Strategic Environmental Assessment and the Logical Framework Approach: Integrating the 2030 Agenda into Spatial Planning

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Abstract. The 2030 Agenda, through its Sustainable Development Goals (SDGs), establishes a new global paradigm for promoting a shared and sustainable model of economic, social, and environmental development. This transformation calls for tools and methodologies capable of systematically embedding the sustainability paradigm into governance processes. In this context, Strategic Environmental Assessment (SEA) serves as a potentially powerful instrument to actively steer decision-making towards sustainable development and to translate it into practice. This paper explores the potential of SEA as an operational tool for integrating sustainability into spatial and territorial planning. Using the Tepilora Regional Natural Park Plan in Sardinia as a pilot project, the paper presents a practical application of a SEA model fully integrated into the decision-making process. The model promotes sustainable territorial development by combining environmental protection, landscape enhancement, and local sustainable development objectives. It is structured around the Logical Framework Approach (LFA), ensuring a coherent and goal-oriented planning process integrated with the assessment framework. The findings highlight the key stages of the strategic process in which the sustainability paradigm, interpreted and contextualised through the Regional Strategy for Sustainable Development (RSSD), is incorporated from the outset of plan formulation. The integration occurs in both strategic and design terms, influencing the definition of objectives, the evaluation of alternatives, and the identification of actions. The proposed methodology enhances consistency, traceability, and effectiveness, while enabling verifiability and adaptability. It proves replicable across diverse institutional and territorial contexts, contributing to the development of a proactive SEA process that is fully integrated with the 2030 Agenda, its regional sustainability frameworks, and the context-specific needs that emerged during the planning process.

Keywords: Strategic environmental assessment · Logical framework approach · 2030 Agenda

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1 Introduction

1.1 Strategic Environmental Assessment: Evolving Towards a Proactive Role

SEA is increasingly recognised in both literature and practice as a strategic instrument for embedding the sustainable development paradigm into decision-making processes and for supporting the effective pursuit of the SDGs [1, 2]. In this context, this study proposes a methodological model grounded in the LFA for integrating Sardinia's RSSD into spatial planning. Through the case study of the SEA for the Tepilora Regional Nature Park Plan illustrated, the methodology was both conceptualized and tested for its effectiveness in a real-world planning context.

Over the years, SEA has been subject to a range of definitions and conceptual developments, reflecting its inherently complex and multidimensional nature [3]. While some of its foundational principles were anticipated in the United States through Programmatic Environmental Impact Assessment (PEIS) in the late 1960s, SEA was first conceptualised and explicitly defined in Europe throughout the 1980s [4]. The emergence of SEA responded to two fundamental environmental protection challenges. On one hand, Environmental Impact Assessment (EIA) was increasingly regarded as insufficient for providing a systematic and effective evaluation of environmental impacts and alternatives at decision-making processes that extend beyond the project level. On the other, there was a growing recognition of the need for broader and more comprehensive assessment instruments, capable of supporting strategic decision-making and integrating environmental considerations into a long-term, future-oriented perspective [5–8]. In response to these needs, SEA has gradually evolved from a technical tool for assessing environmental effects into a sophisticated framework for strategic decision-making support [9]. This evolution has significantly enhanced SEA's role, transforming it from a reactive analytical instrument into a proactive tool for influencing public policy formulation, as well as planning and programming processes. It enables the integration of environmental dimensions from the earliest stages of decision-making and supports the adoption of development approaches oriented towards sustainability [8, 10]. The European SEA Directive formalised and consolidated this shift by establishing clear objectives: the protection of the environment through systematic impact assessment, the integration of environmental considerations into decision-making processes, and the promotion of sustainable development [11]. These principles have contributed to establishing SEA as both a methodological framework and a systematic process, characterised by a structured sequence of procedures through which key elements are integrated into decision-making processes, regardless of the specific characteristics of the governance systems involved [3, 12]. In doing so, SEA ensures the coherent and coordinated evolution of strategic decisions, while fostering greater environmental awareness. In practice, SEA can take on a variety of configurations depending on the administrative level at which it is applied, whether at the level of policies, plans, or programmes, as well as on the sector of intervention, such as transport, energy, waste management, water resources, and spatial planning. Although its adoption has spread globally, the procedures and regulatory frameworks governing SEA vary significantly across national and local contexts. This reflects the heterogeneity of decision-making systems, institutional structures, and

