sustainability

MDPI

Article

The Limitations of EMSs in Comparison with the SDGs When Considering Infrastructure Sustainability: The Case of the Terzo Valico Dei Giovi, Italy

Daniele Soraggi * and Gabriele Ivano D'Amato

Italian Excellence Center for Logistics, Infrastructure and Transport (CIELI), University of Genoa, 16126 Genoa, Italy; cieli@unige.it

* Correspondence: daniele.soraggi@edu.unige.it

Abstract: Infrastructure plays the largest role in the amount of annual emissions, so much so that investments promoted in the European Union must be subjected to a careful assessment of the sustainability of projects. The current landscape for assessing the sustainability of infrastructure is varied and complex. Considering the object of the assessment methodologies (such as the Environmental Impact Assessment or the Ecological Management System) and specific tools such as Envision, there is a shift from the infrastructure in itself and the company's actions to promoting sustainable development. This article introduces a methodology to examine how tools used in environmental impact assessments of transport infrastructure projects, regardless of the actor implementing them, align with different sustainable development objectives. Moreover, it identifies the Sustainable Development Goals (SDGs) as a reference point that can be used in estimating the validity of these instruments. This paper also validates the methodology proposed in our study, by comparing the results obtained on the Envision model with those obtained from its application in a case study regarding the Terzo Valico dei Giovi, a railway infrastructure in Italy. The article shows that although the final target is in many respects the same, the nuances with which actors pursue sustainability through the different instruments vary.

Keywords: sustainable infrastructure evaluation; sustainable development goals; Eco-Management and Audit Scheme; Envision; environmental impact assessment

check for updates

Citation: Soraggi, D.; D'Amato, G.I. The Limitations of EMSs in Comparison with the SDGs When Considering Infrastructure Sustainability: The Case of the Terzo Valico Dei Giovi, Italy. *Sustainability* **2024**, *16*, 1558. https://doi.org/10.3390/su16041558

Academic Editor: Giovanni Leonardi

Received: 10 December 2023
Revised: 23 January 2024
Accepted: 7 February 2024
Published: 12 February 2024

1. Introduction

While the Brundtland Report defined the parameters through which to define what sustainable development is, it is only since 2015, with the endorsement of the 17 sustainability goals (SDGs) of the UN 2030 Agenda, that the applications on which to act to reach global sustainable development have been determined [1]. As well known, SDGs consist of 169 parameters through which to measure progress on each goal [2] and to identify the actions needed to reverse negative trends. This systematic approach makes it possible to describe the global dynamics of sustainability through the SDGs.

The Next-Generation EU policy, in 2020, allocated EUR 738.8 million for the 2021–2026 period to address the post-pandemic socio-economic crisis. This policy not only targets climate change [3], but also advocates for the implementation of the Trans-European Transport Network (TEN-T) [4,5], which aims to develop a coherent, efficient, multimodal, and high-quality transport infrastructure across the EU. According to a UNOPS report based on annual updates of member countries' greenhouse gas inventories [6], infrastructure is associated with 79% of all emissions [7]. For this reason, it is necessary to identify how the management and monitoring of sustainable development and its environmental impact are carried out regarding transport infrastructure, during its construction and throughout its lifetime. This is ensured by the application of assessment methodologies—such as the Environmental Impact Assessment (EIA) or the Ecological Management System (EMS)—and specific tools, such as Envision. EIA determines the preliminary choices and how these affect space and time [8,9], while EMS certifies sustainable development according to a set of rules that define the measurement and monitoring criteria [10]. Inside the family of EMS, in this article, we introduce ISO14001 [11] and the Eco-Management and Audit Scheme (EMAS), which attest to the certification of a company's activities through which arbitrarily identified objectives for a sustainable approach can be measured.

Therefore, numerous methodologies for evaluating social and environmental impacts are thus available today. Gaining a deeper comprehension of these methodologies and their practical applications is valuable for policymakers and industries alike. Given the significant repercussions of infrastructure, along with their considerable investment requirements and enduring impact on various human activities, meticulous and well-informed planning becomes imperative. Both industry stakeholders and local authorities need to adopt a proactive stance, taking into account potential future changes in the landscape and regulatory frameworks.

The demand for new, high-performance, and resilient infrastructure and the projection towards a sustainable future involve conflicting goals that raise questions about the correct approach to evaluation. For this to be possible, it is necessary to identify how the management and monitoring of sustainable development and its environmental impact take place during the construction of a large strategic infrastructure and throughout its lifetime [12].

This makes it necessary to check which of the objectives for sustainable development are covered by such instruments, and in which manner they are assessed. To answer this question, we propose a methodology to assess how closely the Envision tool, the main voluntary tool for assessing infrastructure sustainability, adheres to the SDGs. In this contribution, it is believed that the SDGs should represent the starting point to determine a suitable development direction for the process of infrastructural development and a transformation of territory that is socially and environmentally sustainable. Subsequently, the same methodology is applied to a real case study certified by EMAS, a tool designed for assessing the sustainable approach of companies. Therefore, this paper aims to prove that the assessment of sustainability varies depending on which actor pursues it, especially in the construction of large transport infrastructures.

Section 2 provides background on the impacts that large infrastructures and their implementation have on the territory and introduces the tools and protocols through which to assess their sustainable approach—EIA, ISO14001, EMAS, and Envision. In Section 3, a methodology is proposed for assessing the adherence of infrastructure sustainability assessment tools to the SDGs. In Section 4, this methodology is validated through a case study, the EMAS protocol of the Terzo Valico dei Giovi—Nodo di Genova (Italy) [13]. In Section 5, the results obtained are presented, then discussed in Section 6, and Section 7 concludes.

2. Definitions and Assumptions

Starting from the analysis of the existing literature that examines issues of infrastructure development with respect to the socio-environmental and economic impacts that infrastructure entails, this section will introduce the tools designed to assess the sustainable approach that infrastructure construction implies. To achieve this goal, a brief regulatory overview is given framing the role of EIA in the evaluation of transport infrastructure projects to introduce EMSs, such as ISO14001 and EMAS (Section 2.1), and evaluation tools, such as Envision (Section 2.2). The reflections introduced form the basis on which the methodology proposed in the following paragraphs is articulated.

The theoretical and empirical literature relating the impacts of transport infrastructure on the development of territory and sustainable development is very active. Transport infrastructures play a relevant role in the economic development of a country [14]; they contribute to the enlargement of the market—of labor, goods, and ideas—which affects a territory and lowers previous trade barriers [15], and are the basis of development policies and territorial cohesion [16]. In fact, in a developed country, an adequate transport infrastructure system is capable of fueling a process of economic growth [17], so much so that several authors identify infrastructural development as a key element for economic growth and improved quality of life [18,19]. The presence and construction of an infrastructure represents a strong act of transformation for an area and can generate positive and negative externalities [20], which can be defined as unintentional and unbalanced welfare losses or gains from an extraneous activity [21]. Several studies in the literature have highlighted the attempt to internalize costs arising from negative externalities through targeted policies [22,23], and these include social impacts from the intended use of transportation infrastructure (traffic, noise, injuries, and accidents) and environmental impacts, mainly related to emissions of greenhouse gases. However, as previously mentioned, there is a risk that certain positive externalities may trigger negative externalities [24], but this risk would be reduced with a sustainable approach to infrastructure development that can mitigate the effects of climate change [7].

It is considered that investments in the innovation and development of the transport infrastructure network can ensure a reduction of economic disparities and promote economic development and territorial cohesion [16,25]. Unsurprisingly, the Next-Generation EU and the resulting Recovery and Resilience Fund (RRF)—which are part of development and growth policy promoted by the European Union to overcome the COVID-19 post-pandemic crisis—are based on principles of both reducing economic disparities and promoting economic development and territorial cohesion. To access the funds guaranteed by the EU, each member state had to submit a National Recovery and Resilience Plan (NRRP). The European Union has identified the first two pillars—Green Transition and Digital Transformation—as the investment guidelines through which member states are required to prepare their implementation agenda with projects and policies. The investments in the renewal and development of a competitive and performing infrastructure network represent the territorial dimension through which the NRRPs are cast through project proposals [26].

However, an infrastructure investment plan does not only assume positive spill-over effects, but negative externalities must also be added, covering both social aspects and environmental impacts: on noise, emissions, congestion, and traffic [27,28]. Finding a method by which to measure the various externalities in such a way that they can be objectively compared is the subject of numerous studies [29–32]. At the same time, the search for an adequate assessment of the environmental impact of transport infrastructures and how it can influence the investment evaluation process is added to these evaluations. Exactly as emphasized by the European Union in its agenda with a 2027 horizon [33], the main aim is to invest in a greener and more sustainable Europe.

Sustainable development provides a basis for assessing climate change mitigation policies and highlights the need for adaptation to avoid the risk of significant environmental impacts [34]. Adaptation policies, strategies, and measures, if they are to be truly capable of increasing security, decreasing negative impacts, and producing climate-resilient infrastructures, must be based on local scenarios (that consider social, environmental, and economic aspects) [35]. The first step is the introduction in 1985 of the EU Directive 85/377/EEC which promotes the use of EIA as a fundamental environmental policy and planning tool [8,9]. The EIA is a foresight policy tool through which the main impacts on sustainable development that infrastructure generates can be identified and prioritized [36], and it also has a dedicated attitude to promoting mechanisms for the correction and compensation of these impacts [37]. Thus, the EIA plays a decision-supporting role despite the risk of generating interpretative conflicts between the corporate investment intention and the environmental policies promoted by institutions [38]. Moreover, part of the recent scientific literature proposes to implement the EIA with methodologies capable of determining the temporal and spatial impact that the realization of an infrastructure would have on the territory by considering its effects and costs over the entire life cycle [8,39,40] and not limiting the analysis to a single project. In addition, some research proposes that to make EIA procedures more comprehensive, proactive interventions necessary for the limitation of potential negative impacts and indications raised by local communities should be integrated into them [41].

Finally, a comparison between EIA and EMSs shows how the EIA provides a snapshot before implementation, whereas EMSs give an ongoing update of both monitoring and environmental risk prevention and mitigation actions. While EIA holds a preliminary position, Ecological Management Systems (EMSs) were subsequently introduced to support the implementation process. EMSs, such as ISO14001 and EMAS, are tools that any organization can implement to manage its business processes in compliance with the company's environmental policy, as well as the relevant legislation, through specific assessment metrics [10]. To these can be added a voluntary tool, such as Envision, useful for evaluating an infrastructure according to economic, social, and environmental parameters [42]. These various approaches will all be analyzed below.

