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Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"
Piazzale Tecchio, 80
80125 Naples
web: www.tema.unina.it
e-mail: redazione.tema@unina.it

The cover image shows a copy of the 1987 UN report “Our Common Future – The report of the world Commission on Environment and Developments”. The picture has been taken in TeMA Lab in July 2023. On the bottom, there is a collage made up of four pictures of recent climate disasters (Source: Google images)

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Contents

253 EDITORIAL PREFACE
Rocco Papa

FOCUS

255 **Sustainable mobility for urban regeneration**
Ilenia Spadaro, Chiara Rotelli, Pietro Adinolfi

279 **Suitable sites for built-up area expansion in Kamalamai municipality, Sindhuli district, Nepal**
Samin Poudel, Shahnawaz Shahnawaz, Him Lal Shrestha

307 **The role of peri-urban agriculture in the pandemic era**
Donatella Cialdea

331 **Urban open and green spaces: is Malta planning and designing them to increase resilience and sustainability?**
Sarah Scheiber, Floriana Zucaro

LUME (Land Use, Mobility and Environment)

353 **Climate change-induced conflicts in Southeast Nigeria and urban food security**
Samuel O. Okafor, Sebastian O. Onah, George O. Abah, Chizoba O. Oranu

367 **Nanoparticles on electric, gas and diesel buses in mass transit buses of Bogotá Colombia**
Diego Armando Vargas, Boris Galvis Vanesa Durán Camilo Bernal

383 **Remote sensing investigation of spatiotemporal land-use changes**
Kulasegaram Partheepan, Muneeb M. Musthafa, Thangamani Bhavan

403 **A platform to optimize urban deliveries with e-vans**
Maria Pia Valentini et al.

425 **Evaluation of sustainability of university campuses**
Gamze Altun, Murat Zencirkıran

REVIEW NOTES

443 **City vs Energy consumptions: Energy Communities in Italy**
Carmen Guida

449 **Policies and practices to transition towards Renewable Energy Communities in Positive Energy Districts**
Federica Gaglione

455 **New frontiers for sustainable mobility: MaaS (Mobility as a Service)**
Annunziata D'Amico

461 **The interventions of the Italian Recovery and Resilience Plan: sustainable development**
Sabrina Sgambati

469 **Energy transition: pinning down the gaps between theory and practice**
Nicola Guida

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Sustainable mobility for urban regeneration

NRRP, sustainability certifications in Albisola

Ilenia Spadaro [a*], Chiara Rotelli [b], Pietro Adinolfi [c]

[a] Polytechnic School, Department of Civil, Chemical and Environmental Engineering,
University of Genoa, 16145, Genoa, Italy
e-mail: ilenia.spadaro@unige.it
ORCID: https://orcid.org/0000-0002-8454-2629
* Corresponding author

[b] Building-Architect Engineer,
Savona, Italy
e-mail: chiara.rotelli98@gmail.com

[c] R2M Solution,
Pavia, 27100, Italy
e-mail: pietro.adinolfi@r2msolution.com

Abstract

The choice of the mobility system is very topical today because it determines how the territories will develop in the years to come, which infrastructures will have to be built and which lifestyles will take shape in the cities of the future.

The research presented in the paper starts from the study of sustainable mobility and the analysis of virtuous cases. From this study, a methodological approach was defined which identifies the main phases to follow and the aspects to pay attention in order to achieve a sustainable regeneration of the territory starting from the proposition of sustainable mobility projects. This approach also proposes a method and instrument for assessing the level of sustainability in line with the principle "Do No Significant Harm" presented in the National Recovery and Resilience Plan. The priorities aspect introduced concerns the integration of the quadruple helix concept, for a multi-stakeholder governance and sustainable regeneration. The illustrated research involves in fact four actors: it starts from a call for proposals carried out within the Genoa University, promoted by the Municipality of Albisola Superiore, in Liguria region, and sees the collaboration of the R2M Solution company and citizens.

Keywords

Mobility; Regeneration; Participation; Sustainability; Certification.

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1. Introduction

1.1 The sustainable mobility and urban regeneration: strategies, policies and virtuous case studies

The choice of the mobility system is very topical today because it determines how the territories will develop in the years to come, which infrastructures will have to be built and which lifestyles will take shape in the cities of the future. By virtue of the possibility of choosing mobility on the part of users, the awareness of having to diversify the transport offer has developed by encouraging solutions that are as compatible as possible with the sustainable development of society, the economy and the environment.

Sustainable mobility indicates a way of moving related to the concept of territorial sustainability and oriented towards the reduction of pollution risks and the protection of health and public space as a common good and energy saving. According to the European strategy on sustainable development definition approved in 2006 by the European Council, the objective of sustainable mobility is "to ensure that our transport systems meet society's economic, social and environmental needs whilst minimizing their undesirable impacts on the economy, society and the environment" (Council of European Union, 2006). The concept of sustainable mobility should be seen as an approach that institutions and professionals can use to guide society and govern development in a sustainable way by placing the people at the center of urban mobility (Tscherner, 2016). The main definitions found in the literature stress that it is not enough to consider the environmental aspects, but also the social and economic impacts must be considered (Gallo & Marinelli, 2020).

To understand the evolution of the concept of sustainable mobility, it is enough to retrace the path from the Aalborg Charter, with its 10 principles (1994) to the Leipzig Charter, which more than 10 years later (2007) placed new emphasis on the concept of "urban development integrated" and governance to arrive today at the new approach of urban mobility policies represented by the Sustainable Urban Mobility Plans (SUMP) (Vittadini, 2019). Plans that "builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles" (Eltis, 2013).

To obtain a real development of sustainable mobility it is necessary both to encourage the diffusion of the right technologies and get people to prefer this type of modes of transport. The built environment, the existing mobility system and the perception of its inhabitants, it is now proven that they are able to influence the choice of the mode of movement (means, routes). "This choice is not only conditioned by the mere presence of pedestrian areas, cycle paths, etc..., but also by the perception of their accessibility" (Larco et al., 2012).

The infrastructures of mobility (highways, roads, bridges, cycle path, etc.) that we build today will establish the ecosystem impacts for decades to come. Therefore, we must use the more sustainable, efficiency and effectiveness existing technologies, material, to planning and delivering the most resource and energy conserving infrastructure within the limits of budgets and priorities. In addition, the sustainability of the project depends not only on its intrinsic design, but on how that design integrates and functions for the community in which it resides.

Among the solutions for environmentally friendly and smart mobility policies, there are formulation of Sustainable Urban Mobility Plans; carpooling and car sharing, strengthening of local transport, integrated planning of means of transport, Apps and systems for info mobility, construction of new cycle paths, toll and pricing policies and electric mobility but also pedestrians areas or paths.

As a consequence of a greater quantity and quality of the offer, a greater demand for sustainable mobility can be achieved with measures such as:

- incentives to promote use of local public transport and/or other forms of sustainable mobility;
- incentives to promote less use of private mobility (especially the car);
- integrated urban and transport planning.

In addition to the incentives, the participation, but also communication and sensibilization actions are measures that can act directly on the behaviour and habits of individuals and that can push them towards alternative mobility methods to the use of private vehicles (MIT, 2022). Speaking of planning and strategies to promote sustainable mobility, a fundamental role is played by the integration and involvement of the four actors of the quadruple helix concept of Carayannis & Campbell (2009), in which "technological and social innovations result, in general, from the cooperation and search for synergies among four stakeholder groups: administration (local government, government), business, science and society".

The European Union has set itself ambitious climate goals for the future, with a shared commitment by member states to reduce emissions. Naturally, urban transport is one of the factors that contribute most to CO_2 emissions into the atmosphere and for this reason, initiatives and projects for sustainable mobility have been promoted in Europe for several years now.

In recent years, some of European cities become an example to follow in the field of sustainable mobility. Stockholm, Amsterdam, Copenhagen, Paris, but also Parma and Pesaro in Italy, for example, are cities that have proposed new models to be pursued for a sustainable mobility and urban regeneration.

Stockholm, Swedish capital, has been leader on sustainable mobility for years and since 2017 has powered its bus and subway system exclusively and entirely with renewable energy. About 43% of daily commuting are made by public transport. This means that every day 800,000 people commute between home and work without generating environmentally damaging local emissions (Sjöman et al., 2020).

In Amsterdam, from 1 July 2019 and until 2025, 12,500 parking spaces in the historic centre of the city will be cancelled; the space obtained will be returned to the community through interventions to enhance cycle mobility, widening sidewalks and planting new trees. The use of public transport is facilitated by the changes to the opening hours of the underground, on which it is possible to bring your own bicycle, with the extension of access until midnight, and the introduction of the free ticket for children aged less than twelve years old.

The Dutch city is already the capital of the cycling, around 65% of people travel by bicycle. Only 22% of trips in Amsterdam are by car. Already today there is a massive presence of cycle paths, as well as a branched and efficient public transport system. Yet despite these staggering numbers, the majority of road space is still devoted to cars.

Copenhagen, Danish capital, has been awarded as a Sustainable City of the Future and is one of the "greenest" cities in Europe. Sustainable mobility is intertwined with energy and water saving initiatives, within local policies towards a society that is kinder to the environment and more liveable for its inhabitants. Copenhagen on track to become the first carbon-neutral capital in the world. The city plans to achieve the goal through various sustainable policies, based on four pillars: energy consumption, energy production, low-emission mobility, city administration initiatives.

The historic centre is entirely closed to traffic and the bicycle is one of the preferred means of transport for commuters, but also for tourists.

The city of Copenhagen has launched the first of 26 bicycle-only suburban thoroughfares: long, well-paved, cycle paths to connect the suburbs with the city centre, up to 22 km long and requiring the cooperation of 21 separate municipal administrations. The most innovative thing about the cycling infrastructure in Copenhagen is represented by the "Green Wave": a regulation of traffic lights along the main artery of the center so that the green lights are synchronized to the rhythm of the average cyclist. For the city of Copenhagen, cycling is not an achievement, but rather a highly priority political tool for creating a more sustainable and liveable city for present and future generations.

