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Multilevel scientific approach to impacts of global warming on urban areas, energy transition, optimisation of land use and emergency scenario

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NEW CHALLENGES FOR XXI CENTURY CITIES:

Multilevel scientific approach to impacts of global warming on urban areas, energy transition, optimisation of land use and emergency scenario

1 (2025)

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The cover image shows a composition of two photos of the Temple of Serapis in Pozzuoli (Italy). Giuseppe Mazzeo took them in January 2009 and March 2025. At the top, the 2009 image shows the temple flooded, with the pavement not visible. In the down, the 2025 image shows the temple's pavement dry and exposed. The Temple of Serapis is one of the leading visual indicators of the bradyseism phenomenon in the Phlegraean Fields. The bradyseism phase, highlighted by comparison, started in the first years of this century, as shown by the data published by the National Institute of Geophysics and Volcanology (INGV) on the website dedicated to the phenomena (https://www.ov.ingv.it/index.php/il-bradisismo).

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Revitalising abandoned historical districts. Application of an incremental and adaptive approach to regeneration

Diksha Dody ^a, Daniele Ronsivalle ^{b*}, Maurizio Carta ^c

^a Department of Architecture and Centre for Sustainability and Ecological Transition University of Palermo, Palermo, Italy e-mail: diksha.dody@unipa.it ORCID: https://orcid.org/0009-0000-8709-6209

^c Department of Architecture University of Palermo, Palermo, Italy e-mail: maurizio.carta@unipa.it ORCID: https://orcid.org/0000-0002-3221-8958 ^b Department of Architecture and Centre for Sustainability and Ecological Transition
 University of Palermo, Palermo, Italy
 e-mail: daniele.ronsivalle@unipa.it
 ORCID: https://orcid.org/0000-0003-0002-8460
 * Corresponding author

Abstract

Urban regeneration in historical contexts must integrate physical restoration with socio-economic revitalization. This study examines the regeneration of an abandoned area in Palermo's historic centre, altered by degradation and marginalization. Developed through a research agreement between the Confraternity of the "Unione del Miseremini" and the Department of Architecture at UNIPA, the study proposes a socio-economic regeneration plan.

The research addresses the challenge of balancing heritage conservation with contemporary urban innovation. Previous approaches have often overlooked the need for integrated strategies. This study applies the Cityforming Protocol, an incremental methodology that reconnects urban infrastructures (blue, green, grey, brown, and red systems) to restore urban metabolism. Through dynamic mapping and strategic guidelines, it fosters adaptive and inclusive regeneration.

Findings highlight that reactivating latent urban elements, leveraging governance frameworks, and engaging communities enhance sustainable regeneration. The study provides a holistic approach for revitalizing historic centres as socio-economic hubs, offering insights for policymakers and urban planners.

Keywords

Urban ecosystem; Spatial arrangement; Open space systems; Urban Planning; Cityforming Protocol.

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1. Introduction

1.1 Sparking urban regeneration in a holobiontic vision

In recent years, human-planet relations are under a new light in the comprehension of the relevance and role of anthropogenic action in a fully-transformed world. Coccia (2018) theorized what he describes as a metaphysics of mixture, in which the photosynthetic plant system represents the true creative and regenerative force of the Earth system, not only from a bio-ecological perspective – which is well known – but also in terms of relationships between animals and plants, humans and the environment, and complex settlement systems. According to the Franco-Italian author, our belief in our unique ability to shape every space, place, and behaviour of other humans and nature is unfounded compared to the inexorable capacity for change in the plant world, which is slow, continuous, imperceptible, but suddenly swift when we expect nature's forces to conform to our will or adapt anthropomorphically to our daily behaviours.

After the COVID-19 pandemic altered behaviours and perspectives, Carta (2024) along with other authors, takes a step forward by introducing a holobiontic hypothesis into urban studies and city and territory design. The term "holobiont" originates from scientific studies in microbiomics, relating to the bacterial populations within our bodies and their interactions and functions. The human body hosts and interacts with millions of microbial cells that colonize it, and these organisms play a crucial role in human physiology and the functioning of organs. The concept of human microbiome encompasses the microbial species, their genes, and genomes housed by the human body and involved in individual health. Previously, the theoretical paradigm considered discrete identities, such as whole subjects; consequently, the microorganisms hosted by humans were regarded as pathogens or their impact on human health was ignored: "the absence of microbes was equivalent to health." Greater attention to the mutuality characteristic of cell-microbe interactions leads to a re-evaluation of organ function itself, in line with the recent directions of Eco-Evo-Devo (Ecological Evolutionary Developmental) Biology Schillaci (2021). This approach to developmental biology emphasizes the importance of microbiome interactions with the organism's cells, studying evolutionary change through the understanding of genetic, epigenetic, and environmental influences. In other words, what has traditionally been defined as "solf" is partly dependent on what has traditionally been defined as "non-self" (Rees et al., 2018).