2.1. The Ecological Management Systems: ISO14001 and EMAS

The pivotal principle around which EMSs are conceived is the continuous monitoring and updating of actions through which to avoid and reduce the environmental risk that the realization and initial implementation of an infrastructure entails [43]. Over time, several tools have taken hold that provide systematic support for companies to design their EMSs such as ISO14001 and EMAS [44,45]. EMAS includes the same EMS requirements as ISO14001, and these assume that a company provides itself with and is prepared for proactive environmental strategies [45]. In fact, the European Commission has increased the complementarity between the two and has, since 2001, incorporated the requirements of ISO 14001 as an annex to the EMAS regulation [46,47]. Therefore, below, this will be analyzed according to a common and shared framework for both.

Both ISO14001 and EMAS are among the most important and widespread voluntary and EU-wide environmental management systems [44,48]. Both are currently used to improve the environmental performance of organizations through the implementation of environmental management systems, systematic assessments via audits, transparent communication and continuous updating, the active involvement of stakeholders, and staff training [48–50]. The implementation of the ISO 14001 and EMAS standards thereby aims to improve environmental practices and performance, especially for activities considered particularly polluting [49].

We would like to underline that institutional pressure exists from regulatory and normative forces in inducing their adoption by companies [44,51] and it can be argued that ISO14001 and EMAS-certified companies gain intangible benefits from the credibility gained through their environmental governance [52]. This is further evidenced by the ease of access to bank guarantees by companies certified with EMSs. Indeed, this goes a long way in explaining the adherence by substantial numbers of private companies [53], even though these EMSs refer to government regulations that go beyond the environmental commitment commonly required of companies [52]. Therefore, the projects themselves also gain recognition for their social and environmental legitimacy. To corroborate this assertion, Italian legislation has promulgated the Law of 28 December 2015, no.221 "Dispositions on environmental matters to promote green economy measures and for the containment of the excessive use of natural resources", through which the Catalogue of environmentally harmful and favorable subsidies is instituted in art 68 [54]. This takes on greater value if it is noted that Italy is the European country with the highest number of EMAS-certified companies [55]. This tool allows the consultation and selection of measures according to different criteria, such as the scope, the type of subsidy, and the environmental sector [56].

The approach on which ISO14001 and EMAS are based is the identification and analysis of the critical elements of environmental management, the definition of environmental objectives, rules, and procedures that regulate how an organization interacts with the natural and social environment in which it operates, and the implementation of monitoring actions to identify appropriate corrections and effectively implement improvement plans. This cycle should guarantee continuous improvement in the environmental performance [44,50]. However, despite the progressive affirmation of ISO 14001 certification [44,57] and the centrality of the EMAS protocol [58] there is substantial stagnation concerning the adoption of the SDGs within environmental policies [59,60]. Moreover, since the requirements dictated by the EMAS standards are more substantial than those of ISO 14001, which is part of it [61], EMAS takes prevalence.

In conclusion, ISO14001 and EMAS have the common goal of the continuous improvement of environmental performance and their substantial difference is in their origin: one was born as a regulation and the other as a tool. In both cases, the predominant role in the process is played by the certified company.

2.2. Voluntary Tools for Infrastructure Sustainability: Envision

Envision is a support tool for the design and realization of sustainable infrastructures recently developed by the Institute for Sustainable Infrastructure [42]. Conceived as a protocol, it allows planners to involve stakeholders to improve the decision-making process, accelerate the construction process, and highlight positive effects on the actual sustainability of a project, even in the long term [62]. Moreover, it is a rating system designed to realize, in a sustainable way and through an analysis grid, any type of civil infrastructure [63]. This methodology, promoted by Envision, is aligned with the main trends for assessing transport sustainability based on a system of relevant indicators or indexes [64].

Envision certification differs from ISO 14001 and EMAS certification in that once a third-party assessment has been obtained, there is no subsequent validation phase by any public authority. Although Envision does not reflect the regulatory requirements, it indirectly ensures adherence to them, allowing the penalties associated with any violations to be avoided. Unlike ISO 14001 and EMAS certification, however, it does not involve tax and insurance benefits [49,65].

Envision is based on three different levels: categories, subcategories, and criteria. There are five categories, and they represent the macro-areas of impact according to which the sustainability of the project can be assessed: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk [66]. The 14 subcategories identify the main elements of each area and group a total of 59 criteria under them (Figure 1). Each criterion provides a sustainability indicator related to a specific aspect of environmental, social, or economic interest that can reach five different levels of achievement: improved, enhanced, superior, conserving, and restorative; extra credits are also provided in recognition of any added value in terms of innovation. The certification level is established, in percentage terms, based on the score achieved, and is the ratio between the score obtained and the maximum score attainable. Certification levels can be as follows: verified (at least 20%), silver (at least 30%), gold (at least 40%), and platinum (at least 50%) [65]. As a final act, the project team is asked to carry out a self-assessment to verify the minimum achievable potential [67]. A third party is commissioned to give an opinion on the certification by evaluating all the credits in the protocol, assigning the potential achievement level to each of them, and then certifying that the project meets the protocol requirements [65].

The current European regulation makes EMAS, consequently ISO 14001, a requirement, which results in only a relative use of Envision, even though it is specifically designed for infrastructure assessment, considers resilience more integrally [68], and ensures a greater involvement of all stakeholders.

Categories	Areas	Credits		Improved	Enhanced	Superior	Conserving	Restorative
Quality of Life	Wellbeing	QL1.1	Improve Community Quality of Life	2	5	10	20	26
		QL1.2	Enhance Public Health & Safety	2	7	12	16	20
		QL1.3	Improve Costruction Safety	2	5	10	14	-
		QL1.4	Minimize Noise & Vibration	1	3	6	10	12
		QL1.5	Minimize Light Pollution	1	3	6	10	12
		QL1.6	Minimize Costruction Impacts	1	2	4	8	-
	Mobility	QL2.1	Improve Community Mobility	1	3	7	11	14
		QL2.2	Encourage Sustainable Transportation	-	5	8	12	16
		QL2.3	Improve Access & Wayfinding	1	5	9	14	-
	Community	QL3.1	Advance Equity & Social Justice	3	6	10	14	18
		QL3.2	Preserve Historic & Cultural Resources	-	2	7	12	18
		QL3.3	Enhance Views & Local Character	1	3	7	11	14
		QL3.4	Enhance Public Space & Amenities	1	3	7	11	14
Leadership	Collaboration	LD1.1	Provide Effective Leadership & Commitment	2	5	12	18	-
		LD1.2	Foster Collaboration & Teamwork	2	5	12	18	-
		LD1.3	Provide for Stakeholder Involvement	3	6	9	14	18
		LD1.4	Pursue Byproduct Synergies	3	6	12	14	18
	Planning	LD2.1	Establish a Sutainability Management Plan	4	7	12	18	-
		LD2.2	Plan for Sustainable Communities	4	6	9	12	16
		LD2.3	Plan for Long-Term Monitoring & Maintenance	2	5	8	12	-
		LD2.4	Plan for End-of-Life	2	5	8	14	-
	Economy	LD3.1	Stimulate Economic Prosperity & Development	3	6	12	20	-
		LD3.2	Develop Local Skills & Capabilities	2	4	8	12	16
		LD3.3	Conduct a Life-Cycle Economic Evaluation	5	7	10	12	14
Resource Allocation	Materials	RA1.1	support Sustainable Procurement Practices	3	6	9	12	-
		RA1.2	Use Recycled Materials	4	6	9	16	-
		RA1.3	Reduce Operational Waste	4	7	10	14	-
		RA1.4	Reduce Costruction Waste	4	7	10	16	-
		RA1.5	Balance Earthwork On Site	2	4	6	8	-
	Energy	RA2.1	Reduce Operational Energy Consumption	6	12	18	26	-
		RA2.2	Reduce Costruction Energy Consumption	1	4	8	12	-
		RA2.3	Use Renewable Energy	5	10	15	20	24
		RA2.4	Commission & Monitoring Energy Systems	3	6	12	14	-
	Water	RA3.1	Preserve Water Resources	3	5	7	9	12
		RA3.2	Reduce Operational Water Consumption	4	9	13	17	22
		RA3.3	Reduce Construction Water Consumption	1	3	5	8	-
		RA3.4	Monitoring Water System	1	3	6	12	-
Natural World	Siting	NW1.1	Preserve Sites of High Ecological Value	2	6	12	16	22
		NW1.2	Provide Wetland & Surface Water Buffers	2	5	10	16	20
		NW1.3	Preserve Prime Farmland	-	2	8	12	16
		NW1.4	Preserve Undeveloped Land	3	8	12	18	24
	Conservation	NW2.1	Reclaim Brownfields	11	13	16	19	22
		NW2.2	Manage Stormwater	2	4	9	17	24
		NW2.3	Reduce Pesticide & Fertilizer Impacts	1	2	5	9	12
		NW2.4	Protect Surface & Groundwater Quality	2	5	9	14	20
	Ecology	NW3.1	Enhance Functional Habitants	2	5	9	15	18
		NW3.2	Enhance Wetland & Surface Water Functions	3	7	12	18	20
		NW3.3	Maintain Floodplain Functions	1	3	7	11	14
		NW3.4	Control Invasive Species	1	2	6	9	12
		NW3.5	Protect Soil Helath	-	3	4	6	8
Climate and Resilience	Emissions	CR1.1	Reduce Net Embodied Carbon	5	10	15	20	-
		CR1.2	Reduce Greenhouse Gas Emissions	8	13	18	22	26
		CR1.3	Reduce Air Pollutant Emissions	2	4	9	14	18
	Resilience	CR2.1	Avoid Unsuitable Development	3	6	8	12	16
		CR2.2	Assess Climate Change Vulnerability	8	14	18	20	-
		CR2.3	Evaluate Risk and Resilience	11	18	24	26	-
		CR2.4	Establish Resilience Goals and Strategies	-	8	14	20	-
		CR2.5	Maximize Resilience	11	15	20	26	-
		CR2.6	Improve Infrastructure Integration	2	5	9	13	18

Figure 1. Summary table of the Envision target and scoring system. The chromatic variation depends on the score obtained. Graphic revision by the authors.

3. Materials and Methods

This section presents the methodology used to quantify which SDGs are covered by specific infrastructure sustainability assessment tools. In particular, Envision is analyzed because it is specifically designed for infrastructure assessments and is, therefore, free of constraints related to the regulatory context [69–72] or the type of work [72–74].

