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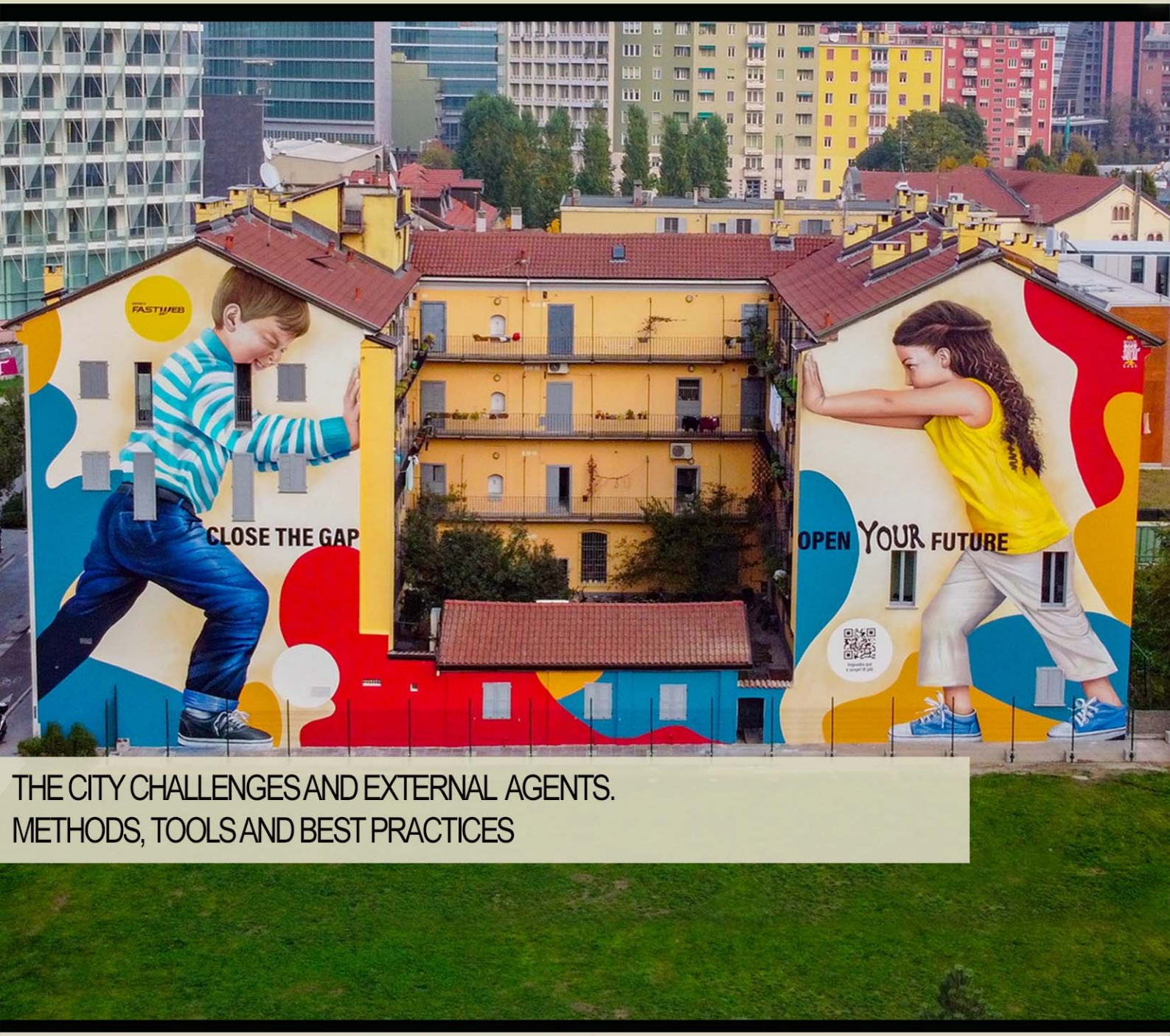

THE CITY CHALLENGES AND EXTERNAL AGENTS. METHODS, TOOLS AND BEST PRACTICES

Vol.15 n.1 April 2022

print ISSN 1970-9889 e-ISSN 1970-9870
University of Naples Federico II

TeMA Journal of
Land Use, Mobility and Environment

THE CITY CHALLENGES AND EXTERNAL AGENTS. METHODS, TOOLS AND BEST PRACTICES

1 (2022)

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realized by CAB - Center for Libraries at “Federico II” University of Naples using Open Journal System

Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | on line ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

Editorial correspondence
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The cover image shows redeveloped building in the Garibaldi neighbourhood in the city of Milano (Picture by Fastweb, retrieved from: https://www.facebook.com/Fastweb/photos/10158794132149472).

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TeMA Journal of Land Use, Mobility and Environment

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TeMA Journal of Land Use, Mobility and Environment

TeMA 1 (2022) 89-110
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6092/1970-9870/8322
Received 12th October 2021, Accepted 28th February 2022, Available online 30th April 2022

www.tema.unina.it

Sustainable urban regeneration in port-cities. A participatory project for the Genoa waterfront

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Abstract
Urban regeneration is an increasingly emerging topic in our urban realities. The challenge that the port-cities have to face lies in the disposal of large areas (often located on the waterfronts), in which it is necessary to establish new functions, to overcome the condition of marginal and degraded areas and become an integral space of the cities and of interaction with the element of water.
The paper reports research developed in the university field starting from a public competition. The research starts from an in-depth study in the literature of the definition of urban regeneration, from the analysis of virtuous international case studies to arrive at the identification of an approach and key issues to be able to develop a regeneration process that is sustainable and leads to an improvement in quality of life of its inhabitants. Particular attention is paid to current policies and strategies related to concepts such as: sustainability, circular economy, resilience and new technologies. According to the "learning-by-doing" approach, the Pra'-Palmaro case study is analyzed here to highlight the strategies implemented for a multi-disciplinary and multi-stakeholder urban regeneration project. The research can therefore help other port-cities in the world to realize sustainable urban regeneration, also attentive to the participation and involvement of stakeholders.

Keywords
Regeneration; Port-cities; Sustainability; Participation.

How to cite item in APA format
Pirlone, F., Spadaro, I., De Nicola, M., Sabattini, M. (2022). Sustainable urban regeneration in port-cities. A participatory project for the Genoa waterfront. *Tema. Journal of Land Use, Mobility and Environment*, *15* (1), 89-110. http://dx.doi.org/10.6092/1970-9870/8322

1. Introduction

1.1 Urban regeneration in a port-city: international sustainability policies and participation

The research reported in the paper explores the theme of urban regeneration in a city-port: an increasingly emerging topic in our urban realities.

Our cities, or port-cities, represent the crucial areas in which to intervene to improve living conditions and promote sustainability. The current COVID-19 pandemic, combined with the climate emergency, translate into an urban emergency, where it is important to intervene (Barbarossa et al., 2014).

Today, 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050 bringing the city's resident population to 2.5 billion people. This phenomenon of population growth will raise demand on services (transportation, infrastructure, waste management, etc.), energy consumption and emissions, leading to increasing pressure on sustainable urban planning (Aslan & Ince, 2019). Urban regeneration is carried out through actions aimed at the recovery and requalification of urban space, limiting the land's use with a view to environmental sustainability. It has the primary aim of improving the life's quality of the people, through an intelligent use of urban spaces, without losing focus of the peculiarities of the context. It can be considered as the virtuous outcome of the interplay between the different elements that characterize urban systems, such as: political power, physical components, social dynamics, environment and economic context (Bottero et al., 2017). Indeed, it represents a sustainable practice, as it operates improvements on the environmental sphere, reducing the anthropic and energy impact on the ecosystem, social, creating new places of gathering, and economic, bringing value to places (Carta, 2008).

In particular, regeneration has taken place in degraded peripheral areas and in disused industrial sites, urban voids which, once regenerated, return to the citizens and increase the value of the context (De Giovanni et al., 2016). This need for recovery today is increasingly felt, not only for the lack of new spaces and the regulatory limits for new buildings, but especially for the spread of a new culture of environmentally friendly recovery. In addition, it has in several cases proved to be an opportunity to promote policies of active participation of the community, contributing to employment and improvement of the social and cultural context. This is one of the aspects that differentiates the broader concept of urban regeneration from that of redevelopment, which for intent is not dissimilar, but which lacks this meaning of integration of environmental, economic, social and cultural aspects, with the involvement of the communities that will live the regenerated places.

The paper intends to explore the issue of urban regeneration of a port city, especially with regard to the waterfront area, that sort of "permeable urban surface" evolves from contact with the water until to involve the internal parts of the city (Pirlone & Erriu, 2016). «Port cities are cities which grow up in close connection with their ports. Over the years, ports influenced cities development becoming the main driver for urban sprawl» (Ugolini et al., 2017). In many cities, history teaches us that for different political reasons, such areas have sometimes been poorly planned or managed.

The regeneration of the waterfronts is a complex issue, a plurality of multidisciplinary aspects and the resolution of numerous problems are involved. Careful study in the functional, social, economic and cultural fields therefore requires (Greco, 2009).