There is then other cities: Paris, Ottawa, Copenhagen, Melbourne, Barcelona and Milan for example that are working on the planning of the "15 minutes-city". This strategy proposes sustainable planning of urban space based on the concept of proximity, in order to reduce car travel within the city, promoting soft mobility. Proximity improves the quality of life of people acting, in particular, on the urban space by favoring closeness

among desired activities, and fostering accessibility though carbon-free movements such as pedestrian and cycle paths (Carra et al., 2022). Carlos Moreno (2019) identifies six essential social functions that must be rapidly accessible from anywhere in the city: housing, work, access to health care, food, learning and leisure should ideally all be reachable, within fifteen minutes, on foot or by bicycle. This innovative approach to urban planning requires ending a fragmented city, reducing the use, but also the presence of cars and leaving plenty of space to be able to plan and allocate to public space. This is a model which, albeit partly unknowingly, has been partially experimented by many citizens around the world during the pandemic period, through the practice of smart working and the application of anti-contagion rules (Moreno et al., 2020).

From the examples given, it is clear that mobility strategies can be a structural part of policies intended to allow cities, where the majority of the population now lives, to govern and contribute to the process of social, environmental and even economic regeneration, making the city more attractive. Therefore, mobility is no longer just a need for movement (of things and people), but as a project component interrelated with the various priority sectors.

Sustainable mobility and the governance processes that lead to the regeneration of our cities are therefore closely linked at "a Sustainable Urban Mobility Plan, a strategic plan that is designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life" (Eltis, 2013). Therefore, when a country develops sustainable mobility projects, it sets itself multiple objectives that must do both with ecology and environment as well as people's quality of life. The latter has a fundamental role in the success of a project, for this reason it is essential to raise awareness and involve the various actors present in the area (Administration, Research, Business and the population) to get to know and plan shared actions with those who will actually use the infrastructures and services and will thus help promote sustainability in regeneration projects.

1.2 National Recovery and Resilience Plan and sustainability certification

The Covid-19 pandemic has occurred in a historical moment in which was already evident and shared the need to adapt the current economic model towards greater environmental and social sustainability. Mobility in our cities has been greatly affected by the spread of the virus and the necessary social distancing measures (Ravagnan et al., 2022). Many cities have adopted mobility strategies for urban resilience, even implemented by tactical urbanism interventions, to face the crisis by the reorganization of urban mobility infrastructures and flows with a glance at a prevention of a massive and unsustainable return to private transport in the post-covid phase. The rethinking of urban mobility has thus raised a new awareness of authorities and citizens on a necessary "paradigm shift" on mobility systems (Ravagnan et al., 2022).

The pandemic, and the resulting economic crisis, prompted the EU to formulate a response with the launch of the Next Generation EU program in July 2020.

In the Next Generation EU, Italy has received resources relating to the Recovery and Resilience Facility (RRF) for a total amount of €191.5 billion to be used in the period 2021-2026 through the implementation of the National Recovery and Resilience Plan - NRRP (of which 51.4 billion for ongoing projects) (MISE, 2021).

As a consequence of the NGEU and consistently with the RRF, in July 2021 the National Recovery and Resilience Plan (NRRP) was approved by the Council of Ministers, which provides for an articulated set of reforms and investments that in the coming years will affect the areas of: digitization, innovation, competitiveness, culture and tourism (Mission 1); green revolution and ecological transition (Mission 2); infrastructure for sustainable mobility (Mission 3); education and research (Mission 4); inclusion and cohesion (Mission 5); health In particular, the Mission 3 of the NRRP aims to make, by 2026, the infrastructure system more modern, digital and sustainable, capable of responding to the decarbonization challenge indicated by the European Union with the strategies connected to the European Green Deal ("strategy for intelligent and

sustainable mobility", published on 9 December 2020) and to achieve the sustainable development goals identified by the United Nations 2030 Agenda.

The current transport infrastructure system in Italy suffers from shortcomings and delays that have significant effects on the country's growth potential and competitiveness. This weakness is exacerbated by the persistence of strong territorial differences, which go beyond the usual difference between North and South; but also between urban areas and internal and rural areas, which represent a strong obstacle to economic and social convergence and determine very different quality levels of transport services on the territory; they effectively limit people's movement possibilities, leaving entire communities isolated; and represent a major obstacle to economic convergence.

The topic of sustainable mobility in urban areas in the plan includes measures that deal with the strengthening of the energy redevelopment, the valorization of green public spaces, the encouragement of private action to improve the energy performance of buildings and consequently urban areas. Dealing with mobility issues is important to tackle the challenges linked to the scarcity of resources and the unavoidable consequences of climate change that threaten the future of urban systems. Measures must be accompanied, according to the NRRP, by integrated actions at the urban and metropolitan levels in order to obtain more efficient and successful results. The interventions will provide substantial benefits in terms of energy performance and environmental sustainability, but also in terms of urban attractiveness and competitiveness for companies and firms specializing in the field of energy management or production (Sgambati, 2022).

An example of an urban regeneration project financed by the NRRP concerns the Municipality of Nicotera: lands confiscated from the mafia which provides several measures including some for urban regeneration with the creation of an urban park and the inclusion of green areas. In addition to this, in the green area there will be also a cycle path and a pedestrian path. The funding is €2,484,335 and the project is presented as an innovative management model which provides for the direct participation of citizens together with the institutions and associations, thus leaving the possibility of participation by the various parties.

Another project financed with PNRR founds concerns the cycle paths of Italy with Mission 2 Component 2. For example, for the Tyrrhenian cycle path, a loan of 20 million euros is foreseen with which extraordinary maintenance of the existing cycle path from Ospedaletti to San Lorenzo al Mare and the new stretch that starts from the border between the municipalities of Imperia to Diano Marina and continue up to Andora. The goal is to connect Ventimiglia to Sarzana in 437-kilometre route along the entire arc of region, between the coast and the hinterland. The overall project of the Tyrrhenian cycle path envisages the creation of a single cycle path of more than 960 kilometres capable of joining Ventimiglia to Rome.

Thanks to the funds of the PNRR it will therefore be possible to create this cycle path, increasingly encouraging sustainable mobility.

The NRRP provides that these works must be completed by 30 June 2026.

In the framework of the European planning tools – the Recovery and Resilience Facility (NRRP) and the technical guidance of the European Commission – within the definition of objectives, principles and constraints for the elaboration of national plans, the focus is on two fundamental aspects: the assessment of direct and indirect environmental impacts of each measure in accordance with the principle of «Do No Significant Harm – DNSH» (Article 17 of EU Regulation 2020/852) and the compliance with strict time constraints for the implementation of interventions and the completion of expenditures.

The investments of the NRRP foresee significant resources for the implementation of programs as well as interventions. However, with respect to the European planning framework, the Italian context has to deal with the structural weaknesses of the existing models and procedures for the planning, design and construction of public works. The monitoring of this field often highlights an overall inefficiency and ineffectiveness with reference to the achievement of the objectives of environmental quality and respect of the implementation costs and times (Tartaglia & Castaldo, 2019).

For this criticality, the methodological approach proposed in section 2 analyzed possible tools that can be used. To produce tangible benefits for national funds for recovery and resilience, but also and above all to evaluate the sustainability of interventions from an environmental, economic and social point of view, the impacts of research must be measurable, for this reason the sustainability certification plays an important role within the presented research. Among these, the Envision protocol could be a valuable support as among the leading rating systems for assessing the level of sustainability of an infrastructure. Created in 2012 in the US by a collaboration between the Institute for Sustainable Infrastructure (ISI) and Harvard University, Envision aims to promote the design and implementation of sustainable infrastructure. The protocol then allows the level of sustainability of any infrastructure to be assessed with a single flexible and adaptable framework. Envision allows for a third-party measurement of an infrastructure's level of sustainability based on social, economic and environmental aspects, in line with the triple bottom line concept. Envision's rating system has been used in several countries, including Italy, certifying more than 142 projects with a total value of $118 billion.
The paper reports a methodology for planning sustainable mobility interventions that lead to urban regeneration, to improve the quality of life of the inhabitants, the environment and the city itself. In the proposed methodology, the National Recovery and Resilience Plan is seen as a possible financing channel and therefore useful for economic sustainability and, thanks to the sustainability certification, it is possible to quantify the sustainability of the intervention and guarantee its eligibility.

2. Methodology

The goal is therefore to create a guideline about the methods to be follow to achieve interventions that are sustainable and sources of urban regeneration for the cities in which they will be implemented.
The methodological approach proposed for a project of sustainable urban regeneration was structured according to different phases: knowledge of state of art, context analysis, planning and design part and sustainability certification.
Figure 1 shows the phases of the approach and the main questions that need to be asked in order to consider the priority aspects in the design.
Before even approaching the knowledge phase, it is necessary to ask oneself about the goal to be achieved, how to pursue it and from which examples you can take inspiration. Since sustainable mobility and regeneration are the objectives of this research, it is necessary to investigate if there are tools and strategies to ensure the sustainability of the planned projects and what funding can be drawn.
In the first phase, to define the state of art is necessary considers the territorial context and its needs, in particular it is necessary to carry out an analysis on the territory regarding the current situation of mobility. The levels of the analysis are two: the first consists in the identification of problems with a global analysis of the situation to understand the connections with the surrounding area (considering the provincial, regional but also national level) and then a punctual analysis is carried out where portions of the territory more small are taken into consideration and for each of them the critical issues are highlighted.
In order to better understand the current situation, it is necessary to involve the population, those who live in the place and therefore the first users of the services, for to fully understand the mechanisms that regulate traffic flows, mobility, availability of public transport and, more generally, the degree of citizens' satisfaction with transport and their need for services and infrastructures. The role of participation in the approach is strategic to achieve the goals of sustainable and participatory regeneration, to which all public and private actors in the area can contribute. The involvement must therefore take place during all phases of the urban planning project. The results of the participation are also transversal to all phases in the sense that it are useful and contribute to enriching the objective information, found during the cognitive and analysis phase, with subjective and qualitative information and are a valid support in the choice of interventions. As part of the approach, about involvement, two moments have been identified: during the survey it is possible to carry

out brief interviews with passers-by who meet, and online, involving a wider catchment area, a specific questionnaire has been planned and structured (an extract of the questionnaire is presented during the application, see section 3).