3.1. SDGs Evaluation on Envision Protocol

Recalling the considerations presented in 2000 by Robèrt [10], the metrics through which sustainable development is currently measured either verify the relevance, quality, and quantity of the various activities in alignment with the same principles or perform specific measurements on impacts that violate the principles themselves. As all the sustainable development evaluation systems highlighted above refer to a framework of goals, this article proposes a methodology and criterion to compare the metrics used by Envision with the SDGs. To carry out this process, the comparison with Envision was decided upon since the latter is structured according to a clear methodical checklist valid for any infrastructure and is, therefore, reproducible. The evaluation systems for sustainable infrastructures differ in their choice of credits, their organization, and the importance attached to each [75] and it is, therefore, possible to assess Envision's adherence to the SDGs by verifying which aspects the 59 credits cover.

The methodology proposed and applied is divided according to two parallel approaches of identifying the relationships between the objectives expected by the Envision protocol and the SDGs. In this way, it was possible to achieve two comparable results that best summarize the relationship. The first approach is based on a process of analogy and similarity of intentions; the second involves a weighted application between the targets of the SDGs and the Envision score attributions (Figure 2).

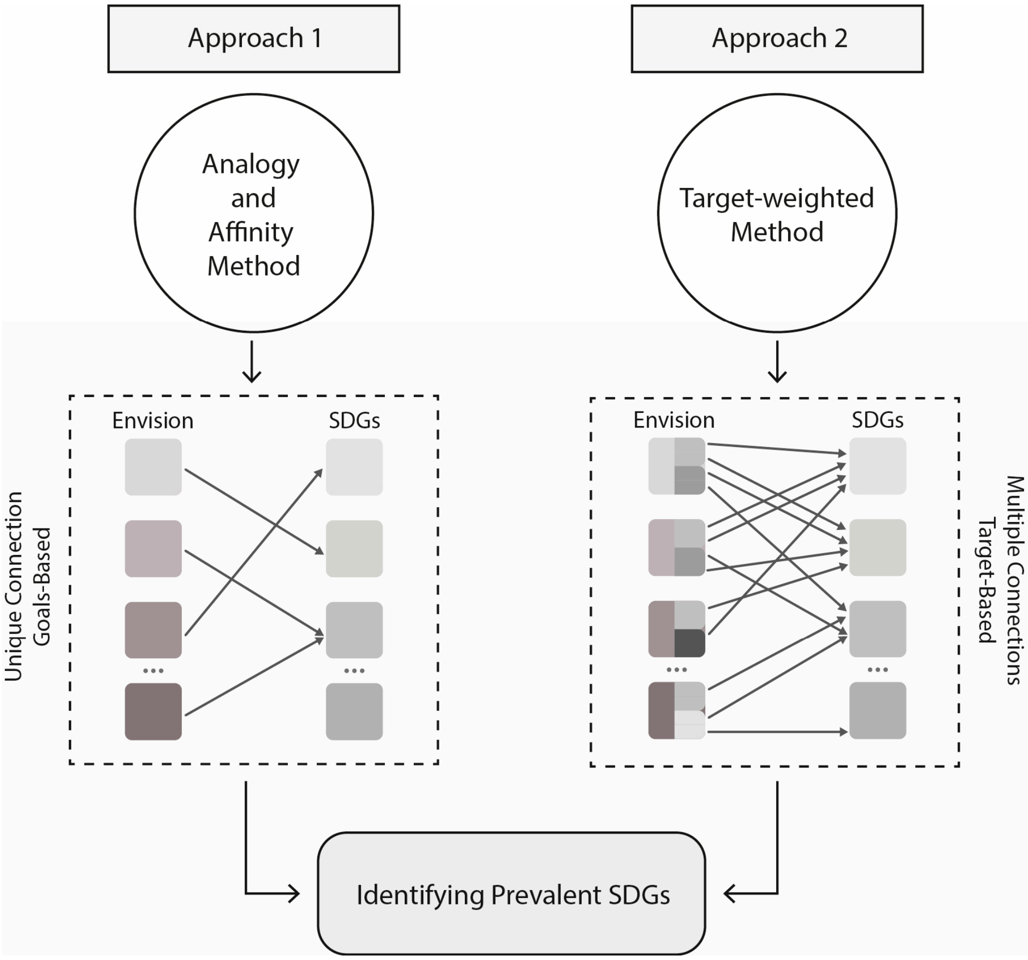

Figure 2. A logical diagram of the two parallel approaches used to determine the relationship and relevance between SDGs and Envision. Graphic elaboration by the authors.

The analogy and affinity approach is a method that identifies an unambiguous relationship between the objectives that make up the Envision protocol and the SDGs, synthetically it can be defined as a Goals-Based method. From the reading and analysis of the "intents" outlined in the protocol, a description more in line with those of the objectives underlying the 17 SDGs was added. Therefore, each Envision criterion corresponds to one of the SDGs. This process was carried out individually by each researcher and then the results obtained were shared and discussed. Finally, for each of the SDGs, the relative weight they hold within the overall score through which the sustainability of an infrastructure is determined according to Envision was calculated, both individually and for each of the 5 areas (Figure 3).

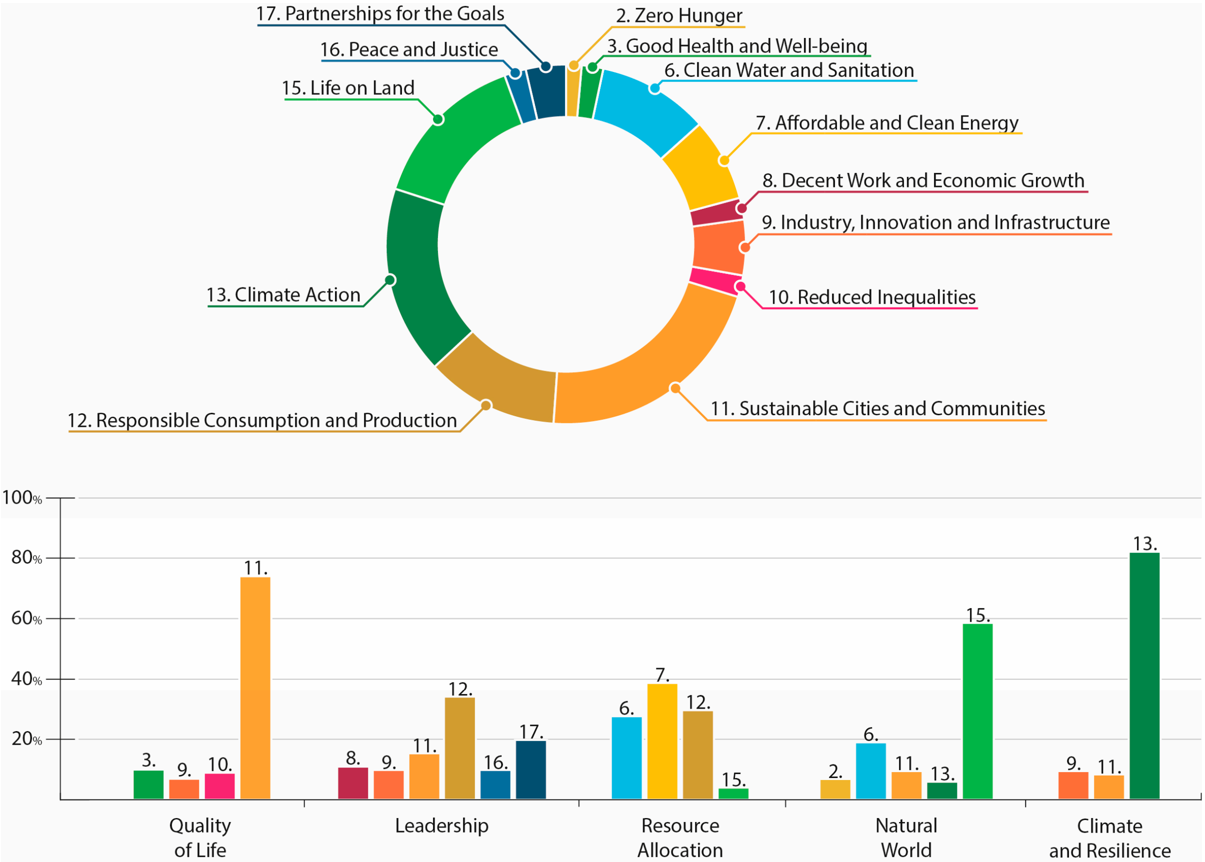

Figure 3. At the top, the graph highlights the percentage values that each identified SDGs covers in the overall Envision scores. The histogram below highlights that there are predominant SDGs within the 5 competence areas: Quality of Life, Leadership, Resource Allocation, Natural World, Climate, and Resilience.

The above analysis, while effective in providing a preliminary overview of the weight of the SDGs in Envision's five areas, has limitations in terms of depth. Since, Envision takes a step-by-step approach to measuring the sustainability of infrastructure, assigning increasing scores to each criterion, generally varying from the 'Improved' level to the 'Restorative' level, concerning the adherence to specific project characteristics (Figure 3), it was decided to apply a second, more target-based methodology (Figure 4). This relates to the individual Envision targets and the observations required to move from one score level to the next with the targets that make up the SDGs. This procedure is more detailed and thoughtful than the individual steps that the protocol requires for its attestation. The Envision checklist not only delineates the targets of each criterion, which is fundamental for the above analysis, but also provides detailed conditions necessary to reach the subsequent levels. Moreover, compared to the methodology used in the first Goals-Based step of our analysis, given the greater level of detail, multiple matches with the SDGs were also assessed. Indeed, it was found that several Envision steps recalled more than one target of the SDGs. Furthermore, to reduce randomness in the correlations, possible indirect spillovers to areas concerning other SDGs were not considered. This process would have detached and overcomplicated the path identified with the objective that this article aims at to have a clear picture of the sustainability of infrastructures through a relationship with the SDGs.

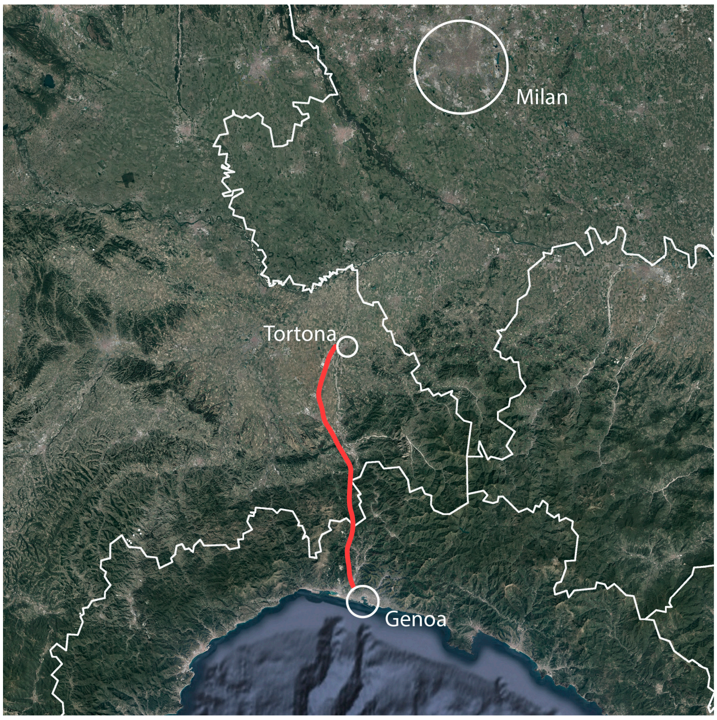

Figure 4. TV layout. Satellite image acquired from Google Earth with post-processing by the authors.

