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Applying the UNECE PIERS Evaluation Methodology for the SDGs to Support the Implementation of Green PPP Projects and Infrastructure: Lessons from Slovenia

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Abstract

Robust evaluation methods are essential for assessing the sustainability of public–private partnerships (PPPs) and advancing the Sustainable Development Goals (SDGs). This study examines the United Nations Economic Commission for Europe (UNECE) People-first PPP and Infrastructure Evaluation and Rating System (PIERS) through three green PPP initiatives in Slovenia, focusing on energy efficiency, renewable energy and sustainable mobility. Using structured scoring across five dimensions—access and equity, economic effectiveness, environmental sustainability, replicability and stakeholder engagement—the analysis considers project-level performance, national SDG alignment and methodological applicability. The results indicate strong overall sustainability performance, but identify stakeholder engagement as a significant weakness, largely due to institutional constraints. Comparison with Slovenia's national SDG progress in 2023–2025 shows broad alignment between project outcomes and wider sustainability achievements. The methodological review also identifies scope for improving the applicability and adaptability of PIERS indicators. Although primarily designed as a self-assessment tool, PIERS provides a systematic framework for integrating SDG principles into PPP management, especially in relation to SDGs 7, 9, 11 and 13. The study contributes empirical evidence and methodological insights for more sustainable public-investment governance.

Keywords: public–private partnerships (PPPs); people-first PPPs; sustainable development goals (SDGs); SDG localisation; UNECE PIERS methodology; sustainability assessment; green investment project implementation; stakeholder engagement; Slovenia

1. Introduction

1.1. Global Context and Relevance

The United Nations 2030 Agenda for Sustainable Development, adopted in 2015 [[1]] requires a systemic transformation in the way governments plan, finance and evaluate public investments [1]. Because implementation of the Sustainable Development Goals (SDGs) is not legally mandatory, sustained efforts at the national, subnational and local levels, and across all stakeholder groups, are essential to their realisation [2,3]. These efforts matter not only for present generations but, even more importantly, for future generations [4]. Even during the preparation and adoption of the 2030 Agenda, it was recognised that private financing would play an important role in achieving the SDGs [5].

In 2023, the United Nations (UN) published The Sustainable Development Goals Report, which assessed global progress towards the SDGs and identified measures for accelerating their implementation. Its conclusions were alarming: at the halfway point to 2030, nearly half of the

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assessed targets were off track, while more than 30 per cent had either stagnated or regressed below the 2015 baseline [6].

The United Nations General Assembly therefore reaffirmed its commitment to the 2030 Agenda and the SDGs in September 2024 through the adoption of the Pact for the Future [7]. The opening pages of the Pact directly address the issue of 'financing for development'. The need for private-sector participation in financing public infrastructure and public services for sustainable development has not diminished since 2015; on the contrary, it has become even more acute in the light of global instability and recurring crises [8].

Sustainable infrastructure development has accordingly emerged as a key enabler of inclusive economic growth and environmental resilience, particularly under SDG 9, which calls for resilient infrastructure, inclusive and sustainable industrialisation, and innovation [9]. The global infrastructure gap is widening as a result of climate change and extreme weather events, geopolitical instability, the increasing number of conflict zones and the continuing deterioration or collapse of existing infrastructure. Although estimates vary by source, sector and region, the available evidence consistently shows that investment needs are increasing.

In 2016, the McKinsey Global Institute estimated that, between 2016 and 2030, the world would need to invest an average of USD 1 trillion per year in economic infrastructure merely to support expected growth rates [10]. The OECD now estimates that the gap between current infrastructure investment levels and the level required to achieve the SDGs could reach as much as USD 18 trillion by 2040. According to the OECD, the scale of need is enormous, and substantial investment will be required from both governments and the private sector, as quality infrastructure will play a vital role in achieving the SDGs [11].

Public finances alone will be insufficient to meet these infrastructure needs [12]. Greater public–private cooperation will therefore be required to establish and maintain such infrastructure, and public–private partnership (PPP) models are among the approaches likely to be used more extensively in the future. PPPs will thus continue to play an important role in financing public infrastructure and public services.

The literature confirms that all SDGs are directly or indirectly connected to, and influenced by, the development of adequate infrastructure [13]. Infrastructure, as a fundamental societal subsystem, supports progress towards other SDGs, including those related to health, education and the environment [14]. Although studies show that many actors involved in construction-sector projects wish to measure SDG impact at both business and project levels, this remains a major challenge because appropriate tools, methods and frameworks for assessing SDG progress at project level are still lacking [15], despite strong motivation at the operational level [16].

The same problem applies to PPP projects intended to support the SDGs. Despite the growing emphasis on sustainability, the systematic evaluation of PPP projects against SDG-related outcomes remains limited and fragmented. Unified, multidimensional assessment tools that integrate economic, social and environmental aspects remain underdeveloped. Traditional PPP evaluation frameworks continue to focus primarily on value for money and fiscal performance rather than sustainability and inclusiveness. Relevant initiatives have nevertheless emerged in business practice, such as the FAST-Infra Sustainable Infrastructure Label (SI Label) [17], and in the literature, including proposals for a contemporary global PPP research agenda [18], the use of the Triple Bottom Line approach—that is, social, environmental or ecological, and economic or financial effects, also reflected in the 'three pillars' of people, profit and planet—throughout the project life cycle as a way of linking SDGs with project success criteria [19], and a conceptual methodology for evaluating PPPs that contribute to the SDGs [20], which may be regarded as a predecessor of the PIERS methodology. This methodological gap limits governments' ability to demonstrate how individual projects contribute to national SDG progress.

In this respect, a major advantage of the PIERS methodology is that it was developed and is being promoted under the auspices of the United Nations Economic Commission for Europe (UNECE). It is also gradually being recognised and applied by financial actors and international

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financial institutions (IFIs) in the evaluation of sustainable infrastructure and PPP projects [21], thereby extending its global reach and influence.

This study aims to demonstrate how the UNECE PIERS methodology, although a voluntary self-assessment tool, can support a more systematic understanding and implementation of SDG objectives in PPP and infrastructure projects at the operational, national and methodological levels. Although SDG 9 provides the starting point for the analysis, the study also recognises that the PIERS methodology systematically incorporates all relevant SDGs identified in the assessment process.

1.2. The UNECE People-First PPP and PIERS Methodology

The PIERS methodology was developed by UNECE in cooperation with more than one hundred experts from the public and private sectors, academia and civil society organisations. It constitutes a comprehensive analytical framework for assessing the contribution of PPP and infrastructure projects to the SDGs. PIERS offers an integrated and multidimensional approach that enables project developers, policymakers and financiers to evaluate and improve the sustainability performance of projects throughout their life cycle. At its core, the methodology seeks to ensure that infrastructure investments generate value both for people and for the planet, with particular emphasis on equity, social inclusion and the needs of vulnerable groups.

When applied at the early stages of project development and maintained throughout design and implementation, PIERS enables stakeholders to identify areas for improvement systematically and to embed resilience, sustainability and circularity into project planning and execution. From an operational perspective, the methodology can also enhance investor confidence by demonstrating that projects using it adhere to concrete sustainability practices. PIERS is freely accessible as a self-assessment instrument and is further supported through the UNECE PIERS Programme, which offers an expert-led 'assisted self-assessment' process. The methodology also encourages continuous project improvement at the stages at which changes are most cost-effective and serves as a capacity-building tool for strengthening institutional understanding of sustainable infrastructure development.

Overall, the PIERS methodology represents an innovative and practical contribution to global efforts to align infrastructure investment with the 2030 Agenda for Sustainable Development. It provides both a rigorous analytical instrument and an educational platform for promoting more sustainable and socially responsible PPP and infrastructure projects worldwide. It is also flexible and adaptable across sectors, project types and national contexts. Rather than replacing existing PPP and infrastructure standards or assessment frameworks, it complements them by offering an integrative and harmonised evaluation tool [22].

The methodological structure of PIERS is anchored in five key outcome dimensions: (1) Access and Equity (hereinafter also: the AE dimension); (2) Economic Effectiveness (hereinafter also: the EE dimension); (3) Environmental Sustainability and Resilience (hereinafter also: the ES dimension); (4) Replicability (hereinafter also: the RE dimension); and (5) Stakeholder Engagement (hereinafter also: the SE dimension). These dimensions reflect the holistic understanding of sustainability underlying UNECE's approach to PPPs for the SDGs. Access and equity emphasise inclusiveness and the fair distribution of benefits; economic effectiveness focuses on value creation and fiscal responsibility; environmental sustainability and resilience address the reduction of ecological impacts and the capacity to withstand external shocks; replicability supports the transfer of successful practices; and stakeholder engagement promotes transparency and participatory governance. Building on these five outcomes, the PIERS evaluation process comprises twenty-two criteria and ninety-five indicators, providing a structured and measurable approach to scoring and benchmarking projects in relation to the SDGs. The User's Guide to the Self-Assessment Tool is available [23].

The credibility of the PIERS methodology and the PIERS Programme is strengthened in two important ways: first, through the involvement of a Technical Panel [24], composed of experts who address complex technical and project-specific issues; and second, through PIERS Project Evaluators and Peer Reviewers [25], who possess detailed knowledge and understanding of the methodology

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and assess and review projects for their alignment with the SDGs. UNECE has contributed to this field not only through conceptual guidance but also through practical measures [26].

Nevertheless, the limitations of the methodology must be recognised. PIERS is not mandatory; it is a voluntary instrument intended to support, rather than replace, formal legal, financial, environmental or social assessments. A key shortcoming lies in the potential subjectivity of its application: users may assess projects either too uncritically or too restrictively. Although guidelines exist to steer the assessment process, they are predominantly descriptive and may allow divergent interpretations, leading to inconsistent or non-comparable evaluations across projects.

Although the development and application of PIERS represent a significant and widely recognised achievement within the global professional PPP community, which regularly convenes under the auspices of the UNECE Working Party on Public–Private Partnerships [27] and the UNECE International PPP Forum [28], the methodology has received limited attention in professional and academic literature. Despite originating in the PPP framework, PIERS was designed to apply not only to PPP projects but also to infrastructure projects more generally. It is straightforward to use, functioning both as a self-assessment tool and as a practical guide that helps project developers ensure that the SDGs are systematically addressed throughout the project cycle.

1.3. The Slovenian Context

Slovenia provides an instructive case for examining the practical application of the PIERS methodology in a small EU Member State pursuing green and digital transformation, as defined, among other instruments, in the Slovenian Development Strategy 2030 [29] and the National Energy and Climate Plan (NECP) [30].

Slovenia demonstrates consistently strong overall performance in achieving the SDGs and ranks among the top-performing countries globally. According to the Sustainable Development Reports 2023–2025 [31], Slovenia ranked between 11th and 13th worldwide out of 166–167 countries, with a stable country score of approximately 81 points, well above global and regional averages. This sustained high ranking indicates a mature and relatively coherent national framework for sustainable development implementation.

In thematic terms, Slovenia performs well, or is improving, across several social SDGs, including SDG 1 (No Poverty), SDG 3 (Good Health and Well-being), SDG 5 (Gender Equality, although the 2025 report indicated stagnation) and SDG 10 (Reduced Inequalities). It also performs comparatively well on infrastructure-related SDGs, including SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation and Infrastructure) and, in particular, SDG 11 (Sustainable Cities and Communities), where progress in 2024 and 2025 moved towards SDG achievement. By contrast, persistent challenges remain in environmentally intensive domains, notably SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life below Water) and SDG 15 (Life on Land), as well as in certain social and partnership-related domains. These include SDG 2 (Zero Hunger), where obesity, human trophic level, sustainable nitrogen management and exports of hazardous pesticides significantly affect Slovenia's weaker performance, as well as SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 16 (Peace, Justice and Strong Institutions) and SDG 17 (Partnerships for the Goals).