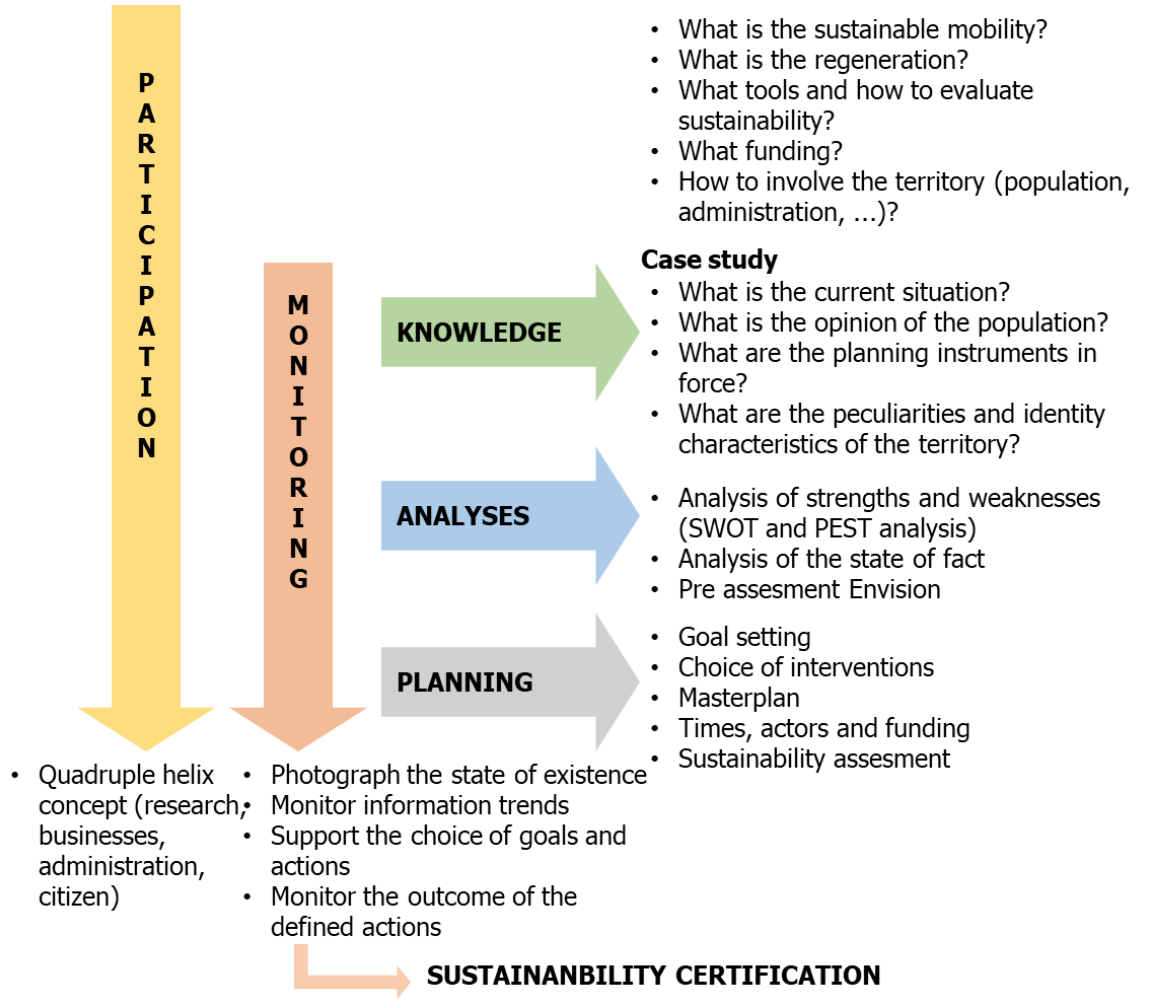


Fig.1 Methodology approach

During the knowledge phase different aspect must be considered.

To encourage the use of sustainable mobility it is essential to provide interchange car parks in which the user can park his car and use another means of transport to move around the city (for example, he could use the bicycle using specific bike sharing services). It is advisable to investigate whether there is sufficient equipment in the area capable of responding to requests throughout the year and whether, if not, there is the presence of spaces that can be used for this function.

Another important aspect to plan are the itineraries to be dedicated to soft mobility: pedestrian and cycle paths. In order to be able to identify the itineraries dedicated to soft mobility, it is advisable to analyze the activities present in the area and understand in in which areas it is a priority to pass because there are essential services to reach and connect (social functions as introduced in the 15 minute-city strategy). During the survey and in the urban planning instruments in force, it is also essential to find information about the spaces available that can be used for any new infrastructure, and it is necessary to carry out site survey in order to identify the shortcomings and strengths present.

In the cognitive phase it is also necessary to identify the peculiarities and places of interest and to analyze the urban planning instruments in force in the area. It is necessary to analyze which urban planning instruments are in force, considering the different territorial levels: regional plans, metropolitan plans and municipal plans.

The second phase consists in the analysis of the information gathered in the first phase. A significant number of analyzes exist as several scholars have pointed out, useful for outlining urban sustainability, with reference to the protection of the environment, economic impacts, participation in the life of the community. In the methodology the combined use of the two known SWOT and PEST analysis is proposed.

The SWOT analysis, short for Strengths, Weaknesses, Opportunities and Threats, provides a complete view of the state of the territory, it is also essential for identifying the strategic and operational context within which one will operate. Therefore, the SWOT analysis manages to evaluate, in the best possible way, all the factors with respect to a choice to be made and allows you to avoid errors of evaluation and make the best decisions for all parties. This happens because the first two factors, strengths and weaknesses, are closely related to the object while the second two factors, opportunities and threats, are related to the surrounding context.

The SWOT analysis begins with the definition of the objectives or goals to be achieved and then it is necessary to consider 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.

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 (Pirlone et al., 2022).

Another tool used for analysis is the PEST analysis, short for Political, Economic, Socio-cultural and Technological. This type of analysis allows to consider aspects that otherwise would not be studied such as political and economic ones. Without them it would not be possible to provide measures and above all that they are subsequently financed. At the same time, analyzing the socio-cultural trends of the territory and the technologies present on it means that it can be considered a phase of complete knowledge in all aspects (Vardopoulos et al., 2021).

As a result of the SWOT and PEST analysis conducted, a pre-assessment of the Envision certification can be carried out. Envision certification is a protocol that aims to measure the social, environmental and economic impact of infrastructure by evaluating the project on five categories: Quality of Life, Leadership, Resource Allocation, Natural World and Climate and Resilience. These macro-areas make it possible to assess the sustainability of the project in its entirety on a scale of four levels: Verified, Silver, Gold, Platinum.

Based on what has been processed and collected from the previous analyses, it is indeed possible to verify the status of the project compared to the Envision assessment framework. Conducting an assessment in the early stages of design allows to estimate the level achieved at the state as is of the infrastructure and identify aspects that can be implemented to reach a higher level. Conducting an Envision pre-assessment at the origins of the design process allows one to understand both the technical aspects that need to be monitored and documented and to identify critical issues and/or opportunities that the project offers.

In a complementary way to SWOT and PEST analyses, Envision certification allows for assessments and criteria that address the design purposes to be developed.

Following the analysis phase, the internal and external context of the case study is now clear. In particular, for the critical points identified, it is possible to propose solutions that enhance the strengths instead.

The last phase involves planning and design part and so the creation of the masterplan with all the works and project proposals. Masterplan allows a better understanding of what will be the final scenarios, above all from a distribution point of view of the interventions on the territory. In fact, through the masterplan it is possible to have an image of what the territory will be like following the measures and therefore understand if there are weaknesses to improve and what the impact will be on the territory.

In the planning phase different design proposals are developed. To choose the most sustainable one a subsequent SWOT analysis is carried out.
After having elaborated the proposals and analyzed them all with the SWOT it is possible to identify the one that is best able to adapt to the territory and to respond to the objectives identified.
In a project whose objective is urban regeneration starting from sustainable mobility, it is necessary to point out some aspects. Urban regeneration is the first point of the strategy for reach a Circular city and ReSOLVE framework, developed by McKinsey, it can constitute a valid support in the choice of possible actions useful for improving the quality of life of our cities. The framework takes the core principles of circularity and applies them to six actions: Regenerate, Share, Optimise, Loop, Virtualise, and Exchange (McKinsey, 2015). Other important aspects are: sustainable mobility, urban furniture, new technologies, accessibility, greenery, architectural barriers and sustainability. These elements should be present in the projects and be able to mitigate the impact on the territory and, at the same time, guarantee sustainable urban regeneration projects that respect the environment and the existing territory, which reduce overbuilding and land consumption as well as to improve the quality of life.
At the end, the methodology questions how to evaluate the sustainability of the planned infrastructures and, above all, how to plan mobility and build infrastructures that help local communities to develop sustainably and therefore to regenerate.
This step takes over the concept of sustainable development, of circularity but also of a hierarchy of mitigation (Fig.2). In taking practical steps toward sustainability, it can be difficult to discern how to prioritize options or even take the first step. One way to prioritize these options is to consider the: (i) avoiding impacts by looking for alternative locations for development where impacts will be less severe, (ii) reducing or minimizing the impacts at the chosen development site, and, as a last resort, (iii) offsetting residual unavoidable damage on biodiversity (Bull et al., 2016).