By restricting the discussion of the topic to the port-cities, we are referring to those realities that have a close link with the port system and can be considered born and sup-ported by this activity. In these cities the sea is the place from which threats of conquest had come, but also possibilities of commercial traffic and, above all, fundamental cultural contributions, which have shaped the character of the cities themselves. Taking action in these realities is not easy, because they are complex spaces where two systems interact, the urban center and the port, which present different needs and are often in conflict with each other (Conca, 2013). Also

«investment decisions must strike a balance between the demands of the Public Authority, which seeks to take full advantage of urban transformation in terms of public services and the subject private oriented to maximizing profits and reducing risk» (Rosasco & Lombardini, 2020).

Due to the quantity and complexity of the activities carried out in the past, this meeting place between city and sea has always tended to be uncrossable, in particular for the presence of areas for port or industrial use. Only in recent decades, thanks to the decommissioning and relocation of some sites, there has been a transformation, which has led the waterfronts from being a place of physical limit to becoming the axis of the new urban structure, an integral part of the city and a space of interaction with the water element. Waterfront regeneration is also fundamental for urban mobility and tourism. Port-cities can use old ports' areas to promoting sustainable mobility - develop new transport infrastructures, bicycle lanes or pedestrian zones - or offering new activities for tourists near the sea. This evolution has restored centrality to these places, which become spaces of everyday life and attraction, for the convergence of a plurality of cultural, economic and social incentives, acting as generators of urban quality (Carta, 2008, 2010, 2016).

To improve the existing urban regeneration processes in the light of current international sustainability policies and strategies is therefore necessary. And understanding the urbanization trends that are likely to develop in the coming years is crucial for the implementation of the 2030 Agenda for Sustainable Development, including efforts to forge a new urban development framework.

Sustainable urbanization and /or regeneration is key to successful development. As the world continues to urbanize, sustainable development depends increasingly on the successful management of urban growth. This aspect is more important, especially in low-income and lower-middle-income countries where the pace of urbanization is projected to be the fastest. The main challenges facing these countries are related to ensuring access to infrastructure (transportation, energy systems) and social services for all such as education, employment, health care and a safe environment.

Policies and funding to manage urban growth is important that they are fully shared, inclusive and therefore centered on urban areas, guided by local needs for which to propose local solutions. In parallel, to develop integrated policies that simultaneously strengthen the links between urban and rural areas is important. These strategies must therefore be built on the basis of their existing economic, social and environmental links.

The research therefore proposes a sustainable urban regeneration, where the latter term also means the involvement of stakeholders.

Local Agenda 21' (LA21), introduced by Chapter 28 of the' Action plan for sustainable development 'adopted at the Earth Summit in Rio in 1992, taught us the importance of participation in improving decision-making processes. «Chapter 28 is an appeal to 'local authorities' to engage in a dialogue for sustainable development with the members of their constituencies. This dialogue seeks for a new participation process where the communication between local authorities and all local stakeholders goes beyond existing and traditional consultation. By nature LA21 is therefore a participatory reform» (Coenen, 2009).

Agenda 2030 makes us reflect about on the importance of investing in cities. In particular, SDG 11 ("make cities and human settlements inclusive, safe, resilient and sustainable") «with its ambition for cities to become inclusive, safe, resilient and sustainable until the year 2030 points to the emerging international consensus that good urban governance has become a matter of global concern». All aspects present in this objective are important for the research developed.

SDG 11 includes a series of sub-objectives that are directly linked to a circular approach at the urban level. Target 11.b then introduces another important aspect in the research developed here, that of resilience.

In summary, the aim of this work is to report result of a systematic analysis of practices and models in the current context of urban planning and to detect the main challenges in adopting sustainable practices and community-based models in the urban regeneration of our port-cities.

Subsequently, according to the "learning by doing" approach, the Pra'-Palmaro case study is analyzed here, at a local level, to highlight the winning strategies for urban regeneration (Salizzoni et al., 2020; Coaffee et al., 2018).

The result of the research is a methodological approach (which suggests the introduction of some new aspects) to support the implementation of an urban regeneration process. This approach is attentive to current policies and strategies related to the concepts of sustainability, circular economy, resilience and new technologies. The research therefore proposes a sustainable urban regeneration, also attentive to the involvement of stakeholders. But also an approach that considers in a circular way the themes of urban planning (transport systems, energy, waste,...), planning sustainable urban development and regeneration that closes production cycles.

1.2 Virtuous experiences of urban waterfronts regeneration at international level

The research analyzed several international case studies that can be considered good practices with respect to the theme of urban waterfront regeneration. Specifically, this section considers three cases: the waterfront of the French city of Lyon, the redevelopment project of New York and that of the city of Genoa, where the methodology presented later in the paper was applied.

Lyon is an important city in France, located at the intersection of two major rivers, the Rhône and the Saône. In recent decades Lyon was interested by an intensive urban and landscape design activity, with the achievement of high-quality results. This process began in the 1990s and particularly involved the redevelopment of public space, giving priority to the relationship between city and nature, the improvement of mobility and the increase of cycle and pedestrian paths. In order to manage the planning of the city, an organisation called Grand Lyon was set up in 1966. It gathered 55 townships and took action on different areas to enhance the regeneration of Lyon. In those years the environmental and cultural changing of Lyon began, with the implementation of a sequence of plans for the government of the territory. In 1991, an overall project was approved for the development of the Rhône and Saône waterfront, which in 1998 merged into the so called Plan Bleu (Ferretti, 2020). Meanwhile the Plan Vert was drew up (Fig. 1).

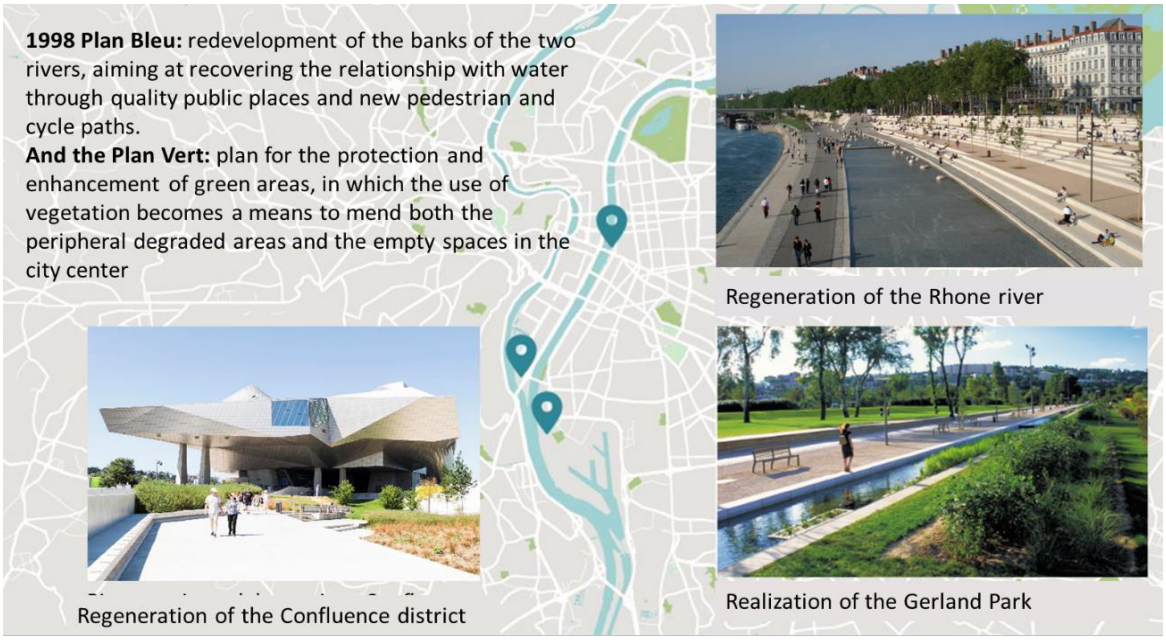


Fig.1 Participation and the main projects of waterfront's regeneration in Lyon

Lyon was studied in depth because it represents a case of participatory urban regeneration, which focused mainly on the relationship with water and vegetation, making public spaces the starting point for the regeneration of the entire city. Despite the extension Lyon is a reality where the typical degradation of large cities is not felt and it represents an exemplary case of integral regeneration of public space.
The redevelopment of the Long Island, ex-industrial area, with the Hunters' Point South Park, is one case of waterfront reusing make them accessible, resilient and sustainable to climate change. The city park has been included in a planning strategy that uses the area as both an urban park and a residential area hosting 5000 residential units. The plan took shape through the succession of two construction phases: the first phase (2011-2013) redeveloped the area by equipping it with green spaces, games for children; the second phase (2015-2018) involved the southern lot by providing "wetlands" and a cantilevered platform that offers a remarkable view of the Manhattan skyline (Hilburg, 2019). The entire project is characterized by different green ecological bands that develop longitudinally for the entire lot, creating multiple path systems. The articulation of the routes also allows a variable relationship with the water, in some panoramic and elevated points, in other proximity points. In the area there are a café and a vaporetto stop The roof houses photovoltaic panels that provide enough energy to support the needs of the pavilion and the lighting of the park. The design of the park also considered the future and inevitable rise of the water level, the sustainability of the materials and the maintenance of the places after construction. In fact, the points of contact with water, cliffs and platforms, have been designed to allow a progressive increase in the water level in a controlled way and in such a way as to allow the use of the park in safety. The vegetation of the park consists of salt marsh plants that do not require active irrigation, reducing maintenance costs, and also act as a natural buffer to floods. The vegetation also has the role of cleaning and filtering the river waters. The materials used to fill the cliffs and the paths derive from the reuse of the aggregates already present on the site, as in the nineteenth and twentieth centuries the area was used as a landfill to dispose of the soil excavated by neighbouring railway yards (Fig.2).