With regard to PPP implementation in Slovenia, the use of PPPs at central-government level remains relatively limited. However, a significant number of PPP projects, programmes and initiatives have been implemented at municipal level, particularly in cities [32]. In addition to social services and related infrastructure, including sports infrastructure and public kindergartens, these initiatives predominantly concern environmental protection public services, including drinking-water supply, wastewater drainage and treatment, municipal waste collection, treatment and disposal, and the cleaning of public roads and public spaces. They also address energy efficiency, renewable energy deployment and sustainable mobility. The general perception is that PPP implementation in Slovenia is broadly aligned with the principles of People-first PPPs.

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Accordingly, this study analyses the use of the PIERS methodology in three green and sustainable PPP programmes implemented by city municipalities in Slovenia. It does so in order to identify differences and commonalities between the outcomes generated by the PIERS methodology and the findings of the global Sustainable Development Reports 2023–2025 for Slovenia.

1.4. Research Gap and Aim of the Study

Although the PIERS methodology has been conceptually endorsed by UNECE and the global PPP community, there is very little academic literature analysing its practical application. This constitutes a clear research gap. At the same time, the gap raises a further methodological question concerning the appropriate level or levels of analysis at which the use and effects of PIERS should be examined. This study therefore represents one of the first empirical contributions in the field. A multi-level analytical approach is both justified and necessary because it allows methodological implications and policy-relevant insights to be identified across different layers, while also highlighting avenues for future research based on broader datasets and a larger number of case studies.

The analysis is therefore conducted at three interconnected levels: (1) the operational level, focusing on the sustainability performance of individual PPP programmes; (2) the national level, examining the alignment between project-level outcomes and the institutional, legal and policy framework governing PPPs and SDG performance in Slovenia; and (3) the methodological cross-context refinement level, which evaluates the PIERS framework itself in order to identify opportunities for enhancing its adaptability, robustness and applicability across different project types, sectors and institutional contexts, drawing on empirical insights from its practical application.

At the operational level, the study focuses on three specific PPP programmes, which serve as empirical case studies for assessing the practical applicability and analytical value of the PIERS methodology. This level of analysis also identifies common strengths and weaknesses across the PIERS outcomes and criteria in all three PPP programmes, thereby indicating areas that could be systematically improved. No comparable project-level analysis aimed at identifying existing challenges and improvement potential has yet been conducted for projects at the national level. This therefore represents a clear research gap.

At the national level, a further research gap arises from the lack of systematic comparative analysis linking PIERS results to national SDG indicators in any country. In particular, no existing studies test the applicability of PIERS or compare its project-level outcomes with national SDG performance data. This limits understanding of how effectively project-level sustainability performance and assessment results reflect macro-level SDG progress. The present study therefore also conducts the analysis at the national level. Although it is based on a small number of case studies, it helps identify pathways for future research using larger samples. It makes a particular contribution to SDG 9 and lays a foundation for further research in this field. UNECE already maintains a substantial body of PPP and infrastructure project cases from a wide range of countries and regions, which are systematically presented at UNECE PPP Forums [33]. At these Forums, projects are also recognised as best-practice examples by the global PPP community; awards are granted following selection by a global PPP expert jury and, where awards are organised, voting by Forum participants.

At the framework level, the study moves beyond empirical assessment and engages in methodological reflection on the PIERS framework. Drawing on insights from project-level application and national-level comparison, this level seeks to identify the structural strengths and limitations of the methodology, including issues related to indicator coverage, weighting, data availability and applicability across different PPP and infrastructure project types. It therefore constitutes a cross-context assessment aimed at enhancing the methodological robustness, transferability and policy relevance of the PIERS framework. PIERS is currently being applied in its initial version, and further methodological development is envisaged. In this context, research-based and cross-contextually grounded proposals for refinement are particularly timely and relevant.

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1.5. Scope of the Study, Objectives, Research Questions, and Contribution

This study examines the application and further development of the UNECE PIERS methodology as a sustainability assessment instrument for public investment projects. Its empirical scope is limited to selected green PPP and infrastructure projects implemented in Slovenia, covering energy efficiency, renewable energy generation and sustainable mobility. Its analytical scope extends beyond individual projects to include the national legal and policy framework governing PPPs, as well as a methodological cross-context refinement of the PIERS framework informed by empirical application. Although the findings are grounded in the Slovenian context, the study is designed to generate insights relevant to broader PPP and infrastructure governance settings.

The primary objective of the study is to assess how the PIERS methodology supports the systematic integration of the SDGs into PPP and infrastructure project implementation. More specifically, the study aims to: (i) evaluate the sustainability performance of selected PPP projects using the PIERS framework; (ii) examine the extent to which project-level PIERS outcomes align with, and contribute to, Slovenia's national SDG performance and PPP regulatory framework; and (iii) identify opportunities for refining the PIERS methodology in order to enhance its applicability, robustness and policy relevance across different institutional and project contexts.

In line with these objectives, the study addresses the following research questions:

RQ1: Project-level perspective – How can the systematic application of the PIERS methodology at the PPP project or programme level improve the implementation of specific PPP projects and programmes, while revealing sustainability strengths and weaknesses in the analysed projects and, through a review of PPP-related legislation, identifying underlying causes of performance issues?

RQ2: National-level perspective – To what extent do PIERS project-level results align with and contribute to Slovenia's national SDG performance?

RQ3: Methodological cross-context PIERS refinement perspective – How can the PIERS methodology be further refined, on the basis of cross-context empirical evidence, to improve its adaptability and effectiveness across diverse PPP and infrastructure project types?

This study contributes to the literature and practice of sustainable public investment governance in three main ways. First, it provides empirical evidence on the application of the PIERS methodology in a national PPP context, illustrating its practical value as a sustainability assessment tool. Second, it develops policy-relevant insights by linking project-level evaluation results with national SDG performance and PPP regulation, thereby informing potential legal and institutional improvements. Third, by adopting a methodological cross-context refinement perspective, the study offers research-based recommendations for the further development of the PIERS framework and contributes to ongoing international discussions on the evaluation and governance of People-first PPPs.

2. Materials and Methods

This study adopts a qualitative, multi-level research design combining a targeted review of academic literature, policy documents and reports with document analysis, case-study analysis, structured self-assessment informed by participant observation, comparative analysis and analytical synthesis. Participant observation refers to the author's direct professional involvement in the preparation, implementation, assessment and evaluation of PPP projects using the PIERS methodology. This involvement enabled contextual understanding of project documentation, evaluation challenges and methodological limitations as they arise in practice. The methodological approach is explicitly aligned with the three analytical levels of the study—operational or project level, national level, and methodological cross-context refinement level—and is designed to answer the three research questions set out in Section 1.5.

First, a targeted review of academic and policy-oriented literature was conducted in order to establish the analytical context of the study. The review focused on two complementary strands. The first addressed SDG-related research with particular reference to Slovenia, including national SDG performance, infrastructure development, the energy transition, sustainable mobility, and the role of

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public investment and PPPs in achieving SDG 9 and related goals. This strand drew primarily on official SDG monitoring publications, including the Sustainable Development Reports 2023–2025. The second strand examined the PIERS methodology and the People-first PPP concept. It included UNECE methodological documents, PPP Forum case studies and the limited academic literature discussing sustainability evaluation frameworks for PPP and infrastructure projects. The literature review informed both the design of the empirical analysis and the interpretation of the results.

At the operational level, three PPP programmes implemented in Slovenia—covering energy efficiency, renewable energy generation and sustainable mobility—were assessed using the UNECE PIERS methodology. The assessment was carried out through a structured self-evaluation process using the official PIERS Excel-based evaluation spreadsheet. Each project was assessed against the full set of PIERS criteria across the five outcome dimensions: access and equity, economic effectiveness and fiscal sustainability, environmental sustainability and resilience, replicability, and stakeholder engagement. Scores were assigned in accordance with the PIERS scoring guidance and were based on project documentation, contractual arrangements, the policy context and available performance data.

The basic characteristics of all three PPP programmes are described in Section 3 in order to support understanding and ensure consistency in the project-level analysis. It should also be clarified that, although the PIERS methodology is most effective when applied at the project-planning stage—where it supports the integration of sustainability considerations into project design—it also provides valuable feedback and learning mechanisms during subsequent phases of project implementation and operation, thereby facilitating continuous improvement and alignment with SDG objectives [34]. Nevertheless, for all PPP programmes analysed in this study, the PIERS methodology was applied after project implementation, namely during the operational and management phase. This post-implementation evaluation enabled a more comprehensive assessment of actual project performance and provided a robust empirical basis for the second- and third-level analyses undertaken in this study.

Following the individual programme assessments, a cross-project comparison was conducted to identify common strengths and weaknesses across the three PPP programmes. Descriptive comparison and qualitative synthesis were used to analyse patterns in the scoring results, with particular attention to criteria that consistently received lower scores. This analysis formed the empirical basis for addressing RQ1.

At the national level, the aggregated results of the three PIERS project assessments were compared with Slovenia's official SDG performance, as reported in the Sustainable Development Reports 2023–2025. This comparison focused on the SDGs most closely aligned with the PIERS framework and the analysed projects, with SDGs 7, 9, 11 and 13 serving as the main analytical reference points, while all other SDGs were also taken into account. The method applied at this stage was qualitative comparative analysis, which examined whether areas of strong or weak performance identified through PIERS at project level corresponded with national SDG trends and indicator performance. This made it possible to assess coherence, or divergence, between project-level sustainability outcomes and national SDG progress, thereby addressing RQ2.

In parallel with the project-level self-evaluation, the author systematically documented PIERS criteria for which scoring proved difficult, ambiguous or insufficiently applicable to certain types of PPP projects. These observations were recorded during the evaluation process in order to reduce retrospective bias. At the analysis stage, the identified criteria were subjected to systematic methodological review, assessing whether the observed challenges reflected project-specific limitations or more structural methodological issues. The criteria were examined in relation to their conceptual clarity, data requirements, relevance across different project types and alignment with SDG targets. This step employed analytical reflection and cross-context synthesis to determine whether targeted refinement, clarification or adaptation of specific PIERS criteria would be methodologically justified. The results of this analysis informed the development of research-based recommendations for enhancing the PIERS framework and addressed RQ3.

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Together, these dimensions form a recursive and multi-scalar framework in which learning at one level informs action at another. Project-level results provide empirical evidence; national frameworks can translate such evidence into policy and regulatory mechanisms; and global methodological development supports the continuous evolution of evaluation standards. This structure enables the study to contribute simultaneously to applied evaluation practice, national policy design and international methodological discourse. Table 1 summarises the analytical framework.

Table 1. Summary of the Analytical Framework.