the socio-cultural, political, and organisational specificities within which SEA is implemented [13–15]. Within this context, the literature identifies two principal approaches to SEA [16, 17]: the first is impact assessment-based SEA, rooted in the EIA tradition and primarily focused on assessing the environmental consequences of predefined planning choices. The second is strategy-based SEA, which emphasizes the integration of assessment into the early stages of strategic decision-making. This approach seeks to strengthen strategic governance, ensure alignment with overarching policy frameworks, and promote the incorporation of the SDGs [18, 19]. Noble and Nwanekezie [9] refer to these as Impact assessment-based SEA and strategy-based SEA respectively, while Rehhausen, Hanusch, and Fischer [20] refer to them as the EIA-like and policy-assessment-like categories. These scholars stress that effective SEA practice requires a complementary application of both perspectives. Given the widespread consolidation of the impact-based approach, the main challenge, both for this study and for the broader field of environmental assessment, lies in the structurally integrating assessment and the sustainability paradigm into the strategic dimension [21]. In other words, the challenge is to incorporate the sustainability paradigm into decision-making processes and to operationalised it through SEA [1]. The need to integrate sustainability into decision-making has become even more pressing with the adoption of the United Nations (UN) 2030 Agenda, which brings new challenges for sustainability-oriented strategic planning.

The paper is structured as follows: Sect. 1 provides the theoretical background, addressing (1.1) the evolution of SEA, (1.2) the 2030 Agenda as a new paradigm for sustainable development, and (1.3) the LFA as a methodological foundation for integrating sustainability into SEA and structuring spatial planning processes. Section 2 illustrates the application of the proposed methodology to the SEA of the Tepilora Park Plan. Finally, Sect. 3 discusses key findings and offers some concluding remarks.

1.2 The 2030 Agenda: A New Development Paradigm

The 2030 Agenda for Sustainable Development is a global action plan for people, the planet, and prosperity, endorsed by the governments of the 193 UN Member States. Through its 17 SDGs and 169 associated targets, it sets out a new global paradigm aimed at pursuing and effectively realising a shared and sustainable model of economic, social, and environmental development [22]. The 2030 Agenda builds on earlier frameworks such as Agenda 21 and the Millennium Development Goals (MDGs), from which it inherits a commitment to sustainability, while introducing a more structured and integrated approach [23]. Compared to the MDGs, it promotes broader collaboration between developed and developing countries and, unlike Agenda 21, it establishes a system of continuous monitoring based on specific indicators [24]. The concept of sustainable development, first introduced in the Brundtland Report [25], finds for the first time in the 2030 Agenda a fully integrated and systematic framework, broader in scope and stronger in structure, capable of addressing complex and, at times, even conflicting emerging goals [26]. A core element of the Agenda is the principle of "leaving no one behind", which highlights the need for a development model that is both equitable and inclusive [27]. As such, the 2030 Agenda represents a coordinated and ambitious global effort that marks a major evolution in thinking: sustainability is no longer a mere option or an aspirational add-on, but a necessary and central objective essential to the

well-being of both present and future generations [22]. This paradigm shift requires the identification and adoption of innovative tools and methodologies capable of effectively integrating the SDGs into governance processes. In this context, SEA emerges as a key instrument, as its integration into decision-making processes can play a crucial role in advancing the SDGs [1, 2, 28]. Integrating the sustainability paradigm into SEA is not only a theoretical and methodological challenge; in Italy, it also constitutes a legal requirement. This obligation was introduced through Legislative Decree No. 104/2017, which amended the Environmental Code, and has since been transposed into regional legislation. Among the regional examples, the Autonomous Region of Sardinia (RAS) formalised its compliance through Regional Government Resolution No. 23/59 of 3 July 2024. This process is part of a broader effort to adapt and localise the 2030 Agenda across multiple levels of governance. Translating the SDGs into concrete and measurable actions requires their contextualisation and adaptation at both national and regional levels, with due consideration for the specificities and unique characteristics of each territory. In Italy, this localisation process is implemented through the National Strategy for Sustainable Development (NSSD) at the national level, and through the Regional Strategies for Sustainable Development at the regional level.

