Assessment of the Current State of Urban Redevelopment Areas and Their Environmental Impacts: An Analysis to Support the Strategic Environmental Assessment (SEA)

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Abstract. In metropolitan areas that have encountered various transformation processes and have a complex urban history, there are often undeveloped or abandoned areas, a result of the rapid and continuous change in cities. For this reason, in urban redevelopment and planning processes, it is important to consider these spaces as potential areas for development and to start with them, as they represent urban voids that should be viewed as a key element in the creation of redevelopment strategies. In this context, the Strategic Environmental Assessment (SEA) procedure becomes mandatory in order to evaluate the environmental impact of transformation strategies. This study proposes a working framework to support the SEA in defining strategies and actions for the development of degraded areas. The method applied consists of two distinct phases.

In the initial phase, an analysis of the present state of the territory was developed to assess the current situation, ongoing dynamics, and critical issues to be resolved. This analysis integrated SWOT analysis and Geographic Information System (GIS) tools. In the subsequent phase, the environmental impact of the proposed strategies was assessed. This assessment was based on the results of the initial analysis, and it was conducted by developing coaxial environmental impact matrices.

Keywords: SWOT analysis · Strategic Environmental Assessment · Geographic Information Systems · Environmental Impact Matrices · Urban planning

1 Introduction

During the last few decades, environmental issues have taken on increasing importance in planning processes, requiring ever greater integration and harmonization between environmental protection objectives and the socioeconomic development dynamics [1, 2]. This growing attention is reflected in the European context, where environmental policy has progressively acquired a more prominent role over time [2, 3]. In this framework, the European Union introduced, through Directive 2001/42/EC, a key instrument: Strategic Environmental Assessment (SEA), a procedure aimed at integrating environmental

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considerations into planning and programming processes. Specifically, the progressive consolidation of European environmental legislation has led to the establishment of an increasingly structured system of principles and rules, designed to ensure high levels of protection and to integrate environmental requirements into various sectoral policies [3, 4]. This instrument applies to plans and programs likely to have significant environmental impacts, based on the premise that the implementation strategic policy decisions may produce significant environmental effects, which must therefore be assessed in advance [1]. The aim is thus to ensure high levels of sustainability in these processes, guiding transformations towards solutions that ensure adequate environment protection [3, 4].

In the Italian context, the SEA framework was introduced by D. Lgs. 3/04/2006, n. 152 (Environmental Regulations), thereby establishing the SEA procedure for plans and programs at the national level [1].

Alongside SEA, additional environmental assessment procedures further contribute to integrating environmental considerations into specific contexts, following specific procedural methods. These include the Environmental Impact Assessment (EIA) and the Appropriate Assessment (AA), both introduced at European level and subsequently transposed into Italian law. In particular, the EIA, introduced by Directive 85/337/EEC, aims to assess the impacts arising from individual projects, whereas the AA, introduced by Directive 92/43/EEC, is applied to any plan, project, or other measure that may have a significant impact on Natura 2000 sites, i.e. areas of high ecological value.

From this perspective, environmental assessment tools play a significant role in urban transformation processes as well, guiding decisions toward more sustainable solutions that prioritize the environmental quality of local contexts, especially in urban areas that have already been transformed or are in a state of decline. In such cases, planning decisions can have a significant impact on environmental balances and the quality of urban space. These areas often represent vestiges of urban transformation processes that have altered the functions and dynamics of cities over time. Despite their current perception as areas of urban decline and substandard quality, through processes of regeneration and repurposing, these districts harbor significant development potential. By facilitating the establishment of social gathering spaces and services within the city, these districts can contribute to the enhancement of the urban environment [5].

This case study, which analyzes a municipality in northern Italy, focuses on the effects of urban transformation processes on the presence of numerous abandoned areas within the city. These areas, which can be characterized as urban voids, have a detrimental impact on urban value and quality. Consequently, there is an imperative to revitalize and repurpose these spaces [6]. In order to address this issue, the areas in question were analyzed individually to assess their current state and establish a knowledge base for developing future design proposals aimed at their reuse. Concurrently, an environmental assessment was conducted within the framework of the SEA, incorporating its principles and functions.

The objective of this study is therefore to propose a methodological approach that is practical and applicable to similar contexts and situations, based on an in-depth analysis that allows for the interpretation of the current state of the territory and an understanding of its ongoing dynamics to create scenarios for future transformations and assess

their impacts, with a particular focus on environmental factors. The analysis was conducted using the SWOT method integrated with the STEEP approach. This methodological framework was selected to analyze the current situation and identify strengths, weaknesses, opportunities, and threats. These elements were considered in the analysis, which was informed by the main socio-economic, technological, environmental, economic, and political dimensions. Subsequently, the results of the analysis of opportunities and threats were used to construct strategic visions. These visions were evaluated from an environmental perspective through the creation of coaxial environmental impact matrices.