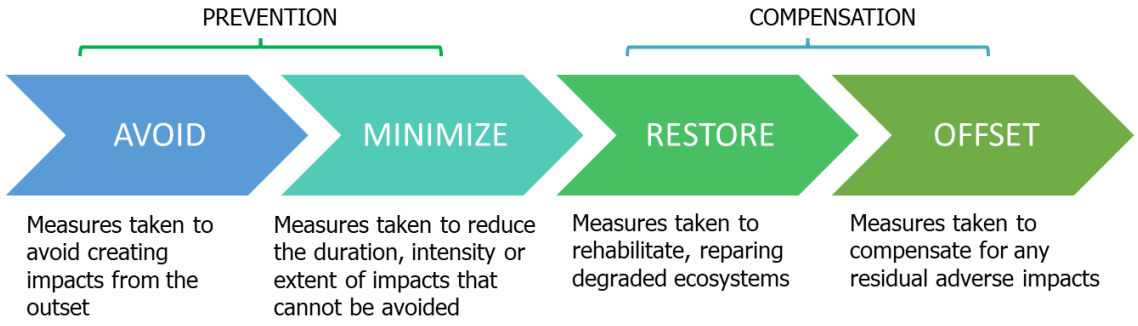


Fig.2 Hierarchy of mitigation

As well as in the world of construction there are multiple systems for assessing sustainability in building projects, various rating systems are also being developed and disseminated in the world of infrastructure. One of the main ones turns out to be Envision, which has a worldwide spread and allows for a comprehensive assessment of the project being analyzed. Envision is based on the use of a framework that applies a hierarchy across a range of topics.
The methodology aims to analyze three fundamental aspects useful for the monitoring and planning of sustainable regeneration projects. And the Envision protocol is proposed in the methodology as it precisely provides the opportunity to improve projects in these three dimensions (Fig.3).
First is the project life cycle: where trying to go beyond planning and design to the construction phase to consider operations and maintenance and also the end of useful life, such as the ability to disassemble and up-cycle materials.

Second is stakeholder collaboration: as introduced, the participation of an inclusive, representative group of stakeholders of the four main players: administration, business, science and society (quadruple helix concept) is essential to know, innovate and implement effective projects that aim at sustainability.

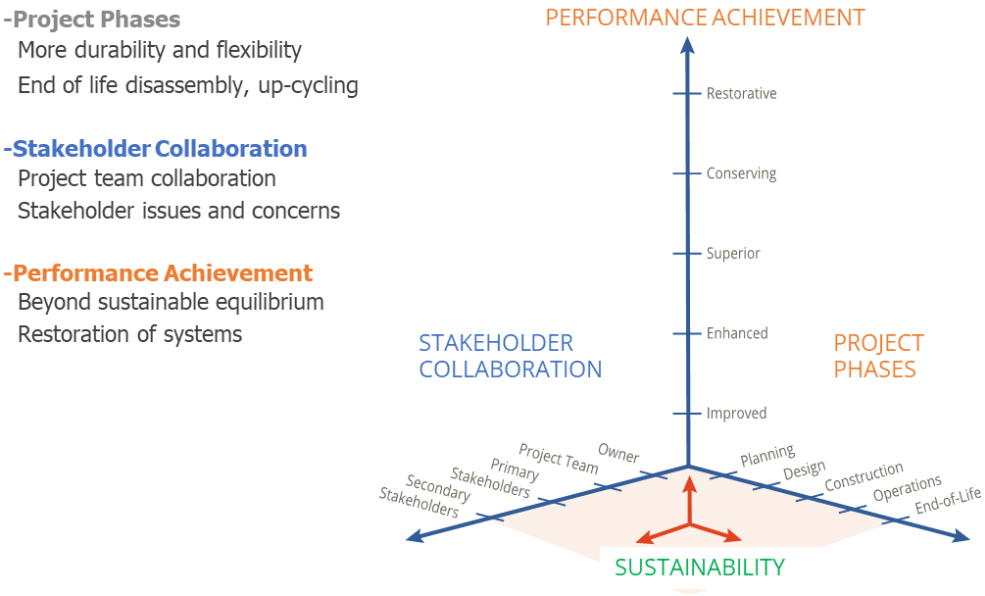


Fig.3 The three dimensions to improve sustainable opportunities in the project

Third are the levels of sustainability achievement. Envision offers credit for a wide range of sustainability success, from slight to outstanding.

This approach is reflected in the assessment metric that the Envision protocol adopts. Envision's sustainability assessment is based on five distinct categories divided into a total of 64 credits. The categories are: Quality of Life; Leadership; Resource Allocation; Natural World and Climate and Resilience (Fig.4).

Fig.4 Envision categories

Each of these credits assesses a specific topic in a way that cross evaluates the social, environmental and economic impacts of the infrastructure. Each credit is given a variable scoring scale according to the level achieved with respect to what is required by Envision. The levels of achievement, used to allow for evaluation of specific performance and scoring for each credit, are:

- improved, above average performance;
- enhanced, performance on the right path to sustainability;
- superior, sustainable performance at the highest level;
- conserving, performance that achieved essentially zero negative impact;
- restorative, performance such as to improve the natural or social system, restoring a balance previously compromised.

Each credit is excludable if it is not applicable to the evaluated infrastructure. This is important because the final certification score is based on four distinct levels of evaluation that are related to the percentage of points obtained out of those available (and not out of the total 1000 expected).

Thus, for a project to be certified it must obtain at least 20 percent of the available points to have a Verified level, 30 percent for Silver, 40 percent for Gold, and over 50 percent for Platinum.

The certification process has two alternative paths: Path A, Design + Post Construction, and Path B, Post Construction. Within the methodology presented, reference is made to Path A, Design + Post Construction. The peculiarity of this evaluation is that the project is subject to two separate assessments, one that evaluates the design choices, Design review, and one post-construction, Post Construction Review, in which the proper execution of the project and the credits that direct the conduct of the construction site are verified.

Given this interdisciplinarity and independence of judgment, Envision is introduced to the methodological approach to measure the status of the six DNSH objectives and obtain a sustainability certification that also meets EU requirements. The Envision certification considers the environmental, economic and social part, thus satisfying the three factors of sustainability. This makes it possible to guarantee the sustainability of the intervention in favour of the disbursement of the funds of the National Recovery and Resilience Plan. In accordance with this, the guidance issued by ICMQ on the compatibility of using Envision to ensure the DNSH criteria required by the NRRP is an important publication regarding the opportunities for Envision to obtain funds provided by the Next Gen EU (Ciraci, 2022).

3. Application and Results

The methodological approach presented in section 2 is applied below to the case study of Albisola Superiore (SV).

The research starts from a call for proposals carried out within the Genoa University (February 2022, during the course of Urban Planning and Laboratory, teachers: Prof. Spadaro and Prof. Pirlone of the Master's Degree Course in Building Engineering-Architecture), promoted by the Municipality of Albisola Superiore (Ligurian Region) entitled: "Albisöa Regeneration" and develops in a subsequent degree thesis (Rotelli, 2022). This research experience leads to the concretization of the four Helix concept, promoting a sustainable regeneration project for Albisola Superiore, thanks the participation and collaboration of four actors: University of Genoa - Department of Civil, Chemic and Environmental Engineering, Municipal Administration - Albisola Superiore, Enterprise - R2M Solution and citizens.

The case study is Albisola Superiore, in province of Savona, a site that allows the coexistence of the sea and the mountains at a short distance from each other (Fig.5). Albisola Superiore together with Albissola Marina make up the territory of the Albisole, famous internationally for the manufacturing of ceramics. Its nucleus is divided into two parts: Albisola Superiore, which is 1 km from the sea, and Albisola Capo, a hamlet overlooking the sea.

Fig.5 Case study: Albisola Superiore (Ligurian Region, Italy)

The participatory project of urban regeneration and sustainable mobility was carried out following the phases: knowledge of state of art, context analysis, planning and design part and sustainability certification.

During the first phase of knowledge, information on points of interest, the mobility system, plans and urban planning tools are collected.

As regards the points of interest, there are the historic villas, the churches, the most popular places, the green areas, the school and the library (Fig.6). The city of Albisola Superiore has numerous churches, some of which are in Romanesque style and others preserve renowned artistic and sculptural works. Besides this, the municipality has interesting civil architecture, consisting of villas built between 1600 and 1700, as well as a medieval bridge.

Also, there is the Ceramics Museum, called Manlio Trucco, which was the home studio of this artist where you can admire works by contemporary painters and potters such as Luzzati, Trucco or Arturo Martini.

Fig.6 Knowledge Phase: Places of interest

The current state of the area was examined, through research, surveys and specific meetings and interviews with administration and population. As introduced in the approach, an important aspect is the role of

participation. In this regard at the beginning of the research an online questionnaire was set up and submitted to find out the opinion of the population, in addition to specific interviews and meetings with the administration. A questionnaire was submitted to the population to obtain an overview of the current situation of the city as well as to interview the direct users of the vehicular system and cycle/pedestrian road system of Albisola Superiore. The survey was completed by 120 people (63 Male, 57 Female), most of whom are citizens of Albisola (63%) or people who travel to the city on a regular basis (28%) (Battaglia, 2021) (Fig.7).

One of the first aspects investigated concerns the means of public transport in the area and it emerges that the population has conflicting opinions on the subject, in fact an averagely satisfied opinion prevails (59%) against 41% of voters who are not satisfied. The latter justify this response by arguing that travel by train and bus is very difficult for logistical reasons: the buses are not able to meet the demand, in the evening there are no buses to reach the more peripheral areas and the timetables are often not respected due to the heavy traffic on via Aurelia. The Via Aurelia is undoubtedly one of the major problems associated with local transport. In addition to this, there is a lack of a cycle path which could help to further relieve city traffic, at least on short routes inside and around the Municipality. The intermodality between bicycle and train would in fact make it possible to remedy most of the problems identified in the answers given above.

