i>	%
1 Digital Agenda	104	20,15	6	12,77
2 Sustainable Mobility	132	25,58	14	29,79
3 Social Inclusion	124	24,03	15	31,91
4 Infrastructures for Social inclusion	112	21,70	8	17,02
5 Capacity Building	44	8,52	4	8,51
<i>Total</i>	<i>516</i>	<i>100</i>	<i>47</i>	<i>100</i>

5 Findings: Detecting Context Vulnerabilities and Leverage Resilience-Based Planning Processes

Given that cities are “complex, dynamic environments made of multiple inter-related systems that are competing with other cities for investment and resources” [1:10], a framework to organize the available data and understand interrelationships is needed [1]. “This is particularly true for multi-dimensional concepts such as resilience which cannot be readily measured [1:10].

In this direction, indicator-based measurement is the predominant approach to assessing urban resilience quantitatively and qualitatively [25]. Indeed, indicators constitute valuable tools for cities to follow their performance, detect weaknesses and deploy actions to improve them [42]. Indicators can serve as powerful tools to facilitate and support decision-making by policymakers because they can help in the identification of opportunities, helping in setting priorities, and comparing performance across different contexts [1]. Moreover, the case study methodology allows exploring a phenomenon in context, using one or more data collection methods to describe a case or cases [45]. Secondary data and on-desk analysis of official documents are the primary sources used for this study. We used two main datasets: the Sustainable Development Goals (SDGs), and the Italian well-being (BES) indicators made publicly available by the Italian National Institute of Statistics (ISTAT). Despite the specific SDG on cities – 11 Make cities inclusive, safe, resilient, and sustainable – we extended our inquiry to all the possible SDG indicators related to urban phenomena or connected with urban dynamics. Consequently, the SDGs should be used as a reference framework to design and deploy urban policies oriented at the transition towards resilience and sustainability.

In this study, SDGs and BES indicators were used and grouped in thematic areas according to the three widely accepted sustainability pillars (social, economic, and environmental) (see Table 6) with the overall aim to detect urban context vulnerabilities. Each dimension contains subthemes selected based on the available indicators in the original dataset.

Table 6. Sustainability dimension and subthemes. Source: authors' elaboration

Dimension	Sub-themes
Social Dimension	Health and Education; Safety; Services; Housing and urban quality
Economic Dimension	Economy; Employment; Digital and Innovation
Environmental Dimension	Waste; Water; Biodiversity

To detect local context vulnerabilities and understand which action should be prioritized, we have adopted a multi-criteria analytical approach by adapting the Weighted Product Model (WPM), a popular Multi-Criteria Decision Method (MCDM) [47]. The WPM evaluates “several alternatives to a set of attributes or criteria, where each attribute is independent of another” [46]. Compared to the WSM, the WPM applies a multiplication technique to relate the attribute rating [46] instead of a sum as in the weighted sum model (WSM). The choice of WPM is based on its ability “to provide optimal solutions in the ranking systems.” The formula – adapted – of the WPM is the following:

$$P(A_K) = \prod_{j=1}^n (a_{Kj})^{w_j}, \text{ for } K = 1, 2, 3, \dots, m.$$

In this study, an adaptation of the weighted product model (WPM) is used to assess the vulnerability weight for each dimension and sub-themes and grasp the interconnections inside each dimension and across them [48, 49]. In this direction, the distance of each attribute from the Italian average is applied as a general criterion to rate vulnerability for building the decisional-making matrix [46].

5.1 Detecting Local Context Vulnerabilities

The adaptation of the WPM consisted of building the decision-making matrix in which the criteria system includes all indicators concerning the three dimensions of Sustainability: social, economic, and environmental. The weight processes have been handled in two steps. In the first step, the study considered the dimensions separately. However, all indicators have been normalized by considering the dimensions as alternatives to finalize the matrix. Tables 7, 8, and 9 report the indicators selected for Calabria related to the social, economic, and environmental dimensions.

Table 7. Social dimension – Indicators per sub-themes.