This paper is structured as follows: Sect. 2 describes the SEA process, explaining the main methodologies incorporated into the assessment and highlighting the most representative regional experiences; Sect. 3 describes the methodological framework used as the basis for the analysis; and Sect. 4 presents the application of the methodology to the case study, outlining the results and concluding remarks.

2 Strategic Environmental Assessment

The SEA process consists of a series of stages designed to ensure that the assessment process is comprehensive and fully integrated with the planning process [7], from the definition of objectives through to the monitoring of environmental impacts. The procedure is designed to ensure broad public participation throughout the entire process, which enables better environmental outcomes to be achieved as a result of shared, informed and sustainable decisions [1, 7].

The SEA begins with a screening phase, which aims to determine whether a plan or program is likely to have significant environmental impacts and therefore needs to be subject to the SEA procedure [8, 9]. This is followed by the scoping phase, the central stage of the process, during which the scope and methodology of the investigation are defined, and the likely significant environmental effects are assessed. During this phase, the Environmental Report is drawn up; this document will accompany the relevant plan or program and contains the information necessary to identify, describe and assess the potential environmental effects arising from its implementation [8, 9]. This is followed by the assessment and decision-making phase, which involves the adoption and approval of the plan or program, and, finally, the phase of monitoring environmental impacts, which entails defining the methods and indicators for evaluating the effects resulting from the implementation of plans or programs [8, 9]. The indicators must therefore provide information on the state and dynamics of a territory, which is essential for supporting decisions based on constantly updated data [9, 10]. Through monitoring, SEA ensures that the planning process is continuous and cyclical, allowing for the verification, reconsideration and/or reorientation of planning choices implemented on the basis of the results obtained [11].

During these stages, various techniques and methodologies are employed to support the decision-making process, although there are no universally valid or standard methods [8, 12]. In this context, several established approaches have been applied, each serving specific functions at different stages of the process [13].

Among these, SWOT analysis is frequently used to carry out context analyses, providing an assessment of the current situation by identifying problems or opportunities and classifying them as strengths, weaknesses, opportunities and threats [8].

Tools used to support the decision-making process also include consistency analysis models, such as correlation matrixes [8]. These matrixes enable the internal and external consistency of the plan to be evaluated by analyzing the degree of correlation between objectives, actions and environmental components. This makes it possible to identify inconsistencies or discrepancies, thereby supporting revisions and adjustments [14].

Methodologies for identifying potential environmental impacts may also be employed; these are used in the initial stages of the assessment to support subsequent analysis and monitoring activities. They enable the identification of certain or potential interactions between the actions associated with plans or programs and the environmental system. The main ones include checklists, impact matrixes and networks [13].

Checklists are structured lists of environmental, project and impact factors that are useful for an initial systematic survey of possible interactions and for establishing the information framework for the main impacts to be analyzed [13].

Environmental impact matrixes are analytical tools that link actions to environmental components, enabling identification and, in some cases, the assessment of the significance of potential effects [13]. An example of a quantitative impact matrix is the Leopold matrix [15], which lists 100 planned project actions in columns and 88 environmental components affected by these actions in rows; at their intersection, an assessment is assigned, ranging from +10 (extremely positive impact) to −10 (very negative impact).

Finally, networks, or impact chains, correspond to cause-and-effect relationship diagrams that represent the interactions between actions and environmental components in a more systematic and structured manner, also highlighting indirect and cumulative effects [13].

Other methods used, derived from a combination of the methods mentioned above, may include, for example, coaxial matrixes, grid-based tools that integrate environmental impact matrixes and networks to enable the relationships between causal factors of impact, environmental components and potential impacts to be analyzed and evaluated in a logical sequence [13].

Following the impact identification phase, the impacts are estimated. This assessment aims to estimate the significance of the changes induced by the implementation of plans or programs on the environmental system, by using a set of indicators capable of describing changes in environmental components and their causes [13]. One of the most widely used models for organizing environmental information is the DPSIR model (Drivers, Pressures, State, Impact, Response), developed by the European Environment Agency (1999) [16], which allows indicators to be structured according to a causal chain linking human activities, pressures exerted, environmental conditions, impacts generated and societal responses, thereby providing an integrated and systemic understanding of environmental dynamics[17, 18].

Finally, the comparison of alternative scenarios and the support for selecting the most sustainable option are entrusted to methodologies such as multi-criteria analysis, which enables the integration of heterogeneous dimensions into a structured decision-making process [19, 20]. Several approaches and techniques for multi-criteria analysis

have been developed in the literature [21] which can be applied to various contexts, specifically designed to assist the decision-maker in identifying the solution that best minimizes environmental impacts and, at the same time, is optimized from a technical and economic perspective [21].