1.3 The Logical Framework Approach: Structuring Planning Through Evaluation

In order for SEA to establish itself as a proactive tool for supporting and shaping decision-making processes, and at the same time translate the principles of sustainability set out in the 2030 Agenda into concrete objectives and actions aligned with both global and local priorities, this study proposes the adoption of the LFA in the context of spatial planning. Over time, and across a range of contexts, integrated planning and programming tools have emerged which, through a structured logical-formal framework, aim to clearly and unequivocally define the purposes and expected outcomes of planning activities. These tools enable a structured understanding of planning content, facilitate *ex ante* assessments of both internal and external coherence, and support *ex post* analyses of the validity of the assumptions underpinning the decision-making process [29, 30]. Among these tools is the LFA. The LFA functions as an in-process assessment model, closely integrated into the planning process, enabling the definition, assessment, and strategic orientation of the plan itself. Its strategic dimension is articulated through general guidelines, objectives, and actions, which determine the overall direction and operational effectiveness of the plan. Originally developed in the United States for military purposes, the approach was later adapted to meet the specific needs of the National Aeronautics and Space Administration (NASA) [31]. Between the late 1960s and early 1970s, it was adopted by the United States Agency for International Development (USAID), where it became widely established in the field of development policy [32].

From the 1980s onwards, the method was integrated into the strategic frameworks of several international organisations, including the European Commission, the World Bank, and the United Nations, as a key instrument for ensuring coherence, transparency, and effectiveness in the design of complex interventions [33]. A significant evolution of the LFA was developed by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the German Agency for Technical Cooperation, which fully integrated the

method into its operational practices and further refined it into what is now known as Zielorientierte Projektplanung (ZOPP), or Goal-Oriented Project Planning (GOPP) in English [34]. Conceived to support both the planning phase and the management and evaluation of interventions, the LFA is recognised as a versatile methodological tool. It can be applied across a wide range of planning, design, and programming contexts, regardless of the nature of the intervention, the reference context, or the complexity of the issues addressed [35]. For this reason, the LFA has found application in numerous sectors. The conceptual foundations of the LFA, and consequently of the ZOPP/GOPP method, can be traced back to the Management by objectives approach, also known as Management by planning, which was popularised by Peter Drucker in the 1960s [36], and remains in use today. This approach is based on the clear and measurable definition of objectives, aimed at improving the efficiency and effectiveness of decision-making processes. Goals are defined at a strategic level and then translated into specific, measurable objectives across operational levels. This logic emphasises transparency in decision-making, fosters the active participation of stakeholders, and enables the measurement of results as well as the periodic evaluation of performance against predefined objectives [37]. It is important to distinguish between the LFA as an analytical process, which includes steps such as problem analysis, stakeholder analysis, objective setting, and strategy selection, and the Logical Framework Matrix (LFM) [38]. The latter constitutes the structured formalisation of the analytical process. In this sense, while the LFA represents the overarching methodological approach, the LFM serves as a project design matrix that logically, systematically, hierarchically, and integratively identifies and synthesises the coherence among the key elements of a project, namely overall goals, specific objectives, actions, and results. This structure is intended to reduce ambiguity, improve quality and effectiveness, and ensure the efficient implementation of the intervention [33, 39]. This study adopts the LFA to operationalise SEA as an assessment model embedded within the planning process and integrated with the sustainability paradigm from the earliest stages of the decision-making cycle. This approach moves beyond the view of SEA as a mere *ex post* assessment tool, positioning it instead as a proactive mechanism capable of guiding strategic choices [40]. Within this perspective, the study highlights how the integration of sustainability, framed by the 2030 Agenda and, locally, by the RSSD, contributes to making decision-making processes more effective in the management of environmental resources, ensuring their equitable and sustainable use, as well as their long-term protection and enhancement.

This study offers a practical application of the LFA in the field where SEA has become most widely established: spatial and territorial planning [41, 42]. As further explored in the following section, this is demonstrated by the pilot project of the SEA conducted for the Tepilora Regional Natural Park Plan in Sardinia, Italy. The case highlights how this methodological approach can meaningfully contribute to more effective and sustainability-oriented spatial and territorial planning.

2 Methodology and Case Study

2.1 The Tepilora Regional Natural Park: A Protected Area in Sardinia[1]

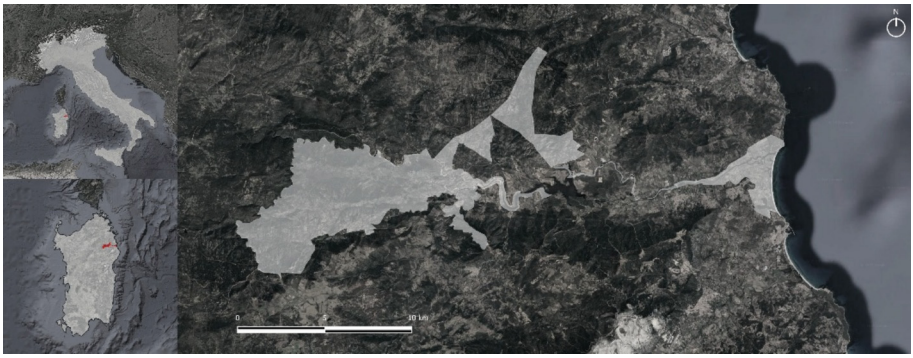

Fig. 1. The Tepilora Regional Natural Park in the Italian and Sardinian context.