Transposing this concept from the microscale of the biome living in and with each individual in a holobiontic relationship to the macroscale of human, animal, and plant communities enriches the perspective. Just as integrating the biological perspective on identity does not resolve the definition of the self but reflects a vision of the organism's structure in terms of a whole rather than the sum of its parts, similarly, the configuration of an urban and territorial community as an additive dynamic of human subjects, environment, ecology, landscapes as a sum of individual parts takes on a new meaning as a community life of relationships – symbiotic or dysbiotic – rather than a simple juxtaposition of elements.

An holobiontic human community is based not only on mutuality as a fundamental principle but is conceived as a typical feature within the sociospatial organism itself, not just in interaction with the external environment: the community is, therefore, primarily a sociospatial relationship. Furthermore, this relational capacity can be interpreted as a mature, multifaceted, and inclusive evolution of "landscape" as vision and identity (Ronsivalle, 2018), leading to a full relational maturity.

The resulting holobiontic sociospatial condition is multifaceted and equipped with numerous access points. One of these keys is found in the glossary attached to the "Climate Change 2022: Impacts, Adaptation and Vulnerability" report (Pörtner et al., 2022). In the entry "Infrastructure", it provides a comprehensive definition of all types of infrastructuring, particularly adapting the definition to the contemporary vision of infrastructure resulting from integrations, overlaps, co-design of all elements belonging to physical systems. These infrastructures are the subject of deliberate anthropogenic projects and are accompanied by integrated

governance systems that mediate relationships between communities and individuals, offering services that support economic growth, health, quality of life, and safety.

In the IPCC definition, however, the social infrastructure – the fourth one – comprises institutions and social, cultural, and financial activities that support community well-being. This infrastructure underpins the welfare state of national and local realities and includes the places and artifacts that house these functions. It is probably the most important in the context of holobiontic landscapes, as it permeates relationships and serves as a continuous and indistinct connective tissue between communities (human, plant, animal) and meaningful connections.

What link is established between physical infrastructures – especially blue and green – and social infrastructures? This is the main topic of the article, taking into account the peculiar condition of a complex historical centre where communities, stakeholders and local administrations can retrace step by step the development path of the Anthropos, the human being – as Martinotti (2017) himself writes – whose germinal phase is educational, generating a personal and social approach to the socio-spatial conditions.

What design tool can we adopt to keep the structure of the social 'con-dividual' rich and vital within the fragmented and impoverished socio-spatial fabric of Palermo's historic centre? This condition of neglect and the need for socio-spatial reconfiguration is often evident in inner area centres (Carta et al., 2024; Carta & Ronsivalle, 2015; Cucinella, 2018; Francini et al., 2017), but even within the abandoned fabric of a large historic centre like Palermo, it is possible to act towards the rediscovery of community spaces and places for redesigning social patterns with an emphasis on social innovation, and restoring the meaning of "centre" as an urban-community reference centre (Francini et al. 2017).

Furthermore, considering the main keywords of this article, it is possible to outline a reading path that transcends the specific conditions that will be discussed later. This study, in fact, adopts an approach that integrates the issues of public space regeneration (Punziano & Terracciano 2017), where the themes of urban resilience are not exclusively related to ecological aspects, but are systemic (Salat & Bourdic, 2012).

The research shares the premises and cultural and theoretical references with Ingaramo & Negrello (2024), and Ceci et al. (2023), particularly when the authors identify the numerous systemic criticalities typical of stone cities in terms of reduced soil permeability, and the need to evaluate current conditions and design hypotheses in systemic terms.

It should also not be overlooked that the themes related to the improvement of urban quality in the historic district of San Matteo, in the heart of the historic center of Palermo, also involve some considerations on the topic of soft mobility and accessibility (Boglietti & Tiboni, 2022). Some aspects proposed in the experimentation, in particular, also relate to the sequencing of future actions in the regeneration phases, with a contribution from the tactical aspects (Boglietti et al., 2024; Casanova & Hernandez, 2014).

To address this question, the paper describes the outcomes of a joint research project conducted by the Department of Architecture at the University of Palermo and the 'Confraternita del Miseremini' at the Catholic Archdiocese of Palermo. Among its outputs, the project produced a master's thesis in Urban Planning.