Level of Analysis	Analytical Focus	Methods Applied	Main Contribution
Project Level	Application of PIERS to three Slovenian PPP programmes (energy efficiency, solar energy, sustainable mobility)	Qualitative scoring, document analysis, cross-project comparison	Identification of project-specific and common sustainability strengths and weaknesses
National Level	Comparison of the project implementation sustainability strengths and weaknesses with the Sustainable Development Reports for Slovenia	PPP-related laws review; comparative analysis of PIERS evaluation with SDG outcomes and national SDG indicators	Policy recommendations for better integration of PIERS outcomes and criteria and SDG principles in PPP regulation
Methodological Cross-Context Refinement Level	Refinement of the PIERS methodology for broader applicability	Comparative analysis drawing from empirical insights of practical PIERS implementation with the PIERS framework itself	Recommendations for enhancement

The study relies in large part on self-evaluation, which is an inherent feature of the PIERS methodology. To mitigate subjectivity, assessments were based on documented evidence and applied consistently across all three PPP programmes. The empirical scope of the study is also limited by the relatively small number of case studies analysed, which restricts the generalisability of the findings.

Qualitative scoring and narrative assessment were carried out for each PIERS dimension in accordance with UNECE's official guidance. Analysis of project documentation, feasibility studies and available evaluation reports enabled comparison across cases and the identification of common performance patterns. Across all analytical levels, the study employs a qualitative comparative research design that integrates document analysis, secondary data review and interpretative synthesis. Primary materials include publicly available project-level documentation, feasibility studies, contractual documents and policy texts related to PPP implementation. Secondary sources include official statistical datasets, national SDG reports, and UNECE methodological and guidance documents. Data organisation, coding and tabulation were performed using standard office software tools. The research did not involve interviews, personal data or direct research participation by human subjects; therefore, ethical approval was not required.

Generative artificial intelligence tools were used exclusively in a supportive and non-substantive manner, in line with journal ethics and transparency requirements. Specifically, ChatGPT, provided by OpenAI, was used as an assistive tool for selected initial data-analysis and writing-related tasks. In addition, Elicit, provided by Ought, and HyperWrite, provided by OthersideAI, were used as AI-based research assistants to support literature screening and the identification of relevant academic sources. HyperWrite was also used for rewriting and summarising earlier drafts of the paper. All outputs generated with AI assistance were critically reviewed, verified and edited by the author, who takes full responsibility for the accuracy, originality and integrity of the final manuscript.

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3. Results

3.1. Project-Level perspective

3.1.1. Structure of the Project-Level Analysis

At the operational level, three Slovenian PPP projects, which were later, de facto, further developed into programmes due to excellent project results, were assessed using the UNECE PIERS methodology. The case studies were selected from a broader pool of Slovenian PPP initiatives and were deliberately chosen as "green by nature" projects, addressing key domains of sustainable public investment. The selected cases cover energy efficiency and retrofit of public buildings, sustainable mobility, and solar energy generation with an emphasis on local energy self-sufficiency. Together, they reflect diversity in project type, sectoral focus, and implementation scale, while remaining comparable in terms of governance structure and sustainability ambition. The three programmes are widely recognised as examples of good practice in Slovenia, both at the national level and within the international PPP community. Their quality and sustainability performance have been acknowledged beyond the national context, with the international PPP community recognising the projects as examples of sustainable PPP implementation. In particular, for two of the analysed programmes (energy efficiency and retrofit of public buildings [35], and sustainable mobility—both the overall project quality and the application of the PIERS methodology were externally reviewed and validated by an international jury within the framework of the UNECE PPP and Infrastructure Forum. This external validation strengthens the credibility of the self-evaluation results and provides additional assurance regarding the consistency of the scoring process.

The project-level analysis was structured in two sequential steps. First, each PPP programme was analysed individually in order to provide a concise description of its objectives, scope, governance model and sustainability focus. These descriptions contextualise the PIERS assessment and clarify the relevance of each project to the People-first PPP principles. Sections 3.1.2–3.1.4 therefore present brief overviews of the scoring results for the three case studies.

Second, a comparative analysis of the PIERS results was conducted across the three case studies. This comparison identifies common patterns in scoring outcomes, highlighting the PIERS dimensions and criteria in which all three projects achieved the highest scores, as well as those in which scores were consistently lower. The comparative assessment makes it possible to identify cross-cutting strengths and weaknesses that are not project-specific but instead indicate broader characteristics of PPP implementation in Slovenia.

From a PPP project-management perspective, outcome areas with consistently lower scores may indicate systematic challenges affecting the successful implementation of sustainability-oriented PPPs. Given the scope and limitations of the present study, the subsequent analysis focuses exclusively on the PIERS outcome dimension that received the lowest scores across the three projects. This targeted focus allows for a more detailed examination of underlying causes and provides a structured basis for the following sections, in which these findings are analysed further in relation to national-level conditions and methodological implications.

3.1.2. Energy Retrofit of Public Buildings in the City of Ljubljana under the Energy Performance Contracting PPP Approach

Launched in 2013 following the adoption of a Decree by the City Council [36], the Energy Retrofit of Public Buildings in the City of Ljubljana programme (the EOL programme) represents one of the largest energy performance contracting (EPC)-based PPP initiatives in Central and Eastern Europe. The programme addresses Ljubljana's extensive stock of energy-inefficient public buildings through successive public tenders (EOL 1–4, with EOL 5 in preparation), covering more than one hundred facilities by the end of 2025, including schools, kindergartens, cultural institutions and administrative buildings.

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The project was implemented under the Slovenian Public–Private Partnership Act (PPP Act) [37], using the EPC model. The total investment amounts to approximately EUR 60 million, excluding VAT, with a contract duration of 15 years. It is financed through a blended structure combining EU Cohesion Fund grants, municipal contributions and private capital from energy service companies (ESCOs). The tendering process was conducted in accordance with EU law through competitive dialogue and was fully digitised, using certified e-procurement platforms to ensure transparency and accountability [38].

The programme is expected to generate cumulative savings of approximately 400,000 MWh of energy and a reduction of around 80,000 tonnes of CO_2, equivalent to the sequestration capacity of 3.2 million trees or approximately 8,000 hectares of forest, over the project life cycle. It demonstrates the scalability of aggregated EPC projects, the effectiveness of competitive dialogue for complex PPPs and the potential of EPC-based models to deliver significant environmental benefits while maintaining fiscal sustainability for local authorities [39].

EPC is a financing mechanism for energy-efficiency measures based on the involvement of an ESCO. The ESCO typically provides financing and guarantees a defined level of energy savings, with its remuneration directly linked to the achievement of those savings. Throughout the repayment period, the ESCO remains responsible for measuring and verifying savings [40].

As shown in Table 2 below, and in greater detail in Appendix A, the PIERS evaluation of the EOL programme indicates a consistently high level of sustainability performance across most assessment dimensions, with an overall composite score of 88 per cent, corresponding to an Excellent rating. The project performs particularly strongly in replicability (95 per cent), reflecting a well-structured contractual model, a standardised implementation approach and strong potential for scaling and transfer to other municipalities. High scores in access and equity (89 per cent), economic effectiveness and fiscal sustainability (89 per cent), and environmental sustainability and resilience (89 per cent) demonstrate that the project delivers public services in an inclusive and affordable manner, achieves value-for-people and value-for-money objectives, and generates substantial environmental benefits, particularly through improved energy efficiency and reduced emissions.

By contrast, stakeholder engagement (79 per cent) is the relatively weakest dimension of the assessment, although it still attains a Good rating. This result suggests that, while basic mechanisms for information provision, public participation and grievance handling are in place, more systematic and institutionalised approaches to stakeholder involvement—such as mandatory structured engagement plans, measurable participation outcomes or independent oversight mechanisms—could further strengthen project performance. Overall, the evaluation indicates that the project constitutes a robust example of a sustainability-oriented PPP, with its main improvement potential lying not in technical or economic design but in the deepening and formalisation of stakeholder engagement practices.

3.1.3. Implementing Electromobility in Slovenia under the PPP Approach

In November 2019, the City Council of Kranj adopted a Decree establishing a public–private partnership for the implementation of the 'Electromobility in the City of Kranj' project [41] in accordance with the PPP Act [42]. The public tender was published in February 2020 [43] and conducted under the competitive dialogue procedure. The project was structured as an EPC scheme, enabling capital investment to be financed through operational savings generated by the transition from fossil-fuel vehicles to electric mobility. The concession contract was signed at the end of 2020, with a total project value of approximately EUR 5.1 million, excluding VAT.

A comprehensive and integrated approach was embedded in the Decree. The central premise of the project was that the introduction of electric vehicles should not place additional pressure on the electricity distribution system. The project was therefore structured around an integrated three-pillar concept: (i) replacement and long-term management of the municipal vehicle fleet with electric vehicles equipped with domicile charging stations; (ii) establishment and operation of public electric

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charging infrastructure; and (iii) installation of solar power plants to ensure renewable energy supply for electromobility.

The project was also structured in accordance with the EPC model, which had until then been applied primarily to the energy refurbishment of public buildings in Slovenia and across the EU. Because the operating costs of fossil-fuel vehicles are substantially higher than those of electric vehicles, the replacement of the fleet—combined with further optimisation opportunities and improved vehicle use through sharing—generated measurable savings that were then used to cover the project's investment costs.

Upon full implementation, the project is expected to achieve annual energy savings of at least 452 MWh and a reduction of approximately 150 tonnes of CO_2, equivalent to the amount absorbed by about 7,700 trees. It thereby demonstrates a scalable and replicable model for sustainable urban mobility through public–private partnerships [44].

The PIERS assessment of the programme demonstrates high sustainability performance, reflected in an overall composite score of 97 per cent, placing the project among the highest-performing cases within the PIERS framework. The evaluation shows outstanding results across all dimensions, with access and equity (100 per cent) and replicability (100 per cent) representing the programme's strongest attributes. These scores indicate that the project ensures universal and equitable access to clean energy solutions while relying on a highly transferable and scalable implementation model that can be adapted to other local contexts.

Equally strong performance is observed in economic effectiveness and fiscal sustainability (95 per cent) and environmental sustainability and resilience (95 per cent), confirming that the programme delivers substantial environmental benefits, particularly in terms of renewable energy generation and emission reduction, while maintaining a sound economic structure and long-term fiscal viability. Stakeholder engagement (94 per cent) also achieves an Excellent rating, suggesting that transparent communication and effective feedback processes are well embedded throughout the project life cycle. Nevertheless, stakeholder engagement remains the lowest-scoring dimension for this project. Overall, the assessment indicates a highly balanced sustainability profile.

3.1.4. Green Energy on Public Buildings in the City of Ljubljana under the PPP Model

The Green Energy Project in the City of Ljubljana is a larger-scale renewable energy initiative implemented through a PPP concession model, primarily structured as a design–finance–build–operate–transfer (DFBOT) scheme and complemented by features typical of a power purchase agreement (PPA). Following the adoption of the Decree by the City Council [45], the procurement was conducted through a competitive dialogue procedure [46] in accordance with EU and national law. The concession contract for Green Energy I was signed in October 2023, while the public tender for Green Energy II was published in July 2025.

Green Energy I is valued at approximately EUR 5 million in capital expenditure (CAPEX), financed primarily by the concessionaire and supplemented by contributions from the EU Cohesion Fund, the Republic of Slovenia and a minor share from the City of Ljubljana. The project focuses on the installation, operation and maintenance of photovoltaic power plants on public buildings, combined into a community self-supply scheme that enables the internal distribution of electricity among municipal users.