To calculate the weight of each of the SDGs within the protocol, the scores recognized by Envision were added to the levels to which they were related. If two SDGs were assigned to a single level, the respective scores were divided equivalently. Finally, the aggregation of the scores associated with each SDG between the levels of the 59 criteria made it possible to identify which SDGs are being pursued and to what extent within the protocol. As with the previously proposed methodology, the analyses and attributions of the SDGs were performed separately by both authors, and then compared and synthesized into a single output of results.

The results obtained from the two methodologies used to describe the relevance of the Envision targets to the SDGs are comparable (Table 1). The most substantial difference can be seen in the exchange of weight between SDGs 12 and 13—"Responsible Consumption and Production" and "Climate Action"—but with variations of less than 5%. Given the cross-cutting impacts that characterize an infrastructure project [20,29,76], it is evident that the Envision protocol considers almost all of the SDGs, albeit with significant variations between them.

Table 1. The table summarizes and compares the results obtained from the application of the two proposed methodologies.

SDGs		Approach 1 Goals-Based [%]	Approach 2 Targets-Based [%]
1.	No Poverty	0.00	0.00
2.	Zero Hunger	1.60	2.75
3.	Good Health and Well-being	2.00	2.95
4.	Quality Education	0.00	0.45
5.	Gender Equality	0.00	0.00
6.	Clean Water and Sanitation	9.80	9.25

Table 1. *Cont.*

SDGs		Approach 1 Goals-Based [%]	Approach 2 Targets-Based [%]
7.	Affordable and Clean Energy	7.60	8.00
8.	Decent Work and Economic Growth	2.00	2.75
9.	Industry, Innovation, and Infrastructure	5.00	2.50
10.	Reduced Inequalities	1.80	1.45
11.	Sustainable Cities and Communities	21.40	20.15
12.	Responsible Consumption and Production	12.00	16.85
13.	Climate Action	17.00	13.55
14.	Life Below Water	0.00	0.00
15.	Life on Land	14.40	12.30
16.	Peace and Justice	1.80	2.85
17.	Partnerships for the Goals	3.60	4.20

From the analysis conducted, in the first position is Goal 11, "Sustainable Cities", with more than 20%, highlighting the protocol's commitment to encouraging the participation of all stakeholders. This aspect is further underlined by the points accumulated in the context of Goal 17, emphasizing the protocol's commitment to ensuring rapid project implementation. The high percentage attributed to Goal 11 can be explained by its inherent cross-cutting nature and the role of infrastructure in the development of sustainable cities [77].

Further considerations will be discussed in Section 6.1—SDGs in Envision Protocol.

4. Case Study and Application of the Method

In this section, the methodology proposed in Section 3 is validated by applying it to assessment methodologies such as the EMAS protocol of a specific infrastructure. Section 4.1 introduces the Terzo Valico dei Giovi, the infrastructure work to which the EMAS certification in question refers. Subsequently, in Section 4.2, the application of the methodology expressed above to this case study is reported to verify its relevance to the SDGs that emerged in Section 3.

4.1. Terzo Valico Del Giovi

The case study selected for this article is the Terzo Valico dei Giovi-Nodo di Genova (TV). This was chosen because of its strategic importance in Italian infrastructure planning, because of the engineering scope of the work, and, finally, because one of the authors was hosted for a six-month research period at the environmental management offices of the general contractor: Consorzio Collegamenti Integrati Veloci (COCIV). The successful outcome of such a complex project depends on finding the compromise between the required construction performance, deadline, cost, safety, logistical constraints, and working conditions, always taking into account compliance with environmental regulations [78].

The TV is a railway infrastructure currently under construction. Its path extends between Genoa and Tortona mainly in a natural tunnel, with the primary objective of optimizing the connections of the Ligurian port system and improving the connections between northern Italy and central Europe (Figure 4).

The project includes the construction of 36 km of tunnels, out of the total 53 km of the line, with a total underground excavation that, considering accessory tunnels, reaches 88 km and a total production of muck equal to 16 million m^3 [13]. The pass tunnel alone, with its 27 km, is currently one of the longest in the world; it crosses various geological formations, in a complex scenario linked to challenging geotechnical conditions and the presence of asbestos and methane gas [79].

The first procedures for the realization of the TV date back to 1991 with the start of the national policy for the construction of new high-speed railway lines. It was only in 2012 that the start of the works was achieved after years of denied outcomes through the EIA procedure; the completion of the works is scheduled for June 2025.

The infrastructure is realized by the COCIV consortium against an expenditure of EUR 6.9 billion, 3.4 of which comes from National Recovery and Resilience Plan [80] fund, is classified as a national strategic infrastructure [81], and is also included in the EU TEN-T policy [4] as the Mediterranean terminus of the Rhine-Alps corridor. The synergy that will be created between the Genoese port and the TEN-T will make it possible to maximize the growth in the commercial traffic expected thanks to the upgrading work being carried out in the Genoese port [78].

COCIV in the analysis of the strategies to be pursued since 2012 is assisted by the Environmental Observatory (EO), which consists of representatives from the Higher Institute of Health, ministries, regions, provinces, and the Regional Agency for Environmental Protection (Arpa) involved [82]. Moreover, to identify solutions capable of certifying the sustainable approach to the construction of the infrastructure, since 2018, COCIV has relied on the ISO 14001 standard and, since 2020, on the EMAS Regulation, with which it maintains control over the environmental impacts that the work generates on seven directives: air, water, waste, hazardous waste, soil, road, and noise.

COCIV, for TV, obtained EMAS certification to optimize business processes, reducing environmental impacts, effectively managing resources, and promoting dialogue with stakeholders. Based on the results shown by the environmental indicators, the protocol defines appropriate actions aimed at pursuing the principle of continuous improvement. The protocol pays special attention to relevant environmental aspects and related investments. The organizational context, stakeholders, performance indicators, and environmental targets complete the picture, providing an overview of environmental initiatives.

The EMAS protocol is subject to verification by the EO via Audit. EMAS identifies the Significant Environmental Aspects (SEAs) according to the type of work, and for each of which indicators are calculated to define any actions necessary to manage and mitigate them. Therefore, it is necessary to pursue a procedure for the identification of SEAs, the most important elements in an EMS [11], although at the same time, their definition represents one of the most problematic parts of the implementation of an EMS [83]. The EMAS regulation does not establish a method for assessing SEAs, but only provides some general guidelines [84]. The criteria on which they are defined must be comprehensive, susceptible to independent verification, and reproducible. These criteria may include issues related to material and energy flows, water resources, waste, biodiversity, emissions, as well as stakeholder opinions [47,49,84].

To identify the SEAs of the TV, COCIV follows a top-down process defined in the company's environmental analysis. The first stage of the analysis delves into existing policies, specific risk elements, sector plans, and construction processes and encapsulates all within an Environmental Management Plan. The environmental risk aspects are organized in a summary table according to the work performed [13]. Each process is assessed individually against each environmental aspect by calculating the risk of generating a negative environmental impact. Following this procedure, SEAs are identified where a high risk is identified (Figure 5). The analysis considers all activities, even those not directly managed by the consortium, for reasonably foreseeable operating conditions and abnormal/emergencies. The perspective adopted covers the entire life cycle of the work, with a sensitivity relationship based on impact management efficiency, relevance, and sensitivity: vulnerability concerning the territory and stakeholder perception [13].

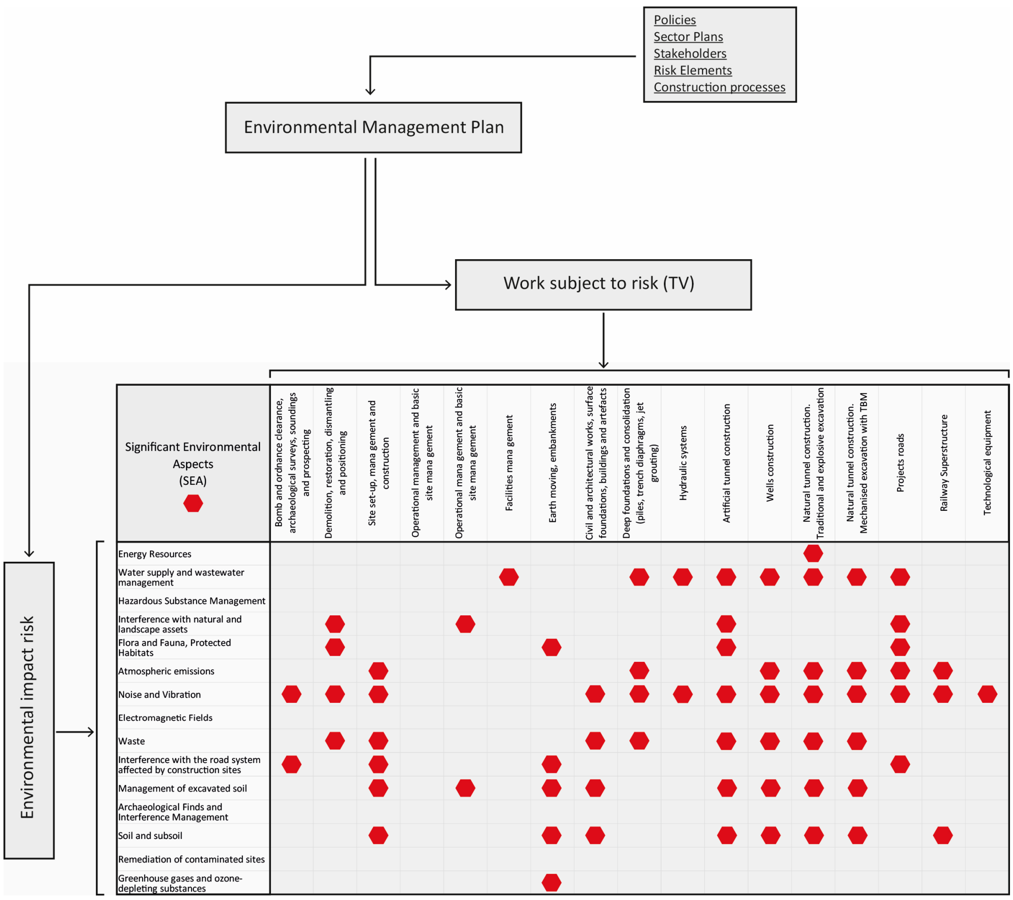

Figure 5. Logical scheme by which SEAs are identified. Graphic reworking by the authors based on the Environmental Statement [13].