1.2 Reactivating the urban metabolism of an abandoned historical fabric

The urban regeneration process in historical contexts has traditionally focused on either physical restoration or socio-economic interventions, often treating these dimensions as separate rather than interconnected processes. Starting from recent statements on historic urban landscapes (Sonkoly, 2017; UNESCO, 2011; UNESCO, 2013) and taking into account some recent solutions to tackle physical and social urban challenges (Casanova & Hernandez, 2014) in sensitive urban contexts, this study advances the discourse by introducing an integrated and innovative approach to urban regeneration, bridging heritage conservation with contemporary urban strategies through the Cityforming Protocol (Carta, 2015). Unlike previous methodologies, which often apply static master planning, this research proposes an incremental, adaptive model that responds dynamically to urban transformations, ensuring long-term sustainability.

The primary focus of this study is to demonstrate how a socioeconomic regeneration plan of a small district in a historic centre, integrating key elements driving urban innovation today, can serve as a catalyst for new energy, nurturing the physical, social, cultural, economic, settlement, productive, infrastructural, and environmental development of cities. Within this framework, this initiative intervenes through urban and social strategies aimed at revitalizing specific areas within Palermo's historic centre, focusing on a particularly prestigious district of Tribunali and Castellamare: the monumental complex of San Matteo. This includes neglected public squares along Salita Sant'Antonio, extending to Via Alloro, incorporating architectural treasures dating back to the 1300s, such as the medieval houses of San Matteo, along with landmarks like the Galleria delle Vittorie and the Convent of the Virgins, as well as addressing vacant commercial spaces.

The research hypothesis suggests that the urban metabolism reactivation process will commence from the San Matteo monumental complex, contributing to the regeneration of the city and its spaces, allowing them to once again become new centres of social and economic life. A significant role in this regeneration process is attributed to partnerships between entities, which are increasingly consolidating as a new form of collaboration to meet community needs.

By leveraging multiscale analysis and a systemic approach to urban metabolism, this research demonstrates how reactivating latent urban elements and engaging local communities can foster a resilient and inclusive urban renewal process. The originality of this study lies in its ability to bridge urban metabolism analysis with participatory governance, offering a holistic and systemic methodology that overcomes the fragmentation often found in urban regeneration projects. By aligning environmental, social, and economic infrastructures, this investigation proposes an integrated approach that enhances urban resilience and sustainability.

The research is divided into two main parts. The first part involves the application of techniques for analysing and interpreting the evolution, current state, and urban structure of Palermo, aiming to identify its identities. The second part involves the development of guidelines and meta-design elements, applying the Cityforming Protocol to activate the regeneration process through targeted actions and incremental phases, also defining intervention policies. This work emphasizes how the urban and human regeneration of the historic centre acts by enhancing the latent green, cultural, and economic resources present in the area and introducing new ones. Consequently, the structure of this paper is as follows:

- Firstly, the contribution presents the adopted theoretical framework, and a review of existing urban regeneration models applied in similar contexts;
- Secondly, it outlines the methodological approach, detailing the application of the Cityforming Protocol in a holobiontic perspective;
- In the end, it discusses the findings, emphasizing socio-economic and environmental impact, and their replicability in similar urban contexts.

2. Research framework

2.1 The metamorphosis of the historic centre

The city of Palermo is characterized by socio-demographic, economic, cultural, and environmental factors that have inevitably contributed to its complex configuration. For example, the succession of diverse cultures has left their marks on both the architectural heritage and the culture of the local population. The interpretation and analysis of the urban metamorphosis, based on the aforementioned external factors, cannot overlook a thorough investigation of historical documents. This approach not only allows for understanding the relationship between the network of settlements and the territory but also for studying the innovative transformations that have introduced new factors and settlement models, with both positive and negative consequences for the city. The historical analysis of the city also enables the rediscovery of a place's lost identity, aiming to reintroduce it during an urban regeneration process.



Fig.1 Technical Map of the Historic Centre of Palermo from 1994, highlighting significant interventions

The historical-urban analysis has focused on the entire historic centre of Palermo, with particular attention to the areas surrounding the San Matteo monumental complex (project area). Through the documents used for this analysis, which constitute a brief and concise selection of certain historical phases¹, it was possible to identify the area's now-lost productive identity, which was based on the presence of a cluster of historic markets². Additionally, the examination of historical documents has shown how significant urban transformations have resulted in the isolation of the entire area within the historic centre, defined by the main access streets³. Consequently, the area has progressively lost its original commercial identity, diminishing the significance of public spaces such as Piazza delle Vergini and Piazza del Parlatoio, which are currently in a

¹ Documents used for historical-urban analysis include "General Cartography of the City of Palermo and Ancient Maps of Sicily" by Rosario La Duca, specifically: Cartography of the Sixteenth Century – TAV. I of 1580, Cartography of the Eighteenth Century – TAV. VII of 1713, Cartography of the Nineteenth Century – TAV. XXIX of 1862, and the Technical Map of the Historic Center of the City of Palermo from 1994, as well as the Giarrusso Plan in its three versions: the edition of May 31, 1885, the version of December 1, 1885, and the final version of September 8, 1886.