<i>Indicator</i>	<i>Reggio Calabria</i>	<i>Calabria</i>	<i>Italy</i>
<i>health and education</i>			
Life expectancy at birth (2020)	82,1	82,0	82,0
Participation in continuing education (2020)	5,1	5,6	7,2
Children 0–2 using childcare services (2018)	1,5	2,2	14,1
Presence of childcare services (2018) (%)	8,2	19,1	14,1
People at risk of poverty or social exclusion (2020) (%)	26		25,3
<i>housing and urban quality</i>			
Density of historic greenery and urban parks of considerable public interest (2019)	0,1	0,5	1,8
Housing crowding index (2020)	2,6	2,3	2,6
Safety			
Population exposed to flood risk (2020)	10,6	13,2	11,4
Population exposed to landslide risk (2020)	0,6	3,4	2,2

Table 8. Economic dimension – Indicators per sub-themes.

<i>indicator</i>	<i>Reggio Calabria</i>	<i>Calabria</i>	<i>Italy</i>
<i>Employment</i>			
Non-participation rate in work (2020)	39,7	38,0	19,7
Unemployment rate (2020)	15,4	20,1	9,2
Neet (2020)	34,5	34,6	23,3
Young unemployment rate (2020)	31,4	40,4	22,1
Occupational gender gap (2020)	-26	-26,4	-19,9
Young Non-participation rate in work (2020)	70,8	69,4	47,2
<i>Income</i>			
Percapita income	12911,5	12920,0	18690,3
Non-performing entry rate of bank loans to households (2020)	1,1	1,2	0,8
<i>Innovation</i>			
Municipalities with services for families entirely online (2018)	11,5	8,7	25,1
Innovation of the productive system (2018)	45,3	45,5	48,1
Fixed network coverage for ultrafast internet access (2019)	26,7	11,4	30,0

The result, visualized by the tree map charts (see Fig. 3, 4, and 5) for each dimension, defines an order of vulnerability factors highly affecting the Reggio Calabria context.

The main vulnerabilities detected are related to the health and education, housing and urban quality (social dimension), the employment and income (economic dimension), and waste and water (environmental dimension) sub-themes.

Table 9. Environment dimension – Indicators per sub-themes.

<i>Indicator</i>	<i>Reggio Calabria</i>	Calabria	Italy
<i>Biodiversity</i>			
Incidence of urban green areas on the urbanized surface of cities (2020)	4,8	4,4	8,5
<i>Energy</i>			
Irregularities in the electricity service (2019)	3,7	4,0	2,4
<i>Water</i>			
Leakage from the municipal water network (2018)	46,6	44,9	42,0
Efficiency of drinking water distribution networks (2018)	53,4	55,1	58,0
<i>Waste</i>			
Separate collection of urban waste trash re	33,5	36,3	39,6

5.2 For a Resilience-Based Planning Approach: Assessing Local Context Resilience Through the Rapid Resilience Review Toolkit

The application of the CRI based on the vulnerability assessment results allows for measuring the performance of the Reggio Calabria. Figure 8 shows the resilience index preview achieved by using the Rapid Resilience Review toolkit derived from the CRI work. Starting from the vulnerabilities selected, we attempted to simulate the City Resilience Index for the city of Reggio Calabria. Data from the initial dataset composed of the SDGs and BES indicators have been used. Each indicator has been assigned to the twelve drivers according to the four dimensions of the CRI using the Rapid Resilience Review tool.

From Fig. 6, it is possible to point out the city's resilience performance according to the main drivers of the City Resilience Index. Almost all the main categories present some criticalities. Specifically: (i) Health and Well-Being – Diverse livelihoods and employment; (ii) Economy and Society – Collective identity and community support; (iii) Infrastructures and Ecosystems – Effective Provision of critical services. The health and well-being category have a low-performance level in all the three main drivers. It suggests that the city should prioritize interventions to reduce unemployment and young participation – which is also one of the principal vulnerabilities detected. The economy and social dimension values suggest how collective identity and community support is the main driver to prioritize, specifically to whom it concerns inclusive social processes through services for vulnerable categories. The infrastructure and ecosystem category suggest that measures to reduce exposure and fragility are priorities to address.