More particularly, the EMAS environmental statement addresses the management of excavated soil: of the 16 million m3, a part will be reused within construction sites and the majority will be used as a by-product for the environmental rehabilitation of former borrow pits [13]. Therefore, the management of these muck volumes presents economic and environmental challenges related to transport and storage to enable its reuse [85] while avoiding its disposal as waste. At the same juncture, the handling that takes place mainly via road vehicles is considered, for which emissions and fuel consumption are monitored [13]. An important additional challenge is the presence of natural asbestos along the route of the work. Consequently, a specific asbestos risk management protocol has been developed and approved to mitigate its possible impacts [86].

4.2. SDGs Evaluation on TV EMAS Protocol

After analyzing the adherence of the Envision protocol to the SDGs in Section 3.1, the same target-based approach was used in our case study to check the correspondence between the SEAs identified in the TV environmental statement and the SDGs.

To assess the alignment of the TV's EMAS protocol with the SDGs, it is possible to use the significance table of environmental aspects [13], associating the SDGs with the 66 identified SEAs. The analysis was started by independently considering each of the areas identified in the rows of the table (Figure 5), concerning the associated or associable works. Similarly, to the operation carried out for the Envision protocol, the definitions of the 169 Targets that make up the SDGs were carefully examined to identify the underlying objectives. Subsequently, up to two SDGs were attributed to each SEA that were deemed to be predominantly pursued by comparing the TV-Targets SDGs.

The assignment was made considering the nature of the infrastructure and the impact of the operations on the areas being monitored, based on the in-depth studies in the EMAS protocol. In particular, the assignment of the SDGs was based on the analysis of the indicators defined in the protocol to monitor the effectiveness of preventive actions and to implement corrective ones. Where no specific indicators were defined, the attribution was based on the characteristics of the work and the area where the work is performed. To minimize randomness in the correlations, any indirect effects on areas related to other SDGs were not considered. The quantification of the weight of each SDG within the EMAS protocol provided for the assignment of one point for each SEA and, consequently, one point for each related SDG. In cases where two SDGs were assigned to a single SEA, the scores were distributed equivalently. Finally, the aggregation of the scores associated with each SDG made it possible to identify the SDGs pursued and their scope within the TV's EMAS protocol. The analysis shows that nine SDGs with different emphases are considered in EMAS certification (Table 2).

Table 2. Summary table of prevailing SDGs from the Target-Based approach applied to TV.

SDGs		Approach Targets-Based [%]
1.	No Poverty	0.00
2.	Zero Hunger	0.00
3.	Good Health and Well-being	9.09
4.	Quality Education	0.00
5.	Gender Equality	0.00
6.	Clean Water and Sanitation	6.06
7.	Affordable and Clean Energy	0.76
8.	Decent Work and Economic Growth	2.27
9.	Industry, Innovation, and Infrastructure	26.52
10.	Reduced Inequalities	0.00
11.	Sustainable Cities and Communities	9.85
12.	Responsible Consumption and Production	15.91
13.	Climate Action	12.88
14.	Life Below Water	0.00
15.	Life on Land	16.67
16.	Peace and Justice	0.00
17.	Partnerships for the Goals	0.00

The analysis shows that the SDG predominantly addressed is SDG 9, 'Innovation and Infrastructure,' with over 26% of the total, given the crucial role played in surveys, prospecting, and excavation and rehabilitation activities. This result is consistent with the nature of certification applied specifically to infrastructure works. Further considerations will be discussed in Section 6.2—SDGs in TV's EMAS certification—as they are useful for comparison with the Envision protocol analyzed above.

5. Results

In the following section, the results obtained from the application of the two Target-based methodologies (described in Section 3.1 above) on the Envision–SDGs relationship and the TV–SDGs relationship will be analyzed more particularly (Table 3). In presenting this comparison, the authors want to focus not only on the points of the greatest difference between the results obtained but, above all, on the points of commonality. Similar results between Envision and the analyzed case study, the EMAS of TV, are at the basis of the validation of the proposed methodology and this ensures that theoretically indispensable SDGs can be identified to determine the maintainability of transport infrastructure.

Table 3. Summary table comparing the results of the two Target-based methodologies applied to Envision and TV's EMAS environmental statement, respectively.

SDGs		Envision–SDGs [%]	Emas TV–SDGs [%]
1.	No Poverty	0.00	0.00
2.	Zero Hunger	2.75	0.00
3.	Good Health and Well-being	2.95	9.09
4.	Quality Education	0.45	0.00
5.	Gender Equality	0.00	0.00
6.	Clean Water and Sanitation	9.25	6.06
7.	Affordable and Clean Energy	8.00	0.76
8.	Decent Work and Economic Growth	2.75	2.27
9.	Industry, Innovation, and Infrastructure	2.50	26.52
10.	Reduced Inequalities	1.45	0.00
11.	Sustainable Cities and Communities	20.15	9.85
12.	Responsible Consumption and Production	16.85	15.91
13.	Climate Action	13.55	12.88
14.	Life Below Water	0.00	0.00
15.	Life on Land	12.30	16.67
16.	Peace and Justice	2.85	0.00
17.	Partnerships for the Goals	4.20	0.00

With comparable percentage weights, SDGs 12, 13, and 15—"Responsible Consumption and Production", "Climate Action", and "Life on Land"—together exceed 40.00% of the total (Table 3). From this, it can be deduced that the sustainable development of an infrastructure, regardless of the matrix of origin of its evaluation, takes more into consideration the reduction of energy consumption and natural resources by acting directly on the productive efficiency of the company (SDG 12), the fight against climate change by reducing emissions both during construction and by promoting conscious use (SDG 13), and the protection and preservation of the environmental conditions with which it will interfere (SDG 15). Three main conditions, therefore, emerge: economic and social sustainability given by SDG 12 and the reduction of its environmental footprint and its spill-over effects on the territory, SDGs 13 and 15.

From the application of Envision's methodology, significant results are observed in the goals oriented toward environmentally sustainable development and concerted planning with all stakeholders. The SDG 11 (Section 3.1) accounts for more than 20% of Envision's total score. In second place is Goal 12 which influences the design of the infrastructure and is positively reflected up to the decommissioning phase. This is followed by Goal 13, "Climate Action", which is not only a fundamental requirement for the realization of the project, but also emphasizes the positive impacts once the infrastructure is in operation, and Goal 11, which rewards the identification of areas in which the realization of the infrastructure limits ecosystem damage. Also, from an environmental perspective, the scores given to SDGs 6 and 7, "Clean Water" and "Clean Energy", which play a crucial role in both the construction and operation phases of the work, are explained.

The validation of the methodology, through its application to the TV EMAS case study, shows a prevailing focus on SDG 9, "Industry, Innovation, and Infrastructure", with 26.52%, followed by, in order: "Life on Land", with almost 17%, "Responsible Consumption and Production", with almost 16%, and "Climate Action", at 12.88%. Other SDGs considered significantly are 11, "Sustainable Cities", and 3, "Good Health and Well-being", both with values of around 10%. The methodology then recognizes a value of 6% for SDG 6, "Clean water", and residual values for Goals 8 and 7. The remaining SDGs, 1, 2, 4, 5, 10, 14, 16, and 17, are not addressed by the TV EMAS protocol.

6. Discussion

This section discusses the results explained in Section 5, obtained thanks to the methodological application proposed in Section 3 and validated in Section 4. The focus will be, firstly, in Section 6.1, on the results that emerged from the application of the methodology to the Envision protocol, then on the evidence that emerged from the validation obtained through the application to the real case in Section 6.2, and finally, in Section 6.3, the evidence that can be deduced thanks to the present article is presented.

6.1. SDGs in the Envision Protocol

The application of the methodology shows that the Envision Protocol pursues all SDGs with the exception of 1 and 5, showing a substantial adherence to the policy defined by the UN. Specifically, as anticipated in Section 5, those pursued in a prevalent manner are 11, "Sustainable Cities and Communities", 12, "Responsible Consumption and Production", and 13, "Climate Action", which weigh in at 50% of the total. Other relevant results are reached by SDG 15, "Life on Land", 6, "Clean Water", and 17, "Partnerships for the Goals". Finally, although in a marginal way, it also considers SDGs 2, 3, 4, 8, 10, and 16. This evidence can be plausibly justified considering the specific context in which the infrastructure is located. Envision is an evaluation perspective oriented towards an advanced and highly developed infrastructure context, in which the pursuit of the SDGs in question is perceived as less urgent [87]. Therefore, the application of Envision to less developed contexts may need substantial adaptations to make it more congruent with the infrastructural assessment of the specific geographic area and, consequently, with the SDGs that are imperative in that context [88]. This need becomes even more imperative in developing countries, which are often characterized by a limited implementation of environmental regulations, leading to greater complexity in the adoption of sustainable assessment systems [70].

The only SDGs not directly addressed by any criteria are 1, "No poverty", and 5, "Gender equality", although infrastructure contributes to national development, social development, the accessibility of services, and resilience, elements that are, nevertheless, considered by Envision and fall under SDGs 9, 10, 11, and 13. However, it is indicated how efforts aimed at a more equitable economic distribution could also be evaluated, e.g., by considering actions aimed at ensuring the use of local materials and labor [89], if necessary, also through a monitoring plan. A different matter, however, must be reserved for Goal 5. Although Envision can contribute to promoting more sustainable environments and inclusive communities through the involvement of stakeholders, it does not explicitly refer to the gender equality issues addressed by SDG target 5.5: "Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life Indicators" [65].

Finally, it is useful to focus on analyzing the percentage achieved by SDG 9, "Industry, Innovation and Infrastructure", which is the one that is most directly aimed at the realization of new infrastructures. This value could be explained in that, more generally, it is the protocol itself that ensures the pursuit of this goal, unless it then declines in the multiplicity of interests concerning infrastructure works.

6.2. SDGs in TV's EMAS Certification

As anticipated in Section 4.2, the application of the methodology shows that the SDG predominantly addressed by the certification is SDG 9, consistent with the nature of the certification, which is related to a large infrastructure project. This is followed by the aforementioned "Life on Land", "Responsible Consumption and Production", and "Climate Action" SDGs, which highlight the high risks associated with natural, landscape, and environmental assets, as well as those arising from the incorrect use of excavated materials.