To the greatest extent possible, the project was designed as an off-grid solution in order to avoid imposing unnecessary burdens on the distribution grid, whose capacities are often limited even in urban areas. The concession duration is 17 years. The project envisages nearly 5 MW of installed photovoltaic capacity and annual electricity production exceeding 5,200 MWh. By maximising on-site consumption and minimising grid dependency, it enhances energy resilience and price stability for public institutions while avoiding additional public debt. Over its lifetime, the project is expected to reduce CO_2 emissions by approximately 2,500 tonnes, equivalent to the sequestration capacity of approximately 95,000 trees. It therefore demonstrates the viability of hybrid PPP–PPA models for

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urban renewable energy deployment and positions Ljubljana as a frontrunner in climate-neutral municipal energy systems [47].

The PIERS evaluation of the Green Energy Ljubljana programme indicates strong and well-balanced sustainability performance, with an overall composite score of 88 per cent, corresponding to an Excellent rating. The project achieves consistently high results across the core outcome dimensions, with replicability (95 per cent) emerging as its strongest attribute. This reflects a robust project structure, clear contractual arrangements and high potential for scaling and transferability to other municipalities and project contexts.

High scores in access and equity (91 per cent), economic effectiveness and fiscal sustainability (91 per cent), and environmental sustainability and resilience (91 per cent) further demonstrate that the programme delivers inclusive and affordable energy solutions, achieves sound economic performance over the project life cycle and generates substantial environmental benefits aligned with climate and energy objectives. By contrast, stakeholder engagement (72 per cent) is the comparatively weakest dimension, although it still attains a Good rating. This result suggests that, while basic engagement and communication mechanisms are in place, there remains scope for more systematic and structured stakeholder involvement, particularly in relation to formal participation processes and the monitoring of engagement outcomes. Overall, the assessment confirms the programme's strong sustainability credentials, while highlighting stakeholder engagement as the primary area for improvement.

3.1.5. Comparative Analysis of the Three Programmes

Overall, the PPP programmes achieved their strongest results in replicability (97 per cent), access and equity (93 per cent), environmental sustainability and resilience (92 per cent), and economic effectiveness and fiscal sustainability (92 per cent). These results reflect advanced technical capacity and a strong focus on performance, feasibility, bankability and environmental objectives. Conversely, stakeholder engagement received the lowest average score (82 per cent), indicating persistent challenges in participatory governance.

Table 2. Performance Comparison of PPP Programmes across PIERS Outcome Categories [48].

PIERS Outcome	EPC Ljubljana	Green Energy Ljubljana	eMobility Kranj	Average Performance
Access & Equity	89% (Excellent)	91% (Excellent)	100% (Excellent)	**93% (Excellent)**
Economic Effectiveness & Fiscal Sustainability	89% (Excellent)	91% (Excellent)	95% (Excellent)	**92% (Excellent)**
Environmental Sustainability & Resilience	89% (Excellent)	91% (Excellent)	95% (Excellent)	**92% (Excellent)**
Replicability	95% (Excellent)	95% (Excellent)	100% (Excellent)	**97% (Excellent)**
Stakeholder Engagement	79% (Good)	79% (Good)	94% (Excellent)	**82% (Excellent)**
Overall PIERS Composite	**88%**	**88%**	**97%**	**92% (Excellent)**

A closer examination of the results suggests that the consistently strong performance in the first four PIERS dimensions—access and equity, economic effectiveness and fiscal sustainability, environmental sustainability and resilience, and replicability—can largely be attributed to the

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Slovenian legal and institutional framework governing public projects and PPPs. These outcomes are either directly regulated or indirectly shaped by mandatory procedural and substantive requirements, which require public partners to devote systematic attention to the relevant policy objectives.

With regard to access and equity, Slovenian PPP legislation explicitly anchors PPP projects in the concept of public interest. Article 2 of the Public–Private Partnership Act (hereinafter also: the PPP Act) [49] stipulates that PPP projects must pursue the public interest, which in Slovenian legal doctrine is understood as an interest defined and regulated by law. This inherently requires consideration of access, availability and equal treatment of users. In addition, many essential services, such as healthcare, education and municipal utilities, are predominantly organised and delivered either directly by the public sector or through PPP arrangements rather than through purely private provision. This structural characteristic is partly the result of historical development: Slovenia, as part of the former Socialist Federal Republic of Yugoslavia, inherited a strongly socially oriented model of service provision, in which universal access and equity remain deeply embedded normative principles [50].

Similarly, the high scores achieved under economic effectiveness and fiscal sustainability are closely linked to the comprehensive public–private partnership and public-finance framework. Article 23 of the Public Finance Act [51] requires feasibility analyses to be prepared for all public projects with budgetary implications at all stages of the project. This obligation is further elaborated by the Government Decree on the Uniform Methodology for the Preparation and Assessment of Investment Documentation in the Field of Public Finance [52], which precisely defines the content and sequence of mandatory documents, including the project fiche, pre-feasibility study with mandatory updates, feasibility study, implementation study and project implementation reports, referred to collectively here as feasibility studies. These requirements impose rigorous ex ante and ex post economic scrutiny and significantly raise the standard of fiscal discipline and value-for-money assessment.

Additional safeguards apply in PPP-specific contexts. The PPP Act mandates the preparation of a ‘PPP Test’ under Article 34 in cases involving unsolicited proposals, requiring comparison and evaluation between the prepared feasibility study and unsolicited proposals. Only if the test is positive may the public tender be prepared. Moreover, Article 25 of the Certain Concessions Act requires a ‘Study on Justification for the Award of a Concession’, including additional analytical elements, inter alia state-aid analysis, for all concessions exceeding approximately EUR 5.4 million in combined CAPEX and OPEX over the concession life cycle.

Environmental sustainability and resilience are likewise strongly supported by mandatory legal requirements. Feasibility studies must explicitly address environmental impacts, and projects with significant environmental effects are subject to environmental impact assessment procedures. Environmental considerations are therefore systematically integrated into project preparation and decision-making, which is reflected in the uniformly high PIERS scores for this dimension.

By contrast, replicability is not formally regulated as a standalone requirement. The excellent results observed in the analysed projects are therefore best explained by the proactive approach of municipal contracting authorities in Slovenia, which develop individual projects into broader programmes. In particular, the full publication of tender documentation, including contractual arrangements, on the national public procurement portal reflects a strong commitment to transparency and aligns with the principles of open contracting. This practice facilitates knowledge transfer, benchmarking and replication by other public authorities, even in the absence of explicit legal obligations.

The weakest and most variable dimension across the projects is stakeholder engagement. Unlike other PIERS outcomes, stakeholder engagement in Slovenia is not mandated at any specific stage of the PPP procedure and is largely left to the discretion and institutional maturity of public partners. Meaningful stakeholder engagement [53] is time- and resource-intensive and may affect project timelines, which often makes contracting authorities reluctant to implement it systematically. The

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relatively favourable scores achieved in the three analysed projects can be attributed to the high level of awareness and proactivity of the two public partners, who recognised that effective project delivery is difficult without stakeholder involvement. However, it is reasonable to assume that stakeholder engagement scores in many other PPP projects in Slovenia might be significantly lower.

Notably, the higher score for stakeholder engagement in the e-Mobility Kranj project reflects the fact that such engagement was essential to the project's success. The project incorporated a sharing-economy dimension, whereby two or more schools, each of which had previously operated its own combined vehicle, would jointly use a shared vehicle. Resistance to implementation was considerable, as the public perceived that vehicles would effectively be 'taken away' from them. Successful implementation therefore required a significantly higher level of stakeholder engagement than would ordinarily be expected in comparable projects.

Nevertheless, an important formal safeguard indirectly supporting stakeholder participation is the requirement that, before launching a PPP, a government regulation for state-level PPPs or a municipal decree adopted by the municipal or city council for local-level PPPs must be adopted. These acts are publicly disclosed before adoption, enabling the general public to submit comments and proposals. This mechanism resembles the approach commonly referred to as 'notice-and-comment rulemaking', whereby draft legislation or regulatory acts are published in advance to enable public participation in the decision-making process [54]. While valuable, this safeguard remains limited in scope and cannot substitute for systematic stakeholder engagement throughout the project life cycle.

3.1.6. Findings on Research Question 1

The systematic application of the PIERS methodology at project and programme level demonstrably enhances the implementation of PPP projects and programmes by providing a structured framework for evaluating critical performance dimensions, including all PIERS outcomes. The high scores achieved in the first four PIERS dimensions across the analysed programmes show how procedural and substantive legal requirements embedded in Slovenian PPP legislation require public partners to address key policy objectives systematically, thereby improving project outcomes.

Access and equity outcomes benefit from the explicit legal anchoring of PPP projects in the public interest, which requires equal availability and equal treatment of users. This legal basis ensures that projects inherently consider social dimensions and is reinforced by Slovenia's historically socially oriented model of service provision.

Economic effectiveness and fiscal sustainability are strengthened through rigorous public-finance regulations requiring comprehensive feasibility studies and economic scrutiny both before and after project implementation. These legislative provisions foster fiscal discipline and value-for-money assessment, which are crucial for project viability and sustainability.

Environmental sustainability and resilience are systematically integrated into project planning through mandatory environmental impact assessments and the explicit inclusion of environmental considerations in investment documentation, which the PIERS methodology captures effectively.

Although replicability is not a formal legal requirement, proactive transparency practices in Slovenia, such as the publication of full tender documentation and contracts, promote knowledge sharing and benchmarking, thereby facilitating the replication and scaling of successful projects.

By contrast, stakeholder engagement emerges as the weakest dimension, primarily because there are no explicit legislative mandates for participatory stakeholder engagement throughout the PPP life cycle. Its reliance on the discretion and institutional maturity of public partners leads to inconsistent application and lower scores. Although procedural safeguards, such as public disclosure of regulatory acts before the launch of a PPP, provide limited opportunities for public input, they are not sufficient substitutes for systematic stakeholder involvement. This gap shows how the PIERS methodology can reveal critical weaknesses and encourage stronger governance practices.

In summary, when applied systematically at project and programme level, the PIERS methodology not only improves the implementation of PPP projects by aligning evaluation with

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existing legal and procedural frameworks, but also identifies sustainability strengths and weaknesses rooted in those frameworks. This dual role supports evidence-based improvements in PPP design and execution and highlights the need for stronger stakeholder-engagement requirements to address persistent governance challenges.

3.2. National-Level Perspective

3.2.1. Structure of the National-Level Analysis

The analysis in this section integrates macro-level SDG performance trends for Slovenia, as reported in the Sustainable Development Reports 2023–2025, with micro-level sustainability evidence derived from the UNECE PIERS evaluation of three representative green PPP programmes. This multi-scalar perspective allows both structural convergence, where project performance reinforces national progress, and divergence, where systemic or institutional barriers prevent project success from translating into national acceleration, to be identified.

To answer RQ2—'To what extent do PIERS project-level results align with Slovenia's national SDG performance and contribute to it?'—two types of analysis are conducted. First, all 17 SDGs are examined from the perspective of the contribution of individual projects to each specific SDG, including their degree of alignment and potential contribution. On the basis of this analysis, the SDGs most relevant to the three programmes under consideration are identified, followed by a more detailed assessment of the projects' contribution to those SDGs.