Finally, the leadership and management category indicate that the integrated development planning driver should be boosted. This last dimension should be further investigated as the available indicators are not fully explanatory of the local integrated planning system. In the case under investigation, we have considered the available PON urban development strategy and the existence of official planning tools as a moderate example of integrated planning. Further inquiries should assess the coherence of all the planning tools available for the city of Reggio Calabria.

Table 10. Relational Matrix: vulnerabilities detected, resilience drivers, Pon Metro actions

<i>Vulnerability (main)</i>	<i>CRI vulnerability detected</i>	<i>PON - Metro Strategy</i>
housing and urban quality	Collective identity and community support: <i>Active community engagement, strong social networks and social integration</i>	<p>housing</p> <p>Center for homeless people</p> <p>Recovery of the Ex Colonia (Catona headquarters for "After us" interventions)</p> <p>Recovery of "Ricoveri Riuniti" for social housing</p> <p>Recovery of public property for the Social Housing Agency</p> <p>Redevelopment and adaptation of affordable housing units</p> <p>Urban Regeneration of the Trabocchetto urban area</p> <p>Services and tools to address housing problems</p> <p>services housing</p> <p>Network of Proximity services in the peripheral areas</p> <p>Beauty sites in degraded peripheral areas of the Municipality of Reggio Calabria and the small cities of the Metropolitan Area;</p> <p>Recovery of property in Arghilla for the creation of a proximity centre (community-based);</p> <p>Services Hub for families</p> <p>Redevelopment of Waterfront public spaces</p> <p>Redevelopment of confiscated property for minors who have left the criminal circuit</p> <p>Sport facilities energy retrofiting</p>

(continued)

Table 10. (continued)

<i>Vulnerability (main)</i>	<i>CRI vulnerability detected</i>	<i>PON - Metro Strategy</i>
Health and Education		<p>Under used and abandoned Urban Public Spaces maintenance and improvement</p> <p>Redevelopment and maintenance of public spaces and urban green areas</p> <p>redevelopment and maintenance of public spaces and urban green areas</p> <p>Networks for the socio-working inclusion of Roma, Sinti and travelers</p> <p>Coordination street unit</p> <p>Services for homeless people</p>
Employment and Income	<p>Diverse livelihoods and employment: <i>Access to finance, ability to accrue savings, skills training, business support and social welfare</i></p>	<p>inclusion</p> <p>work and entrepreneurship</p> <p>Networks for the socio-working inclusion of Roma, Sinti and travelers</p> <p>Social entrepreneurship</p> <p>innovative services for the job placement of disadvantaged categories</p> <p>Support for citizenship of persons with disabilities and their families</p> <p>Recycle and reuse start-up center</p> <p>circular economy grants for small business</p>
	<p>Sustainable economy: <i>Sound management of city finances, diverse revenue streams, and the ability to attract business investment, allocate capital and build emergency funds</i></p>	<p>energy retrofiting of the public lighting system</p> <p>Energy retrofiting of the Municipality Directional Building</p>

(continued)

Table 10. (continued)

<i>Vulnerability (main)</i>	<i>CRI vulnerability detected</i>	<i>PON - Metro Strategy</i>
		Photovoltaic panels of the Municipality Directional Building Smart traffic and mobility control platform (CCM) Public transportation vehicles Protected pedestrian path and Waterfront-Pineta Zerbi cycle path Multi-storey car park and "Rausel" interchange TPL Waterfront protected preferential lanes City waterfront intermodal junction sustainable mobility measure to face the COVID emergency
Water	Effective provision of critical services Active management and maintenance of ecosystems, diversity, redundant capacity, maintenance of essential services & contingency planning	circularity SMEs contributions for circular economy solutions Startup del centro del riuso Smart metering: conscious consumption and valorization of water resources Refurbishment of the electrical panels of the wells Sewage treatment ecological waste collection plants Engineered bins
Waste	Waste collection	