The Tepilora Regional Natural Park was established by Regional Law No. 21 of 24 October 2014, entitled "Establishment of the Tepilora Regional Natural Park". Located in northeastern Sardinia, the park spans approximately 8,000 hectares, encompassing the administrative territories of the municipalities of Bitti, Lodè, Posada, and Torpè.

This extensive area presents itself as a mosaic of high landscape value and significant ecological complexity. The territory stretches from the wide beaches of Sardinia's eastern coast, through a succession of heterogeneous environments that include the mouth of the Rio Posada and the alluvial coastal plain, up to the inland plateaus, rising to about 1,000 m above sea level and characterized by dense, high-quality forests and steep mountain slopes. The Rio Posada, a defining and structural feature of the landscape, flows through all four municipalities and serves as a vital freshwater resource for local ecosystems. It also functions as a key ecological corridor, linking coastal and inland environments. Of particular importance is the wetland system at its lower course and estuary, recognised internationally as a Ramsar Site "Mouth of the Rio Posada" under the Ramsar Convention of 2 February 1971, which protects wetlands of global significance, especially for the conservation of waterfowl. The area's low level of urbanization and sparse population, mainly concentrated in small settlements and scattered rural buildings, has allowed for the preservation of a largely natural landscape. The one notable exception is the area near the river mouth, which shows a higher degree of human activity and development. The park's conservation value is further enhanced by the presence of two designated wildlife protection areas, which play a crucial role in safeguarding native fauna. Botanical and faunal surveys conducted by experts have identified 25 plant species of conservation interest and more than 50 non-native floral species. Regarding fauna,

[1] This paragraph is based on a structured interpretive analysis conducted by subject-matter experts as part of the elaboration of the Park Plan, through a critical examination of the knowledge framework established therein.

179 species have been recorded, confirming the area's outstanding biodiversity. In 2017, UNESCO awarded the park a prestigious international designation, recognising it as part of the Tepilora, Rio Posada and Montalbo Biosphere Reserve, under the Man and the Biosphere (MAB) Programme. This recognition affirms the park's role as a model of multifunctional protected area, where the conservation of biodiversity and landscapes is integrated with territorial enhancement and the promotion of sustainable development [43].

Within this framework, the planning of land use and territorial transformation in the park emerges as a strategic challenge of primary importance, one that necessarily requires the integration of SEA, which is essential to ensuring the long-term conservation of natural resources, the enhancement of local distinctiveness, and, at the same time, the well-being of local communities and the promotion of sustainable development.

2.2 The Logical Framework for Sustainability

This study proposes the LFM as a tool for defining the strategic dimension of the Tepilora Park Plan, fully integrated with the sustainability paradigm outlined at the local level in the RSSD of the RAS. The LFM is articulated across four hierarchical levels, comprising three categories of planning objectives and their corresponding actions:

- environmental sustainability objectives (level 1);
- external coherence objectives (level 2);
- specific objectives (level 3;
- plan actions (level 4).

All components are developed with direct reference to the RSSD.

The RSSD is structured around five strategic themes: Smarter Sardinia, Greener Sardinia, More Connected Sardinia, More Social Sardinia, and Closer Sardinia. Each theme is articulated through three levels of detail, which collectively include 34 strategic objectives, 104 lines of intervention (also referred to as specific objectives), and 571 actions [44]. These elements are integrated into the LFM during the objective, and action, definition phase.