Fig.2 Resilience to climate change: Hunter's Point South Park in New York

After the industrial crisis of the 1970s and 1980s, Genoa started a process of urban, economic and social regeneration, thanks above all to events for which it received funding from the European Union.
The value of these events lies in the fact that they didn't end with the event itself, but were a springboard for subsequent long-lasting development and regeneration projects. In this way entire areas of the city have been reconverted, through restorations of facades and urban renovations in the historic center, changes in road system and pedestrianization projects.
A milestone was the "Colombian Expo" (1992), the manifestation held for the 500th century of the discovery of America. On this occasion, the reconnection between the historic center and the city waterfront was realized by the recovery of the Area of the Porto Antico.
Renzo Piano's project has provided a multifunctional destination of the site, through the recovery of the buildings, the creation of public space and a connection with the historic center, also realized thanks to the burying of the roadway behind. In addition, the project has planned the construction of an iconic structure such as the Bigo, capable of connoting the image of the city, as well as the Aquarium, which has become one of the major attractions of Genoa. Other projects in the area have been implemented in view of the G8 Summit in 2001.
For Genoa European Capital of Culture in 2004 the projects focused on the western side of the port, in implementation of the Dock Redevelopment Program, with the construction of the Galata Maritime Museum.
In conjunction with the interventions carried out in view of big events, other transformations have been undertaken thanks to the so-called "complex programs" of urban regeneration. These interventions have made possible to achieve an integration between the redevelopment of buildings, public space and an overall social, cultural and economic revitalization of places.
The role of the University of Genoa was important for the regeneration of the historic center and the waterfront. The establishment of facilities in these areas has led to a complete renewal, attracting students and leading private investors to open new activities. In this way the image of these neighbourhoods was revived, from the point of view of tourist attendance, real estate value and quality of life.
Important urban transformation interventions have been carried out also in the suburbs of Genoa. The Fiumara project was significant, built on an industrial site in disuse for 20 years.

Fig.3 Urban empties to rebuild the link with the sea: the main projects of urban regeneration in Genoa

The project was promoted through a special Urban Recovery Program in 1998, after the signing of a Program Agreement between the Municipality and the construction company. The result was the construction of large green spaces, pedestrian areas, urban furniture, as well as the realization of residences and various commercial and leisure activities.

Municipality of Genoa has recently approved an Urban Resilience Strategy, called "Genova Lighthouse" (2020), a strategic vision document of the city's resilience, intended as a smart paradigm of urban transformation. This document will enable the city to be prepared to face the global change: climate, demographic, technological / digital, starting at the local level.

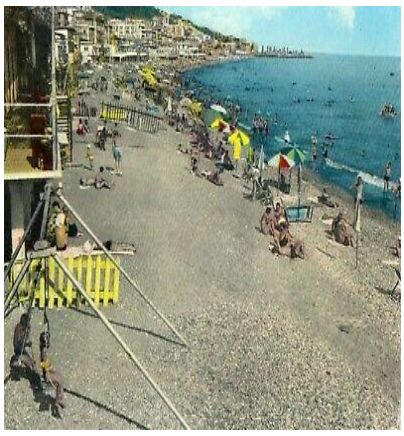
The urban regeneration policy of the city of Genoa is taking action on various areas, reasoning to environmental and energy priorities and avoiding the consumption of new land. The target in the central area is to rebuild the link with the sea, through the reconnection with the Porto Antico area (Blue Print project), strengthen the Port-City axis with the Hennebique and Caruggi projects and finally improve the Ponente area with the Erzelli Great Campus Project and the Val Polcevera Masterplan (Fig.3).

1.3 Case study: "Give back the sea to Pra'-Palmaro"

The public competition and the research, thanks to the use of a participatory approach by different institutions, is aimed at proposing a regeneration project in an area west of the port city of Genoa. The case study is Pra'-Palmaro, a site that due to the presence of the port and railway infrastructure has lost contact with the sea and needs an extensive and participatory regeneration project, to improve the quality of life for the residents of the neighbourhood.

The construction of the Port of Pra' began in 1968, while the first container ship docked in 1994. After 51 years from the beginning of the works, the east side of the port embankment is not yet docked and large areas are still unpaved and unused.

Until the 70s in the area there were several beaches at the service of residents, but also of tourists who came from outside the region. The implementation of the port infrastructure has led to a deterioration in the quality of life for the inhabitants of the area (Fig.4). The situation is critical because port and rail operations take place at any hour of the day and night in front of homes, causing dust and noise.



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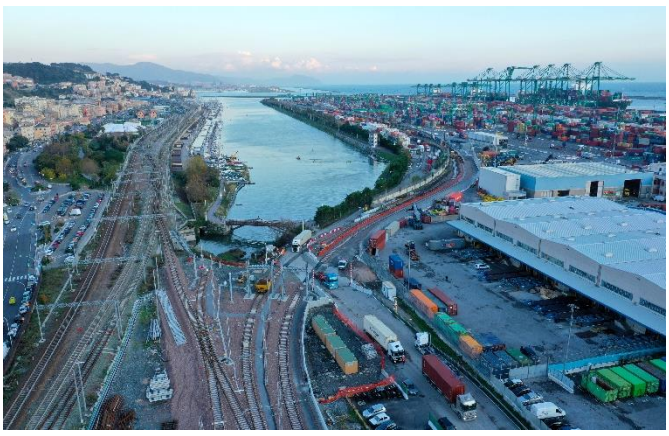


(b)

Fig.4 (a) An historical postcard of Pra' before the '70s and (b) Pra' nowadays (source: www.liguria.bizjournal.it)

In recent years, significant investments have been made for Pra' by the Municipality of Genoa, for the construction, for example, of new green areas, a navigable canal that can be used for competitions and rowing training and also home to the tourist port of Pra', and a promenade that runs along the canal, called Fascia di Rispetto.

The presence of the railway, leaning against via Pra', has prevented recovery and enhancement operations in the coastal area. Only recently, the institutions began to plan the shift to the sea of the Genoa - XX Miglia stretch of railway. The idea of the competition comes from the need to design the free area.
In February 2020 FondAzione PRimA'vera and Comunità Praese (a participatory foundation of the community of Pra'), under the coordination of the Municipality VII Ponente and the Municipality of Genoa, have held the competition entitled: "*Ridiamo il mare a Pra' – Palmaro*/ Give back the sea to Pra' Palmaro". This initiative intends to regenerate the Praese waterfront, in order to improve the livability of the neighborhood through the construction of a promenade with "water blade" and rows of trees, for the separation from the port and the railway. The project plans to maintain the aesthetic style, materials and urban furnishings present in the Fascia di Rispetto and used for the Pra' Marina project, funded by the Regional Operational Program.
The University of Genoa was involved in the competition and made itself available to collaborate in the case Study with its students, in order to further develop the idea with graphic and design works during the course of Urban Planning and Laboratory (teachers: Prof. Pirlone and Prof. Spadaro) of the Master's Degree Course in Building Engineering – Architecture of the Genoa (Department of Civil, Chemic and Environmental Engineering).
In March 2020 there was the telematic launch event, due to the health emergency, and the project works were completed in June 2020, with the consequent award ceremony in December 2020.
This initiative was developed as part of a technical working group composed of various actors: Department of Port and Maritime Economic Development – Logistics of the Municipality, Directorate for Economic Development of Innovation Projects of the Municipality, Municipality of Genoa and Commissioner for Reconstruction, Port System Authority of the M.L.O., Italian Railway Network (RFI), Highways for Italy,...
The projects that have been developed are therefore real "participatory projects", which bring together the needs of the various actors who live and work in the area.

2. Methodology

The methodological approach proposed for a participatory project of sustainable urban regeneration was structured according to different phases: State of the art; Context analysis, Planning and design part and Monitoring part (Fig.5). Then there is the transversal phase of participation which involves the various stakeholders - public and private, referring to both the port area and the urban territory - as responsible for the elaboration, monitoring and subsequent implementation of the plan.
Stakeholders should be consulted during all phases. In this case Stakeholders involvement is aimed at formulation, at sharing the contents and ensuring the achievement of the objectives of the plan.
In the first phase, to define the Strategy is necessary to start from the analysis of the territorial context and its needs. At the same time, as presented in section 1.2, it is essential to investigate the experiences of other port-cities and, through the construction of multilevel governance, create partnerships and identify common objectives for port and urban development, in line with the objectives of the International Agenda. Using this type of approach: integrated, systemic and participatory, it is possible to resize the two individual strategies into a single and consistent one with the requests a «local strategy coherent with the European requests and expectations as well as the global trends, in order to enhance the bond between urban territory, climate and environment» and also to innovate the offer of the waterfront services.
In the State of the art part is important to consider: the territorial framework, interest points, the destinations of use, the pedestrian and vehicular accessibility, the mobility, the transport and the presence of green areas. In this section it is crucial to find and analyze the existing urban plans at different scales or other useful tools for the case study. The inspection with related photographic documentation is also fundamental.