² The cluster consisted of the historic markets of the former Tannery or New Vucciria, the Vucciria, and the public slaughterhouse in Piazza Caldoma.

³ The main axes of the historic center of Palermo that delineate the San Matteo area are Via Vittorio Emanuele (1581), Via Maqueda (1599), Via Roma (1936), and Via Napoli (1898, partially completed).

state of abandonment. The reasons for the progressive loss of relevance of the area, which has become a periphery within the very centre, are therefore multiple and derive from a convergence of events.

2.2 Dynamic analysis of the historic centre

To undertake any project effectively, it is essential to conduct a comprehensive analysis of a city's urban structures. This process involves recognizing and interpreting the defining traits that shape the city's form, characterize its identity, highlight its enduring elements, and trace its evolutionary changes in comparison to similar cities worldwide. By understanding these elements, one can interpret how different dimensions of the city function, either independently or in conjunction with specialized roles, much like the organs in a human body. This analogy provides valuable insights into the city's overall "state of health" and its potential for growth and development.

Furthermore, this approach allows for identifying and evaluating the pathological conditions affecting the city, enabling the devising of appropriate remedies to address any crises (Carta, 2021a).

The original methodology proposed by this research, "the analysis of the urban life cycles" (Carta et al., 2017) uses the aforementioned analogy to interpret the physical structures of Palermo. By analysing their functional sequence and ecosystemic roles, the general functioning dynamics of the "urban organism" can be understood. This methodology represents the urban structure through five specific "life cycles", and it is coherently linked to the definition of infrastructures as in Pörtner et al. (2022):

- Red Cycle. This cycle includes all elements of the historical-cultural heritage system, encompassing cultural assets and services, places of creative resources, knowledge, and the transmission of the city's culture and history;
- Brown Cycle. This cycle encompasses all areas related to the production system, commercial zones, and commercial axes that are spatially connected and exhibit functional relationships among themselves and with other cycles, such as the grey cycle. These elements are necessary for the urban transformations of services;
- Grey Cycle. This cycle consists of the urban mobility and logistics systems essential for the internal and external connections of the city. The cycle is subdivided into fast in/out mobility, internal mobility, slow mobility, and gateways to facilitate identification and its general interpretation. These elements in the grey cycle help to identify the overall functioning of the city, defining the access and usability of the city;
- Green Cycle. This cycle groups the elements that form the urban vegetative system, which includes the network of parks, ecological corridors, public gardens, historic gardens, and agricultural areas. Like the brown cycle, due to its nature, this cycle can be associated with the grey cycle, as interpreted and analysed under specific conditions, demonstrating a symbiosis between them, for example, in greenways and agricultural areas;
- Blue Cycle. This cycle contains the elements of the internal, surface, and underground hydrographic and coastal systems, regardless of their current state (whether they have undergone artificial modifications altering their original structure), which constitute the city's complex water system.

When examining the complexities of the "urban life cycle" and its highly selective filters, it becomes apparent that this concept can be effectively compared to the "systems approach," an alternative interpretation of urban dynamics. Understanding urban infrastructure⁴ - particularly blue (water systems), green (vegetative systems), grey (constructed systems), and social (community and service systems) infrastructure - requires considering the interdependencies and interactions among these different types of infrastructure to create a holistic and resilient urban environment (Bai et al., 2016).

⁴ The designed and built set of physical systems and corresponding institutional arrangements that mediate between people, their communities and the broader environment to provide services that support economic growth, health, quality of life and safety (Chester, 2019; Dawson et al., 2018).

To illustrate the above-mentioned aspects, an analogy to a software and hardware system can be helpful. In this analogy, the "urban life cycle" can be seen as the software, while the "systems approach" represents the hardware.

The "urban life cycle" emphasizes identifying and interpreting the structures and functions of urban systems, much like software defines and manages the operations and processes within a computer. It focuses on understanding the roles of these structures in the overall functioning of the territorial system, similar to how software applications determine the tasks and functionality of a computer system.