3.2.2. Comparative Analysis of Average PPP Programme Performance across PIERS Outcome Categories and Contribution to Slovenia's National SDG Performance

From the project perspective, as described above, the EPC Ljubljana programme achieves excellent scores in environmental and fiscal dimensions, underscoring strong alignment with SDG 7 (Affordable and Clean Energy) and SDG 9 (Industry, Innovation and Infrastructure). However, lower results in stakeholder engagement (79 per cent) reveal limitations in public participation processes, corresponding to weaker national performance under SDG 17 (Partnerships for the Goals) and certain aspects of SDG 11 (Sustainable Cities and Communities). The project shows significant potential for replication and scaling, with very high scores under the replicability dimension, suggesting that the EPC model could be expanded further nationally if institutional support for participatory governance were strengthened.

The Green Energy Ljubljana programme has an almost identical sustainability profile to EPC Ljubljana, with environmental and economic dimensions above 90 per cent. It is particularly notable for strong outcomes in transparency, fiscal management and replicability, which relate to Slovenia's improved national SDG 11 performance in 2024 and 2025. However, stakeholder engagement (72 per cent) remains lower, indicating that project benefits could be better internalised by the local community. Although technological and financial indicators are strong, societal participation and behavioural change lag behind.

The e-Mobility Kranj PPP demonstrates the most balanced and comprehensive performance among the three programmes, reaching near-perfect scores across all five PIERS dimensions, including 94 per cent in stakeholder engagement. This exceptional result positions the Kranj e-Mobility initiative as a model People-first PPP, reflecting direct contributions to SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action). The project's success in community engagement, participatory planning and transparent communication contrasts with the weaker engagement observed in the other two cases and provides evidence of how inclusive governance can strengthen environmental and replicability outcomes.

The analysis below examines the alignment between the SDGs and the performance of the three PPP projects evaluated using the PIERS methodology. Although the PIERS framework is structured primarily around PIERS outcomes and criteria, its results have varying degrees of direct, indirect, neutral and corrective alignment with national SDG targets. In other case studies, negative alignment

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could also arise, although that is not the case here. By reviewing each SDG individually, the analysis shows how PIERS outcomes support, complement or remain neutral in relation to Slovenia's progress towards the global goals. This provides a more nuanced understanding of how local project impacts resonate with broader sustainability objectives.

SDG 1 – No Poverty

Slovenia consistently ranks among the top countries for poverty reduction, maintaining a very low at-risk-of-poverty rate and broad access to social protection systems. Between 2023 and 2025, progress remained stable, with no significant new initiatives altering the trajectory. The PIERS methodology does not directly address poverty alleviation, but its employment and affordability elements, particularly the AE and EE dimensions, indirectly support SDG 1 through local job creation and reduced municipal energy expenditure. The alignment is therefore indirect. As all three analysed projects achieved excellent results in the PIERS AE and EE dimensions, they indirectly contribute to SDG 1.

SDG 2 – Zero Hunger

Food security has been achieved nationally, although major challenges remain, as described above. Performance remains stable. The three PPP projects are not food-sector initiatives, although improved municipal budgets resulting from energy savings may release resources for programmes related to SDG 2. The alignment is therefore indirect and positive.

SDG 3 – Good Health and Well-Being

Health outcomes remain strong, although air-quality externalities related to mortality remain a continuing challenge. The e-Mobility Kranj project contributes directly to urban air-quality improvement by reducing transport emissions and therefore supports SDG 3. The EPC Ljubljana programme also contributes to improved air quality by reducing the energy consumption required for the operation of public buildings. This reduction decreases reliance on energy sources traditionally associated with air pollution, including district-heating plants. Similarly, the Green Energy Ljubljana initiative ensures that the energy needed for public-building operations is generated from an environmentally friendly, non-polluting source. Collectively, all three programmes have a direct impact on SDG 3, particularly on the indicator measuring the age-standardised death rate attributable to household and ambient air pollution per 100,000 population, which remains a significant challenge in Slovenia.

SDG 4 – Quality Education

Education and skills indicators continue to face persistent challenges, with progress remaining stagnant in national SDG performance. Each of the three programmes incorporates training and capacity-building elements in accordance with the PIERS EE4 criterion. At the same time, all three programmes improve educational conditions by focusing on the infrastructure, equipment and energy standards necessary for the effective and high-quality operation of schools. These initiatives therefore contribute to the development of human capital and generate micro-level improvements that align indirectly with SDG 4.

SDG 5 – Gender Equality

Slovenia demonstrates relatively strong performance on SDG 5; however, the 2025 report indicates stagnation in progress. All three initiatives address gender inclusion through employment and equal-opportunity clauses under EE 4.5, and women were proactively engaged in all three initiatives. The connection with SDG 5 is therefore direct.

SDG 6 – Clean Water and Sanitation

The continuing challenge of scarce-water consumption embodied in imports negatively affects Slovenia's performance on SDG 6, although performance on this indicator improved between 2023 and 2025. None of the projects is primarily or directly linked to SDG 6 in terms of water consumption and wastewater discharge. However, after applying the PIERS methodology, opportunities were identified in all three projects for influencing water consumption and wastewater discharge, including ecological waterless vehicle cleaning, the installation of drinking fountains in schools and

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analysis of the feasibility of solar-panel cleaning solutions. The alignment is therefore direct, with all three programmes affecting freshwater withdrawal and use in a corrective way.

SDG 7 – Affordable and Clean Energy

Slovenia demonstrates strong performance in achieving SDG 7, although challenges remain, particularly in increasing the share of renewable energy in the overall energy mix. PIERS scores for all projects reach 100 per cent on energy efficiency and GHG reduction under ES1. The projects directly operationalise SDG 7 by achieving energy savings and renewable-energy integration at municipal level. This demonstrates strong convergence, as the projects reinforce national leadership in SDG 7.

SDG 8 – Decent Work and Economic Growth

Progress towards decent work and economic growth in Slovenia is hindered by several factors. These include the prevalence of modern slavery and modern slavery linked to imports, the significant number of young people not in employment, education or training, and fatal work-related accidents. These issues limit the potential for improved employment rates and productivity growth. PIERS project results for EE4, ranging from 71 to 84 per cent, show that systematic challenges also exist at project level, namely that issues related to enhanced employment and economic opportunities are addressed implicitly rather than explicitly. Alignment between the PIERS results for all three projects and national SDG 8 results is direct and coherent, reflecting structural constraints. In other words, the projects reflect the same structural limitations as those observed nationally.

SDG 9 – Industry, Innovation and Infrastructure

SDG 9 is one of Slovenia's flagship SDGs. Slovenia performs well on all indicators in the 2025 report, with the exception of expenditure on research and development as a percentage of GDP, which has been achieved but is stagnating, similarly to the female share of graduates from science, technology, engineering and mathematics (STEM) fields at tertiary level. Internet access by income also lags slightly behind, although remaining challenges are improving.

All three projects perform excellently on economic effectiveness and replicability, with scores of at least 90 per cent, indicating strong capacity for innovation diffusion. However, the PIERS score for the Environmental Sustainability and Resilience criterion ES5 is slightly lower, ranging from 76 to 86 per cent. ES5 aims to ensure that a comprehensive risk and resilience assessment is carried out, addressing climate change, acute shocks and chronic stressors, while ensuring that adequate funding is allocated for project and community resilience and disaster management. The criterion also focuses, inter alia, on securing resources for research, innovation, capacity building and awareness programmes. Alignment between PIERS results for all three projects and national SDG 9 results is therefore direct and coherent but also reflective, as the projects reproduce the same structural limitations as those observed nationally.

SDG 10 – Reduced Inequalities

Slovenia performs well on SDG 10, although the elderly poverty rate prevents full achievement of the goal. PIERS access and equity scores, ranging from 89 to 100 per cent and most closely linked to SDG 10, confirm equitable access and affordability in the analysed projects, indicating that PPP benefits are not regressive. The projects therefore maintain Slovenia's strong equity profile and reinforce SDG 10 outcomes, although the alignment is indirect.

SDG 11 – Sustainable Cities and Communities

National trends for SDG 11 between 2023 and 2025 were mixed but steadily improved over the three-year period observed. According to the 2025 report, only the annual mean concentration of PM2.5 is stagnating, and there is no data for access to an improved piped water source as a percentage of the urban population in the SDG report for Slovenia, although the situation in terms of piped water supply is favourable [55]. All three projects demonstrate excellent average performance overall, directly and correctively supporting the achievement of SDG 11, which is already on track according to the 2025 report. Notably, the projects exhibit outstanding replicability scores, which was a critical factor in their development into broader programmes. The replicability outcome is a composite

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measure: if other evaluation criteria do not receive very good or excellent scores, a project is unlikely to progress into a programme.

SDG 12 – Responsible Consumption and Production

Slovenia faces major challenges in achieving SDG 12, and progress is stagnating. Project evidence in the ES dimension is excellent across all three projects: ES1 scores 100 per cent for all projects; ES2 ranges from 72 to 100 per cent; and ES3 ranges from 87 to 100 per cent. These results show substantial integration of circular practices and a generally strong corrective and indirect contribution to achieving SDG 12, especially in relation to production-based air pollution and production-based nitrogen emissions in kg per capita. The alignment is nevertheless partial, as project-level excellence has not yet scaled into system-wide behavioural change.

SDG 13 – Climate Action

Slovenia remains nationally off track on SDG 13, as emission reductions are insufficient and adaptation is lagging. However, all three PPPs achieve outstanding environmental performance, with scores between 89 and 95 per cent and quantified CO_2 and GHG reductions, as well as risk-management planning. This represents direct convergence and corrective alignment: micro-level projects outperform macro-level trends, indicating implementation strength but insufficient policy diffusion.

SDG 14 – Life below Water

Although Slovenia is largely landlocked, it remains nationally off track on SDG 14. All three projects contribute only indirectly and to a minor extent to progress on SDG 14 through their influence on water and air quality affecting biodiversity. This indicates indirect neutral-corrective alignment.

SDG 15 – Life on Land

Challenges remain in relation to SDG 15, and progress is stagnant. Biodiversity pressures and import-related deforestation remain relevant. Projects involving nature-conservation components achieve strong ES4 biodiversity scores, ranging from 75 to 100 per cent, and therefore indirectly and correctively influence SDG 15. Micro-level leadership thus complements moderate national progress.

SDG 16 – Peace, Justice and Strong Institutions

Governance indicators remain relatively high nationally. The projects also achieve scores of 96 to 100 per cent under Zero Tolerance to Corruption (EE1), ensuring transparency and legality in PPP procurement. The projects therefore show strong alignment with SDG 16, particularly in relation to the corruption perception index indicator.

SDG 17 – Partnerships for the Goals

Slovenia faces significant challenges in relation to SDG 17, although it is moderately improving. At project level, the initiatives are not explicitly associated with SDG 17. However, they may indirectly improve outcomes by reducing the financial resources required to operate the physical infrastructure necessary for delivering health and educational services. These savings could then be reallocated to other sectors.

Table 3. Comparative Classification of SDG Alignment and Contribution Patterns in PIERS-Evaluated PPP Programmes.