Integration with GIS tools is particularly important in supporting the application of these methodologies, as it enables the analysis and representation of georeferenced data and the construction of knowledge frameworks useful for a comprehensive interpretation of territorial components [14, 22].

In the presence of a plurality of established approaches and methods, and in the absence of a regulatory framework defining the methodological aspects of SEA, a differentiated methodological and operational framework has progressively emerged at the national level [1]. Within this context, regional authorities have developed different approaches through the adoption of their own regulations, guidelines and operational tools [1, 23]. Some of these experiences stand out for their level of methodological structuring and can be regarded as good reference practices. Among these, notable examples include the cases examined within the ENPLAN project (*ENPLAN Guidelines – Environmental Assessment of Plans and Programmes*, 2004), such as Emilia-Romagna and other regional contexts that have adopted specific assessment models. This overall framework highlights how SEA can be understood as an inherently flexible tool, open to a variety of methodological approaches.

3 Methodology

The proposed methodology provides knowledge and interpretive support during the ex-ante phase of the SEA, in which it is necessary to assess the environmental context of the study area and define the objectives, goals, and priorities of future actions. As these are currently abandoned or disused areas, it is essential to assess their environmental condition in order to develop focused actions that improve the current situation and enhance the value of the territory.

In this regard, the methodology comprised two distinct phases. The first phase focused on analyzing the current situation in order to gain a thorough understanding of the factors that characterize the areas. The second phase aimed to assess the potential environmental impacts of these changes.

The SWOT analysis was used as the evaluation method for the first part of the study, as it allows for the detailed identification of the positive and negative factors influencing the area and its potential for transformation.

After gaining a thorough understanding of the area, development scenarios were defined for the second phase based on the results of the SWOT analysis. This was done to assess their potential environmental impact, as required by the SEA process. This involved creating coaxial environmental impact matrices based on the opportunities and threats identified in the SWOT analysis, in order to assess the types and extent of potential environmental impacts, and to determine the sustainability of the planned interventions.

3.1 SWOT Analysis

SWOT analysis is a decision-making tool designed to improve the effectiveness of decision-making processes [24]. Its primary objective is to identify the Strengths (S), Weaknesses (W), Opportunities (O) and Threats (T) related to complex issues [25]. When integrated with the SEA process, SWOT analysis provides a clear and interactive way to highlight the key characteristics of the context in short and long term. It serves as a tool for both strategic and environmental impact assessments of plans or programs. The aim is therefore to assess the current state of a territory by identifying the factors that define and influence it, whether endogenous or exogenous [26].

Specifically, the strengths and weaknesses of the case study are endogenous factors, that is, factors related to the current situation or expected in the near future. In contrast, opportunities and threats represent exogenous factors; that is factors or dynamics that influence the study area, but which are still potential in terms of their occurrence and effect. Examples include events and conditions that could potentially have a positive or negative impact on the territory [27].

SWOT analysis can be applied at various stages of the SEA process. During the *ex-ante* phase, it can be used to better integrate the plan or programs from a sustainability perspective. During the *in-itinere*, it can be used to verify compliance with previously defined sustainability objectives and make adjustments as needed. Finally, during the *ex-post* phase, it can be used to justify and interpret the results obtained. If necessary, it can also be used to explain any changes made to the initial choices [28].

In order to make the analysis more comprehensive by taking into account the various components that characterize the territorial system, the SWOT analysis is supplemented with the STEEP method, an acronym referring to the dimensions analyzed: Social (S), Technological (T), Environmental (E), Economic (E), and Political (P) [29]. This approach enables systematic analysis to be carried out, taking into account the various sectors that characterize the local context, thereby facilitating the creation of the SWOT-STEEP matrix.

By integrating the STEEP approach, it is possible to identify and analyze the dynamics of the study area in a more structured way. This systematic methodology allows for comprehensive consideration of all factors that may influence the area's transformation and development processes [30].

In order to provide a clearer, integrated approach that helps decision-makers choose actions and strategies, the assessment of complex decision-making problems requires the integration of decision-support tools with spatial components [31].

Visualizing trends identified through analytical models in a spatial context improves understanding of their geographic distribution. This enables development of strategies better suited to the local context, which can address negative aspects or highlight positive elements.

In this study, the SWOT analysis was integrated with a spatial analysis conducted using GIS systems to create a graphical representation of the elements identified during the analysis and transform qualitative factors into spatial data. The integration of these two methods made it possible to easily understand the dynamics at play within the

relevant territorial context. An integrated interpretation of analytical and spatial information provides thematic maps that support and assist decision-makers and stakeholders in selecting planning and transformation strategies [32].