Conversely, the systems approach looks at urban infrastructure comprehensively, similar to how hardware components (such as the CPU, memory, and storage) provide the physical foundation for the system's operation. This approach considers the interdependencies and interactions among various infrastructures, just as hardware components must work together seamlessly to ensure optimal performance, adaptability and flexibility.

By combining the detailed structural analysis of the urban life cycle with the integrative systems approach, a comprehensive understanding can be gained of how different infrastructures (the hardware) support each other and contribute to the city's overall adaptive capacity (the software).

The urban life cycle's focus on identifying key structures can inform the systems approach, providing a detailed understanding of critical components that need to be preserved or enhanced within the broader urban ecosystem.

The systems approach's emphasis on interdependencies and planned flexibility can complement the urban life cycle by ensuring that planning strategies are adaptable to changes and can manage the dynamic nature of urban environments effectively.

This integrated perspective allows for an understanding of urban structures and their functions, fostering resilient, sustainable, and adaptable urban environments. Through this comprehensive analysis, it is possible to better address the challenges of modern urbanization and create cities that thrive both functionally and ecologically.

Moreover, the analysis of Palermo's historic centre reveals that its actual identity is primarily productive and cultural.

This identity is comparable to the social infrastructure focus of the systems approach, which emphasizes the importance of community and service systems in creating an adaptive urban environment. The analysis by cycles, structured in this way, allowed for the comprehensive understanding and interpretation of the overall functioning of the urban organism. The interpretative results of the various cycles identified in the historical context first reveal the presence of a cultural system of national and international significance, consolidated by the UNESCO itinerary "Palermo Arab-Norman and the Cathedrals of Cefalù and Monreale," which extends well beyond the municipal boundary. Furthermore, thanks to an in-depth reading on a reduced scale within a radius of 500 meters, it was possible to identify, with greater detail, the less impactful elements that still govern this cultural system.

A second identity present in the city of Palermo is that of productivity in all its forms. The reading of this system was conducted directly on the urban area restricted within a 500-meter radius, thus facilitating this phase of analysis and allowing for a more detailed examination. This approach enabled the mapping of workshops based on the different types of artisanal activities present within the same area.

The analysis identified 11 different types of crafts and a total of 80 artisans. Of these, 28 are specialized in the production of handcrafted jewellery and accessories, 12 in the production of artistic objects (art studios), and 10 in artisanal leather goods. Thus, both theories highlight critical aspects of urban dynamics that are essential for understanding and improving urban spaces.



Fig.2a Life Cycles of the Historic Centre of Palermo

Legend



Fig.2b Legend of life Cycles of the Historic Centre of Palermo



2.3 Land use analysis of the project area

The subsequent phase involved investigating the land use for the project area. The analysis of urban land was structured into five categories based on the functions present in the context:

Services and Amenities. This category includes public administrations, decentralized offices, public utility services, health services and facilities, educational services, university education, cultural and tourist services and activities, and recreational and sports services. Particular attention was given to the analysis and mapping of used and underutilization green spaces like the historic gardens of Villa Garibaldi (at Piazza Marina) and the public urban park Foro Italico Umberto I, Piazza Franco Franchi e Ciccio Ingrassia, and areas in via Alloro have been identified. These facilities and green spaces are critical in supporting the daily needs of the urban population, ensuring accessibility to essential services, enhancing the quality of life, and providing valuable recreational areas;



Fig.3a Map of land use of the project area



Fig.3b Legend of map of land use of the project area

- Cultural Heritage. This category is particularly characteristic of the area under examination, including UNESCO sites. Preserving cultural heritage is vital for maintaining the historical and cultural identity of the area, promoting tourism, and ensuring that cultural assets are protected for future generations. Notably, the San Matteo complex in Palermo is a significant cultural landmark, with its construction history spanning from the 17th to the 18th century and including baroque, late baroque, and medieval structures. The medieval houses of San Matteo, critical to the urban regeneration research, are divided into three subunits, each reflecting distinct medieval architectural characteristics and varying degrees of preservation and alteration;
- Estate. Two subcategories were identified, historical nodes, which make up almost the entirety of the fabric, and non-historical private residential buildings, mainly found near the monumental complex of San Matteo. This distinction helps in planning for conservation areas versus areas that may be suitable for redevelopment or new housing projects;
- Infrastructure. This category is divided into types of road infrastructure, essential for ensuring efficient movement within the urban area. Infrastructure includes major roads, secondary roads, pedestrian pathways, all of which are necessary for the smooth functioning of the city's transport network;
- Commercial Activities. This includes financial and directional activities, commercial and professional activities, hospitality, recreational and tourism service activities, and a subcategory that includes all catering and hotel service activities, which the area is rich in. These activities contribute to the economic vitality of the area, providing employment opportunities and services that attract both residents and visitors.