The second phase concerns the Context analysis, which can be split into two parts. The first consists in the identification of problems from an objective point of view, through the well-established methodologies of SWOT and PEST analysis.

SWOT analysis, short for Strengths, Weaknesses, Opportunities and Threats, as you know, «is a business strategy tool to assess how an organization compares to its competition. The strategy is historically credited to Albert Humphrey in the 1960s, but this attribution remains debatable… Beyond the business world, SWOT Analysis can also be applied to the individual level to assess a person's situation versus their competition further». «SWOT analysis, a commonly used tool for strategic planning, is traditionally a form of brainstorming». SWOT has been described as the tried-and-true tool of strategic analysis.

The SWOT analysis or matrix allows to evaluate Strengths, Weaknesses, Opportunities and Threats of a project, when an organization or an individual must make a decision to accomplish a goal.

The SWOT analysis begins with the definition of the objectives or purposes to be achieved. Next we define its main points:

- S) Strengths: all the factors present that are useful to achieve the goal;
- W) Weaknesses: all the factors present that are harmful to achieve the goal;
- O) Opportunities: external conditions that are helpful to achieve the goal;
- T) Threats: external conditions that could cause damage to performance.

By combining these aspects we can define the actions to be carried out to realise the desired purpose.

Once the SWOT matrix has been created, it will be necessary to consider whether this purpose is achievable and, if so, the several prescribed actions will be carried out; in negative case, however, a new matrix will have to be made in order to succeed in the task.

The four points referred to are somewhat interrelated and can be grouped into two categories: internal factors and external factors. The former include the strengths and weaknesses that characterize the organization, while the latter depend on external factors from which one can try to derive advantages or, on the contrary, limit the disadvantages.

Another interesting tool proposed to better analyze the reality object of the study is the PEST analysis, short for Political, Economic, Socio-cultural and Technological. It is a strategic tool for an external analysis. It describes a framework of macro-environmental factors to be taken into consideration for understanding market growth or decline, business position, potential and direction for operations. It is also known as Quantitative Analysis or also STEER, which considers sociocultural, technological, economic, ecological, and regulatory factors, but does not specifically include political factors. The model has recently been extended to STEEPLE and STEEPLED, with the addition of demographic and education-related factors.

Regarding the political tendencies, particular attention should be paid to the legislative measures governing their functioning, such as trade restrictions, political stability and fiscal policy. Relating to economic scenarios, it is required to look at market movements, disposable incomes, prices and inflation. From a social point of view, on the other hand, the characteristics of the community are analyzed, which can influence the demand for products or modify management strategies. In the case of the technological scenario, investments in strategy and development can influence business approaches (Joseph Kim-Keung Ho, 2014).

The PEST analysis, together with the SWOT analysis, allows you to have a broad objective view of the positivity and negativity that could arise when creating a new business or planning a territory or re-generating a pre-existing one.

At the same time, it is interesting to proceed with participatory analysis that identifies problems and potentialities starting from moments of dialogue between the different stakeholders (forums, interviews, ...). The analysis phase is fundamental to develop objectives and actions of the Planning and design part.

The research proposes an interaction between the results emerged from the individual analyzes, that will result in the identification of the main themes / aspects on which to focus to implement a sustainable regeneration of the waterfronts.

The last phase involves planning and identifying the interventions to be implemented in the short, medium and long term, through a general design (masterplan) and focus areas.

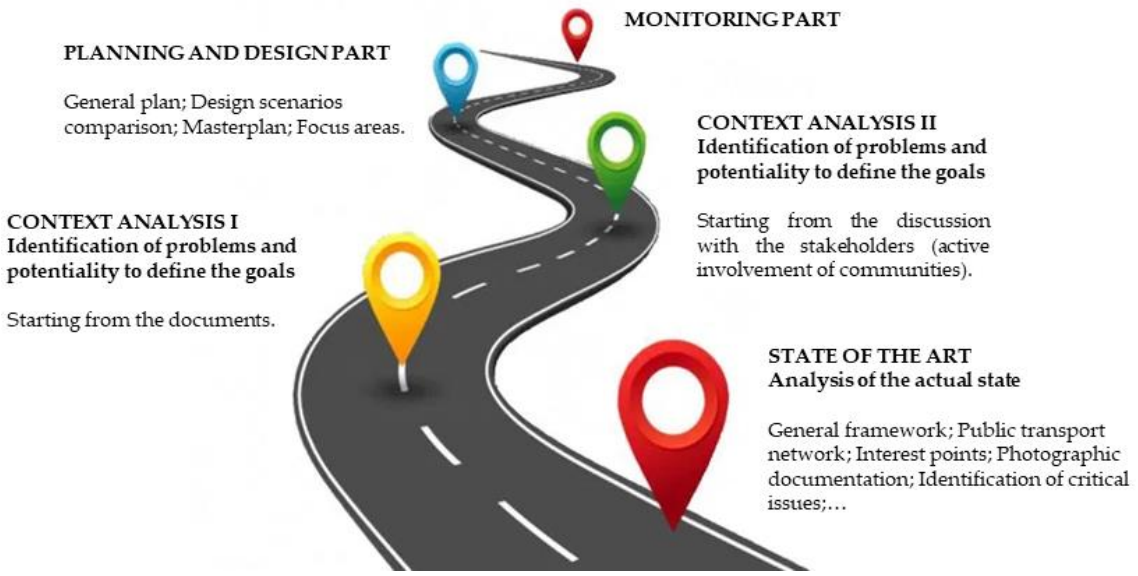


Fig.5 The main phases of methodology proposed

3. Application and Results

The methodological approach presented in section 1.3 is applied below to the case study of Pra'-Palmaro neighbourhood, in the city of Genoa. This reality is affected by a series of infrastructural criticalities and by the presence of the port, which over the years has negatively influenced the quality of life of the inhabitants.

The participatory project of sustainable waterfront (port-cities) regeneration was carried out following the following phases: State of the art; Context analysis, Planning and design part.

In the first phase, the current state of the area was examined, through research, inspections and specific meetings and interviews with associations representing the population. With regard to the participatory process, since the site is shared with different bodies (port, railway, motorway and public administration infrastructure system), for the definition of the area's regeneration project, technical tables have been created to which the University of Genoa participated. These technical tables meet periodically in order to favour the coexistence of the plurality of interests at stake of the various entities and citizens. Another important aspect from a social point of view is in fact the considerable commitment and strong participation of the inhabitants in the political activities of management and transformation of this area.

In Genoa Pra 'the creation of the buffer around the calm channel, a zone which allowed a separation between the port and the inhabited area, was of considerable importance (Fig.6). This redevelopment work did not continue in the nearby area of Pra'-Palmaro, the subject of the study. The urban fabric adjacent to the site is characterized by a highly heterogeneous and anthropized configuration. In addition to the port, there are various road infrastructures, such as the Aurelia road and a motorway flyover for accessing the port area, which overtakes the area itself. These structures coexist with the consolidated urban fabric. The site is compressed by two bands of tracks: to the north there are those serving the Genoa-Ventimiglia route, while to the south, there is a freight yard available to the Port.

As regards the mobility, Pra'-Palmaro area is well served by public transport. In fact, several bus lines pass along the state road and there are two railway stations near the area: Genova Pra' and Genova Voltri. With

regard to private transport, the Genova Pra' motorway exit is a crucial link. Finally, as concerns cycling, there are short sections of a dedicated cycle path, interspersed with mixed cycle-pedestrian paths, which are interrupted in the project area.

Over time, the neighbourhood has changed considerably, reaching its current conformation. Surely the strongest connotation is given by the port basin, which constitutes an important regional and national economic pole, although it also represents a great problem for the liveability of the place. Another distinctive feature is the cultivation of basil, of which Pra' is the main producer, and the presence of numerous villas dating back to the seventeenth century, located along the Aurelia road. Finally, various spaces dedicated to sport and recreational activities have been created in the Pra' buffer zone.

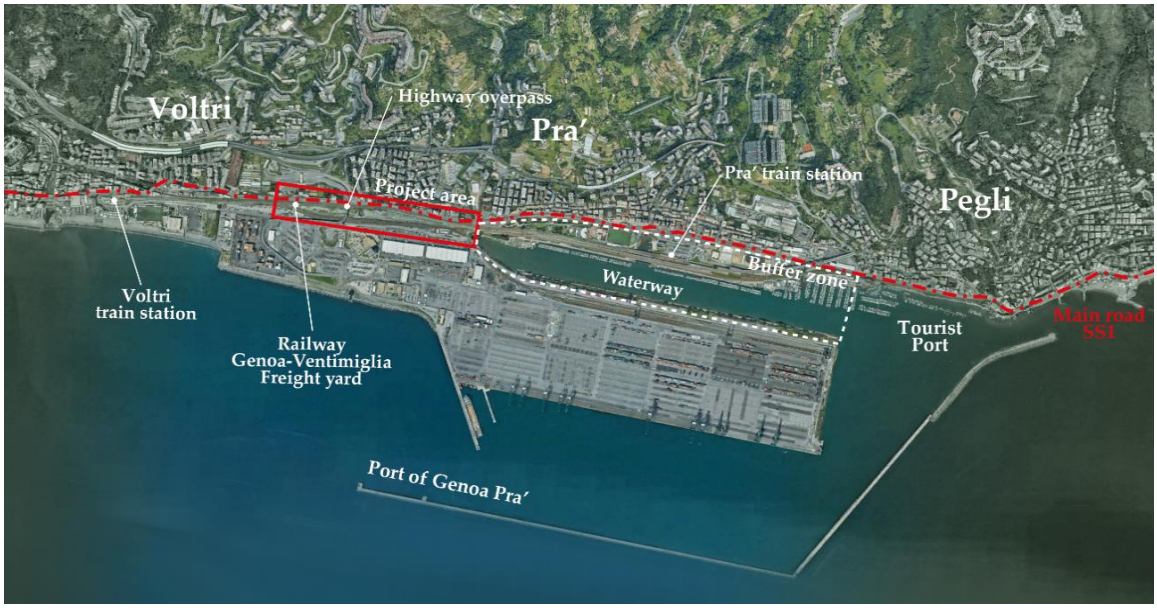


Fig.6 Framework of the study area

Fundamental to the study of the territory was the analysis of planning tools, both those relating to the urban reality and those of the port. Municipal, metropolitan and regional regulations were taken into consideration, which contained indications on the project area.