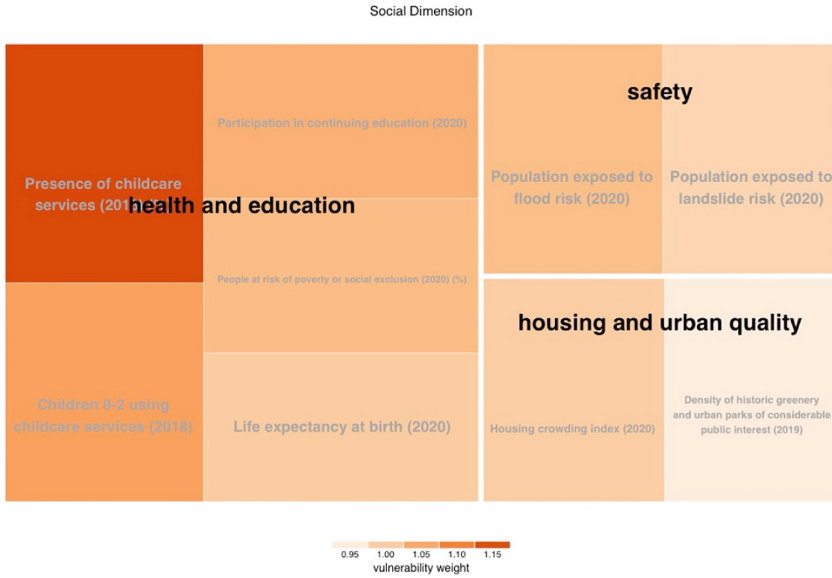


Fig. 3. Social Pillar indicators for the Metropolitan City of Reggio Calabria. Vulnerabilities by sub-themes and indicators.

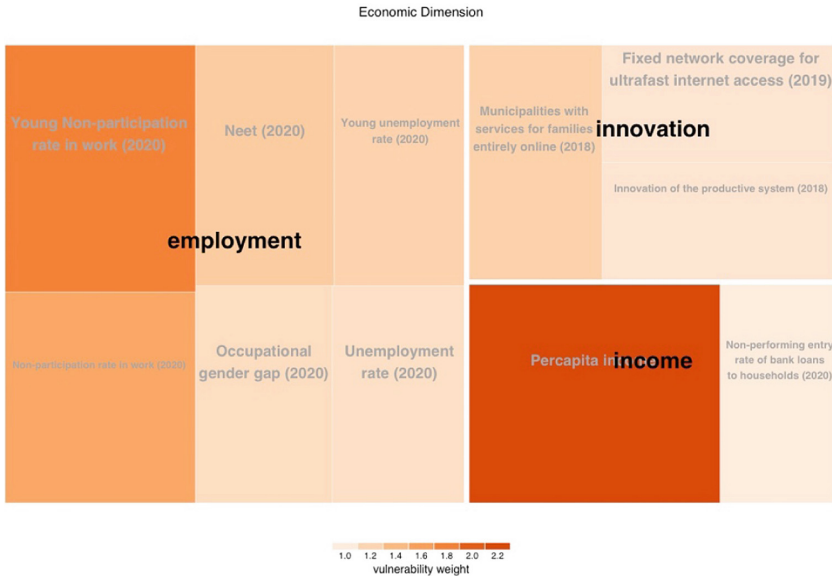


Fig. 4. Economic pillar indicators for the Metropolitan City of Reggio Calabria.

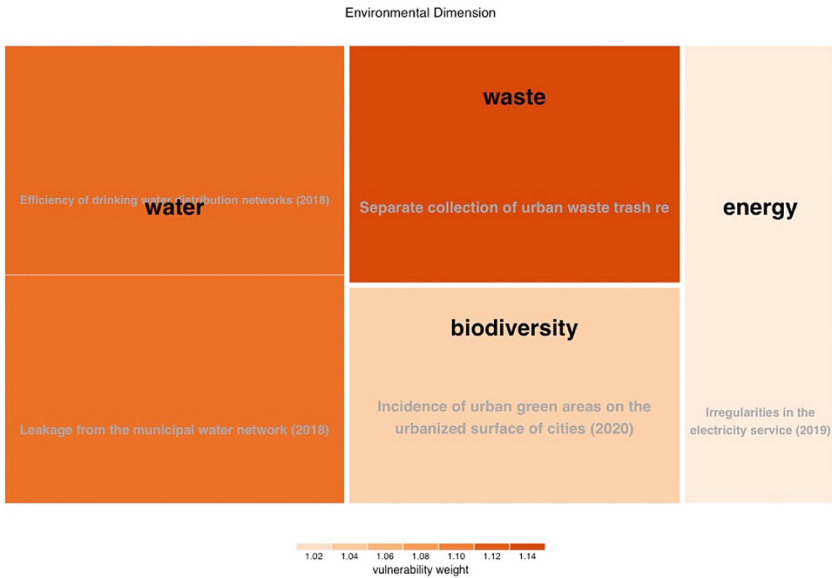


Fig. 5. Environmental dimension indicators for the Metropolitan City of Reggio Calabria.