2.4 SWOT analysis

Following the development of the multiscale and multithemed analytical and evaluative framework described so far, a strategic assessment of the current and future state of the project area was conducted using a SWOT

matrix (as defined in Carta et al., 2020; Carta et al., 2025). The following elements were identified in each category:

<u>Strengths</u> on which the regeneration should be built e.g. cultural identity resources, employees, financial resources, location, cost advantages and sparks of competitiveness of the economical context. The area is home to numerous cultural heritages and significant institutional headquarters, including:

- Parks and gardens with considerable ecological, environmental, and landscape potential;
- Cultural attractors;
- Strategic location in the historic centre of Palermo enhancing accessibility.

<u>Weaknesses</u> that the regeneration plan needs to address e.g. conditions that could limit or cancel the development of the project. Urban fragmentation currently characterizing the project area, leading to marginalization and decay of cultural heritages.

<u>Opportunities</u> derived from external decisions or planned action contexts that regeneration should seize. In the site-specific condition of San Matteo and its district, the main strategic and operational reference is the Strategic Plan of the city of Palermo and the "Piano Particolareggiato Esecutivo" (PPE)⁵ of the historical centre. Both documents are important, each one on a specific scale and approach (strategic vs. operational). The strategic plan is the general framework for regeneration, sustainable mobility, wellness and quality-of-life projects (Carta, 2021b; 2023). On the other hand, PPE currently needs to be updated from a new perspective (UNESCO 2011; 2013), taking into account both the gentrification and the overtourism aspects. The key interventions deriving from the abovementioned plans could present development opportunities for the project area:

- Actions aimed at regenerating the historic centre, including the regeneration of urban fabrics and public spaces;
- Actions aimed at enhancing and improving slow mobility, including the expansion of pedestrian areas;
- Actions aimed at the development of the tram line, enhancing the tram line through the historic centre, with the line passing via Roma adjacent to the project area;
- Actions to be verified and systematized for the creation of the light rail, with potential stops near the project area.

<u>Threats</u> that could jeopardise the systematic transformation of the San Matteo district, and of which the regeneration project should be aware. PPE, drafted and approved 30 years ago and to be formally updated, poses significant challenges, as the expropriation constraints have now expired. This leads to significant difficulties in managing the current condition of the historic centre, contrasting with the widespread abandonment seen in the 1990s. Furthermore, the absence of an updated PPE, fully in effect, threatens the fragile state of the area, where urban voids resulting from unplanned events and improper uses of public areas pose a threat to the overall stability of the sector.

3. Goals and expected results with the application of the cityforming protocol

3.1 General goals

The strategic objectives, identified through these targeted analyses, address the project area with a programmatic vision of urban regeneration, focusing on the enhancement of public spaces and incorporating the San Matteo monumental complex into this process. Temporary reuse techniques will be employed to

⁵ The Site Development and Restoration Plan for the recovery of Palermo's historic center (PPE), approved in 1993, provides an urban planning framework for the entire walled city (from its founding to the end of the *ancien régime* in the first half of the 19th century) that ensures the preservation of all elements of the ancient city as they still exist today.

activate latent resources, paving the way for the creation of new stable urban functions. From the regeneration processes derives a system of actions that, starting from the project area, can also extend beyond it, thus becoming part of a network of actions where cultural, environmental and productive catalysts operate, capable of providing the right stimulus for a concrete revival of the historic centre.



Fig.4a Map of urban strategies for the project area



The main strategic objectives include:

- Enhancing the urban ecological system Interventions aimed at creating new urban green areas that can contribute to the urban identity of the historic city, alongside existing ones such as Piazza Marina, Foro Italico, and Piazza Magione. These actions will focus on increasing green spaces, improving biodiversity, and promoting sustainable urban systems, incorporating the San Matteo complex into this green network;
- Connecting the project area with cultural and commercial hubs in the historic centre This means a
 material connection, a physical link that includes some of the key elements present in the area (such as
 public spaces and squares, new pedestrian passages, and the Medieval Houses of San Matteo, connected
 with clusters of artisans already partially present in the area), which thus become an integral part of the
 connection system;
- Regenerating the area Through interventions that, starting from the initial regeneration epicentre in San Matteo, can generate new vitality for the socio-economic system of the historic centre. In this regard, it is proposed to requalify urban voids to foster the creation of new public convival spaces;
- Strengthening the social dimension of the area under consideration Implementing new professional training actions in the field of applied arts for production to foster community engagement and skill development.