The first level of the LFM consists of environmental sustainability objectives. These form the backbone of a system that is firmly anchored in the environmental context to which the plan refers, and they are derived from the environmental analysis. In this study, the environmental analysis is conducted by assessing specific environmental components that structure the plan's territorial context. In the case of Tepilora, the identified components include: air, water, flora - fauna and biodiversity, agroforestry systems, soil and geomorphology, landscape and cultural heritage, settlement systems, productive - recreational and educational activities, mobility and accessibility, and technological systems and networks. These ten components are examined through dedicated analytical sheets, which provide a detailed assessment of the current environmental conditions of the Tepilora area. Each sheet combines qualitative descriptions, quantitative data, tabular summaries, and cartographic representations to illustrate the most relevant thematic aspects. The environmental analysis concludes with a Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis, an interpretive tool that enables a critical reading of the territory and a synthesis of its baseline conditions. The SWOT framework enables

the identification of both positive and negative aspects of the environmental context. The former refer to environmental characteristics and conditions that offer added value and may facilitate the achievement of planning objectives; the latter represent potential obstacles. Positive and negative elements that are internal to the system and can be directly influenced by the plan are classified as strengths and weaknesses, respectively. In contrast, external variables that could significantly affect the territorial system but fall outside its direct capacity for intervention or transformation are identified as opportunities and threats. The environmental sustainability objectives are defined on the basis of the SWOT analysis, reflecting the priorities that emerge from the contextual assessment. In order to incorporate the sustainability principles outlined at the local level by the RSSD, these objectives are integrated with the Strategy's Strategic Objectives (StO). The integration process involves a preliminary relevance analysis of the RSSD StO with respect to territorial planning, and specifically in relation to the Tepilora Park Plan. A selection of this analysis, consisting of two StO per RSSD theme, is presented in Table 1.

Based on this analysis, 21 out of the 34 StOs of the RSSD were selected. These were then associated with the identified environmental components and the corresponding 21 environmental sustainability objectives derived from the environmental analysis.

The objectives assessed as coherent were subsequently integrated and, where appropriate, reformulated, as presented in Table 2. The resulting environmental sustainability objectives, which make up the first level of the LFM, incorporate both the context-specific priorities and those promoted by the RSSD.

The second level of the LFM consists of the external coherence objectives. In the context of planning, coordination among instruments operating at different scales and administrative levels is essential to ensure effective, integrated, and coherent governance of territorial transformations. Within this framework, external coherence objectives are identified through the analysis of higher-level and parallel programming and planning instruments. These objectives are then associated with the relevant environmental components and corresponding environmental sustainability objectives. Unlike sustainability objectives, specific objectives, and actions, which directly define the strategic orientation of the plan, external coherence objectives are not integrated with the RSSD. Instead, they serve as a reference framework to ensure that the plan does not diverge from or conflict with the existing governance system.

The third level of the LFM consists of the specific objectives. These define the expected results in terms of the plan's strategic goals, translating them into concrete guidelines for land management and territorial transformation. This study identifies three main sources from which specific objectives are derived: governance objectives, reflecting the political and administrative priorities of the authority responsible for drafting the plan; planning objectives, based on the guidelines defined by the appointed planners, which may also include insights drawn from the environmental analysis and contributions from participatory processes; RSSD-specific objectives.

In the case of the Tepilora Park Plan, the political and administrative priorities of the responsible authority coincide with those of the plan's Scientific Coordination Group, which was entrusted not only with drafting the plan itself but also with the SEA process.

Table 1. Excerpt from the relevance assessment of RSSD strategic objectives to spatial planning and the plan context

Strategic themes	RSSD Strategic Objectives	Relevance assessment
Smarter Sardinia	Enhance the competitiveness of enterprises by facilitating sustainable innovation in products and organizational processes	Yes
	Support research and development, fostering collaboration among enterprises, research centers, universities, and higher education institutions	No
Greener Sardinia	Promote human health and well-being through environmental remediation of soil, air, and water	Yes
	Pursue the decarbonization of productive sectors	No
More connected Sardinia	Improve accessibility to Sardinia and ensure territorial continuity	No
	Strengthen sustainable mobility in both public and private transport systems	Yes
More social Sardinia	Reduce unemployment, improve access to quality employment opportunities, and promote entrepreneurship and self-employment initiatives	No
	Create employment opportunities and deliver essential services in rural areas to promote inclusive and widespread well-being	Yes
Closer Sardinia	Promote, protect, and ensure access to cultural, identity-based, and natural heritage	Yes
	Ensure access to quality healthcare and promote universal, inclusive health services	No

Consequently, the governance objectives are the same as the planning objectives. The appointed planners adopt a methodological approach focused on the sustainable and integrated management of resources, with particular attention to the protection and enhancement of local specificities. This approach is grounded in an in-depth understanding of the territorial context and in the ability to translate the environmental analysis into practical tools for plan development. From this perspective, the planning objectives are identified through the analysis of the environmental context, ensuring coherence between the assessment phase and the intervention strategies. As a result, specific objectives of the Tepilora Park Plan are derived from two main sources: the specific objectives identified through the environmental analysis, and the specific objectives of the RSSD, tailored to the context of the Plan.