3.2 Coaxial Matrix

A preliminary analysis of the area's current state provides a foundation for understanding the potential environmental impacts of the transformation.

The aforementioned impacts can be defined as alterations to the environmental system that result from the interaction between an external agent and the specific aspect of the system that is affected [33]. Their evaluation can be carried out by constructing two-way matrices that take into account the environmental factors and design strategies into which the activity has been broken down; the intersection of these factors represents a potential interaction between them [34].

A series of coaxial environmental impact matrices have been developed, thereby constituting a theoretical extension of Leopold's matrix framework. As previously mentioned, the coaxial matrices are based on the same principle; however, they consist of multiple entries, thereby allowing for the correlation of causal impact factors, environmental components, potential changes, and human activities vulnerable to impact.

A co-axial matrix is defined by its capacity to accommodate a variable number of entry points, with the potential for both qualitative and quantitative data representation. In the first case, value judgments (symbols or colors) are entered; in the second, numerical values are assigned to the intersections.

For the case study analyzed, the co-axial matrix was constructed based on the DPSIR model [16], which describes the cause-and-effect interactions between environmental components and the socioeconomic system. The elements of the model are the Driving forces, the dynamics that activate the transformation processes; the Pressures, the effects of the driving forces on environmental components; the State, the changes induced in environmental components; the Impacts, the consequences resulting from the change in state; and the Responses, actions necessary to compensate for or mitigate the impacts [16].

These elements are outlined as follows to construct the matrix for the case study: Driving forces represent the factors that influence the territorial system (e.g., urban planning policies, the transportation system, the availability of green spaces…). Pressures refer specifically to the pressures imposed on environmental components (e.g., land consumption, water and noise pollution…). The State assesses changes in the environmental components under consideration (e.g., water, air, soil and subsoil, waste, noise, biodiversity…). The Impacts describe how environmental components are altered by changes (e.g., effects on water quality, on soil…). The Responses consider urban planning and regulatory standards and tools aimed at defining mitigation and compensation measures for managing potential impacts.

The previously mentioned elements are correlated within the co-axial matrix to assess, by filling in the sections with a color-coded scale, whether the strategy under evaluation has a positive, moderately positive, neutral (i.e., present but without significant effects in either a positive or negative sense), moderately negative, or negative impact on the environmental components analyzed.

4 Application

The methodological approach outlined above has been applied to a major urban center in northern Italy. In this paper, to provide a practical illustration of the analytical criteria used in the development of the analysis, we propose applying them to one of the areas under consideration.

4.1 SWOT-STEEP Analysis

The aim of the SWOT-STEEP analysis is to obtain and present a comprehensive overview of the study area and its context. The process was informed by a thorough examination of the local area, encompassing the aggregation of data on various infrastructural and socio-economic factors. The factors considered included the number of vacant properties, employment levels, and service availability. The data were collected using online portals and statistical sources.

The SWOT-STEEP matrix is a tool used to simplify territorial analysis by dividing the system into smaller, more manageable components. This approach entails the identification of the positive and negative aspects of the area, including the opportunities offered by infrastructure and critical issues such as depopulation and lack of services.

Subsequent to the delineation of the SWOT elements for each STEEP category, a systematic collection of data was conducted for the purpose of establishing a solid knowledge base and supporting the implementation and development of the proposed methodology.

In practice, the process entailed the analysis of information gathered from official statistical sources (*Agenzia Regionale per la Protezione Ambientale* - ARPA, *Istituto Superiore per la Protezione e la Ricerca Ambientale* - ISPRA, *Istituto Nazionale di Statistica* - ISTAT), scientific literature (universities and other research bodies) and spatial databases (Geo-topographic databases). This made it possible to identify a set of key factors categorized as strengths, weaknesses, opportunities and threats, depending on whether they were internal or external to the territorial system. The assessment of these factors was carried out according to three main criteria: relevance, source reliability and representativeness of territorial dynamics.

Subsequently, the identified components were organized according to the analytical categories of the STEEP framework [35], in order to identify the territory's values more clearly (Table 1).

For example, the presence of attractive hubs and good transport links were classified as strengths (economic and technological dimensions), whilst the lack of local amenities and the presence of derelict or underused sites (social and environmental dimensions) were classified as weaknesses. Similarly, the attractiveness to prestigious international brands (economic dimension) was interpreted as an opportunity, whilst the high site remediation costs (environmental dimension) were seen as threats.

In this context, this functional integration enables a cross-referenced analysis of the nature of the phenomenon and its strategic significance.