3.2 Cityforming Protocol application

The application of strategic objectives follows an incremental approach to urban regeneration based on the Cityforming Protocol.

This design protocol focuses on reactivating the metabolism of an area layer by layer, starting from its dormant regenerative components and initiating multiple cycles of increasing intensity to create a new sustainable urban ecosystem over time.

The strategic Cityforming Protocol develops through incremental and adaptive phases necessary to produce partial results that become the generative basis for the next phase.

The first phase, called colonization, acts on the components already present in the area through minimal interventions that require almost zero resource usage, thereby partially activating the area's metabolism and creating optimal conditions for the next phase.

The second phase, defined as consolidation, acts on the colonies by creating networks involving both material and immaterial resources. Through the introduction of new functions, varied in profit and value, it creates new visions for the area and its existing and new users, laying the groundwork for the subsequent phase.

The final phase, called development, acts on the urban metabolism through a master plan defined and incrementally built by the previous phases. It identifies new high-level actions that serve as new catalysts, designing a new urban scenario by leveraging a more powerful investment multiplier to complete the area's transformation. Before focus on the interventions planned for the colonization phase, the regeneration project must start with a brief "Phase 0", a sort of "formatting" of the area, which primarily involves recovery, structural restoration, and demolition interventions to ensure the entire area is safe and accessible. These interventions are particularly necessary for the Medieval Houses, currently secured with works to ensure public safety. The formatting phase aims to prepare the intervention area for the next phase, accelerating the introduction of new activities and already providing a partial degree of revitalization.

In the colonization phase, it is planned to intervene with tactical urban regeneration actions and by opening some floors of the San Matteo complex, such as transforming the oratory into a conference room. The objective of this first phase is to reopen this area to the rest of the historic centre, making it more liveable and not just a transit area connecting two main axes of Palermo's historic centre.

To this end, the interventions promoted in this phase are mainly renaturalisation and space reconfiguration actions (Casanova & Hernandez, 2014).

The consolidation phase continues the urban transformation actions from the previous phase, with more substantial and complex interventions, and initiates a phase focused on social innovation and new living styles, attracting new users who will animate the area and trigger a process of economic regeneration.

For example, the creation of a multifunctional hub through the repurposing of the San Matteo medieval houses, where functions will be introduced to address and enhance various weak aspects of the area. In this phase, unlike colonization, interventions extend beyond the perimeter of the original colony, starting a large-scale regeneration process that proceeds through wide-ranging interventions targeting multiple elements simultaneously. An example is the creation of a museum and artisanal itinerary of tourist and economic interest, extending through the two districts and promoting the knowledge of the 14th-century heritage and the less visible artisanal activities of the historic centre. Along this itinerary, interventions are planned for the reconfiguration of both open and closed spaces, including the reactivation of abandoned commercial spaces, the creation of an open-air artisanal market, and the initiation of maintenance work on historic pavements. The consolidation interventions aim to create new visions of the context and lay the foundations for the final phase. The final phase, development, activates all components of the project, planning higher investment and profitability interventions. These interventions are new high-level actions that serve as new catalysts, designing a new urban scenario and giving a new spatial dynamic to the entire context of the historic centre. An example of an intervention planned in this regeneration plan includes the reconstruction of the missing corner of the so-called tower of the San Matteo monumental complex by inserting a new volume, following the logic of "parasitic architecture."

The space will be reconfigured to integrate with the new design and allow for the complete utilization of the monumental complex. To achieve this, the space is reimagined as a tower enclosed by a shading envelope with an elevator at its centre, surrounded by a vegetative skin with a potential microclimatic function. This structure will connect with the adjacent external environment and the entire project area through new urban passage spaces.



Fig.5b Graphic representation of the urban Development phase of the Cityforming Protocol applied to the project area



Fig.6 (a) The reconfiguration of the tower (b) Photomontage of the tower

4. Conclusions

In this research project, the drafting of a socio-economic regeneration plan incorporates key themes necessary for the evolution of the urban form (inclusion, culture, environment, and economy) with a multi-scale vision applied not only to the green networks but also to the cultural network, particularly the historic architectural complex of San Matteo. This approach aims to functionally reactivate the historic centre district. To achieve this, the research envisioned a complex process of reactivating the urban metabolism, stemming from a long and careful analysis of the urban context. This analysis revealed that the urban matrices useful for creating a new opening towards a porous system between the project area and the historic city are culture, green spaces, and productivity in all their forms.