Table 2. Excerpt from the definition table of the environmental sustainability objectives of the Tepilora Park Plan, integrated with the RSSD framework and related to the soil component

Strategic objectives of RSSD	Environmental component	Environmental sustainability objectives derived from the environmental analysis	Assessment of coherence	Environmental sustainability objectives
Promote human well-being and health through the environmental remediation of soil, air, and water	Soil	Safeguard geological heritage, including with reference to landslide risk	Inconsistent	
Promote human well-being and health through the environmental remediation of soil, air, and water	Soil	Enhance and preserve the territory's high levels of naturalness	Consistent	Promote human well-being and health through the enhancement and preservation of the territory's high levels of naturalness
Reduce exposure to landslide and flood risk	Soil	Safeguard geological heritage, including with reference to landslide risk	Consistent	Safeguard geological heritage, also with the aim of reducing population exposure to landslide risk
Reduce exposure to landslide and flood risk	Soil	Enhance and preserve the territory's high levels of naturalness	Inconsistent	

The contextualization of the RSSD's specific objectives is carried out by establishing correlations between the StOs of the RSSD and the environmental sustainability objectives of the plan—defined as the result of integrating objectives derived from the environmental analysis with those from the RSSD—and by associating the corresponding specific objectives of the RSSD. Those objectives deemed relevant to the context of the Tepilora Park are subsequently reformulated and adapted to the plan.

Table 3. Excerpt from the definition table of the specific objectives of the Tepilora Park Plan, within the framework of the RSSD

Strategic objectives of RSSD	Environmental sustainability objectives	Specific objectives derived from the RSSD	Relevance assessment	Reformulated objectives
Promote human well-being and health in connection with the environmental remediation of soil, air, and water	Promote human well-being and health through the maintenance of high levels of marine and coastal water quality	Minimize pollutant loads in water bodies and aquifers, taking into account the levels of good status of the water bodies	Yes	Achieve 'Good' ecological and chemical status of water bodies
/	Promote human well-being and health through the maintenance of high levels of marine and coastal water quality	/	/	Promote the integrated management and sustainable use of water resources

Table 3 provides an excerpt summarizing this process, including in the final column the specific objectives derived from the environmental analysis, and showing their correlation with the sustainability objectives and the identified environmental components.

The fourth level of the LFM consists of plan actions. This study identifies three sources for these actions: governance and planning actions, actions derived from the RSSD, and actions stemming from local planning frameworks. Governance and planning actions, like the corresponding objectives, originate from the political priorities of the promoting authority and the planners. In this case, the two coincide, and they are both derived from the environmental analysis, with reference to the identified environmental components and associated sustainability objectives. Actions linked to the RSSD refer to those associated with the strategy's specific objectives, which were deemed relevant to the themes addressed in the Tepilora Park Plan. Local planning actions are defined at the national level within the framework of the "Competenze e Reti per l'Integrazione Ambientale per il Miglioramento delle Organizzazioni della Pubblica Amministrazione" (CReIAMO PA) project—Intervention Line LQS1 on Environmental Assessments, aimed at improving the effectiveness of SEA and EIA processes for programs, plans, and projects—developed by the Ministry of Environment and Energy Security. From this set, those actions considered pertinent to spatial planning and relevant to the context of the Park Plan were selected. Table 4 presents a selection of the identified actions, grouped according to their respective sources.

Table 4. Excerpt from the definition table of the preliminary actions of the Tepilora Park Plan within the framework of the RSSD, categorized by source of origin

Actions associated with the specific objectives derived from the RSSD	Actions derived from local planning according to the project CReIAMO PA	Actions defined through the environmental analysis	Plan actions
Natural water retention measures	/	/	Natural water retention measures
/	/	Adaptation of the potable water distribution system	Adaptation of the potable water distribution system
/	/	Rainwater recovery and reuse interventions	Rainwater recovery and reuse interventions
/	Interventions requiring water supply and wastewater disposal	/	Interventions requiring water supply and wastewater disposal
Minimize pollutant loads in water bodies and aquifers	/	/	Minimize pollutant loads in water bodies and aquifers

These actions are considered preliminary, as they are subject to a thorough critical review designed to enhance the effectiveness of the intervention strategy by eliminating redundancies and overlaps. This process involved the systematization of actions within coherent thematic clusters, through the selection, reformulation, and consolidation of similar actions, as well as the exclusion of those deemed duplicated.