Despite the specific nature of the infrastructure, concentrated mainly on excavation activities, the methodology confirms the centrality of Goals 13 and 15, corroborating what Ikrma et al. stated in 2021 [90]. Goal 11, "Sustainable Cities," follows with almost 10% concerning interference with the road network affected by construction sites. Objective 3, "Good Health," with 9%, reflects the measures taken to ensure the safety and health of operators during construction activities, as evidenced in the management of asbestos [86]. With 6%, Goal 6, "Clean Water," is addressed by drawing on local wells and groundwater, in compliance with established limits [13]. Finally, the SDGs with residual values, Goal 8, "Decent Work," and Goal 7, "Clean Energy," indicate the presence of risks for social impacts and the adoption of sustainable energy practices in activities, although with lower risks.

The results of the analysis of the SDGs in the context of the case study provide generalizable insights into the adherence of all EMS certifications to the SDGs; in particular, it is effective to focus on the SDGs excluded from certification. The absence of SDGs such as 1, 2, and 4 is consistent with the socio-economic nature in which EMS is embedded and the goals that the infrastructure sets. More significant is the absence of SDGs such as 17, the pursuit of which has strongly characterized the implementation process of the work through consultations between public authorities and stakeholders, and whose most evident consequence is represented by the institution of the Environmental Observatory. Similarly, Goal 7 may appear underestimated, to which a residual value of less than 1% is associated, despite the efforts to reduce fuel use and the energy required by mechanized excavation via the Tunnel Boring Machine.

These shortcomings may be attributable to the methodology that characterizes all EMS certifications that focus exclusively on SEAs, that is, on those aspects for which a high environmental risk emerges. These procedures, therefore, prevent a more complete assessment of the work and its phases, neglecting crucial aspects that, although raised by the work, are considered environmentally less risky according to sensitivity analyses. Consequently, their application does not ensure the implementation of strategies aimed at achieving the best performance in all the fields of the SDGs relevant to the infrastructure.

6.3. Emerging Consequences

If the path to achieving sustainability is not based on deep-rooted general principles, such as the SDGs, there is a risk of solving the current problems of sustainable development and creating new problems not previously present or not considered. Assuming the SDGs as a point of reference for sustainable development, the methodology proposed in this article demonstrates that Envision is more suitable for pursuing sustainable development than the EMAS protocol. Since the criteria that companies voluntarily decide to comply with and prioritize in environmental impact assessments are identified and determined through an internal procedure that is subsequently validated, there is still the risk of having a limited view of the sustainability of the entire life cycle of infrastructure: design, construction, use, maintenance, and future decommissioning. In this situation, a conflict is generated between a corporate approach that pursues profit and internal economic stability, which can also be achieved through the benefits associated with sustainability certifications, and a fragmented description of the procedure that does not form a unitary vision of the entire process and, consequently, complicates the assessment of the sustainability of an infrastructure. Thus, it could be said that the set of criteria through which a company plans its activities to promote sustainable development are aimed at the construction of the infrastructure and not at its complete sustainability.

On this basis, the EIA becomes a tool for political action to motivate an initial investment in the creation of a strategic infrastructure; ISO14001 and EMAS can be thought of as industrial certifications through which the company approach is rewarded, and, finally, Envision represents a voluntary approach suited to the size of the work. From this representation, it emerges how the adequate assessment of the environmental impact of infrastructure over time is provided by a voluntary tool such as Envision, while in other cases, sustainable development takes on a supporting role in the construction and management process of infrastructure.

6.4. Limitation of the Research

The proposed methodology assesses the congruence of the evaluation instruments with the SDGs, assuming that the project's adherence to them can guarantee the pursuit of sustainable development. It should be pointed out that this assumption, however, overlooks one of the two meanings to which the term "sustainability" can be referred. This is because it can encompass, on the one hand, policy commitments such as the SDGs and, on the other, the actual needs of the planet, which includes the concept of "planetary boundaries" [91]. This concept, highlighted in the disparities between resource use and social outcomes found in societies [92], underlines how the pursuit of sustainable development through adherence to the SDGs may overlook some elements of sustainability not addressed by the policy outlined by the UN.

The methodology proposed in Section 3 and applied to the case study in Section 4 adds to the large number of indicator-based approaches to assessing social and environmental impacts. Although this approach is recognized as valid for understanding whether human activities are compatible with sustainable development [93], it may compromise the restitution and interpretation of data. In fact, according to the concept of a "safe operating space for humanity" [91,92,94,95], there is a risk of using tools designed primarily for contexts of already developed countries, neglecting their limited applicability in different contexts.

A methodological limitation presented in this article can be identified in the choice of the Envision protocol alone as the evaluation criteria of relevance to the SDGs. The choice of this tool is motivated by its specific design for the evaluation of infrastructures while being adaptable to different types of projects. To ensure more robust results and a more reliable SDGs adherence framework, it will be necessary to consolidate the statistical basis by applying it again to the other existing infrastructure assessment tools [89].

In this paper, we have also started by showing an application of the methodology to a real case, the EMAS protocol of the TV, but even in this case, to obtain a greater validation of the procedure, one of the possible future developments of the research is its more widespread application to other real cases.

For the same need to validate the methodology with a larger sample, it will be necessary to extend its application to other real cases. In fact, in Section 4 of the paper, the authors limited themselves to presenting an example of a concrete case, represented by TV's EMAS protocol. While this limits the reliability of the proposed conclusions, it is considered that it does not compromise their validity. The case study was sufficient to demonstrate that not all SDGs were addressed by the certification. However, to increase the validity of the procedure, one of the potential developments of the research is to extend the application to a wider range of concrete cases.

A further critical aspect concerns the arbitrariness of the correlations established between the SDGs on the one hand and Envision and EMAS on the other. A greater standardization of the process is deemed necessary in order to minimize the risk arising from the subjective interpretations by which authors related the various targets to the SDGs. To mitigate this risk, the correlations made by the researchers were compared and mutually motivated in such a way as to reach a single, common result.

7. Conclusions

This paper introduces a methodology, applied to the Envision protocol, to test the adherence of these tools to the SDGs, taken by the authors as a benchmark for the pursuit of sustainable development. The attempted validation of the methodology through its application to a case study shows different degrees of alignment with the SDGs according to the tool used.

However, it is no coincidence that when dealing with these certifications, the focus shifts from the infrastructure to the company. An initial analysis shows that the substantial difference between Envision and EMSs is the object of application, on the one hand, the work, and on the other, the activities promoted by the implementing company, despite the common objective being the promotion of sustainable development.

This difference is made clear by the analysis of the SDGs, which showed that the Envision protocol is better suited to their pursuit, in the context of major transport infrastructure projects. This implies, in fact, a more complete management of the different aspects involved in the construction of a work, while EMS certifications, considering only the environmental aspects with a higher environmental risk, precisely emphasize the mitigation actions introduced by companies. The fact that the Envision protocol is applied less frequently than ISO14001 and EMAS in the European context is, therefore, significant considering its greater adherence to the SDGs established at an international level, even though this protocol was not explicitly designed with this aim.

This article is the first step in deeper research on the analysis of evaluation tools for sustainable infrastructures. In the future, the proposed methodology can be validated with a broader statistical basis by applying it to other sustainability protocols than Envision and other case studies.

Author Contributions: Conceptualization, methodology, writing, review, editing, and visualization was carried out by D.S. and G.I.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are contained within the article.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. United Nations (UN). *Transforming Our World: The 2030 Agenda for Sustainable Development—A/RES/70/1 UNITED*; United Nations: New York, NY, USA, 2016.
2. United Nations. Department of Economic and Social Affairs. In *The Sustainable Development Goals Report 2022*; United Nations: New York, NY, USA, 2022.
3. Afman, B.E.; Engels, S.; Langedijk, S.; Pfeiffer, P.; Recovery, T. An Overview of the Economics of the Recovery and Resilience Facility. *Q. Rep. Euro Area* **2021**, *20*, 7–16.
4. The European Parliament and the Council Regulation (EU) 1315/2013 of 11 December 2013. *Off. J. Eur. Union* **2013**, 1–128. Available online: https://publications.europa.eu/resource/cellar/f277232a-699e-11e3-8e4e-01aa75ed71a1.0006.01/DOC_1 (accessed on 9 December 2023).
5. Erki Savisaar. Stockholm+50: A Healthy Planet for the Prosperity of All—Our Responsibility, Our Opportunity. a/Conf.238/9 2022. 1–28. Available online: https://www.stockholm50.global/ (accessed on 9 December 2023).
6. European Court of Auditors. Greenhouse Gas Emissions in the EU: Reporting Is Adequate, but a Better Understanding of Future Reductions. 2019. Available online: https://www.eca.europa.eu/Lists/ECADocuments/SR19_18/SR_Greenhouse_gas_emissions_EN.pdf (accessed on 9 December 2023).
7. United Nations Office for Project Services. Infrastructure for Climate Action. 2021, 70. Available online: https://content.unops.org/publications/Infrastructure-for-climate-action_EN.pdf (accessed on 9 December 2023).
8. Ortega, E.; Martín, B.; Gonzalez, E.; Moreno, E. A Contribution for the Evaluation of the Territorial Impact of Transport Infrastructures in the Early Stages of the EIA: Application to the Huelva (Spain)–Faro (Portugal) Rail Link. *J. Environ. Plan. Manag.* **2016**, *59*, 302–319. [CrossRef]