5.3 Vulnerabilities, Resilience, and On-Going Urban Development Strategies

The vulnerabilities identified according to the sustainability dimensions point out the main context criticalities related to the city of Reggio Calabria. The City of Reggio Calabria has designed its green and digital transition towards resilience and sustainability. This strategy, funded by the National Resilience and Recovery Plan (PNRR), has been designed within the PON – Metro overall strategy. Table 10 shows the coherence of the actions in place with the context vulnerabilities detected for the city of Reggio Calabria and the resilience priorities emerged from the CRI Rapid Resilience Review Toolkit. However, starting from the vulnerabilities detected and the related resilience-based drivers, it is possible to notice how not all the vulnerabilities detected are adequately addressed by the city development strategy designed. While housing and urban quality seem to be oriented to address context vulnerabilities, employment and water vulnerabilities are poorly addressed.

Specifically, the main vulnerabilities addressed are the housing and urban quality subthemes, mobility, and energy. Few actions target employment and water vulnerabilities. The strategy was designed before 2014, and only recently, with the REACT-EU financial resources, it has been re-designed to foster urban resilience. Additionally, the PON METRO Programme has specific axes and objectives focusing on the digital transition of the public administration, mobility, and the increase of quality in the delivery of public services.



Fig. 6. Reggio Calabria Rapid Resilience Review Toolkit (CRI) based on the vulnerabilities selected [42].

6 Discussion: The Potential of the Integrated Approach to Address City’s Vulnerabilities

The EU response to the recent pandemic has brought to the definition of the overall strategy for the recovery of the Union centered on the green, digital, and just transition, which is shaped in the NextGenEU instrument. Within the National Recovery and Resilience Plan, cities play a crucial role in implementing the transition towards resilience and sustainability. As the case presented in this contribution has shown, the main local vulnerabilities are not always adequately addressed. However, the policy frameworks and financial resources available call for implementing an integrated approach to facilitate such an ambitious transition.

In the case of the Metropolitan City of Reggio Calabria, two specific measures (but not limited to) allow the implementation of an integrated approach thanks to urban regeneration mechanisms: the PINQUA program [34] and the Integrated Urban Plans (PIU) [29]. The first focuses on urban regeneration projects in the city, the second on

funding an overall set of interventions for the entire Metropolitan areas, including other municipalities. Reggio Calabria is benefiting from MEUR 45 to implement three urban regeneration projects funded by the PNRR within the national Programma Innovativo Nazionale Qualità dell' Abitare (PINQUA) [34], a specific national program to foster urban regeneration actions in distressed urban areas. Figure 7 shows the localization of the PON-Metro actions in place in the City of Reggio Calabria. The majority [34] are located in the southern part of its urban center. Figure 8 also shows the location of three urban regeneration projects funded by the Italian government within the One in the northern part of the city, where seven PON-Metro actions are localized and precisely one