The strategic elements thus defined constitute the LFM of the Tepilora Park Plan. Table 5 presents an excerpt, showcasing for each environmental component one environmental sustainability objective, one specific objective, and one corresponding action.

Table 5. Excerpt from the Logical Framework of the Tepilora Park Plan

Environmental sustainability objectives – 1st level	External coherence objectives – 2nd level	Specific objectives – 3rd level	Actions – 4th level
Environmental component: Air			
Promote human well-being and health through the enhancement and preservation of high air quality levels	Promote and support cycling as an alternative means of transport, as well as for sports activities and touring-based tourism	Promote sustainable mobility	Interventions supporting sustainable mobility
Environmental component: Water			
Safeguard the quality and quantity of surface and groundwater in relation to human well-being and health	Improve the integrated water service, also with the aim of reducing the risk of water crises	Promote the integrated management and sustainable use of water resources	Adaptation of the potable water distribution system
Environmental component: Flora, fauna, and biodiversity			
Protect biodiversity and to safeguard and conserve the habitats and species within the Park area	Maintain and enhance the biodiversity of ecosystems and local ecotypes	Promote an ecosystem-based approach	Interventions for the protection, enhancement, and compensation related to ecosystem services and green infrastructure
Environmental component: Agricultural and forestry system			
Enhance traditional agricultural and forestry systems and to contribute to the development of innovative systems capable of combining modern farming practices with the enhancement of ecosystem services	Improve the functionality and vitality of existing forest systems, including in terms of silvicultural strategies	Promote agricultural and forestry management practices compatible with the conservation of existing habitats	Diversified agro-silvo-pastoral management interventions compatible with the ecological characteristics of the area and the conservation of existing habitats

(*continued*)

Table 5. (*continued*)

Environmental sustainability objectives – 1st level	External coherence objectives – 2nd level	Specific objectives – 3rd level	Actions – 4th level
Environmental component: Soil and geomorphology			
Safeguard geological heritage, also with the aim of reducing population exposure to landslide risk	Ensure the safety and security of the territory	Prevent and counteract erosion phenomena	Interventions for the prevention and mitigation of erosion phenomena
Environmental component: Landscape and historical-cultural heritage			
Protect, restore, enhance, and connect the three landscape areas within the Tepilora Park, mountain-forest, river-agricultural, and coastal-wetland, also for productive and ecotourism purposes aimed at the development of inland and coastal areas	Redevelop the coastal settlement system by integrating the environmental conservation project for the landscapes of coastal wetlands and agricultural floodplains	Promote and enhance the recognition of the territory's socio-cultural and environmental identity	Interventions aimed at enhancing the agricultural landscape
Environmental component: Settlement system			
Conservation and enhancement of the existing public building heritage aimed at improving the usability and livability of the Park's areas	Redevelop the coastal settlement system by integrating the environmental conservation project for the landscapes of coastal wetlands and agricultural floodplains	Redevelopment of the existing building stock	Interventions for the redevelopment of the existing building stock aimed at tourism use and hospitality
Environmental component: Economic-productive, tourism, recreational, and educational activities			
Promote the Park's tourism appeal in relation to socio-economic development and greater cultural and environmental awareness	Increase, innovate, specialise, and diversify the tourism offer throughout the year	Promote new forms of ecotourism	Interventions for the management, adaptation, and enhancement of trails designated for outdoor activities

(*continued*)

Table 5. (*continued*)

Environmental sustainability objectives – 1st level	External coherence objectives – 2nd level	Specific objectives – 3rd level	Actions – 4th level
Environmental component: Mobility and accessibility			
Overall reorganisation of the mobility and accessibility system aimed at improving sustainable access to the Park, with particular reference to the physical connections between inland areas and coastal zones	Improve the accessibility and usability of beaches	Improve accessibility to public and private sites	Interventions to enhance accessibility and usability through the removal of architectural barriers
Environmental component: Technological systems and networks			
Improve the system of facilities and technological networks	Promote a balance between the protection of sensitive areas, such as natural areas safeguarded from noise pollution, and the economic development of the territory	Noise pollution containment	Use of low-noise emission materials for road pavements