The cartographic representation of the SWOT-STEEP analysis, an innovative element of the research, makes it possible to highlight the geographical distribution of the

Table 1. Description of STEEP components

	Description	Subtopics
SOCIAL	Analysis of the main sociodemographic variables, with a particular focus on factors influencing well-being and quality of life	Culture; Demographics factors; Housing; Services
TECHNOLOGICAL	Identification of current technological and infrastructure systems, based on their contribution to the local economy and market dynamics	Infrastructure; Mobility; Digitalization; Buildings
ENVIRONMENT	Assessment of the area's state of health, with reference to the general environmental factors that contribute to the sustainability and livability of the area	Air and climate; Green and blue infrastructure; Landscape; Sustainability; Soil and waste
ECONOMIC	Survey of relevant economic sectors, aimed at understanding their impact on the local context and on the dynamics of regional attractiveness	Economic activity; Investment; Property market; Income and employment
POLITICAL	Determination of the existence of plans, resources and programs designed to improve quality of life	Urban planning; Procedures; Public and/or private projects

identified elements, as well as their interactions and relationships with environmental and anthropogenic components.

The analysis of the maps shows that strengths (Fig. 1) are concentrated near significant environmental systems and complexes of recognized historical and artistic value, as well as along strategic transport routes and motorway links, and in areas characterized by emerging economic trends. Weaknesses (Fig. 2) mainly concern the lack of social welfare and sports facilities, the absence of sustainable transport solutions, the condition of the building stock, and the high volume of traffic along the main highways.

Opportunities (Fig. 3) are related to urban regeneration processes and the economic revaluation of the built environment following the conversion of abandoned industrial sites, while threats (Fig. 4) concern economic and administrative constraints and environmental problems related to soil sealing and hydraulic inertia.

Overall, the analysis provides a picture of an area in transition, where local potentialities and structural challenges coexist and mutually influence each other. These conditions are due to the area's peripheral location relative to the city center, which simultaneously functions as a gateway to the city, with important implications.

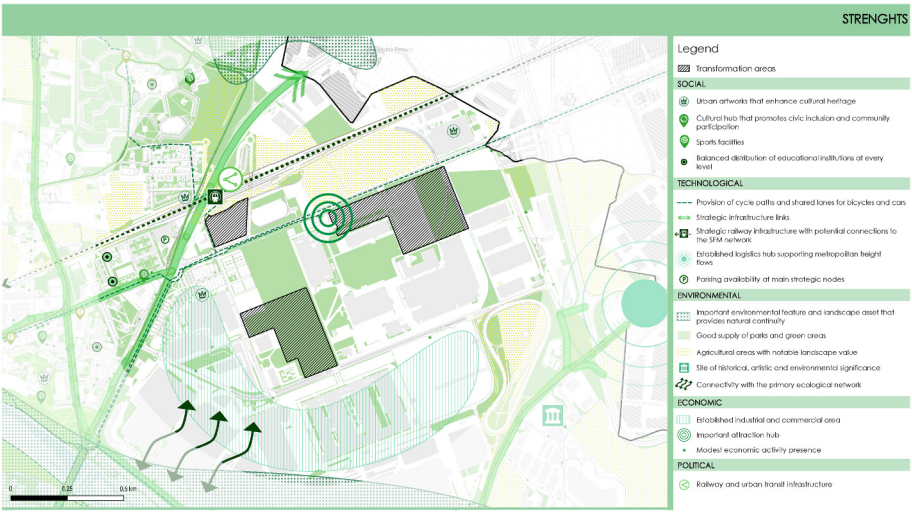

Fig. 1. A visual representation of the strengths identified by the SWOT-STEEP analysis for the area of study.

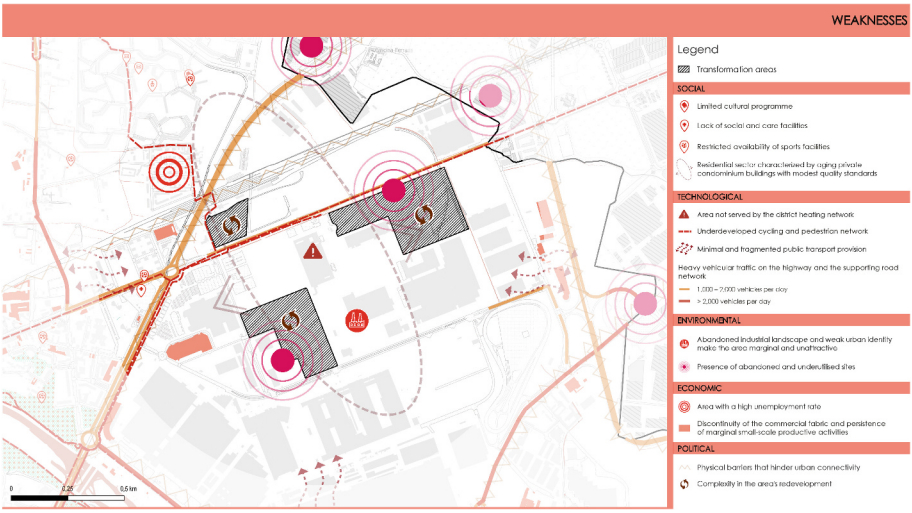

Fig. 2. A visual representation of the weaknesses identified by the SWOT-STEEP analysis for the area of study.