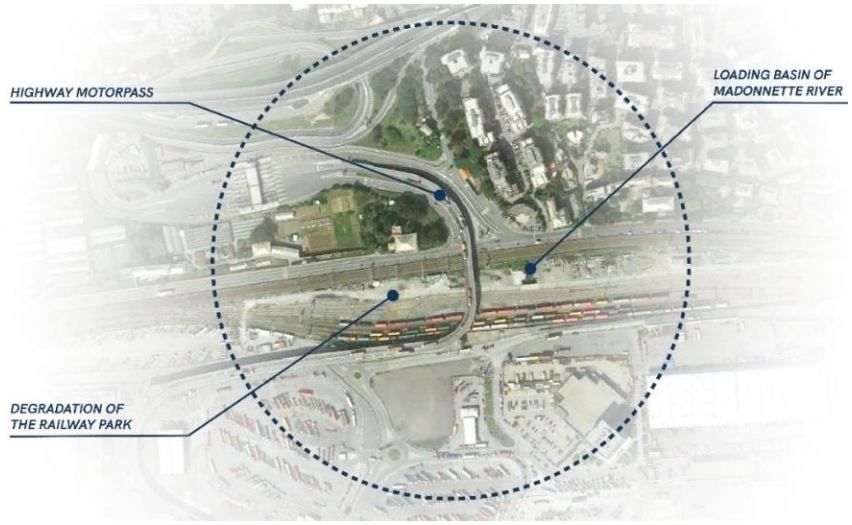
At the urban level, the provisions contained in the Municipal Urban Plan are important, which among other indications, in the area in question envisage the modification of the access road to the Port and the addition of a railway stop. With regard to mobility, the Sustainable Urban Mobility Plan (SUMP, 2019) is analyzed, which for cycling provides for the creation of a path to connect Voltri and the buffer zone of Pra'.

As concerns the port, a plan of interest is the Port Regulatory Plan of the city of Genoa, which for the Voltri-Pra' territorial area indicates among the objectives the enhancement of the waterfront and a rearrangement of the tracks, with the translation of the Genoa-Ventimiglia line to the sea, to create the buffer zone between the town and the port under study. Finally, with the Regional Operational Program (POR-FESR) 2007-2013, Pra' Marina was selected among the urban development projects admitted to contribution. This project has led to the implementation of numerous redevelopment interventions, such as parks, squares and areas used for recreational activities and sports.

As part of the design, the issue of the management of the site's water resources was also investigated. This choice derives from the desire to introduce the water element in the area's redevelopment project, as an ideal reference to the past presence of the sea in the site. Therefore, the technical and economic feasibility of the possible viable solutions was investigated, based on the characteristics and constraints of the area.

Once the characteristics of the site were identified, the second phase of analysis was undertaken through an analytical and participatory process to determine the main criticalities and strengths present.

Summarizing the problems of the site, the main one concerns the cycle-pedestrian viability, as at the moment it is insufficient, given the small size of the sidewalk, occupied by parked cars. As for accessibility to the port area, with the exception of the viaduct, it consists only of a very long path, a factor that discourages the use of public transport by port workers. In terms of environmental impact, the motorway viaduct certainly represents a critical element. Furthermore, the presence of a loading tank for the Rio Madonnette water, positioned in the center of the site, represents a factor of interference with the project. Finally, the east end of the area is a particularly complex node due to the intersection between the mouth of the Rio Branega, the railway tracks and the end of the pedestrian and cycle paths coming from the nearby Dapelo Park, which it is essential to connect with the future area of intervention (Fig.7).



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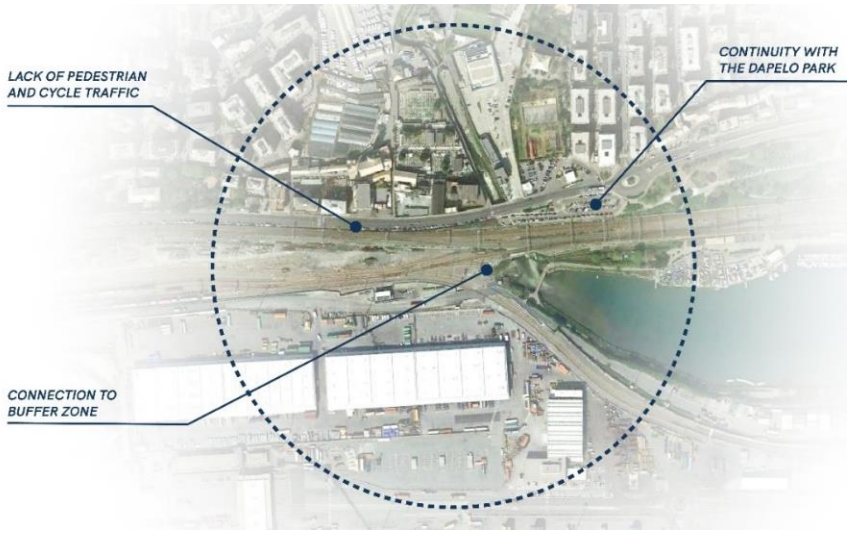


(b)

Fig.7 The critical issues of the central (a) and the east final (b) part of the site

By drawing up the SWOT analysis, an image emerged of an area subject to many problems, but also with great potential to develop. A crucial issue is certainly the port, which represents a strong point due to its commercial importance, but at the same time it is a source of great inconvenience. Among the weaknesses there is the lack of a pedestrian and cycle path in the area, with great risks for safety. The creation of a buffer zone, with paths for soft mobility, vegetation and water, would represent an opportunity to address these problems. The construction of the new railway stop in Pra'-Palmaro also constitutes a great opportunity,

allowing a direct connection both to the port, for workers, and to the project site, with a view to intermodality (Fig. 8).

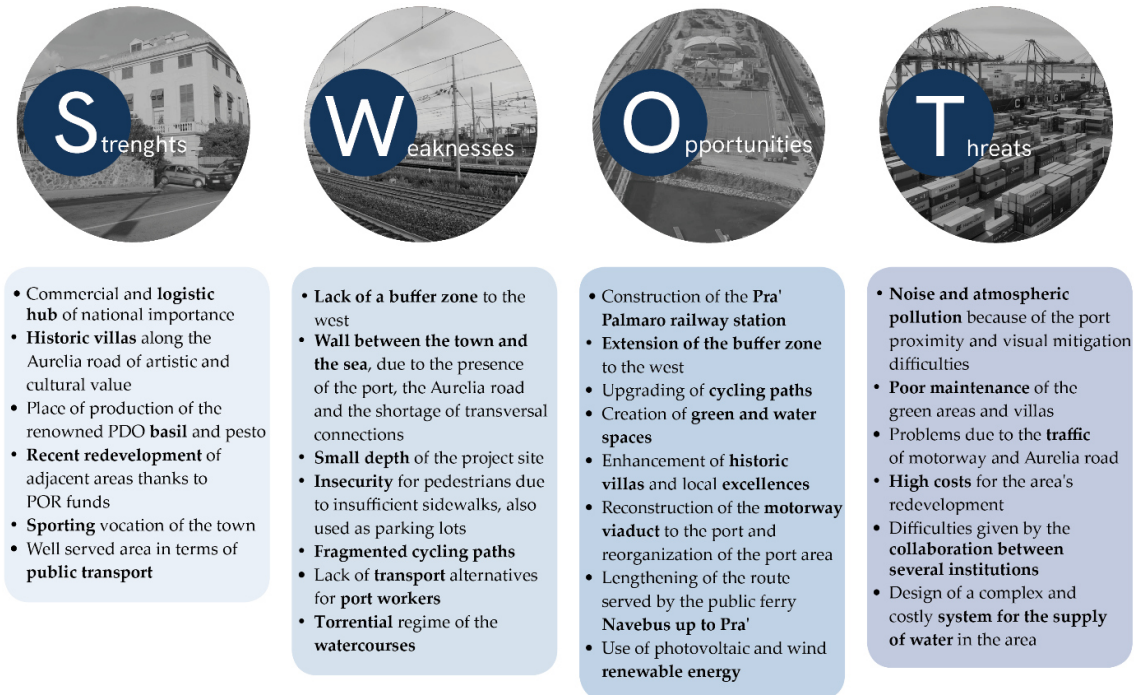


Fig.8 SWOT analysis for the Pra'- Palmaro case study

The PEST analysis summarizes the site transformation forecasts: by railways network (Ferroviaria Italiana) with the construction of the Pra'-Palmaro railway stop, by Motorways for Italy (Autostrade per l'Italia) with the project for the new viaduct and by the local associations, which ask for the redevelopment of the site. With regard to the implementation of the new project, there is the possibility of resorting to European, national and regional funds, as previously happened for the realization of the Pra'-Marina project. Ultimately, the need to implement an energetically sustainable project must be included, thanks to the use of plants and technologies that exploit renewable resources (Fig. 9).