9. Council of European Communities. *Directive on the Assessment of the Effects of Certain Public and Private Projects on the Environment —85/33 7/EEC*, 1985; Volume 175/40.
10. Robèrt, K.H. Tools and Concepts for Sustainable Development, How Do They Relate to a General Framework for Sustainable Development, and to Each Other? *J. Clean. Prod.* **2000**, *8*, 243–254. [CrossRef]
11. Whitelaw, K. *ISO 14001 Environmental Systems Handbook*; Routledge: Abingdon-on-Thames, UK, 2012; ISBN 9781136391576.
12. Li, M.; Zhou, X.; Liu, J.; Ma, W.; Li, X. Topological Modeling and Analysis of Urban Rail Transit Safety Risk Relationship. *J. Intell. Manag. Decis.* **2022**, *1*, 108–117. [CrossRef]
13. COCIV. (Consorzio Collegamenti Integrati Veloci) Dichiarazione Ambientale. Available online: https://www.terzovalico.it/static/upload/dic/dichiarazione-ambientale-2023_signed.pdf (accessed on 1 December 2023).
14. Calderon, C.; Servén, L. Infrastructure and Growth. In *The New Palgrave Dictionary of Economics*; Palgrave Macmillan: London, UK, 2014; pp. 1–9. [CrossRef]
15. Prud'homme, R. *Infrastructure and Development*; World Bank: Washington, DC, USA, 2005; ISBN 978-0-8213-6021-7.
16. Crescenzi, R.; Rodríguez-Pose, A. Infrastructure and Regional Growth in the European Union. *Pap. Reg. Sci.* **2012**, *91*, 487–513. [CrossRef]
17. Smith, A. *An Inquiry into the Nature and Causes of the Wealth of Nations*; Oxford University Press: Oxford, UK, 2008.
18. Ingram, G.; Kessides, C. Infrastructure for Development. *Atlas Glob. Dev.* **2013**, 74–77. [CrossRef]
19. Cornes, R.; Sandler, T. *The Theory of Externalities, Public Goods, and Club Goods*; Cambridge University Press: Cambridge, UK, 1996; ISBN 9781139174312.
20. Hulten, C.R.; Bennathan, E.; Srinivasan, S. Infrastructure, Externalities, and Economic Development: A Study of the Indian Manufacturing Industry. *World Bank Econ. Rev.* **2006**, *20*, 291–308. [CrossRef]
21. Dahlman, C.J. The Problem of Externality. *J. Law Econ.* **1979**, *22*, 141–162. [CrossRef]
22. Profillidis, V.A.; Botzoris, G.N.; Galanis, A.T. Environmental Effects and Externalities from the Transport Sector and Sustainable Transportation Planning—A Review. *Int. J. Energy Econ. Policy* **2014**, *4*, 647–661.
23. Chapman, L. Transport and Climate Change: A Review. *J. Transp. Geogr.* **2007**, *15*, 354–367. [CrossRef]
24. Platje, J.; Paradowska, M.; Will, M. Limits to Positive Externalities of Transport and Infrastructure. In Proceedings of the International Scientific Conference "ECOTREND 2017", Targu Jiu, Romania, 20–21 October 2017; pp. 455–461.
25. Abdel-Raheem, M.; Ramsbottom, C. Factors Affecting Social Sustainability in Highway Projects in Missouri. *Procedia Eng.* **2016**, *145*, 548–555. [CrossRef]
26. Viesti, G. The Territorial Dimension of the Italian NRRP. In *The Regional Challenges in the Post-Covid Era*; Caloffi, A., De Castris, M., Perucca, G., Eds.; Franco Angeli srl: Milano, Italy, 2022; pp. 201–217. ISBN 9788835142256.
27. Levinson, D.M.; Gillen, D.; Kanafani, A. The Social Costs of Intercity Transportation: A Review and Comparision of Air Ahd Highway. *Transp. Rev.* **1998**, *18*, 215–240. [CrossRef]
28. Chatziioannou, I.; Alvarez-Icaza, L.; Bakogiannis, E.; Kyriakidis, C.; Chias-Becerril, L. A Structural Analysis for the Categorization of the Negative Externalities of Transport and the Hierarchical Organization of Sustainable Mobility's Strategies. *Sustainability* **2020**, *12*, 6011. [CrossRef]
29. Zhu, L.; Zhang, L.; Ye, Q.; Du, J.; Zhao, X. A Three-Dimensional Evaluation Model of the Externalities of Highway Infrastructures to Capture the Temporal and Spatial Distance to Optimal—A Case Study of China. *Buildings* **2022**, *12*, 328. [CrossRef]
30. Raicu, S.; Costescu, D.; Popa, M.; Rosca, M.A. Including Negative Externalities during Transport Infrastructure Construction in Assessment of Investment Projects. *Eur. Transp. Res. Rev.* **2019**, *11*, 24. [CrossRef]
31. Pratt, C. Estimation and Valuation of Environmental and Social Externalities for the Transport Sector. In Proceedings of the 25th Australasian Transport Research Forum—Incorporating the BTRE Transport Policy Colloquium, Canberra, Australia, 2–4 October 2002; pp. 847–860.
32. Coppola, P.; Deponte, D.; Vacca, A.; Messa, F.; Silvestri, F. Multi-Dimensional Cost-Effectiveness Analysis for Prioritizing Railway Station Investments: A General Framework with an Application to the Italian Case Study. *Sustainability* **2022**, *14*, 4906. [CrossRef]
33. *European Commission Regulation of the European Parliament and of the Council on Union Guidelines for the Development of the Trans-European Transport Network, Amending Regulation (EU) 2021/1153 and Regulation (EU) No 913/2010 and Repealing Regulation (EU) 1315/2013*; United Nations: New York, NY, USA, 2021.
34. United Nations (UN). *Report of the World Commission on Environment and Development: Our Common Future*; United Nations: New York, NY, USA, 1987.
35. Roy, S.; Debnath, P.; Vulevic, A.; Mitra, S. Incorporating Climate Change Resilience in India's Railway Infrastructure: Challenges and Potential. *Mechatron. Intell. Transp. Syst.* **2023**, *2*, 102–116. [CrossRef]
36. Pavlickova, K.; Vyskupova, M. A Method Proposal for Cumulative Environmental Impact Assessment Based on the Landscape Vulnerability Evaluation. *Environ. Impact Assess. Rev.* **2015**, *50*, 74–84. [CrossRef]
37. Glasson, J.; Therivel, R. *Introduction to Environmental Impact Assessment*; Routledge: London, UK, 2012; ISBN 2011026482.
38. Leknes, E. The Roles of EIA in the Decision-Making Process. *Environ. Impact Assess. Rev.* **2001**, *21*, 309–334. [CrossRef]
39. Gharehbaghi, K.; Hosseinian-Far, A.; Hilletofth, P. The Predicaments of Environmental Impact Assessment (EIA) for Transport Infrastructure: An Examination of Policy Stagnation and Progress. *Transform. Gov. People Process Policy* **2022**, *16*, 449–463. [CrossRef]

40. Celauro, C.; Cardella, A.; Guerrieri, M. LCA of Different Construction Choices for a Double-Track Railway Line for Sustainability Evaluations. *Sustainability* **2023**, *15*, 5066. [CrossRef]
41. Roy, S. Ecological Consequences of Railway Infrastructure Development: A Case Study of the Belgrade-Novi Sad Corridor. *Oppor. Chall. Sustain.* **2023**, *2*, 116–129. [CrossRef]
42. Ranza, G. "Envision": Un Sistema Di Rating per Progettare Infrastrutture Sostenibili Con Impatto Sulla Salute e Sicurezza. 2017, *Q2*, 101–106. Available online: https://www.envisionitalia.it/wp-content/uploads/2017/06/Artciolo-Ranza_Estratti-da-Q2_aifos_2017.pdf (accessed on 9 December 2023).
43. Rennings, K.; Ziegler, A.; Ankele, K.; Hoffmann, E. The Influence of Different Characteristics of the EU Environmental Management and Auditing Scheme on Technical Environmental Innovations and Economic Performance. *Ecol. Econ.* **2006**, *57*, 45–59. [CrossRef]
44. Daddi, T.; Testa, F.; Frey, M.; Iraldo, F. Exploring the Link between Institutional Pressures and Environmental Management Systems Effectiveness: An Empirical Study. *J. Environ. Manage.* **2016**, *183*, 647–656. [CrossRef] [PubMed]
45. Testa, F.; Rizzi, F.; Daddi, T.; Gusmerotti, N.M.; Frey, M.; Iraldo, F. EMAS and ISO 14001: The Differences in Effectively Improving Environmental Performance. *J. Clean. Prod.* **2014**, *68*, 165–173. [CrossRef]
46. Testa, F.; Iraldo, F.; Daddi, T. The Effectiveness of EMAS as a Management Tool: A Key Role for the Internalization of Environmental Practices. *Organ. Environ.* **2018**, *31*, 48–69. [CrossRef]
47. Gernuks, M.; Buchgeister, J.; Schebek, L. Assessment of Environmental Aspects and Determination of Environmental Targets within Environmental Management Systems (EMS)—Development of a Procedure for Volkswagen. *J. Clean. Prod.* **2007**, *15*, 1063–1075. [CrossRef]
48. Edwards, R.; Smith, G.; Büchs, M. Environmental Management Systems and the Third Sector: Exploring Weak Adoption in the UK. *Environ. Plan. C Gov. Policy* **2013**, *31*, 119–133. [CrossRef]
49. Parlamento Europeo e Consiglio dell'Unione Europea Regolamento (CE) n. 1221/2009 Del Parlamento Europeo e Del Consiglio. 2009. Available online: https://www.eliosingegneria.it/i-nostri-servizi/tutela-dellambiente/67-registrazione-emas-regolamento-76101ce#:~:text=Il%20Regolamento%20CE%20n.,ambientali%20e%20comunicarle%20al%20pubblico. (accessed on 9 December 2023).
50. Heras-Saizarbitoria, I.; Boiral, O. ISO 9001 and ISO 14001: Towards a Research Agenda on Management System Standards. *Int. J. Manag. Rev.* **2013**, *15*, 47–65. [CrossRef]
51. Delmas, M.A.; Montes-Sancho, M.J. An Institutional Perspective on the Diffusion of International Management System Standards: The Case of the Environmental Management Standard ISO 14001. *Bus. Ethics Q.* **2011**, *21*, 103–132. [CrossRef]
52. Prakash, A.; Potoski, M. *The Voluntary Environmentalists*; Cambridge University Press: Cambridge, UK, 2009; ISBN 9780511617683.
53. Iraldo, F.; Testa, F.; Frey, M. Is an Environmental Management System Able to Influence Environmental and Competitive Performance? The Case of the Eco-Management and Audit Scheme (EMAS) in the European Union. *J. Clean. Prod.* **2009**, *17*, 1444–1452. [CrossRef]
54. Legge 28 Dicembre 2015, n. Legge 28 Dicembre 2015, n.221, "Disposizioni in Materia Ambientale per Promuovere Misure Di Green Economy e per Il Contenimento Dell'uso Eccessivo Di Risorse Naturali". *Gazzetta Ufficiale*, 18 January 2016; p. 58.
55. Merli, R.; Preziosi, M.; Ippolito, C. Promoting Sustainability through EMS Application: A Survey Examining the Critical Factors about EMAS Registration in Italian Organizations. *Sustainability* **2016**, *8*, 197. [CrossRef]
56. Ministero della Transizione Ecologica. Catalogo Dei Sussidi Ambientalmente Dannosi e Dei Sussidi Ambientalmente Favorevoli. 2020. Available online: https://www.mase.gov.it/pagina/catalogo-dei-sussidi-ambientalmente-dannosi-e-dei-sussidi-ambientalmente-favorevoli (accessed on 9 December 2023).
57. Vernon, W. The Delphi Technique: A Review. *Int. J. Ther. Rehabil.* **2009**, *16*, 69–76. [CrossRef]
58. Papamichael, I.; Voukkali, I.; Loizia, P.; Pappas, G.; Zorpas, A.A. Existing Tools Used in the Framework of Environmental Performance. *Sustain. Chem. Pharm.* **2023**, *32*, 101026. [CrossRef]
59. Merli, R.; Preziosi, M. The EMAS Impasse: Factors Influencing Italian Organizations to Withdraw or Renew the Registration. *J. Clean. Prod.* **2018**, *172*, 4532–4543. [CrossRef]
60. European Commission. *Statistics and Graphs*; European Commission: Brussel, Belgium, 2021.
61. Heras-Saizarbitoria, I.; Arana, G.; Boiral, O. Exploring the Dissemination of Environmental Certifications in High and Low Polluting Industries. *J. Clean. Prod.* **2015**, *89*, 50–58. [CrossRef]
62. Beer, M.; Zio, E. Research Publishing Services. In Proceedings of the 29th European Safety and Reliability Conference (ESREL 2019), Hannover, Germany, 22–26 September 2019. ISBN 9789811127243.
63. Dall'O', G.; Bruni, E. Sustainable Rating Systems for Infrastructure. In *Research for Development*; Springer: Berlin/Heidelberg, Germany, 2020; pp. 329–345.
64. Sdoukopoulos, A.; Pitsiava-Latinopoulou, M.; Basbas, S.; Papaioannou, P. Measuring Progress towards Transport Sustainability through Indicators: Analysis and Metrics of the Main Indicator Initiatives. *Transp. Res. Part D Transp. Environ.* **2019**, *67*, 316–333. [CrossRef]
65. ISI—Institute for Sustainable Infrastructure. *Envision. Sustainable Infrastructure Framework*; ISI: Washington, DC, USA, 2018.
66. Harris, N.; Shealy, T.; Klotz, L. How Exposure to "Role Model" Projects Can Lead to Decisions for More Sustainable Infrastructure. *Sustainability* **2016**, *8*, 130. [CrossRef]