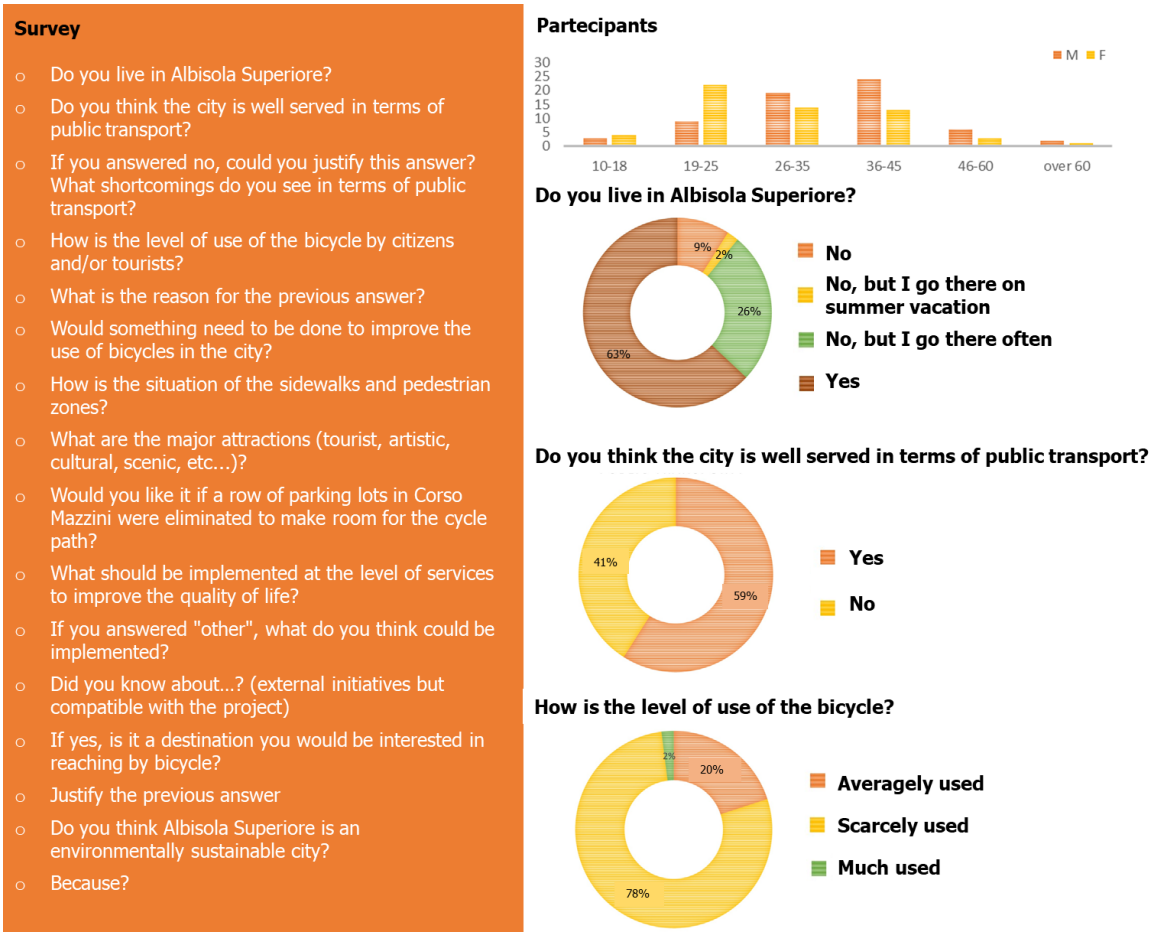


Fig.7 Participatory Phase: Extract from the survey and Graphs with some results

Currently, however, the use of the bicycle by the inhabitants of Albisola is rather low: 78% of the answers indicate that it is scarcely used, while only 20% affirm that its use is on average widespread, and a 2% believe that this medium is widely used. People who responded indicating a low use of the bicycle as a means of transport were then asked to explain why this is the trend.

The answers can be summarized in some macro groups:

- dangerousness of vehicular traffic, which makes it impossible to travel by bicycle;
- absence of a cycle route that allows cyclists to move through the city in safety;
- poorly structured connections between the center of Albisola and the surrounding hamlets;
- absence of a culture that focuses on cycle mobility.

Among the problems mentioned above, the absence of an itinerary intended for cycle traffic emerges above all. This aspect is confirmed by the results of the survey, which see the prevailing yes as a response to the need to take concrete actions to solve the problem of the lack of cycling spaces in the city.

The results of participatory phase, as proposed in the methodology, were useful in the various phases: from knowledge, analysis to the choice of interventions.

Regarding the mobility and viability system Albisola Superiore has different connecting roads with nearby towns. Albisola can be reached by car via the A10 Genova-Ventimiglia motorway and the Via Aurelia which are the main ways to reach the city. The Albisola motorway exit leads directly to Corso Mazzini, the city's main artery. In the city there are some public car parks available to both the resident and non-resident population.

At the urban level, the primary road system is limited to two roads: Corso Ferrari (consisting of the urban section of the Aurelia) and Corso Mazzini (urban section of the SS 334). The rest of the secondary urban road system has a limited physical capacity and should have a local role; however, the movement surveys show that over 50% of them are crossings.

With regards to public transport, in Albisola Superiore there are several lines that pass through the city and allow to connect various points, including Albissola Marina with Albisola Superiore. In fact, 5 bus lines pass through the city, all of which connect the city with Savona and one, in particular line 30, connects the city with Celle Ligure and Varazze.

As regards rail transport, the station is located in a central and convenient position for travellers because it is only 10 minutes from the sea. The Genoa-Ventimiglia line and the Savona-Sestri Levante line pass here, thus allowing direct connection with a large part of the Ligurian Region.

Within the city of Albisola Superiore, Corso Mazzini represents the main road artery, where there are numerous services, and therefore appears to be very busy. As a consequence, this generates acoustic and atmospheric pollution problem; aspect that is demonstrated by the values that are currently recorded by a special ARPAL control unit located in this street (Fig.8).

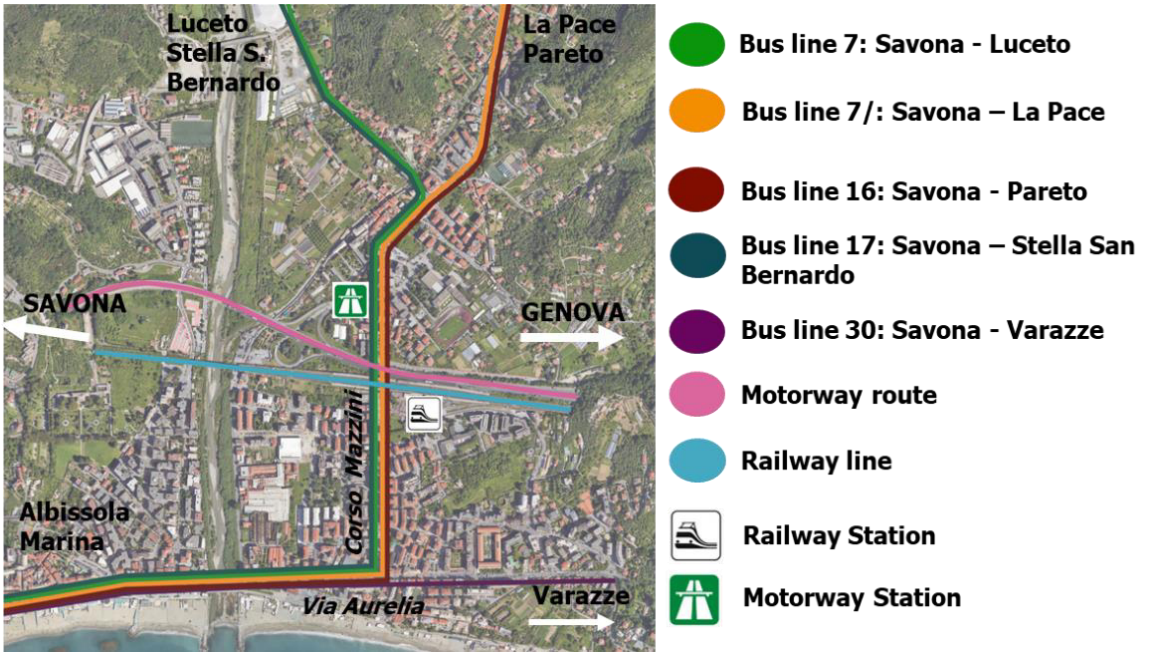


Fig.8 Knowledge Phase: Mobility system

Fundamental to the study of the territory is the analysis of planning tools and Municipal and Regional regulations.

At the urban planning level, the provisions contained in the Municipal Urban Plan (last update in 2004) are important; it provides the construction of new infrastructures. These aspects are also present in the draft version of the Urban Traffic Plan (2011). In particular, a cycle route (Tyrrhenian cycle route) and the creation of new parking lots is envisaged. The Basin Plan is also analyzed at the municipal level. Here are reported indications regarding the areas where the risk of flooding is present.

At the regional level, the Regional Territorial Plan, the Landscape Coordination Plan and the Coastal Coordination Plan have been analyzed, which provide indications at a territorial level, specifically for the coastal area and for the inland area.

In the second phase of analysis, the strengths and weaknesses present in the area emerge.

The city of Albisola Superiore has a very particular territory conformation, in fact there are flatter areas and more hilly areas not far from the sea. The infrastructure of the city does not go together with this division into zones; in fact, even if there are means of local public transport, they are not sufficient to guarantee satisfaction of the population, making connections very difficult with the different areas.

Among the main critical issues that have emerged is the lack of a square as a meeting place, there are problems in terms of noise in the main area (especially in Corso Mazzini) and therefore causes consequences on the quality of life of the population itself. This is because the city of Albisola Superiore, due to the presence of the tollbooth, represents a transit route. Today, in fact, one of the main criticalities of Albisola Superiore is the passage of cars and, above all, of heavy vehicles, which, leaving the motorway tollbooth, cross Corso Mazzini and continue on the Via Aurelia to reach the nearby city of Savona and the port of Vado. The high levels of congestion that characterize Corso Mazzini and Corso Ferrari during peak hours in fact lead to the search for alternative routes. Inevitably, this condition generates very important levels of atmospheric and acoustic pollution.