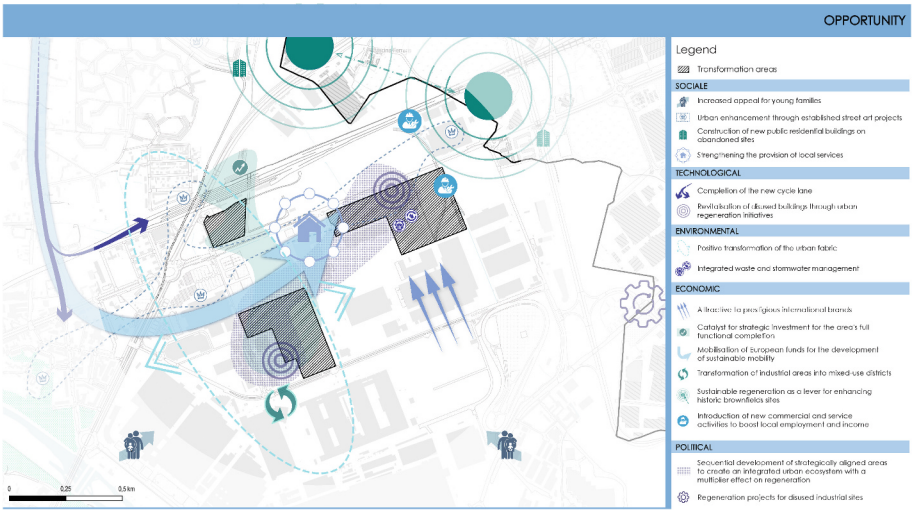

Fig. 3. A visual representation of the opportunity identified by the SWOT-STEEP analysis for the area of study.

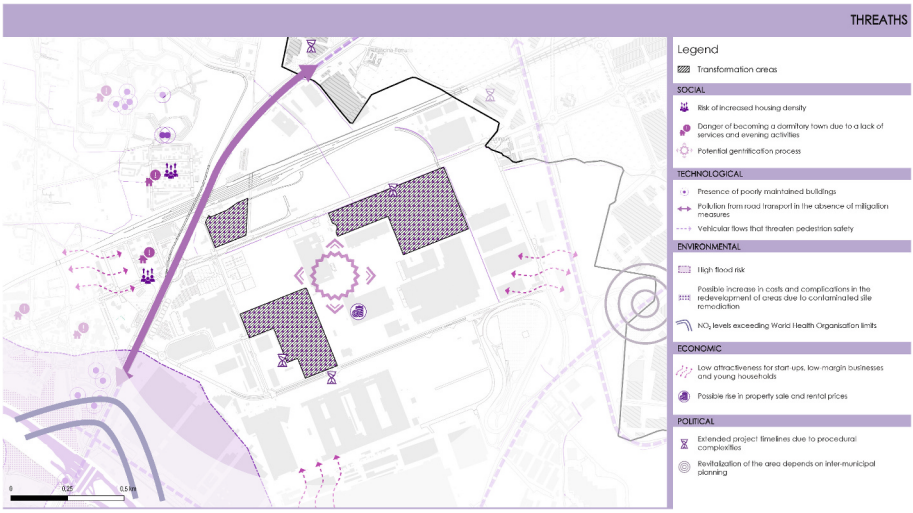

Fig. 4. A visual representation of the threats identified by the SWOT-STEEP analysis for the area of study.

4.2 Coaxial Matrix

Comparative analysis of the different scenarios using coaxial matrices highlights the systemic implications of the different components analyzed and supports the development of integrated spatial strategies, while also providing an operational tool to guide planning decisions.

The coaxial matrices were developed by translating the elements of the SWOT-STEEP analysis into causal relationships based on the DPSIR model, with the aim of clarifying cause-and-effect dynamics, making system interdependencies explicit, and sequentially identifying causal links and crucial points for intervention. In this process, the identified factors (strengths, weaknesses, opportunities and threats) were associated with drivers and pressures, with the observable effects were attributed to the state and impact components, and finally to possible planning response. For example, the increase in traffic flows (mobility system) is linked to higher emissions of atmospheric pollutants, the deterioration of air quality (state) and negative impacts on human health and well-being, and the quality of the urban environment; responses such as environmental mitigation are associated with these effects.