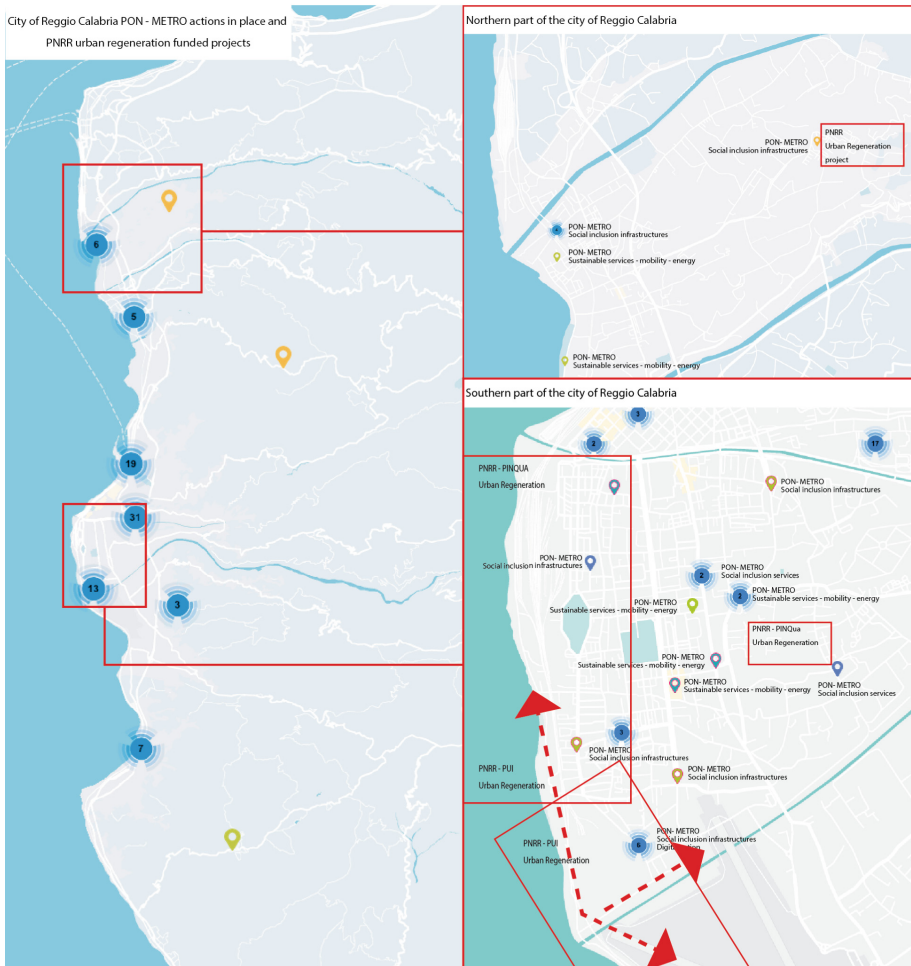


Fig. 7. Localization of Reggio Calabria PON METRO operations (available at <http://www.ponmetro.it/home/ecosistema/viaggio-nei-cantieri-pon-metro/pon-metro-reggio-calabria/>) - Italian Metropolitan Cities – PON Metro Programme [44], PINQUA, and PUI projects [29]. Authors' elaboration.

in the area of the PNRR project. Two are located in the southern part of the city center, where most of the PON Metro interventions are localized. Furthermore, the city also benefits from one of the interventions included in the PUI strategy, specifically a MEUR 20 urban regeneration project located in the south part of the city [29]. This intervention aims to reconnect the existing ecological corridors of the city with the urban and social context. It also addresses sustainable urban mobility, the energy efficiency of renewable sources, and urban public spaces empowerment. (Italian government, homeland minister). This area, characterized by environmental and urban decay, is crucial for the city as it connects the airport area to the urban center and revitalizes the ecological corridors.

Despite the relevance of such interventions, a better integration with the existing urban planning tools could ensure the strategy's effectiveness. The granting procedures established at the national level are tightly scheduled and require huge efforts by the local public administration to draft adequate proposals. The risk is to formulate proposals that are not aligned with the current local vulnerabilities and with the objectives of urban planning tools, making ineffective the designed and funded interventions. Interestingly, following the Italian Partnership Agreement proposal on the next programming period, the PUI instrument could allow for a better territorial integration of the interventions at the metropolitan level as the Metropolitan City is the body in charge of the design implementation of the overall strategy (see Fig. 7 as an example of possible complementarity of strategies).