Alignment Group	SDGs	Main Characteristics of Alignment
Strong direct reinforced Alignment	SDG 3; SDG 5; SDG 7; SDG 11; SDG 16	Projects directly advance SDG goals by enhancing environmental quality, reducing emissions, promoting gender inclusion, ensuring transparent governance, and improving sustainable urban infrastructure and energy efficiency. They strengthen national achievements in these SDGs, often surpassing national trends, particularly

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		in SDG 7 (and SDG 13, which we categorised below in category of Corrective Alignment).
Direct corrective Incremental or Transformative Alignment	SDG 6; SDG 13;	Projects directly address relevant SDG dimensions, but impacts remain partial, developmental, or corrective. Contributions are visible in innovation diffusion, employment support, resilience planning, and water-efficiency measures, although broader structural national challenges persist. Micro-level projects outperform macro-level trends.
Direct reflective Alignment	SDG 8; SDG 9	Projects reflect the same structural limitations as observed nationally. Their contribution is direct and coherent with national SDG priorities, but also reproduces broader systemic weaknesses.
Indirect Positive Alignment	SDG 1; SDG 2; SDG 4; SDG 10; SDG 15; SDG 17	Projects indirectly support these SDGs by enhancing affordability, educational infrastructure, equitable service access, and biodiversity through reduced pollution, as well as generating financial savings that bolster public-sector capacity, social programmes, and related partnerships. Their contributions are supportive rather than primary.
Indirect Partial / Limited Alignment	SDG 12; SDG 14	Projects demonstrate positive project-level practices, particularly regarding circular economy and environmental sustainability, but impacts remain insufficiently systemic or only indirectly connected to broader SDG targets.

3.2.3. Findings on Research Question 2

The analysed case studies demonstrate outstanding environmental and fiscal sustainability, as shown in Section 3.1, suggesting a solid micro-foundation for achieving targets under SDGs 7, 9, 11 and 13. At the national level, however, the Sustainable Development Reports 2023–2025 show that progress on SDG 7 (Affordable and Clean Energy) and SDG 9 (Industry, Innovation and Infrastructure) is moderately improving rather than accelerating. Nevertheless, the vast majority of indicators for SDGs 7 and 9 have been achieved: the 2025 report states that, for SDG 7, only the renewable-energy share indicator has not been achieved, while for SDG 9, the gap in the internet-access indicator has not yet been closed.

By contrast, SDG 13 (Climate Action) faces major challenges and is stagnating, primarily because of structural and institutional factors beyond the control of individual projects. Public opinion is also not strongly supportive of climate action, which may correlate with weaker stakeholder-engagement results. Social cost-benefit analyses are not mandatory [56]. In a 2023 survey, only 41 per cent of Slovenians, compared with an EU average of 46 per cent, identified climate change as one of the four most serious problems facing the world [57].

Among the most relevant SDGs to which these programmes contribute and which serve as analytical reference points, only SDG 11 (Sustainable Cities and Communities) showed stronger results in 2024 and 2025, with the trend on track or maintaining SDG achievement. This is also because cities in particular are acting proactively and implementing various projects, including the three PPP programmes analysed in this paper, often replicating good results achieved by other cities [58]. Unfortunately, municipalities without urban-municipality status often lack sufficient

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administrative capacity, expertise and project scale to achieve measurable progress, owing to the high degree of territorial fragmentation in Slovenia. The country has a population of approximately two million inhabitants and 212 municipalities, of which only 12 have urban-municipality status, while the smallest municipality has fewer than 1,000 inhabitants [59].

Accordingly, the alignment between the three analysed PPP programmes and the most relevant SDGs is: strong direct reinforced alignment for SDGs 7 and 11, as national progress is on track or maintaining SDG achievement and the projects reinforce it; direct corrective alignment for SDG 13, as national progress is weak and the projects act as corrective exemplars; and direct reflective alignment for SDG 9, as the projects reproduce broader systemic weaknesses.

This pattern underscores a key finding: Slovenia's PPPs are technically and environmentally mature but institutionally under-leveraged. To translate excellent project outcomes into greater national SDG acceleration, stronger stakeholder-engagement frameworks, horizontal policy integration and systematic upscaling mechanisms are required.

3.3. Methodological Cross-Context Refinement of PIERS as a Global Framework

3.3.1. Analysis Structure

The cross-context methodological refinement was conducted alongside the application of the PIERS methodology to the three PPP programmes. The evaluation focused not only on project performance but also on the operational functionality, adaptability and contextual sensitivity of the PIERS framework. The analysis therefore assessed both project outcomes and methodological behaviour across different project environments.

This level of analysis emphasised methodological observation and refinement. Systematic records were kept on the applicability of individual PIERS indicators across projects; the methodology's flexibility in relation to project-specific characteristics; the clarity of indicators and scoring criteria; sensitivity to local governance, institutional and infrastructural contexts; and the balance between quantitative and qualitative elements.

Particular attention was given to identifying indicators that were consistently effective across all projects and those whose usefulness depended on sectoral or contextual factors. This distinction enabled the identification of both universally transferable elements and elements requiring contextual adaptation.

These observations informed the development of a cross-context refinement framework designed to enhance the adaptability, analytical precision and operational relevance of the PIERS methodology across diverse PPP and infrastructure projects.

A limitation of this research is that all three PPP programmes, despite differing in design and implementation, relate to connected sectors, namely energy efficiency, sustainable infrastructure and urban environmental transition. The empirical foundation for broad cross-sector methodological refinement is therefore limited. The findings accordingly generate context-specific proposals rather than universally applicable adaptations. Future research should extend the empirical application of PIERS to markedly different sectors, such as healthcare, water management, waste management, digital and social infrastructure, nature preservation, heritage, or transport logistics. Such broader application would allow more robust validation of indicator adaptability, contextual sensitivity and methodological transferability across diverse governance and infrastructure settings.

3.3.2. Analysis and Findings for Research Question 3

On the basis of the analysis of the PIERS User Guide and the comparative assessment logic, one of the strongest recommendations for methodological refinement is the broader and more systematic introduction of an explicit 'Not Applicable' (N/A) option for indicators whose relevance depends heavily on sectoral, geographical, governance or operational context. Although PIERS acknowledges contextual flexibility, the current absence of a clear operational N/A option in certain places often requires users to select numerical scores for indicators that are not substantively relevant to the

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project being assessed. This may artificially distort project evaluation outcomes and negatively affect the overall PIERS score, particularly in projects with limited environmental, social, operational or stakeholder-related impacts in specific assessment areas. The introduction of more explicit and consistently applicable N/A mechanisms would therefore improve methodological proportionality, scoring accuracy and cross-sector comparability.

The analysed projects and the structure of PIERS suggest that several criteria or indicators require clearer or expanded N/A applicability options, as presented in Table 4.

Table 4. PIERS Criteria and Indicators Requiring Clearer or Expanded N/A Applicability Options.

Criteria / Indicator	Reasoning for Additional N/A Option
AE1.3: Is there evidence that stakeholder lives will be / have been / are being transformed as a result of the project providing new or improved access to essential services?	Demonstrating measurable 'transformation' of stakeholder lives may not be proportionate or realistically measurable for smaller-scale projects. Alternatively, the word 'transformed' could be replaced with 'improved'.
AE3.2 - Is an Environmental and Social Impact Assessment being conducted notably to assess and mitigate the project's range of direct and indirect social impacts it will have on the citizens and more particularly the host and affected people communities?	Full Environmental and Social Impact Assessments may not be proportionate for small, medium-sized or low-impact projects with minimal direct social disruption. Alternatively, the wording should allow for adequate measures that do not require a full Environmental and Social Impact Assessment. This indicator also appears to duplicate indicator 4.1, 'Is the project conducting an ESIA?', which is mandatory and has an N/A option.
EE4.3: Is the project identifying skill or capability gaps in the local workforce and establishing targeted training and capacity building programmes towards groups that face barriers to employment and upward mobility in the workplace?	Formal workforce-transition or labour-market transformation measures may not apply where projects involve limited employment restructuring.
ES1.1.1: Are the annual greenhouse gas emissions over the life of the project being calculated?	Although this is not the case in the initiatives analysed in this paper, certain projects may not have material direct GHG-emission sources requiring detailed annual life-cycle calculations.
ES1.1.2 (mandatory indicator): Is the project developing a plan/identifying strategies to reduce or offset greenhouse gas emissions over the life of the project?	Although this is not the case in the initiatives analysed in this paper, some projects may not realistically develop standalone GHG-offset strategies.
ES1.1.3: Is the project implementing measures to reduce (against the baseline) or offset greenhouse gas emissions compared with global norms or widely recognised industry standards (including potentially seeking some form of certification)?	Although this is not the case in the initiatives analysed in this paper, comparison against global norms or certification systems may not be proportionate for certain types of projects or for smaller and medium-sized projects.
ES4.2: **Is the project developing and implementing an environmental management plan (EMP) to avoid, mitigate impacts to, or restore the impact area?**	Development of a full environmental management plan for biodiversity impacts may not be proportionate for some projects, as was the case in the analysed projects. Because the projects indirectly contribute to biodiversity protection through reduced pollution, they were scored 5 in the PIERS methodology, although no EMP specifically protecting biodiversity was developed. An N/A option would have been more appropriate had it existed.
ES4.2: **Is the project preserving and/or improving the functionality of habitats (terrestrial and/or aquatic) in partnership with local authorities (for**	Habitat-preservation partnerships are not equally relevant for all projects, for example urban energy-efficiency or public-building modernisation programmes with minimal ecosystem interaction.

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example, local conservation authorities) or internationally recognised conservation initiatives?	
ES5.4.2: Is there a defined community-driven development (CDD) programme being put in place: making a plan to assess poverty related measures to support the development of the CDD programme?	Poverty-oriented resilience planning may not directly relate to all projects.
ES5.4.3: Is there a defined community-driven development (CDD) programme being put in place: establishing a community socio-economic resilience indicator to support the development of the CDD programme?	Socio-economic resilience indicators may be disproportionate for certain projects.
ES5.4.4: Is there a defined community-driven development (CDD) programme being put in place: being aligned with the Disaster Mitigation Law with respect to CDD programme targets, opportunities, standards and best practices, with appropriate institutional set-up?	Alignment with formal disaster-law institutional frameworks may not apply equally across governance and project contexts.
RE1.2: Is the project replicable and/or scalable, allowing for potential economies of scale and affording wider benefits across the economy such as, but not limited to, the development of the circular economy?	In certain, although rare, cases a project may not be replicable despite achieving excellent project results. The methodology should clearly acknowledge this possibility rather than requiring users to choose one of the numerical options.
SE1.3: Are stakeholder engagement and public participation metrics being established to measure the effectiveness and inclusiveness of the stakeholder engagement and public participation process and metrics, and to measure the specific outcomes achieved as a result of the process?	Comprehensive public-participation structures and metrics may be disproportionate for certain projects with a low public interface or for small and medium-sized projects. Their costs could significantly increase project preparation and implementation costs. An N/A option would be preferable, similar to that for indicator SE1.4, which acknowledges this reality.

As shown above, the comparative application of the PIERS Self-Assessment Tool revealed potential improvements in the treatment of several indicators. Although certain indicators already include an explicit N/A option, this approach is not implemented consistently across the methodology or the Excel-based assessment tool. As a result, users may in practice be required to assign numerical scores to indicators that are not substantively relevant to the specific project type, sectoral context or operational characteristics. This may artificially influence category-level and overall PIERS scores. A more systematic and consistently operationalised N/A framework would therefore improve methodological proportionality, scoring accuracy and cross-sector comparability, while preserving the integrity and flexibility of the methodology.

4. Discussion

This study sheds light on how the PIERS methodology functions across project-level, national-level and methodological dimensions in Slovenia's sustainable PPP landscape, revealing both significant achievements and important challenges.