In order to evaluate all possible strategies and alternatives, three reference scenarios were considered: The first type is Inertial, which corresponds to maintaining the status quo and the absence of significant changes. The second type is Tendential, which considers the implementation of current planning requirements. The third type is Strategic, which is built on the opportunities identified by the SWOT analysis. A coaxial reference matrix was compiled for each of the above scenarios to assess the environmental impact of each one.

The coaxial matrix provides a systemic understanding of the entire DPSIR framework, showing the propagation of the effects of urban and infrastructural transformation and how pressures translate into cumulative impacts across multiple environmental components. Its main value lies in going beyond the limitations of a sectoral assessment, as it enables the identification of critical points and cross-cutting relationships, as well as the evaluation of the effectiveness of planned response. The different scenarios are directly integrated into the matrix, modifying driving forces and pressures and generating distinct configurations of the impact chain, thereby allowing the environmental effects associated with each alternative to be compared.

Figure 5 exemplifies the application of the co-axial matrix for the Strategic scenario and it shows consistency between certain planning projections and the development trajectories identified through the SWOT-STEEP analysis, with a stronger emphasis on sustainability, resilience and urban quality.

The interpretation of the coaxial matrix is based on the legend, which guides the reading of relationships along the DPSIR framework by distinguishing between the type and intensity of impacts. The cells indicate the presence, absence, or neutrality of effects, whilst the color scale specifies their nature (positive, negative, or neutral) and relative intensity. In order to facilitate the interpretation of the results Fig. 5, the distinction between the categories ‘no impact’ and ‘no effect’ is clarified: in the first instance, it can be stated that there is no interaction of any kind between the elements identified in the table; in the second case, however, the interactions between elements are tangible, but the result of these forces does not suggest any impact, neither positive or negative. This configuration enables the direction and magnitude of interactions to be immediately understood, thereby making the transformation dynamics associated with the various scenarios clearly legible and facilitating comparison between their configurations.

In particular, only the Strategic scenario results in a reduction of pressures and an overall improvement in urban quality, the analysis highlights how development outcomes are highly sensitive to the implementation of integrated policies on mobility, the environment and urban regeneration, although some residual issues remain regarding traffic volumes, noise and environmental pollution. The findings of the co-axial matrix analysis indicate the presence of potential environmental pressures, primarily associated with consumption, soil sealing, water resource exploitation, and increased atmospheric emissions. The aforementioned issues have the potential to affect ecosystem balance and the quality of the urban environment; however, they can generally be mitigated through the implementation of appropriate measures, such as environmental compensation. In this context, the implementation of permeable paving and rainwater harvesting systems has been identified as a potential strategy for mitigating pressure on soil and the water network. Additionally, the promotion of natural regeneration and urban reforestation initiatives has been proposed as a means of compensating for environmental damage. The implementation of these actions would result in the enhancement of environmental conditions and the ecological quality of urban spaces.