67. Shivakumar, S.; Pedersen, T.; Sp, E.; Wilkins, S.; Schuster, S. *Envision TM-A Measure of Infrastructure Sustainability*; American Society of Civil Engineers: Reston, VA, USA, 2014.
68. Rodriguez-Nikl, T.; Asce, M.; Mazari, M.; Asce, A.M. *Resilience and Sustainability in Underground Transportation Infrastructure: Literature Review and Assessment of Envision Rating System*; American Society of Civil Engineers: Reston, VA, USA, 2019.
69. Laali, A.; Nourzad, S.H.H.; Faghihi, V. Optimizing Sustainability of Infrastructure Projects through the Integration of Building Information Modeling and Envision Rating System at the Design Stage. *Sustain. Cities Soc.* **2022**, *84*, 104013. [CrossRef]
70. Taherian, G.; Hosseini Nourzad, S.H.; Neyestani, M. Customizing a Sustainability Evaluation Framework for Infrastructure Projects in Developing Countries: The Case Study of Iran. *Sustain. Resilient Infrastruct.* **2023**, *9*, 1–24. [CrossRef]
71. Georgoulias, A. The Envision Rating System for Sustainable Infrastructure: Development, Applications, and the Potential for Lebanon. *Cedro* **2015**, *13*, 1–14.
72. Censorii, F.; Cotignoli, L.; Vignali, V.; Bartoli, A. ENVISION—Italy Adapted—Sustainable and Resistant Road Infrastructures. *Coatings* **2022**, *12*, 236. [CrossRef]
73. Saville, C.R.; Miller, G.R.; Brumbelow, K. Using Envision to Assess the Sustainability of Groundwater Infrastructure: A Case Study of the Twin Oaks Aquifer Storage and Recovery Project. *Sustainability* **2016**, *8*, 501. [CrossRef]
74. Bourzac, M.T.P.; Sánchez, C.A.C.; Yerena, M.L.G. Public Space and Mass Transportation: Uses and Perceptions. Paseo Alcalde and Line 3 SITEUR in the Metropolitan Area of Guadalajara, México. *Archit. City Environ.* **2021**, *16*, 1–19. [CrossRef]
75. Oluwalaiye, O.; Ozbek, M.E. Consistency between Infrastructure Rating Systems in Measuring Sustainability. *Infrastructures* **2019**, *4*, 9. [CrossRef]
76. Navarro, I.J.; Yepes, V.; Martí, J.V. A Review of Multicriteria Assessment Techniques Applied to Sustainable Infrastructure Design. *Adv. Civ. Eng.* **2019**, *2019*. [CrossRef]
77. Lomba-Fernández, C.; Hernantes, J.; Labaka, L. Guide for Climate-Resilient Cities: An Urban Critical Infrastructures Approach. *Sustainability* **2019**, *11*, 4727. [CrossRef]
78. Meistro, N.; Caruso, S.; Mancarella, A.; Ricci, M.; Di Gatti, L.; Di Cara, A. Hydrogeological, Environmental and Logistical Challenges for TBM Excavation in the Longest Tunnel in the Italian Territory. In *Tunnels and Underground Cities: Engineering and Innovation meet Archaeology, Architecture and Art-Proceedings of the WTC 2019 ITA-AITES World Tunnel Congress*; Routledge: Abingdon-on-Thames, UK, 2019; pp. 4006–4015. ISBN 9781138388659.
79. Meistro, N.; Parisi, G.; Scuderi, A.; Pistorio, S.; Genito, S. Compliant Reuse of Terzo Valico Excavation Material: Design and Operations. In *Tunnels and Underground Cities: Engineering and Innovation meet Archaeology, Architecture and Art*; CRC Press: Boca Raton, FL, USA, 2019; pp. 445–454.
80. Presidenza del Consiglio dei Ministri. Il Piano Nazionale Di Ripresa e Resilienza. 2021; p. 269. Available online: https://www.mef.gov.it/focus/Il-Piano-Nazionale-di-Ripresa-e-Resilienza-PNRR/#:~:text=Il%20Piano%20Nazionale%20di%20Ripresa%20e%20Resilienza%20(PNRR)%20si%20inserisce,in%20risposta%20alla%20crisi%20pandemica (accessed on 9 December 2023).
81. Gazzetta Ufficiale n. 299—Repubblica Italiana. Legge 443/2001; 2001. Available online: https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2001-12-27&atto.codiceRedazionale=001G0492&elenco30giorni=false (accessed on 9 December 2023).
82. Ministero dell'Ambiente e della Tutela del Territorio e del Mare. Decreto Direttoriale Osservatorio Ambientale. 2017. Available online: https://www.autostradaregionalecispadana.it/it/osservatorio-ambientale/ (accessed on 9 December 2023).
83. Zobel, T.; Burman, J.O. Factors of Importance in Identification and Assessment of Environmental Aspects in an EMS Context: Experiences in Swedish Organizations. *J. Clean. Prod.* **2004**, *12*, 13–27. [CrossRef]
84. European Commission. *EMAS User Guide*; European Commission: Brussels, Belgium, 2023.
85. Foresta, M.; Consonni, E.; Manai, S.; Petito, G.; Zannini, A. Analisi Dei Materiali Condizionati Provenienti Dallo Scavo Mediante TBM-EPB. Galleria Serravalle—Terzo Valico Dei Giovi. 2021. Available online: https://www.italferr.it/content/dam/italferr_nd/italiano/documenti/media-e-contatti/eventi/Articolo%20premiato_TP_Luglio-Agosto_2021.pdf (accessed on 9 December 2023).
86. Ministero dell'Ambiente e della Tutela del Territorio e del Mare. Osservatorio Ambientale Terzo valico dei Giovi. In Protocollo Gestione Amianto. 2014. Available online: https://terzovalico.mit.gov.it/wp-content/uploads/2021/04/opuscolo-amianto_0.pdf (accessed on 9 December 2023).
87. Davies, I.E.E.; Nwankwo, C.O.; Olofinnade, O.M.; Michaels, T.A. Insight Review on Impact of Infrastructural Development in Driving the SDGs in Developing Nations: A Case Study of Nigeria. In Proceedings of the 1st International Conference on Sustainable Infrastructural Development, Ota, Nigeria, 24–28 June 2019; Volume 640.
88. Amaral, R.E.A.C.; Abraham, Y.S. Feasibility of a Sustainable Infrastructure Rating System Framework in a Developing Country. *J. Infrastruct. Dev.* **2020**, *12*, 91–104. [CrossRef]
89. Diaz-Sarachaga, J.M.; Jato-Espino, D.; Alsulami, B.; Castro-Fresno, D. Evaluation of Existing Sustainable Infrastructure Rating Systems for Their Application in Developing Countries. *Ecol. Indic.* **2016**, *71*, 491–502. [CrossRef]
90. Ikram, M.; Zhang, Q.; Sroufe, R.; Ferasso, M. Contribution of Certification Bodies and Sustainability Standards to Sustainable Development Goals: An Integrated Grey Systems Approach. *Sustain. Prod. Consum.* **2021**, *28*, 326–345. [CrossRef]
91. O'Neill, D.W.; Fanning, A.L.; Lamb, W.F.; Steinberger, J.K. A Good Life for All within Planetary Boundaries. *Nat. Sustain.* **2018**, *1*, 88–95. [CrossRef]

92. Fanning, A.L.; O'Neill, D.W.; Büchs, M. Provisioning Systems for a Good Life within Planetary Boundaries. *Glob. Environ. Chang.* **2020**, *64*, 102135. [CrossRef]
93. Boggia, A.; Cortina, C. Un Modello per La Valutazione Della Dello Sviluppo a Livello. In *AESTIMUM 52*; Firenze University Press: Firenze, Italy, 2008; pp. 31–52.
94. Rockström, J.; Steffen, W.; Noone, K.; Persson, Å.; Stuart Chapin, F.I.; Lambin, E.F.; Lenton, T.M.; Scheffer, M.; Folke, C.; Schellnhuber, H.J.; et al. A Safe Operating Space for Humanity. *Futur. Nat.* **2009**, *461*, 472–475. [CrossRef] [PubMed]
95. Biermann, F.; Kim, R.E. The Boundaries of the Planetary Boundary Framework: A Critical Appraisal of Approaches to Define a "Safe Operating Space" for Humanity. *Annu. Rev. Environ. Resour.* **2020**, *45*, 497–521. [CrossRef]