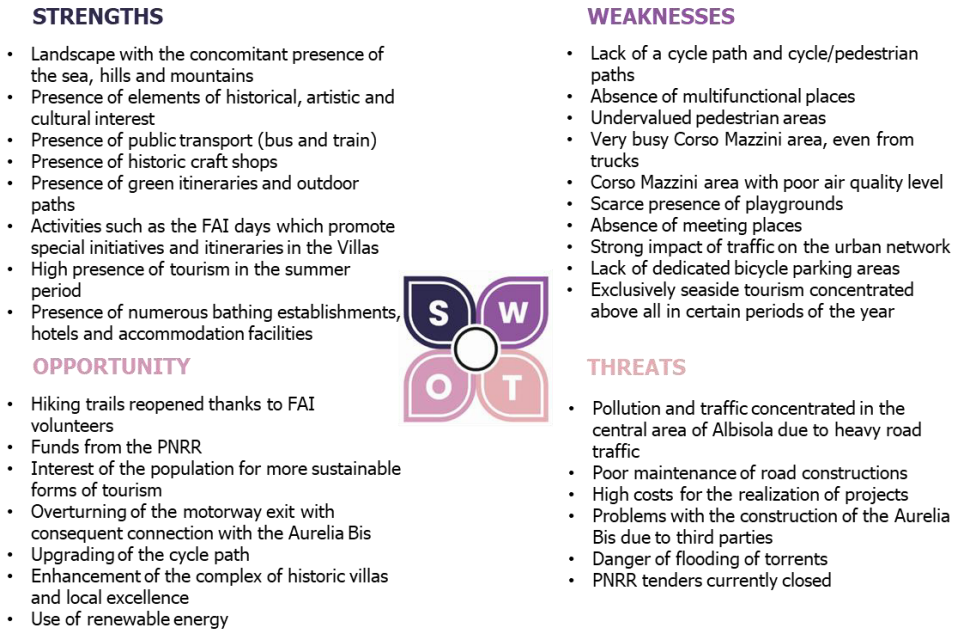


Fig.9 Analysis phase: S.W.O.T. analysis

By drawing up the SWOT analysis, numerous problems related to the territory emerge but also great potential to be seized. Its geographical conformation allows you to have sea, plain and mountainous territory together, a few kilometers away from each other. This turns out to be a point in favour for the city, to be exploited for

all future projects and implement those already present, so as to further make the area interesting from a tourist point of view.

However, a weakness of Albisola Superiore appears to be linked to the infrastructures as the current ones are not able to fully satisfy the needs of the population, without considering the total absence of electrical infrastructure. The creation of a cycle path able to cross the city and which connects with the Borgo della Ceramica cycle path between Ellera and Luceto, built in March 2022 and inaugurated in May 2022, constitutes an opportunity so that the city has an entirely dedicated to soft mobility and which obviously connects with the neighbouring cities (Fig.9).

The PEST analysis summarizes the city's transformation forecasts: the presence of numerous urban planning tools together with the interest from various entities, ensures that there is an important guarantee regarding the realization of new ideas and the transformation of the territory. Thanks to European and national funding, and above all to that coming from the NRRP, destined for different sectors, a participatory project of regeneration can be created capable of assisting questions and answers coming from population itself, but also from productive sectors such as the production of ceramics and tourism (Fig.10).

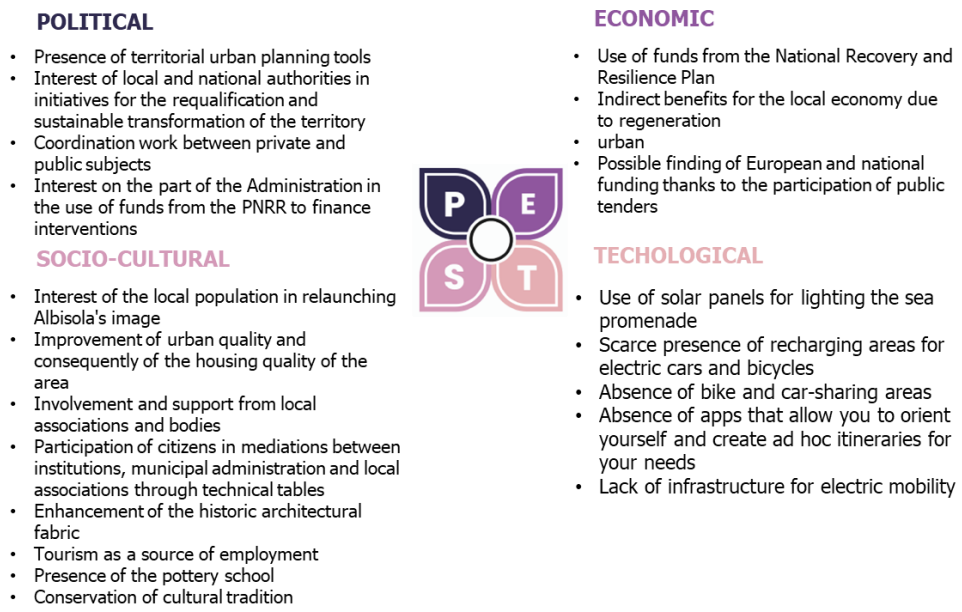


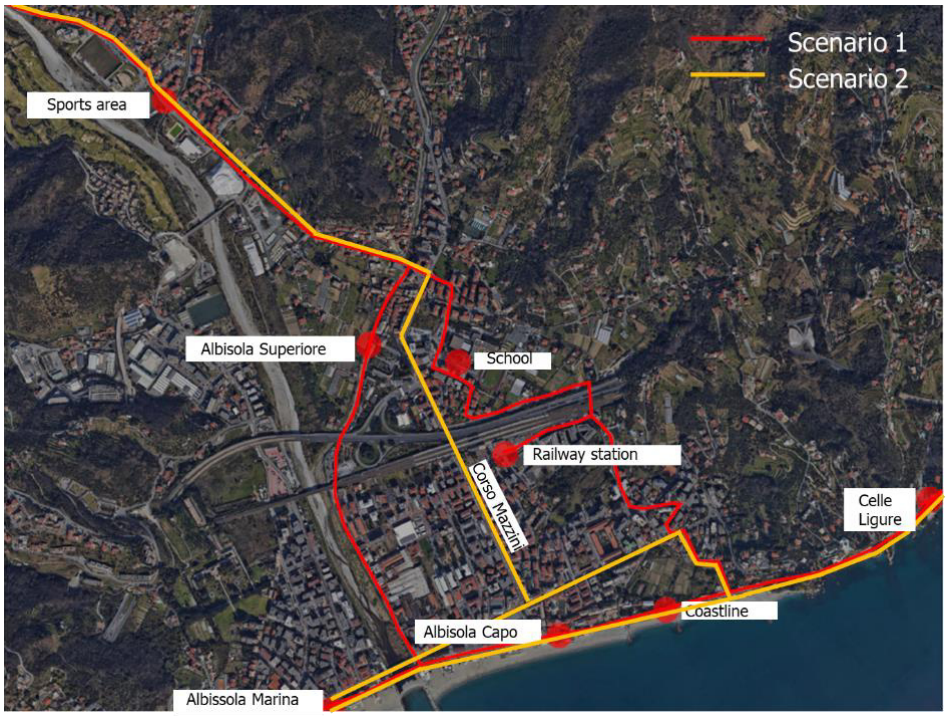
Fig.10 Analysis phase: P.E.S.T. analysis

The third phase of planning start with the proposal of two projects, analyzed by means of SWOT analysis and, at the end, the one that is best choice is identified as able to respond to the needs and demands of the territory, the population and the Administration.

The objective of increasingly sustainable mobility to regenerate the area is one of the most important to pursue since there would be environmental, social and economic benefits by making Albisola Superiore a city not only for passing through or for seaside tourism but also to be appreciated for its services and accessibility.

The first proposal providing the construction of the cycle path on an itinerary that does not pass along Corso Mazzini and is based on the current configuration of the territory. This itinerary encourages soft mobility and allow for a better connection with the various parts of the city exploiting the existing infrastructure, making small changes. This path allows you to connect the main points of interest of the city that have been highlighted and around which the greatest flow of citizens is concentrated. These are the railway station, the historic center of Albisola Superiore and Albisola Capo, the school area with the annexed sports area and, especially in the summer months, the sea area. The cycle itinerary therefore tries to connect these key points and wants to connect to the recently built cycle path between Ellera and Luceto and then connecting with the cycling

itinerary foreseen by the Tyrrhenian cycle path so as to be able to create another stretch leading to the closure of the Tyrrhenian network project which intends to connect Ventimiglia to Roma. In fact, the cycle path intends to propose a connection with the neighbouring cities of Albissola Marina, Savona and Celle Ligure because the planning is important not to be limited to the single area of the Albisola Superiore territory, but to extend in such a way as to guarantee an effective alternative to other means less sustainable transport.



SCENARIO 1

STRENGTHS	WEAKNESSES
• Cycle path away from heavy vehicle traffic • Transit of the cycle path along areas with little pollution • There is no need to build new infrastructure • Go through multiple areas of the city	• Does not pass through the main street of the city (Corso Mazzini) • Difficult to create historical itineraries to enhance archaeological remains
OPPORTUNITY	**THREATS**
• Immediate realization • Possibility to reach the whole city by bicycle • Possibility of incentives for the use of soft mobility • Redevelopment of the station area • Cycle path that can be used to reach the beaches • Connection with the "ceramic village" cycle path.	• Risk of not using part of it during alerts (area along Torrente Sansobbia • The E. Montale seafront is too crowded during the summer, making transit difficult

(a)

SCENARIO 2

STRENGTHS	WEAKNESSES
• Less dangerous road and therefore safer cycle route • Enhancement of the archaeological site • Transit in the main street for commerce and full of different uses • Traffic reduction during peak hours	• Track connecting only with the main street of the city • Transit through Corso Mazzini which currently has high levels of pollution
OPPORTUNITY	**THREATS**
• The cycle path is built in the width of the sidewalk in Corso Mazzini • Possibility of incentives for the use of soft mobility • Redevelopment of the station area • Connection with the "ceramic village" cycle path • PUMT of the city of Savona for the Aurelia Bis	• Medium-long term proposal linked to the construction of the Aurelia BisThe E. Montale seafront is too crowded during the summer, making transit difficult

(b)

Fig.11 Planning phase: a) SWOT analysis Scenario 1 and b) SWOT analysis Scenario 2

The second proposal, on the other hand, considers a future situation, where the end of the construction of the Aurelia Bis is assumed and therefore the reversal of the Albisola motorway exit and a connection between the two. In this second option, a transit of the cycle path along Corso Mazzini is assumed. By favouring the layout along this itinerary, it inevitably turns out to be more simplicist than in the first scenario. However, this scenario remains valid because it is equally functional in the connections between the main hubs of the city and with the hinterland (Fig.11). As in the previous scenario the connection with the neighbouring cities are proposed.