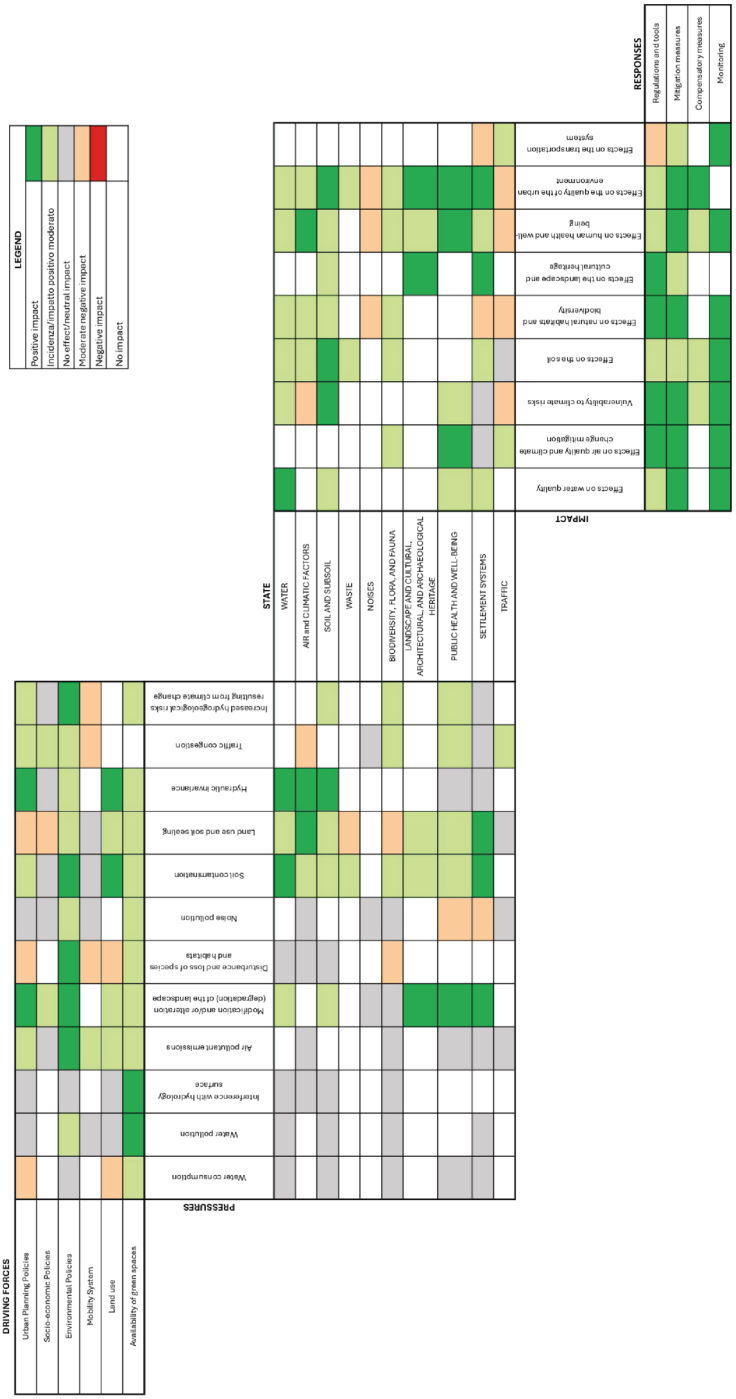

Fig. 5. Example of co-axial matrix of environmental impacts related to the Strategic scenario

5 Conclusions

This study proposes a work methodology to support the SEA process for the assessment of areas under transformation. The approach integrates the various components and dimensions of the territorial system. This integration facilitates the interpretation of preliminary analyses and results by visualizing key characteristics and ensuring that the work is comprehensible not only to experts but also to all stakeholders involved in the process.

The analysis conducted enabled a comprehensive and integrated assessment of the areas, highlighting the unique characteristics and shortcomings of the territory through an objective approach. This facilitated the SEA by conducting territorial analyses designed to examine individual aspects of the local context from the perspective of environmental sustainability. The objective of this approach was to ensure the proper development of the decision-making process.

The operational process followed a linear approach, starting from the current state of the areas to analyze it in detail. This analysis took into account not only the physical characteristics of the territory but also other dimensions, such as social, technological, economic, environmental, and political factors. Furthermore, consideration was given not only to ongoing or implemented actions, plans, or programs, but also to those that are foreseeable, thereby shifting the focus toward the area's potential. This methodological approach enabled the assessment of the potential benefits arising from the transformations, as well as any threats posed by current or future dynamics. In this manner, development scenarios and hypotheses were formulated that are congruent with the context and aimed at the regeneration of the area.

The workflow was enhanced by the development of coaxial matrices, which are widely used in SEA to quantify the potential effects of actions outlined in plans or programs. These matrices enabled the assessment of environmental impacts, thereby facilitating the identification of changes or alterations to this system. Additionally, they permitted the evaluation of the potential consequences of such transformations. A thorough analysis of these matrices revealed that the development of design scenarios based on a comprehensive study of the area, even if in some respects differing from current regulations, promotes their implementation in a more sustainable manner, from both an environmental perspective and in terms of public health and the restoration of communal and social spaces to cities.

The principal strength of this approach is its flexibility and replicability. It can be applied to study different contexts and case studies, ranging from an in-depth analysis of each territorial dimension to the development of coherent and well-informed strategies. Furthermore, integration with spatial analysis methods allows for the visualization of the spatial distribution of the identified elements, facilitating a deeper understanding of the dynamics at play and the identification of potential critical and strategic points for strategy development. This approach is further enhanced using coaxial matrices, which facilitate the visualization and assessment of potential environmental impacts.

Conversely, there appears to be a absence of participatory process involving the public in identifying the elements of both the SWOT analysis and the compilation of the co-axial matrices. Such a process could lead to a more comprehensive analysis that considers a variety of perspectives, including that of residents.

In the future, to refine the model, one preliminary step could be to consider the adoption of participatory methods, such as surveys and questionnaires. The implementation of these methodologies would facilitate the incorporation of supplementary viewpoints into the evaluation process, thereby ensuring the achievement of more comprehensive and accurate outcomes. Furthermore, the methodology could be executed through the utilization of quantitative factors and numerical indices. This approach is especially pertinent in the compilation of the coaxial matrix, where the application of value judgments expressed in numerical terms facilitates the derivation of a final index.

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