With regard to RQ1, the project-level analysis shows that the PIERS methodology is a robust framework for evaluating the sustainability dimensions of PPP projects. Its systematic application demonstrates how Slovenia's legal and procedural framework embeds key sustainability criteria into project design and implementation. The strong outcomes achieved in access and equity (AE), economic effectiveness and fiscal sustainability (EE), environmental sustainability and resilience (ES), and replicability (RE) indicate that the analysed projects are firmly rooted in the public interest and fiscal rigour, and are supported by strong regulatory and environmental safeguards.

However, the persistent weakness in stakeholder engagement (SE) exposes a governance gap that is not adequately addressed by existing legislation. The absence of mandatory structured

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participatory processes results in uneven stakeholder involvement, often depending on institutional discretion rather than formal policy requirements. The resources required for meaningful engagement also play an important role: where engagement is not mandatory, it may not be applied consistently. PIERS' ability to identify this shortcoming highlights its value not only as a measurement instrument but also as a diagnostic tool capable of informing governance reform. Strengthening stakeholder engagement through clearer mandates and structured practices could substantially enhance the social legitimacy and long-term sustainability of PPP and infrastructure initiatives.

With regard to RQ2, the relationship between Slovenia's PPP project outcomes and national SDG progress reveals a complex and nuanced pattern of alignment, characterised by varying degrees of reinforcement, correction, reflection and indirect support across different SDGs.

The projects make a strong and proactive contribution to SDGs such as good health and well-being (SDG 3), gender equality (SDG 5), affordable and clean energy (SDG 7), sustainable cities and communities (SDG 11), and peace, justice and strong institutions (SDG 16). Through tangible improvements in environmental quality, emission reductions, the promotion of gender inclusion, transparent governance, and improvements in urban infrastructure and energy efficiency, these initiatives reinforce national sustainability achievements and, in some respects, go beyond prevailing national trends. This is especially evident in relation to SDG 7 and in the corrective contribution of the analysed projects to SDG 13, confirming the strategic value of Slovenia's green PPP portfolio.

For clean water and sanitation (SDG 6) and climate action (SDG 13), the projects act as important corrective forces. Their contributions to resilience planning, water-efficiency measures and emissions reduction are visible and meaningful at project level, but remain partial and developmental in relation to broader national challenges. This suggests that, although systemic issues persist, these PPP initiatives provide valuable examples that could inform policy refinement and scaling.

In areas such as decent work and economic growth (SDG 8) and industry, innovation and infrastructure (SDG 9), the projects tend to reflect the structural limitations visible at national level. Their performance aligns with national priorities and contributes directly to these goals, but it also reproduces challenges that extend beyond individual project boundaries.

Beyond direct contributions, the projects indirectly support SDGs related to poverty reduction, zero hunger, quality education, reduced inequalities, life on land, and partnerships for the goals (SDGs 1, 2, 4, 10, 15 and 17). By improving affordability, enhancing educational infrastructure, ensuring equitable access to services, reducing pollution and strengthening public-sector financial capacity, the projects support broader sustainability goals even where their impact is not primary. Similarly, with regard to responsible consumption and production (SDG 12) and life below water (SDG 14), the projects demonstrate promising practices, especially in relation to circular economy and environmental sustainability. However, their influence remains indirect and insufficiently systemic to drive transformative national progress.

A notable divergence appears in the area of stakeholder engagement, where the projects score lower despite their technical and environmental maturity. This governance gap mirrors national challenges in participatory governance and multi-sector partnerships, limiting the ability to scale and integrate sustainability outcomes effectively. It also constrains the translation of project-level technical success into broader national SDG acceleration.

Overall, the integrated analysis shows that Slovenia's PPPs strongly reinforce, and in some cases correct, national SDG trajectories. At the same time, they reflect systemic constraints and provide indirect support where direct impact is less feasible. To move beyond steady progress towards accelerated national SDG achievement, Slovenia should strengthen institutional frameworks for stakeholder engagement, improve horizontal policy integration and develop mechanisms for replicating and scaling successful project models. These priorities are essential for bridging the gap between micro-level project excellence and macro-level sustainability impact.

Future research could examine whether similarly high levels of direct alignment can be identified in other countries and in other institutional contexts.

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With regard to methodological refinement and cross-context adaptability (RQ3), the study identifies opportunities to improve the adaptability and evaluative precision of the PIERS framework. Although the analysis is limited to three initiatives in related sectors, the main methodological challenge identified concerns the imposition of numerical scores on indicators that may lack substantive relevance in specific project contexts. This can distort evaluation outcomes and compromise cross-sector comparability. Introducing a more explicit and consistently applied 'Not Applicable' (N/A) option would mitigate this problem, enabling assessments that are more accurate, proportionate and context-sensitive.

Such methodological enhancement would strengthen the validity and flexibility of PIERS across a diverse range of PPP and infrastructure projects. It is particularly relevant for sectors or project types in which certain sustainability criteria may be peripheral. A clearer and more systematic N/A mechanism would help prevent artificial score inflation or deflation and would support more nuanced decision-making and policy-relevant evaluation. By incorporating such refinements, PIERS would be better positioned to support international discussions on sustainable public–private partnerships and the assessment of People-first infrastructure projects.

At the same time, the analysis conducted across all three analytical levels confirms that all 17 SDGs are reflected within the PIERS methodology. PIERS can therefore be regarded as a comprehensive sustainability assessment framework. Future research could further examine the relationship between national SDG indicators and PIERS indicators and explore whether the methodological framework should be expanded accordingly. However, any such expansion would likely increase the need for a broader and more systematically operationalised use of N/A categories in order to preserve methodological proportionality and cross-sector applicability.

5. Conclusions

Slovenia's PIERS-assessed PPP projects demonstrate a strong capacity to implement sustainability at project level, particularly in relation to energy, innovation, environmental resilience and sustainable cities. The application of the PIERS methodology also identified areas for improvement in specific projects that had not originally been considered, including the potential influence of all three projects on drinking-water-related issues.

However, broader progress towards the SDGs depends on addressing institutional barriers, especially in participatory governance and climate action. By introducing mandatory participatory stakeholder engagement in PPP project preparation and implementation, and by embedding the PIERS methodology more extensively into project preparation, Slovenia could translate project-level successes into more systematic, widespread and coherent progress across all SDGs. This would help close the gap between isolated achievements and nationwide sustainability impact.

From a methodological perspective, refining the PIERS framework by improving its adaptability and introducing clearer options for context-specific relevance would enhance its effectiveness across diverse projects and sectors.

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Appendix A

Nr.		EPC Ljubljana	Green Energy Ljubljana	eMobility Kranj
	ACCESS AND EQUITY			
AE1.	PROVIDE ESSENTIAL SERVICES			
AE1.1	Is the project identifying and taking into account the real needs of the people by reference to their economic and social situation as established through the stakeholder engagement process?	5	5	5
AE1.2	Is the project contributing in an organised manner to the expansion and improvement (for example including but not limited to circular economy processes) of essential services?	5	5	5
AE1.3	Is there evidence that stakeholder lives will be / have been / are being transformed as a result of the project providing new or improved access to essential services?	5	5	5
AE1.4	Is the project avoiding, eliminating, mitigating, and/or offsetting impacts to existing essential services?	N/A	N/A	N/A
AE1 score:		100% (Excellent)	100% (Excellent)	100% (Excellent)
AE2.	ADVANCE AFFORDABILITY AND UNIVERSAL ACCESS			
AE2.1	Affordability: Is the level of service provided by the project clearly identifying and addressing in a conservative manner the affordability capacity of the people that the project is intended to serve over the life cycle of the project, such that, *inter alia*:			
AE2.1.1	for a concessions PPP, the service provided by the project is and can be expected to remain reasonably affordable for the users including if necessary, through special rules for those most vulnerable and disadvantaged?	5	5	5
AE2.1.2	for a government-pay PPP, the costs of the service provided by the project can be accommodated within the available public sector budget?			
AE2.1.3	in both cases, there are plans to monitor and regulate (giving due consideration to the maintenance of the project's economic and financial balance) the ongoing effectiveness of the affordability measures put in place by the project and to confirm that the costs of the service provided by the project are lower than the cost of the same service provided by the contracting authority under any other procurement form?	5	5	5
AE2.2	Accessibility: Is the level of service provided by the project clearly identifying and addressing the accessibility needs of the people the project is intended to serve over the life cycle of the project and taking			

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	into account various economic development scenarios, such that, *inter alia*:			
AE2.2.1	the service is provided by the project accessible by all users including those most vulnerable and disadvantaged?	4	4	5
AE2.2.2	there are plans to monitor (through indicators and targets for both nominal and effective access) and regulate the ongoing effectiveness of the accessibility measures put in place by the project?	5	5	5
AE2 score:		88% (Excellent)	92% (Excellent)	100% (Excellent)
AE1.	IMPROVE EQUITY AND SOCIAL JUSTICE			
AE3.1	Is the historic context of equity and social justice being taken into account and remedied through the project?	5	5	5
AE3.2	Is an Environmental and Social Impact Assessment being conducted notably to assess and mitigate the project's range of direct and indirect social impacts it will have on the citizens and more particularly the host and affected people communities?	3	3	5
AE3 score:		67% (Good)	67% (Good)	100% (Excellent)
AE4.	PLAN FOR LONG-TERM ACCESS AND EQUITY			
AE4.1	Are potential impacts to project performance and economic and financial equilibrium over the project life cycle in terms of accessibility and equitability being evaluated?	5	5	5
AE4.2	Is the project being designed, structured, developed, managed, or contracted (based on a contract template included in the tender documents) in such a way to:			
AE4.2.1	be able to continue to anticipate and respond to potential future needs to project performance in terms of affordability, accessibility, and equitability over the life cycle of the project?	5	5	5
AE4.2.2	share fairly project's benefits among stakeholders (the parties to the PPP contract as well as the users and affected communities) over the life cycle?	5	5	5
AE4.3	Are monitoring and orderly contract adaptation mechanisms in place to ensure continued service delivery at acceptable performance levels over the life of the project?	4	5	5
AE4 score:		93% (Excellent)	100% (Excellent)	100% (Excellent)
AE5.	AVOID/MINIMISE AND MITIGATE PHYSICAL AND ECONOMIC DISPLACEMENT			

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AE5.1	Is the land to be permanently acquired or temporarily used for the project being selected only for the unavoidable, exclusive and necessary needs of the project?	5	5	5
AE5.2	Where land acquisition is unavoidable, is the physical and economic displacement process following the UN Basic Principles and Guidelines on Development-based Evictions and Displacement (2007)?	N/A	N/A	5
AE5 score:		100% (Excellent)	100% (Excellent)	100% (Excellent)
AE score:		89% (Excellent)	91% (Excellent)	100% (Excellent)
	ECONOMIC EFFECTIVENESS AND FISCAL SUSTAINABILITY			
EE1.	AVOID CORRUPTION AND ENCOURAGE TRANSPARENT PROCUREMENT			
EE1.1	Is the project generally following or adhering to the UNECE Standard on a Zero Tolerance Approach to Corruption in PPP Procurement (ZTC) or the principles contained therein?	5	5	5
EE1.2	Are approvals of the project, PPP contract and private sponsor/shareholder being processed according to law and in full transparency?	5	5	5
EE1.3	Is the project being awarded transparently, namely:			
EE1.3.1	through an open and transparent competitive tender?	5	5	5
EE1.3.2	in the case of an unsolicited proposal or alternative approach devoid of competition, generally following the safeguards stipulated in the UNECE Standard on a Zero Tolerance Approach to Corruption in PPP Procurement (ZTC) or the principles contained therein?	5	5	5
EE1.4	Is evidence of corruption or undue influence absent throughout the stages of PPP procurement (identification, development, and implementation)?	5	5	5
EE1.5	Is the PPP the result of a structured negotiation process resulting in a balanced contract (based on a contract template included in the tender documents)?	4	5	5
EE1 score:		96% (Excellent)	100% (Excellent)	100% (Excellent)
EE2	MAXIMISE ECONOMIC VIABILITY AND FISCAL SUSTAINABILITY			
EE2.1	Is the project delivering “value-for-people” meaning:			
EE2.1.1	the project is offering net tangible and intangible benefits to society by providing services to a consistently and verifiably higher standard?	5	5	5
EE2.1.2	positive externalities are being generated over the life of the project in line with national strategy and programmes?	5	5	5
EE2.2	Is the project generating positive “value-for-money” meaning:			