After analyzing the two scenarios with SWOT analysis it is clear that the first scenario better enhances the territorial context of Albisola Superiore and can be implemented immediately, thus allowing access to the funds made available by the National Recovery and Resilience Plan. This itinerary is also able to connect several parts of the city, also reaching secondary roads. However, it does not pass along Corso Mazzini, an element against it, but this choice has the intention of guaranteeing a safe cycle path, away from the transit of heavy vehicles.

After defining the cycle path, it should be underlined how the mobility interventions generates further urban regeneration projects within the territory. These interventions concern the station square in which is assumed a general reorganization: in particular, the construction of an interchange car park and the creation of an open space with a collective function and a special green area are planned. Moreover, the inclusion of bike sharing stations and electric recharging stations is planned within the city.

Taking the opportunity to create this interchange area, a square was also created, a need underlined by both the administration and the population (Fig.12). Inside the square there is a circular pedestrian path so that users arriving in Albisola Superiore by train can decide how to move around the area: on foot, following the pedestrian path or by bicycle using the sharing services made available; by bus as there is a stop not far away, precisely along Corso Mazzini. The station square can therefore become the starting point for visiting Albisola Superiore through sustainable means of mobility.

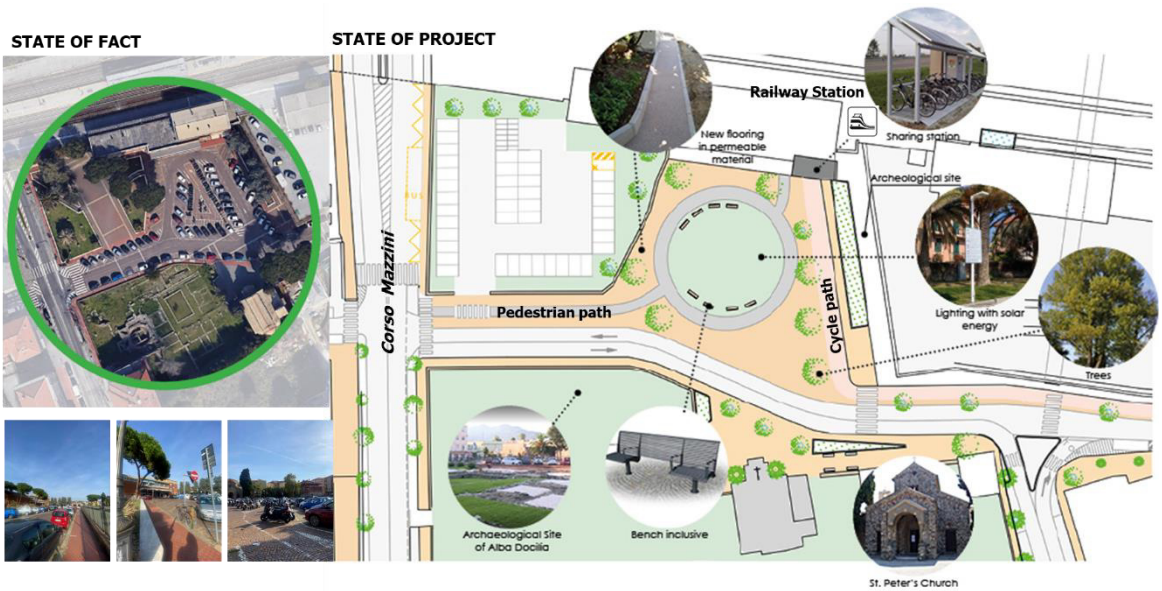


Fig.12 Planning Phase: the place of station railways (Comparison between State of fact and State of project)

After having carried out a technical feasibility assessment, having therefore exposed the project and analyzed the individual areas, an economic feasibility assessment was carried out in order to obtain a complete vision of the intervention.

			Credit Assessment Status	Evaluation Questions Assessed		Assessment Status						Assessed Maximum Points Available	Total Maximum Points
				Yes	No	Improved	Enhanced	Superior	Conserving	Restorative	Points		
Quality of Life	Wellbeing	QL1.1 Improve Community Quality of Life	Assessed	6	1	0	5	0	0	0	5	26	26
		QL1.2 Enhance Public Health & Safety	Assessed	2	4	2	0	0	0	0	2	20	20
		QL1.3 Improve Construction Safety	Assessed	4	1	0	0	10	0	--	10	14	14
		QL1.4 Minimize Noise & Vibration	Not Applicable	0	0	0	0	0	0	0	0	0	12
		QL1.5 Minimize Light Pollution	Assessed	4	2	0	0	6	0	0	6	12	12
		QL1.6 Minimize Construction Impacts	Assessed	3	3	0	2	0	0	--	2	8	8
	Mobility	QL2.1 Improve Community Mobility Access	Assessed	6	0	0	0	0	0	14	14	14	14
		QL2.2 Encourage Sustainable Transportation	Assessed	4	0	--	0	0	0	16	16	16	16
		QL2.3 Improve Access & Wayfinding	Assessed	4	0	0	0	0	14	--	14	14	14
	Community	QL3.1 Advance Equity & Social Justice	Not Applicable	0	0	0	0	0	0	0	0	0	18
		QL3.2 Preserve Historic & Cultural Resources	Assessed	5	1	--	0	0	12	0	12	18	18
		QL3.3 Enhance Views & Local Character	Assessed	5	1	0	0	7	0	0	7	14	14
		QL3.4 Enhance Public Space & Amenities	Assessed	4	0	0	0	0	11	0	11	14	14

			Credit Assessment Status	Evaluation Questions Assessed		Assessment Status						Assessed Maximum Points Available	Total Maximum Points
				Yes	No	Improved	Enhanced	Superior	Conserving	Restorative	Points		
Leadership	Collaboration	LD1.1 Provide Effective Leadership & Commitment	Assessed	1	3	2	0	0	0	--	2	18	18
		LD1.2 Foster Collaboration & Teamwork	Assessed	1	3	2	0	0	0	--	2	18	18
		LD1.3 Provide for Stakeholder Involvement	Assessed	2	4	3	0	0	0	0	3	18	18
		LD1.4 Pursue Byproduct Synergies	Assessed	0	5	0	0	0	0	0	0	18	18
	Planning	LD2.1 Establish a Sustainability Management Plan	Assessed	2	3	4	0	0	0	--	4	18	18
		LD2.2 Plan for Sustainable Communities	Assessed	2	3	0	6	0	0	0	6	16	16
		LD2.3 Plan for Long-Term Monitoring & Maintenance	Assessed	1	4	2	0	0	0	--	2	12	12
		LD2.4 Plan for End-of-Life	Assessed	0	5	0	0	0	0	--	0	14	14
	Economy	LD3.1 Stimulate Economic Prosperity & Development	Assessed	0	5	0	0	0	0	--	0	20	20
		LD3.2 Develop Local Skills & Capabilities	Assessed	1	3	2	0	0	0	0	2	16	16
		LD3.3 Conduct a Life-Cycle Economic Evaluation	Assessed	1	4	5	0	0	0	0	5	14	14

			Credit Assessment Status	Evaluation Questions Assessed		Assessment Status						Assessed Maximum Points Available	Total Maximum Points
				Yes	No	Improved	Enhanced	Superior	Conserving	Restorative	Points		
Resource Allocation	Materials	RA1.1 Support Sustainable Procurement Practices	Assessed	2	0	0	0	0	12	--	12	12	12
		RA1.2 Use Recycled Materials	Assessed	1	0	0	6	0	0	--	6	16	16
		RA1.3 Reduce Operational Waste	Not Applicable	0	0	0	0	0	0	--	0	0	14
		RA1.4 Reduce Construction Waste	Assessed	2	0	0	7	0	0	--	7	16	16
		RA1.5 Balance Earthwork On Site	Assessed	1	0	2	0	0	0	--	2	8	8
	Energy	RA2.1 Reduce Operational Energy Consumption	Assessed	2	0	6	0	0	0	--	6	26	26
		RA2.2 Reduce Construction Energy Consumption	Assessed	1	1	1	0	0	0	--	1	12	12
		RA2.3 Use Renewable Energy	Assessed	1	0	0	10	0	0	0	10	24	24
		RA2.4 Commission & Monitor Energy Systems	Not Applicable	0	0	0	0	0	0	--	0	0	14
	Water	RA3.1 Preserve Water Resources	Not Applicable	0	0	0	0	0	0	0	0	0	12
		RA3.2 Reduce Operational Water Consumption	Not Applicable	0	0	0	0	0	0	0	0	0	22
		RA3.3 Reduce Construction Water Consumption	Not Applicable	0	0	0	0	0	0	--	0	0	8
		RA3.4 Monitor Water Systems	Not Applicable	0	0	0	0	0	0	--	0	0	12