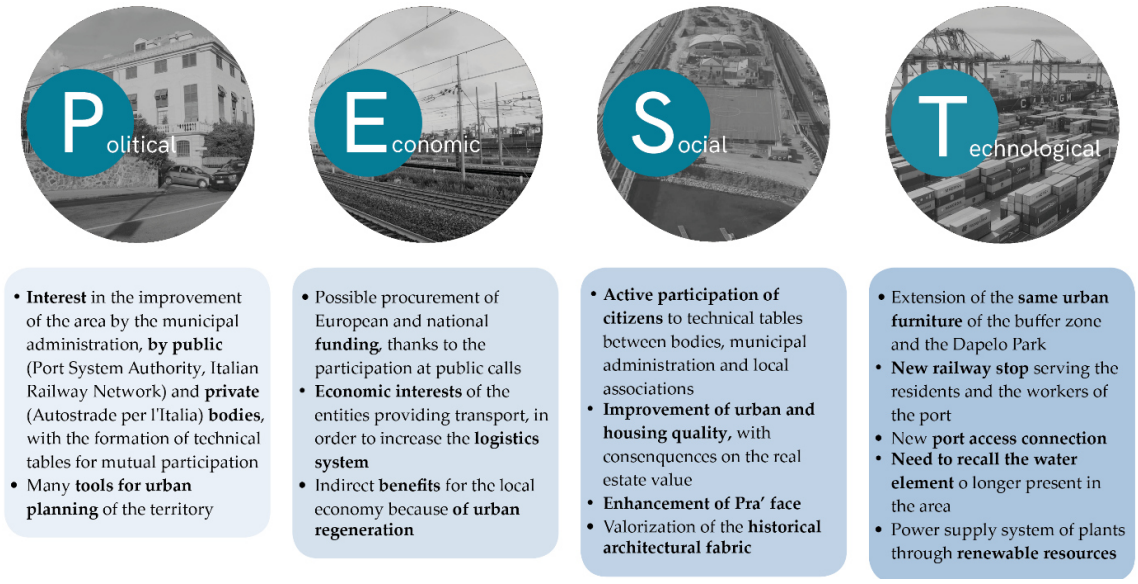


Fig.9 PEST analysis for the Pra'-Palmaro case study

Knowledge of the context and critical analysis of the factors that act on it led to the development of the design phase. It consisted in the preparation of a masterplan of the area, subsequently deepened in detailed documents. The aspects considered for sustainable regeneration in the case study are: sustainable mobility, accessibility, the arrangement of green areas, the identity of the place and the presence of the water element. The project area, due to its morphology and the set of boundary conditions, consists of a complex place to be designed. The biggest challenge is managing the various flows (vehicular, pedestrian, cycle), in order not to create interference and guarantee the safety of the users. Therefore, the first concern was to create pedestrian and cycle paths separated from the road, also thanks to the use of green. The same separation work was carried out on the front of the railway park where earth dunes were created hosting many types of trees and shrubs, in order to mitigate the noise and visual impact caused by the passage of railway trains and port operations.

Green is an element that takes on particular importance within the project, as in addition to perceptually characterizing the experience in the area, it performs different functions. First of all, it is used as a physical separation between the public space and the road and railway arteries, to mitigate the visual but also the acoustic impact of these two nearby realities. Furthermore, it is well known how urban vegetation also affects the quality of the air we breathe locally, being able to absorb carbon dioxide, filter pollutants and control the microclimate, both in summer and in winter. Finally, the large trees present guarantee shading in summer and favour the reduction of the "heat island" phenomenon, ensuring higher thermal comfort. The vegetation present in the area creates a system with the greenery of the context, consisting of the dense trees of the historic villas along the Aurelia road, the public gardens, the Dapelo Park and the green areas along the calm canal.

One of the main objectives of the project is to improve sustainable mobility through the creation of pedestrian and cycle paths, as well as exploiting the concept of intermodality between the different possible forms of mobility (bus, foot, bike, train, ...).

In this sense, the integration of the project with the existing context is fundamental, thus reasoning on the concept of continuity, in particular with the recent interventions that have led to the requalification of the Pra' buffer zone.

Continuity was also guaranteed with respect to existing materials, vegetation species and urban furnishings. For this reason, the area provides for the articulation of two pedestrian paths, main and secondary, a cycle path and a life path. These itineraries allow to cross the entire area longitudinally, but at the same time transverse links ensure the relationship with the urban fabric behind it. With regard to the intermodality of transport systems, a fundamental point is the construction of the new railway stop in Pra`-Palmaro, directly connected to the city center and the port area via an underpass.

It represents an opportunity to increase the accessibility, reachability and usability of the area. This is in line with the aim of redeveloping the site and of encouraging the use of sustainable means (public but also private using the new cycle and pedestrian routes) by the inhabitants and port workers. For the latter, it is currently difficult to reach the port by alternative means to a private car, because of the absence of pedestrian connections. In the building of the railway stop, the construction of a covered parking for bicycles is planned, which allows both to favour intermodality and to improve the usability of bicycles throughout the entire Pra'. In this regard, a bike-sharing service, including electric vehicles, can also be envisaged.

Still with regard to mobility infrastructures, the project includes the maintenance of parking spaces for vehicles, inserted in way to make them safer from the viability of the principal road.

The project also uses constructive solutions that make the park accessible to all. In this case, the connecting ramps between the various paths and the avenues have a reduced slope to facilitate their travel.

Finally, at the strong request of the population of Pra', which was deprived of contact with the sea due to the construction of the port, a water channel was planned to cross the site for its entire length.

The main function of the canal within the project is that of an ideal lure to the sea.
In addition to the aesthetic purpose, the environmental one was also pursued, as the water allows, together with the green areas, a local reduction of the "heat island" effect. In addition, the flow of water allows for greater oxygenation of the mouth of the Branega stream. The water blade begins at the western end of the park and is articulated along the area having a variable section from 2 to 4 meters. Along the canal there are numerous areas of contact with the water, such as seating with steps and games, which afford interaction in different ways.
As regards the origin of the water, different hypotheses were analyzed, such as the collection of rainwater, the use of water from the purification system and the interception of waterways. These systems proved to be impracticable in the project, leading the choice towards the construction of a seawater pumping plant, possible thanks to the proximity of the site to the sea.
It is certainly an economically disadvantageous hypothesis, both in terms of construction and management costs, but the only one capable of guaranteeing the necessary range and in a constant manner. To ensure the sustainability of the intervention, the construction of a photovoltaic system above the roof of the new Pra'-Palmaro railway stop is considered. This system would allow the supply of the seawater lifting system for the canal and the park services, such as public lighting, bicycle parking and more.
As can be seen in the masterplan of Figure 10, the project gave absolute priority to the creation of a public space, trying to minimize the new construction, so as not to aggravate an already highly urbanized area. For this reason, the focus was on adding vegetation, seating, play areas, limiting the new constructions to the building that houses the ticket office of the Pra'-Palmaro station, a coffee and a covered parking for bicycles, functions considered useful in the area.
Sports activities have also been privileged, with the creation of spaces dedicated to a life path and a cycle path. Urban gardens have also been added, which constitute a social and also educational opportunity, being a place where children and young people from the schools of Pra' can be brought to know and personally grow fruit, vegetables and aromatic plants typical of the Ligurian territory.