3 Discussion and Conclusions

The aim of this study is to define and apply a methodology for integrating the 2030 Agenda into the strategic dimension of spatial planning through SEA. Several scholars have noted that planners and decision-makers often perceive SEA primarily as a regulatory requirement, rather than as a process capable of generating real added value for planning [45]. Furthermore, they stress that the utility and effectiveness of SEA are often confined to minor adjustments on peripheral issues, rather than reflecting a genuine capacity to steer and shape the entire decision-making process and its outcomes [46]. This study adopts an innovative approach to SEA, conceived as a core part of the planning process, embedded from the earliest stages [47]. In this way, SEA is no longer treated as a merely technical tool for *ex post* evaluation and verification, but rather as a proactive mechanism capable of substantially influencing the formulation of public policies and the broader processes of programming and planning. The adopted reference model is the strategy-based SEA [9], which seeks to reinforce the strategic dimension of decision-making. Accordingly, the study focuses on the process of defining and formulating plan objectives and actions, ensuring the early integration of environmental considerations

and a more effective assessment of planning and design alternatives. Crucially, the study enables the integration of the sustainability paradigm set out in the 2030 Agenda, as adapted at the national and regional levels through the NSSD and RSSD. It promotes a more equitable and rational approach to managing environmental resources, balancing long-term protection with territorial enhancement. This objective becomes even more significant in protected areas, such as the Tepilora Regional Natural Park, which serves as the pilot project for this research. The adoption of the LFM enables the formulation of a structured system of objectives and actions integrated with the RSSD, ensuring continuous evaluation of the strategy as an embedded component of the planning process. This framework provides a hierarchical and internally coherent structure for organizing strategic elements. At the core of this matrix framework lie the environmental sustainability objectives, which serve as the primary reference for all subsequent planning objectives and actions, establishing the conceptual foundation of the entire decision-making process. These are operationalized through specific objectives that translate general goals into concrete, measurable outcomes. Finally, plan actions represent the executive dimension of the strategy, identifying the interventions and measures required to achieve the defined objectives. This hierarchical articulation ensures internal consistency across the various components of the plan and, in the implementation phase, supports systematic monitoring and evaluation of progress, thereby maintaining alignment with the overarching principles of sustainability. All strategic elements of the plan are integrated into the sustainability paradigm through an approach that combines in-depth analysis of territorial specificities with interpretation, adaptation, and contextualisation informed by sustainable development principles articulated at global, national, and regional levels. As a result, the defined objectives and actions are designed to address local needs while remaining coherently aligned with, and rooted in, overarching strategic and sustainable frameworks. From this perspective, SEA is no longer confined to the assessment of environmental impacts; rather, it becomes a structural component of the planning process, contributing to the development of a comprehensive strategy grounded in an integrated vision of sustainable development. Accordingly, the assessment–planning process assumes the form of a coherent system in which the 2030 Agenda, the NSSD, and the RSSD are fully embedded.

Another key feature that emerges from this study is that the application of the LFA renders the sustainability integration process both transparent and traceable. Each step involved in the formulation, integration, and revision of objectives and actions, as well as the related decisions and evaluations, can be clearly retraced. This allows for a critical reassessment of the choices made and the incorporation of proposals, amendments, and contributions that may arise during the planning process, whether from public authorities, experts, or stakeholders. Furthermore, this structure enables the integration of such contributions within the sustainability paradigm, ensuring that even politically driven orientations, if not originally rooted in sustainable development principles, are nonetheless compelled to align with them. As a result, potential contradictions can be addressed during the planning phase, thereby reducing the risk of incoherence during subsequent stages, particularly during plan implementation and the concrete transformation of the territory. A further relevant outcome of the study concerns the transferability of the methodology. The process of defining the strategic dimension of the plan, integrated

with the RSSD and grounded in the planning–assessment framework, proposes a modular and adaptable structure that can be applied to other territorial and institutional contexts. While preserving its foundational principles, the methodology allows for the calibration of tools and procedures in response to local specificities. The replicability of the LFA stems from its capacity to combine flexibility with methodological rigour, making it a dynamic and iterative assessment system capable of adapting to complex and evolving scenarios. This adaptability enables the model to be articulated at various levels of governance, regardless of the characteristics of the context in which it is applied, providing a coherent reference framework for guiding territorial transformations towards balanced and sustainable development. The model has in fact been applied not only to the SEA of the Regional Natural Park of Tepilora Plan, but also to the Preliminary Environmental Report and the Environmental Report of the SEA for the Municipal Urban Plan of Cagliari, thereby demonstrating its versatility and adaptability across different planning contexts.

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