			Credit Assessment Status	Evaluation Questions Assessed		Assessment Status						Assessed Maximum Points Available	Total Maximum Points
				Yes	No	Improved	Enhanced	Superior	Conserving	Restorative	Points		
Natural World	Siting	NW1.1 Preserve Sites of High Ecological Value	Not Applicable	0	0	0	0	0	0	0	0	0	22
		NW1.2 Provide Wetland & Surface Water Buffers	Not Applicable	0	0	0	0	0	0	0	0	0	20
		NW1.3 Preserve Prime Farmland	Not Applicable	0	0	--	0	0	0	0	0	0	16
		NW1.4 Preserve Undeveloped Land	Assessed	2	0	0	0	0	0	24	24	24	24
	Conservation	NW2.1 Reclaim Brownfields	Assessed	1	3	11	0	0	0	0	11	22	22
		NW2.2 Manage Stormwater	Not Applicable	0	0	0	0	0	0	0	0	0	24
		NW2.3 Reduce Pesticide & Fertilizer Impacts	Not Applicable	0	0	0	0	0	0	0	0	0	12
		NW2.4 Protect Surface & Groundwater Quality	Not Applicable	0	0	0	0	0	0	0	0	0	20
	Ecology	NW3.1 Enhance Functional Habitats	Not Applicable	0	0	0	0	0	0	0	0	0	18
		NW3.2 Enhance Wetland & Surface Water Functions	Not Applicable	0	0	0	0	0	0	0	0	0	20
		NW3.3 Maintain Floodplain Functions	Not Applicable	0	0	0	0	0	0	0	0	0	14
		NW3.4 Control Invasive Species	Not Applicable	0	0	0	0	0	0	0	0	0	12
		NW3.5 Protect Soil Health	Assessed	2	2	--	3	0	0	0	3	8	8

			Credit Assessment Status	Evaluation Questions Assessed		Assessment Status						Assessed Maximum Points Available	Total Maximum Points
				Yes	No	Improved	Enhanced	Superior	Conserving	Restorative	Points		
Climate and Resilience	Emissions	CR1.1 Reduce Net Embodied Carbon	Assessed	3	0	0	10	0	0	--	10	20	20
		CR1.2 Reduce Greenhouse Gas Emissions	Assessed	2	0	0	13	0	0	0	13	26	26
		CR1.3 Reduce Air Pollutant Emissions	Not Applicable	0	0	0	0	0	0	0	0	0	18
	Resilience	CR2.1 Avoid Unsuitable Development	Assessed	3	3	0	6	0	0	0	6	16	16
		CR2.2 Assess Climate Change Vulnerability	Assessed	0	5	0	0	0	0	--	0	20	20
		CR2.3 Evaluate Risk and Resilience	Assessed	5	1	11	0	0	0	--	11	26	26
		CR2.4 Establish Resilience Goals and Strategies	Assessed	0	4	--	0	0	0	--	0	20	20
		CR2.5 Maximize Resilience	Assessed	0	5	0	0	0	0	--	0	26	26
		CR2.6 Improve Infrastructure Integration	Assessed	1	4	2	0	0	0	0	2	18	18

	Credit Assessment Status	Evaluation Questions Assessed		Assessment Status						Assessed Maximum Points Available	Total Maximum Points
		Yes	No	Improved	Enhanced	Superior	Conserving	Restorative	Points		
Total Points	**All Credits Assessed**	**87**	**83**	**55**	**68**	**23**	**49**	**54**	**249**	**692**	**1000**

Possible Award Level:	Silver

Fig.13 Monitoring Phase: sustainability certification

The last phase, sustainability certification, foresees the application of the Envision Protocol. In particular, the sustainability of the intervention relating to the construction of the cycle path within the municipality of Albisola Superiore and of the urban regeneration project of the railway station area is assessed.
All five macro-categories of Quality of Life, Leadership, Resource Allocation, Natural World and Climate and Resilience were analysed. In order to establish the level reached by each credit, the Envision manual was used as a support and a Pre-assessment evaluation was carried out with Envision's tool.
Operationally speaking, the Envision pre-assessment is implemented by filling out a pre-established form from the Institute for Sustainable Infrastructure, the initiating body of Envision. The document includes all sixty-four credits of the protocol and requires that all questions be answered.
Each credit was first evaluated whether or not it was applicable for the case of the Albisola Superiore project. This is a delicate and crucial step because if a credit is not applicable it is excluded from the baseline score on which to calculate the percentage of achievement that determines the score. To define whether a credit is applicable or not, the guidance given in the Envision manual that provides protocol guidelines was used.
After determining which credits are pursuable in the Albisola Superiore project, the expected scores for each were assigned. To do this step, the documentary and performance requirements that the Envision protocol requires for each credit were analyzed. Based on the analyses performed, construction practices and current regulatory requirements, several assumptions could be made that allowed different credits to be answered. At the same time, a precautionary approach was maintained where doubts arose as to whether the requirements of the Envision protocol were actually met, so as to have a more truthful overall assessment of the work.
Answering all applicable credits, assigning the level of achievement reached (Improved, Enhanced, Superior, Conserving, Restorative) and related points yielded the total points that the Albisola Superiore project scores compared to the Envision framework. Dividing this score with the maximum score applicable to the project yields the percentage that assigns the Envision level. In this case, 249 out of 622 applicable points were obtained, which is 36 percent corresponding to a Silver level, as shown in the Fig.13.
The result obtained is carried out on the preliminary project, future improvements such as to allow the achievement of a higher level are not excluded. This is a pre-assessment, in order to be awarded certification it is necessary to achieve the documentation required for Design Review and Post Construction Review.

4. Discussion and conclusion

Sustainable Development Goal (SDG) 11 of the "2030 Agenda for Sustainable Development" (UN, 2015) aims to "make cities and human settlements inclusive, safe, resilient and sustainable" and outlines a series of actions to achieve the goal, including the expansion of local public transport and a special attention on vulnerable road users (woman, children, person with disabilities and other persons). A joint strategy of urban regeneration of public spaces for mobility and services, such as the research reported in the paper, can contribute to achieving this goal. Infact, "urban regeneration processes represent an opportunity to pursue a sustainable city model and, in this perspective, the redesign of public spaces and mobility infrastructures becomes rather significant, comprising the enhancement of pedestrian and cycle accessibility to public amenities for all users, including the most vulnerable ones" (Pellicelli et al., 2022).
During the application have surfaced fundamental aspects to pay attention in order to achieve a sustainable regeneration of the territory starting from the proposition of sustainable mobility projects.
The priorities aspect introduced concerns the integration of the quadruple helix concept, for a multi-stakeholder governance and sustainable regeneration. Participation, awareness and involvement these are important actions that must follow the different project phases: planning, design and construction. This is essential to give the various stakeholders the opportunity to contribute their own ideas and learn about, and therefore be able to change, their own mobility habits. As a project progresses over time the ability to influence

its overall sustainability decreases while the cost to do so increases. Broad and effective collaboration early in a project can increase the sustainability potential at little to no cost (Fig.14).
Another fundamental aspect is technological innovation (new materials, infrastructures) but also process innovation linked to the services promoted and any incentives useful as a lever to promote sustainability.

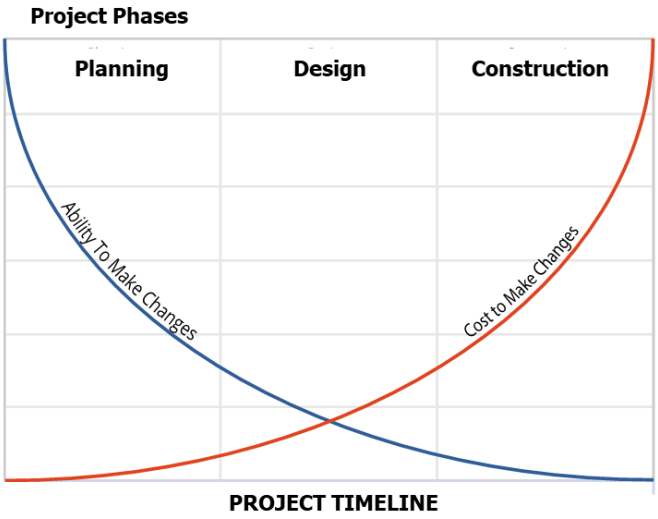


Fig.14 Relationship between costs and the ability to create changes

Finally, the training of new professional figures who are experts in the field of sustainability and in the use of useful tools to evaluate and monitor it concretely. To truly do sustainable regeneration project, you need to understand the interconnected nature of what you do, how each project connects to the community and to the characteristic of territory within which it functions. This is a richer landscape that requires much more inclusive participation and wider horizons. This new breed of sustainability engineer/practitioner must understand the wider implications of this work, and brings the judgement and skill to plan, build, and operate in this new sustainability paradigm.
The experience presented in the paper summarizes these latter aspects. The competition within the urban planning technique course in the Polytechnic School of Engineering of Genoa aims at the participation and collaboration between four fundamental players: Research - Genoa University; Public administration - Municipality of Albisola Superiore; Company - R2M Solution and Population. And it aims at training future engineers who have studied, deepened and therefore developed a sensitivity on the issue of sustainability, the closure of the life cycle and of town planning and who therefore know how to give the right weight to the priority issues to be considered in order to be able to plan urban and sustainable regeneration processes.

Author Contributions

Introduction, Methodology, Discussion and Conclusions, I.S.; Application and Results C.R. in collaboration with I.S.; Sustainability Certification P.A.in collaboration with I.S.. All authors have read and agreed to the published version of the manuscript.

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Image Sources

Figg.1-12 are elaboration of the authors.

Fig.14: "Relationship between costs and the ability to create changes.", is an elaboration of the authors start by Institute for sustainable infrastructure, 2018.

Author's profile

Ilenia Spadaro

Engineer, PhD and Assistant Professor in town planning; she carries out scientific activities at Polytechnic School, University of Genoa, where she is a teacher in courses on Territorial Planning. Her research work is focused on urban regeneration, natural risks, requalification of historical-cultural heritage, environmental sustainability themes: waste, tourism, mobility and transport, energy. Author of several publications and speaker at International and National conferences.

Chiara Rotelli

Freelance and graduated in master Architecture and Building Engineering. Pupil of IANUA High School of the University of Genoa. Her Master's thesis focused on the principles of sustainability and sustainable mobility in relation to the National Recovery and Resilience Plan and the certification of sustainability of the urban regeneration project.

Pietro Adinolfi

Engineer at R2M Solution, specialized in Sustainable Building and Infrastructures at Fratelli Pesenti School, Polytechnic of Milan. His work focuses both on rating systems for green buildings such as Envision, LEED and BREEAM and on the development of ESG issues in real estate. He is ENV SP and LEED GA certified and has lectured on sustainability issues in buildings at the Fratelli Pesenti School.