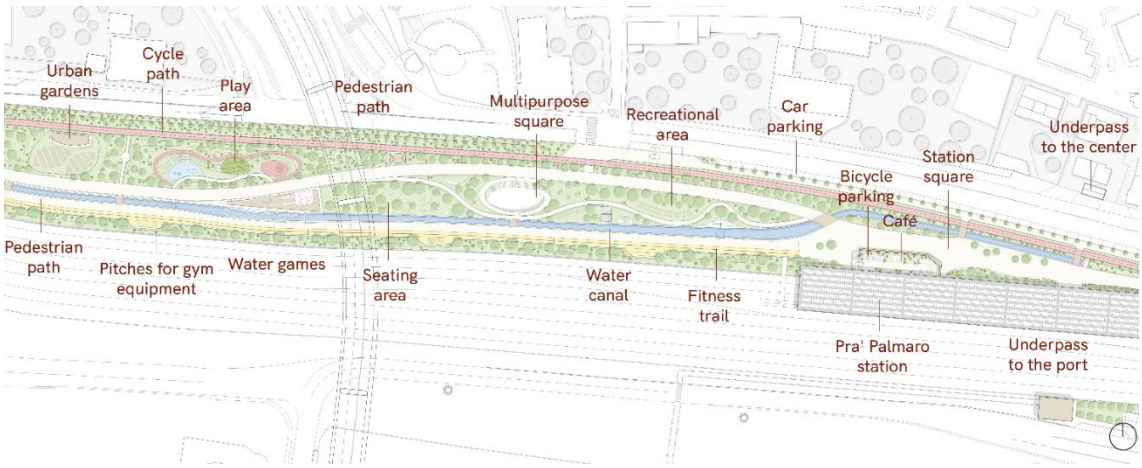
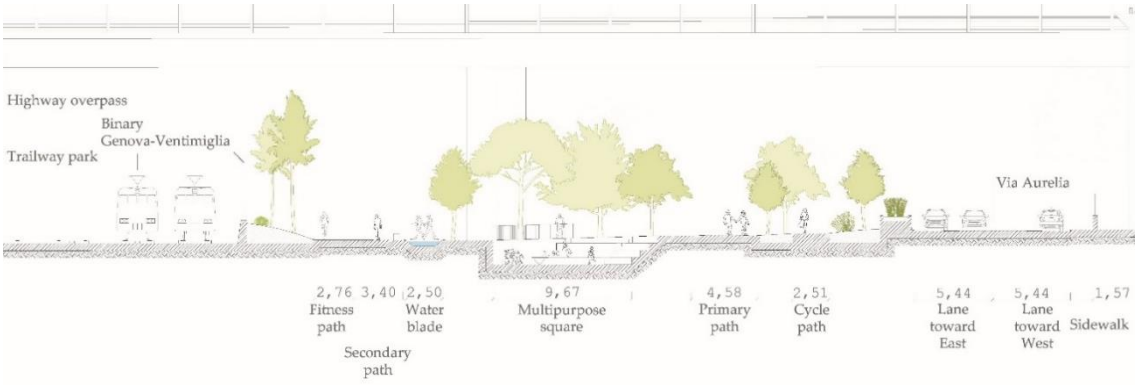


Fig.10 Masterplan of the regeneration project

Finally, the multi-purpose square in the center of the site is the most versatile place of the project. It can normally be used as a play area and skating rink, but can also host small events, such as open-air cinema or exhibitions.
Furthermore, this square can perform the function of a rolling basin, a place capable of collecting excess water volumes during flood events. The result is a place that interprets the definition of resilience in the urban environment, making the space less vulnerable to climatic and social stresses (Fig. 11).



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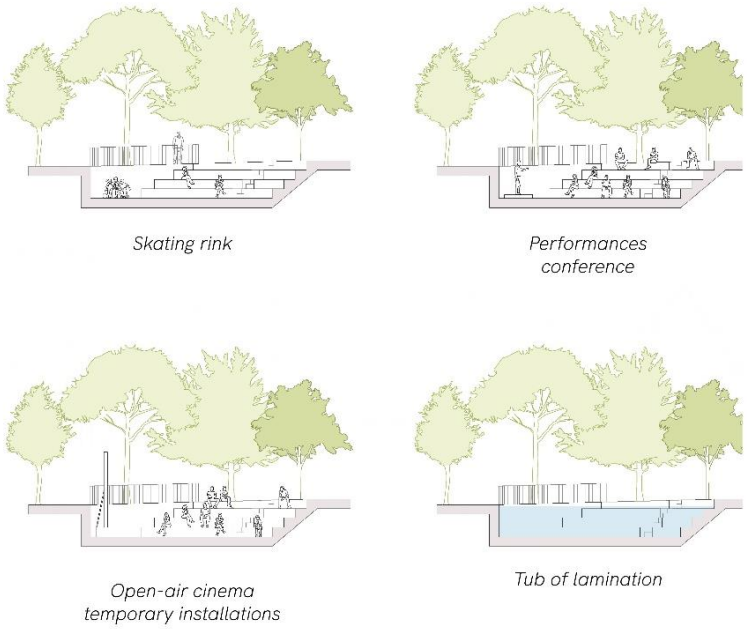

(b)

Fig.11 (a) Cross section of the project and (b) The functions of the multi-purpose square

In summary, the aspects considered in the definition of the Pra'-Palmaro regeneration project were: accessibility, soft mobility, relationship with water and the network or presence of green.

4. Discussion

The European Union, as anticipated in Introduction, promotes and finances urban regeneration, addressing recommendations for less land use and the redevelopment of urban areas in a sustainable key.

Even Italy with the Green New Deal 2020-2023 fund in the 2020 State Budget has made 4.2 billion euros available to «carry out economically sustainable projects that have as their objective the decarbonization of the economy, the circular economy, urban regeneration, sustainable tourism, adaptation and mitigation of risks on the territory deriving from climate change and investment programs and projects of an innovative nature and with high environmental sustainability».

From the analysis of the application of the Pra'-Palmaro case study approach (Section 2), there are several aspects to consider in order to carry out sustainable regeneration projects, which aim to a real improvement in the quality of life. Among these: the redevelopment and recovery of the area; the reduction of the anthropic and energy impact according to a circular approach, as well as the participation of the local community. From the researches developed it emerges that urban regeneration projects often arise from public initiative with

the participation of private subjects and professionals, who collaborate by putting together the various skills in order to an inclusive and sustainable requalification.
Other important aspects to focus on concern (Fig.12): the identity of the place, accessibility, sustainable mobility and soft mobility, the continuity of greenery, the use of ICT tools and obviously, being areas close to the sea, water element (Bamani & Ronsivalle, 2018).

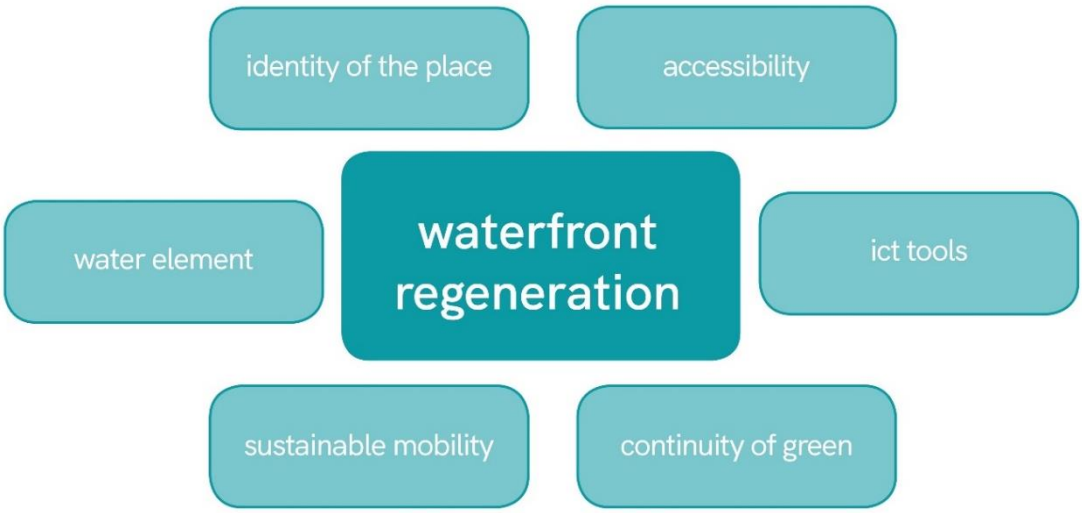

Fig.12 The regeneration of port-cities

Due to the current importance that waterfronts can assume, in their transformation to take into account the balance of multiple aspects is necessary. First of all, to be aware of the legacies of the past and assimilate them to build the future space is essential for intervene consciously. In fact, modernity does not mean denying tradition, but knowing how to integrate it into an evolving system, in which the identity of the place remains recognizable and the new constitutes a continuation of the city, avoiding caesuras (Giovinazzi & Moretti, 2010). In particular, the enhancement of industrial archaeology can represent the hinge between these redeveloped areas and the historic center, favouring the good practice of safeguarding the artefacts over time. The permanence of these local elements also has consequences on the economic level, allowing the creation of a network with the cultural assets of the territory and favouring tourism, thanks to the function of attractors that these places often come to assume. On the other side, this does not mean that innovation does not find space in the waterfronts; on the contrary, they often welcome the most actual and international economic and cultural activities. Therefore, they are a place of meeting and cultural exchange on the one hand and a place of identity and connection with history on the other (Russo, 2014).
Another relevant issue is the environmental one, as the design of the territory must safeguard the natural landscape of the waterfront and provide for a sustainable management of the water resource, from an integrated environmental-landscape planning perspective. In fact, water is an added value, as well as from an aesthetic point of view, especially from an environmental one, representing a fundamental resource for a city, in terms of improving the quality of life. From a social point of view, the involvement and participation of the community is important in the transformation of a waterfront, to meet the needs of citizens. Therefore, horizontal integration between public administrations, private investors and the population should be encouraged, which should be involved throughout the project process.
As regards the regulatory aspect, we can find two models regarding the governance of port. «These two models determine the decisive differences between the European countries. In the centralized model (that we can find in port cities of Southern Europe such as Genoa, Marseille and Lisbon), the State is the major leader and is often responsible for the Port Authorities board. In this case, the central government takes the majority of choices regarding the strategic planning excluding local municipalities from the decision-making process

and the relationship between the city and its port is weak. According to this model the PA and the city do not control the port revenues and do not decide the investments to make. In northern European countries, on the other hand, cities have a fundamental role in the control of Port Authorities». Wanting to develop regeneration projects on waterfronts, it is therefore important to develop integrated tools, plans and programs that can manage port-cities' common problems. It is also important to fully identify the invariant characteristics of the territory and integrate the various components: cultural, environmental, economic, mobility, etc, in order to carry out interventions with a view to sustainability (Iovino, 2016). Peripheral and degraded intervention sites, often such as disused port areas, represent an opportunity, but at the same time there is the risk of developing phenomena of marginalization. This generally occurs when the design does not adequately consider the connections with the city center and the super-local level. It is important to try to escape from conventional solutions, which do not look at the intrinsic characteristics of the territory, derived from economic and political interests. Sustainable development of port areas should be developed on the basis of the synergy principle (Girard, 2013). For this reason, the paper proposes a new multi-disciplinary e multi-stakeholders approach capable of assessing and managing the complex regeneration topic by considering cities and ports as a single entity. The creation of such an instrument requires first of all a joint work among the various local stakeholders – in the urban and port context – which currently does not exist.