7 Conclusions

The paper aimed to explore how cities can formulate their recovery strategy towards resilience and transition in response to the pressing challenges they are called to face. The literature review showed how urban resilience is shaped by the complex interactions between socio-ecological and socio-technical systems [3]. Following the evolutionary resilience perspective, such interaction has implications for the urban planning dimension as it implies an effort to accommodate the process of change, adaptation, and transformation to stresses [21]. Therefore, designing and implementing effective urban development strategies to address local context vulnerabilities and boost local potential towards resilience and sustainability is central for the future of cities. The EU approach appears to support this perspective. The REACT-EU makes available unprecedented financial resources to facilitate the recovery and foster the green and digital transition of the union towards resilience and sustainability. Furthermore, the Italian PNRR shows how urban regeneration can connect many PNRR actions. In addition, the National Operative Program for Metropolitan Cities - selected to channel the financial resources from the REACT-EU for cities - can constitute the platform for implementing urban regeneration strategies. Therefore, urban regeneration appears strategic to address local vulnerabilities and leverage the untapped local potential toward sustainability.

Given this policy context, the study explored the case of the Metropolitan City of Reggio Calabria by assessing the alignment of its PON Metro strategy with the local context vulnerabilities. The case of Reggio Calabria was explored to three analytical layers. In the Italian Metropolitan cities' context, intermediate cities - such as Reggio Calabria - are experiencing a decrease in total population. The PNRR goes in this direction as

one of its aims is to foster the territorial balance between northern and southern cities and urban and inner areas. The second analytical level allowed to detect context vulnerabilities by applying a multicriteria analytical approach (an adaptation of the weighted product model). Specifically, housing, and urban quality, health and education, employment, income, and water supply and distribution and waste are the vulnerabilities that should be prioritized. Second, the analysis of the city resilience performance level has allowed identifying the main drivers to follow for the city in addressing local vulnerabilities oriented to a resilience-based planning process. In this direction, the matching with the PON Metro strategy allowed us to explore the city's planned response to foster resilience and sustainability. Third, the on-desk analysis of the related official documents revealed how the actions included in the PON – METRO strategy (including the REACT-EU addition) implemented for the city address only partially the vulnerabilities detected according to three sustainability pillars. The reason is twofold. The nature of the PON-METRO strategy focuses on specific axes with specific overall objectives and actions, and the first version of the strategy was designed and implemented before the pandemic, with many of the designed measures not yet in place.

A further element to emphasize is the multilevel governance perspective and the integrated planning approach for deploying effective development strategies toward resilience and sustainability. For example, exploring possible interconnections of the PNRR with urban regeneration actions – such as the PINQUA or the PUI – can better address local vulnerabilities and leverage the potential for the green and digital transition towards resilience and sustainability through urban regeneration. In the case under investigation, it is possible to notice the linkages that urban regeneration mechanisms can activate in synergy with the PON Metro strategy.

The study's limitations match the potential further developments to improve this work. First, the datasets used – SDGs and BES – can be integrated with other quantitative and qualitative indicators according to the Cities Resilience Framework [41]. Second, stakeholders' interviews can provide helpful insights to detect urban vulnerabilities and the local potential to facilitate urban resilience and sustainability and better assess the city resilience index.

Finally, a specific element for further investigation lies in the role of traditional urban planning tools in managing the complexity of transition. Comprehensive and general urban planning instruments provides the framework for small, medium, and large municipalities to channel these investments more holistically and effectively. Such tools, where possible, should be updated based on a renovated analytical approach more oriented to the understanding of local context socio-economic and environmental transition dynamics. Moreover, given the financial resources available and the common strategic policy framework for EU Member States, such instruments can effectively facilitate the envisaged transition towards resilience and sustainability by placing cities at the core of such processes.

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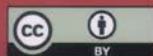


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Transition with Resilience for Evolutionary Development

This open access book conveys attention to the theme of transition towards resilience and sustainability and its evolutionary perspective that emphasizes the complexity and uncertainty that governments and society are called to address in response to the ongoing challenges. "New Metropolitan Perspective Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages' Perspectives", 25–27 May 2022, Reggio Calabria, Italy. The papers included in the book are grouped around the following main topics: the envisaged transition towards resilience and sustainability; the relevance of the planning dimension for defining sustainable development pathways and managing complexity; and the green and digital transition by glimpsing at approaches, experiences, and cases that outline innovative solutions in cities and inner areas. The book primarily targets the academic and policymaker communities involved in managing the complexity of the transition for regions and cities.

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