With this perspective, it was decided to act on the project area through actions suggested by the socioeconomic regeneration plan, primarily focusing on the environment, culture, and craftsmanship. These actions will influence the current spatial arrangement and set of functions, spreading throughout the urban fabric. Therefore, the decision to design a new cultural and productive network that integrates with the existing network in the urban fabric, while considering current plans and expected future transformations, was a key factor in the transition process for this regenerative urban model.

Another important aspect is the involvement of a non-economic entity such as the "Confraternita del Miseremini", which, through an unprecedented engagement mechanism in the city, requested the Chair of Urban Planning at the Department of Architecture to initiate a study process aimed at urban regeneration. This approach does not rely on proposals from the municipal administration or mandatory interventions from the Superintendent of Cultural Heritage but instead builds the scientific foundations for the future regeneration project.

We must also remember that in Palermo — and many other historic centres in the Mediterranean area — there is a widespread condition of neglected spaces predominantly owned by the public, for which there is no significant financial availability for restoration and repurposing. This entails the need to rethink urban recovery (De Carlo et al., 1983) and regeneration processes by drawing on incremental and adaptive solutions as proposed by this project and adopting design approaches that are not exclusively philological and typological. Many fronts and numerous challenges remain open, including:

- The need to integrate the interventions of public entities into a single coordinated action for the restoration and redevelopment of buildings;
- The difficulty of fostering awareness among local residents for a new spirit of coexistence within the law and the maintenance of the quality of places;
- The necessity to integrate the project for the San Matteo district within a broader action of reconnection with neighbouring areas, particularly with the area of Via Maqueda, where the conditions of crisis caused by over-tourism, nightlife, and the loss of the previous socio-economic fabric are most pronounced.

Enduring multi-crisis conditions, the expected results of the regeneration project for the San Matteo district consider and call for changing the ways of designing and living urban collective spaces, as well as learning from new practices where sustainable mobility, cooperative solidarity, sense of community can spark a new way of life in the historic centre. The expected impact of the project can be summarised in:

- amplifying the short radius of proximity, extending and enriching the functions of living in a polycentric pattern;
- strengthening the spatialisation of activities and flows;
- rethinking the density and intensity of urban functions in more flexible ways;

- inserting nature into public and collective spaces to reconnect the human habitat to the natural world.

In concrete terms, the project expects accommodating new multiple functions within a circadian cycle that takes into account the whole day - or a year maybe too - in its collaboration with nature, in attracting temporary uses, in the reception of functions with high level of innovation, in the refuge of citizens in difficulty.

San Matteo district project, in the end, aims to host new functions, flexible, transforming quickly to adapt to the adaptive needs of the historic centre of Palermo, engaged in the challenge of integration of residential needs and touristic allure.

The San Matteo district will host multifaceted functions – related to the local craft traditions – and houses, schools, hostels, and offices will change after discovering new functions that they may contain, eliminate, or exchange with other places returning to exercise fruitful proxemics of urban spaces (Hall, 1966).

In summary, the regeneration project for the San Matteo district represents a unique opportunity to address contemporary urban challenges through an integrated and multidisciplinary approach. By focusing on culture, environment, and craftsmanship, the plan aims to reactivate a neglected district of the historic centre, promoting new social cohesion and sustainable quality of life. The proposed actions not only respond to current needs but also lay the groundwork for a resilient future, where collaboration between public entities and local communities will be essential. Transforming the district into a multifunctional space capable of adapting to residential and tourist demands is a crucial step towards the renaissance of Palermo as a model of urban innovation.

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Image Sources

Fig.1: Elaboration by the authors;

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Author's profile

Diksha Dody

Spatial planner, doctoral candidate in the PhD program in Ecological Transition. Her research focuses on urban and human regeneration of historic centres. Specifically, the theme of neo-population as an opportunity for reconstructing socio-spatial fabrics is the main topic of her doctoral research

Daniele Ronsivalle

He is an Associate Professor of Urban Planning at the University of Palermo. His research focuses on sustainable urban planning, urban area regeneration, and land management. He has contributed to the contemporary urban planning debate with innovative articles and studies. Ronsivalle is also active in consulting for urban development projects and collaborates with local authorities to improve the quality of life in cities.

Maurizio Carta

He is a full professor of Urban Planning at the University of Palermo and an architect. He specializes in urban and regional planning and is known for his commitment to urban regeneration and sustainable development. An author of numerous books and articles, he is internationally recognized for his academic and professional work in the field of urban regeneration. Currently he is city councillor for urban planning at the Municipality of Palermo.