What the research proposes in this context is an urban regeneration participated by the different actors, according to the principle of the triple, quadruple, up to the quintuple helix, they must be involved: public authorities, researchers, enterprises, citizens and associations. Each actor of the quintuple helix is responsible for the implementation of the actions foreseen in the plan and the involvement, and therefore the participation, of the five identified players is fundamental in all phases of regeneration project.

A multi-disciplinary e multi-stakeholders approach is welcome, as buildings and open spaces have to be considered as a whole when it comes to urban sustainable regeneration. «An inclusive approach where stakeholder are co-ownership and leadership, the main initiatives of a city should provide for participatory enabling process to reach a better working on the ground». Participation is essential to support for planning processes and to gain awareness of the real problems, seen by the various stakeholders who use the area and the services present, and thus define a shared and inclusive strategy. Furthermore, participation can also be useful in identifying priorities to focus on and the tools to transform challenges into opportunities, increasing the quality of the outcome of planning (Hartmann et al., 2018). From an urban planning point of view, we have gone from the concept of recovery (recovery of the urban fabric) of the late 70s, to the concept of urban redevelopment (putting quality of life at the center) of the 90s, to the regeneration of the 2000s to the recycling of parts of cities (with the application of the circular strategy).

In summary, the projects focused on the regeneration of an area of Genoa with a view to a sustainable city, that is, a resilient, smart and circular city (Fig.13).

Fig.13 Concept of sustainable city

The resilient city introduces a new aspect different from the smart city. It arises from the need to respond consistently to the stresses caused by critical events such as sudden shocks and chronic stress conditions, to become a model of sustainable urban development. Resilience, therefore, does not only imply response and adaptation strategies, but also transformative paths aimed at improving the city and its territory both during its "negative" and "positive" phases, targeting prevention policies and governance through a process that requires the development of knowledge, flexibility, differentiation, integration, inclusiveness and adaptation.
If the smart city, in fact, focuses on efficiency and, therefore, on the elimination of "repetitions" which represent a cost for the community, the resilient city presents characteristics of redundancy and diversity, enhancing the creation of alternatives and aiming to prevent situations of stress and shock for all its communities to guarantee high standards of quality, attractiveness and competitiveness.
Both the Smart city with its specializations and the Resilient city with its character of urgency, innovation and proactive evolution look carefully and contribute as prominent elements to the "Human City", a city on a human scale in which the human being will be at the center of a more liveable ecosystem designed specifically to make his life better, in order to avoid further depletion of resources and allow a renewal of the urban environment in favour of high standards of quality of life (Hoyle, 1988).
Finally, a city must be circular, that is, designed to be regenerated. A circular approach considers topics of urban planning: transport systems, water, sanitation, waste management, disaster risk reduction, access to information, education and capacity-building in a circular way, planning a sustainable urban development and regeneration that close the production cycles (Pirlone, 2020).
The circular strategy / economy is an opportunity to redevelop the territory. Disused factories converted into centers for the recovery of bulky objects, former railway sites transformed into cycle or pedestrian paths, abandoned buildings entrusted to associations that deal with environmental education are some of the examples of circular economy for the redevelopment of the urban environment. These transformations constitute a good practice that can be transferred to other realities.
For now, these are isolated experiences which, if included in an urban plan, could become a valid solution for the systematic regeneration of abandoned areas and premises, while contributing to the development of a new environmental awareness among citizens.
Circular solutions could not spread if they were not supported by an adequate infrastructure. The types of infrastructures are different:

- transport infrastructure (roads and motorways, railways, airports, ports);
- digital infrastructures;
- energy networks.

These are fields in which the circular economy can play a fundamental role in the design, construction, maintenance and eventual disposal.
The concept of circularity should finally be taken up in the presented approach (section 1.3) of urban regeneration. After analyzing and planning objectives and interventions (phase 1, 2 and 3), thanks to the subsequent monitoring phase it is possible to calibrate the effectiveness and efficiency of the proposed actions and, if necessary, make improvements by returning to the planning phase in a circular perspective.
Finally, in this context, the importance of Information Communication Technology for a circular city and the role of innovation of the idea or technology in the regeneration project are fundamental.

5. Conclusions

The article therefore reports a research developed in academic field, which describes the different meanings of urban regeneration. This phase is preliminary to the identification of an approach and key issues that can be applied to the Genoa Pra'-Palmaro case study, an area that, due to the presence of the port and railway

infrastructure, has lost contact with the sea and needs an extensive and participatory regeneration project to improve the quality of life for the residents of the neighbourhood.

According to the "learning-by-doing" approach the Pra'-Palmaro case study, at the local level, is analyzed here to highlight the strategies implemented for urban regeneration. The results can help other cities around the world to understand what aspects investigate and aim for, adapting resiliently, to natural, economic or in general the possible changing events thanks to the collaboration of all the public and private stakeholders involvement. Urban resilience has become an important objective for cities, particularly to face climate change (Savino, 2010).

But, this approach may also be important to consider in the current context of health emergency linked to COVID-19. Cities and citizens of the whole world have been increasingly confronted with rapid alterations in their physical and social environment by profound natural and human hazards like climate change, hi-tech innovation, pandemic events, and economic recessions. As a consequence, cities cannot survive and prosper if buildings and urban spaces are not reconsidered and reshaped according to climatic-response procedures and sustainable strategies. In this case, the concept of urban resilience and sustainable regeneration is important to increase in the post-emergency phase, but also during the peace period.

Another relevant element that emerged from the research is that of participation. Having dealt with associations (PRimA'vera Foundation and Praese Community) and local population from the beginning (the overall technical and public opinion assessment involved 4000 people who took part in the project), Public Administration (VII Municipality of Ponente, Port Department and Maritime Economic Development - Logistics of the Municipality, Economic Development Directorate for Innovation Projects of the Municipality, Municipality of Genoa and Commissioner for reconstruction for Genoa) and local and national authorities (Port System Authority of the Western Ligurian Sea, Italian railway network RFI, Highways for Italy, ...). All the stakeholders participated according to their skills (as anticipated in Introduction) in the meetings and planning works leading to the definition of a shared project of sustainable urban regeneration.

Despite a period of lockdown, the competition represented a participatory opportunity towards a sustainable rebirth. The decision-making process is based on the participation and involvement of the various stakeholders, the main player being the population. With regard to the future developments of the area under study, starting from the works carried out, the Municipality of Genoa has developed a project for the recovery and enhancement of the Pra'-Palmaro district by participating in the Italian National Innovation Programme for the quality of living (PinQua Programma innovativo nazionale per la Qualità dell'abitare) promoted by the Ministry of Sustainable Infrastructure and Mobility, for a loan of 15 million euros. This project was submitted in March 2021 and presented to citizens in June 2021. The involvement and research and cooperation of the various actors therefore led to a participatory regeneration project and hopefully soon realized thanks to national funding.

Author Contributions

Introduction, Methodology, Discussion, Conclusions, F.P. and I.S.; Application and Results M. D. N. and M. S.. All authors have read and agreed to the published version of the manuscript.

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Image Sources

Fig.1: "Participation and the main projects of waterfront's regeneration in Lyon." is an elaboration of the authors;

Fig.2: "Resilience to climate change: Hunter's Point South Park in New York." is an elaboration of the authors;

Fig.3: "Urban empties to rebuild the link with the sea: the main projects of urban regeneration in Genoa." is an elaboration of the authors;

Fig.4: "(a) An historical postcard of Pra' before the '70s and (b) Pra' nowadays": source: www.liguria.bizjournal.it;

Fig.5: "The methodology proposed by the paper" is an elaboration of the authors;

Fig.6: "Framework of the study area" is an elaboration of the authors;

Fig.7: "The critical issues of the central (a) and the east final (b) part of the site" is an elaboration of the authors;

Fig.8: "SWOT analysis for the Pra'- Palmaro case study" is an elaboration of the authors;

Fig.9: "PEST analysis for the Pra'-Palmaro case study" is an elaboration of the authors;

Fig.10: "Masterplan of the regeneration project" is an elaboration of the authors;

Fig.11: "(a) Cross section of the project and (b) The functions of the multi-purpose square" is an elaboration of the authors;

Fig.12: "The regeneration of port-cities" is an elaboration of the authors;

Fig.13: "Concept of sustainable city" is an elaboration of the authors.

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