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EE2.2.1	the costs net of benefits of the selected PPP contractual model are lower vs. a modern public procurement model?	5	5	5
EE2.2.2	the project's cost/benefit analysis is favourable for the public party, comparing the amount of taxpayer's money required for the project and the economic benefits (including any upfront or annual fees from the project) that will accrue from the project's implementation?	5	5	5
EE2.3	Are any budgetary impacts or revenues being transparently reflected in public accounts meaning:			
EE2.3.1	the fiscal sustainability of the PPP contract and creditworthiness of the public authority are being positively assessed?	5	5	5
EE2.3.2	the burden of any direct payment, the fiscal return to the public authority and the potential burden of the debt from contingent liabilities are being openly disclosed to interested parties?	5	5	5
EE2.4	Is the project maximising development impact and facilitating women's empowerment?	3	4	4
EE2 score:		90% (Excellent)	95% (Excellent)	95% (Excellent)
EE3.	MAXIMISE LONG-TERM FINANCIAL VIABILITY			
EE3.1	Is the project's private sponsor/shareholder of adequate technical, financial and reputational standing to successfully finance, implement, operate and maintain the project over its life, including having access to necessary resources to fulfil its contractual obligations under various economic scenarios and to adapt the services provided to the potentially evolving needs?	5	5	5
EE3.2	Are the revenues under the PPP contract enabling the private partner to cover during the project life cycle operating and maintenance costs and to repay the capital invested including an agreed target Internal Rate of Return (IRR) commensurate with project's risk and reward profile?	5	5	5
EE3.3	Are material risks and rewards of the PPP being identified and appropriately mitigated, allocated or shared (as the case may be) in the contract or in the underlying regulations for the PPP delivery form selected and sector?	4	5	5
EE3 score:		94% (Excellent)	100% (Excellent)	100% (Excellent)
EE4.	ENHANCE EMPLOYMENT AND ECONOMIC OPPORTUNITIES			
EE4.1	Is the project creating a significant number of new local jobs during project identification, development, and implementation?	4	4	4
EE4.2	Are quality jobs being created by the PPP that are in line with the ILO Decent Work Indicators?	5	5	5

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EE4.3	Is the project identifying skill or capability gaps in the local workforce and establishing targeted training and capacity building programmes towards groups that face barriers to employment and upward mobility in the workplace?	3	3	4
EE4.4	Are there plans and programmes, including key performance indicators (KPIs) being put in place to ensure diversity and inclusion in the workforce?	3	3	3
EE4.5	Are there commitments being made for the protection of workers' rights that include:			
EE4.5.1	women's rights?	4	3	5
EE4.5.2	non-discrimination?	4	3	5
EE4.5.3	prevention of violence and harassment in the workplace?	4	3	5
EE4.5.4	equal pay for equal work?	4	3	5
EE4.5.5	access to education and other essential services?	4	3	5
EE4 score:		76% (Good)	71% (Good)	84% (Excellent)
EE score:		89% (Excellent)	91% (Excellent)	95% (Excellent)
	ENVIRONMENTAL SUSTAINABILITY AND RESILIENCE			
ES1.	REDUCE GHG EMISSIONS AND IMPROVE ENERGY EFFICIENCY			
ES1.1	Greenhouse gas emissions:			
ES1.1.1	Are the annual greenhouse gas emissions over the life of the project being calculated?	5	5	5
ES1.1.2	Is the project developing a plan/identifying strategies to reduce or offset greenhouse gas emissions over the life of the project?	5	5	5
ES1.1.3	Is the project implementing measures to reduce (against the baseline) or offset greenhouse gas emissions compared with global norms or widely recognised industry standards (including potentially seeking some form of certification)?	5	5	5
ES1.2	Energy efficiency:			
ES1.2.1	Is the annual energy consumption of the project, per unit of output/service, being regularly calculated?	5	5	5
ES1.2.2	Is the project developing a plan/identifying strategies to improve the energy efficiency/reduce energy consumption of the project?	5	5	5
ES1.2.3	Is the project implementing measures to reduce energy consumption per unit of output/service compared to national norms?	5	5	5
ES1.2.4	Is the project improving the Energy Performance Index (EPI), the Energy Use Index (EUI) or meeting the EU Energy performance of buildings directive (EPBD) or other equivalent regulatory standard of any facilities and/or buildings included in the project, as measured by the total energy consumed in a building/facility over a year divided by the total built-up area compared to national norms?	5	5	5

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ES1 score:		100% (Excellent)	100% (Excellent)	100% (Excellent)
ES2.	REDUCE WASTE AND RESTORE DEGRADED LAND			
ES2.1	Circular economy:			
ES2.1.1	Is the project investigating the potential to utilise unwanted waste and/or excess resources from another local project or by finding local destinations for the beneficial use/reuse of its unwanted waste and/or excess resources?	N/A	N/A	5
ES2.1.2	Is the material input per unit of service (MIPS) for the project being calculated, and is the project reducing the raw material intensity of materials compared to national norms?	N/A	N/A	N/A
ES2.1.3	Is the project preparing an operational waste management plan, which addresses the reduction of waste (including hazardous waste) over the life of the project?	N/A	3	N/A
ES2.1.4	Is the project reducing waste generation (including hazardous waste) per unit of output or service per year compared to the national industry norm?	N/A	5	5
ES2.1.5	For any waste generated by the project (after reduction measures have been incorporated), is the project reducing the diversion of waste (including hazardous waste) to a landfill per unit of output or service per year compared to the national industry norm?	N/A	3	N/A
ES2.2	Is the project located on previously developed land or barren or degraded land unfit as farmland?	N/A	5	N/A
ES2.3	Is the project restoring (compensating) equivalent degraded land in the project footprint at a location outside the project boundary, but within the impact area of the project?	N/A	N/A	N/A
ES2 score:		N/A	72% (Good)	100% (Excellent)
ES3.	WATER CONSUMPTION AND WASTEWATER DISCHARGE			
ES3.1	Is the project meeting the statutory wastewater discharge norms after treatment and including features to minimise the negative impacts of water usage, and/or watershed-scale issues?	5	5	5
ES3.2	Is the project identifying and implementing strategies to reduce the amount of freshwater consumed/used by the project per unit of output/service compared to national norms?	5	N/A	4
ES3.3	Is the project having a net-zero impact on the quantity and availability of fresh surface water and groundwater supplies?	5	5	4
ES3 score:		100% (Excellent)	100% (Excellent)	87% (Excellent)
ES4.	PROTECT BIODIVERSITY			
ES4.1	Is the project conducting an ESIA?	3	N/A	5

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ES4.2	Is the project developing and implementing an environmental management plan (EMP) to avoid, mitigate impacts to, or restore the impact area?	5	5	5
ES4.3	Is the project preserving and/or improving the functionality of habitats (terrestrial and/or aquatic) in partnership with local authorities (for example, local conservation authorities) or internationally recognised conservation initiatives?	5	5	5
ES4 score:		75% (Good)	100% (Excellent)	100% (Excellent)
ES5.	ASSESS RISK AND PREPARE FOR DISASTER MANAGEMENT			
ES5.1	Is the project developing a well-articulated risk reduction and mitigation strategy for the project involving a response and recovery coordination mechanism being put in place with the host and the affected communities?	5	4	4
ES5.2	Is the project identifying funds from different sources and/or providing a budget for:			
ES5.2.1	asset losses?	5	5	5
ES5.2.2	well-being losses?	5	5	5
ES5.3	Is the project allocating funds to support research, innovation, capacity building and/or awareness programmes?	5	3	5
ES5.4	Is there a defined community driven development (CDD) programme being put in place:			
ES5.4.1	identifying preventive measures and preparatory actions before, emergency actions during, and recovery and resilience actions after natural and human induced disasters?	4	5	5
ES5.4.2	making a plan to assess poverty related measures to support the development of the CDD programme?	3	3	4
ES5.4.3	establishing a community socio-economic resilience indicator to support the development of the CDD programme?	2	3	4
ES5.4.4	being aligned with the Disaster Mitigation Law with respect to CDD programme targets, opportunities, standards and best practices, with appropriate institutional set-up?	3	4	5
ES5 score:		80% (Excellent)	76% (Good)	86% (Excellent)
ES score:		89% (Excellent)	91% (Excellent)	95% (Excellent)
	REPLICABILITY			
RE1.	ENCOURAGE REPLICABILITY AND SCALABILITY			
RE1.1	Is the PPP designed by reference to lessons learnt on common issues and solutions for PPP projects in general?	5	5	5

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RE1.2	Is the project replicable and/or scalable, allowing for potential economies of scale and affording wider benefits across the economy such as, but not limited to, the development of the circular economy?	5	5	5
RE1.3	Is the project increasing revenue and/or reducing costs over its life cycle through optimised design, resource efficiency, appropriate commercialisation and/or an innovative business model?	5	5	5
RE1 score:		100% (Excellent)	100% (Excellent)	100% (Excellent)
RE2.	STANDARDISE PPP PREPARATION AND TENDER			
RE2.1	Are template contracts being developed within the country providing for inter alia, financial and economic equilibrium during the project life cycle, special rights of the public contractor to adapt the service provision when public interest justifies together with special compensation rights for the private partner?	4	4	5
RE2 score:		75% (Good)	75% (Good)	100% (Excellent)
RE3.	ENHANCE GOVERNMENT, INDUSTRY AND COMMUNITY CAPACITY			
RE3.1	Are opportunities for the transfer of knowledge/know-how, technologies and skills from the private party to the public party and/or local community stakeholders being assessed and/or successfully implemented?	5	5	5
RE3.2	Is the PPP increasing government capacity and/or project/industry capacity?	5	5	5
RE3.3	Is the PPP increasing local community capacity?	5	5	5
RE3 score:		100% (Excellent)	100% (Excellent)	100% (Excellent)
RE4.	SUPPORT INNOVATION AND TECHNOLOGY TRANSFER			
RE4.1	Is the project implementing one or more innovative methods, technologies, or processes that eliminate or substantially reduce significant problems, barriers or limitations, and/or create scalable and transferrable solutions?	5	5	5
RE4.2	Is the PPP including a transfer of technology (e.g. to enable a circular economy) or know-how that contributes to inclusive growth, service quality, sustainability and replicability?	5	5	5
RE4.3	Is the project pursuing or intending to pursue recognition so that the project be recognised for its contributions to sustainability and resiliency?	5	5	5
RE4.4	Are other opportunities arising from the PPP to enhance the capacity, efficiency and effectiveness of public and private sector and/or the local community being initiated or implemented?	5	5	5

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RE4 score:		100 % (Excellent)	100 % (Excellent)	100 % (Excellent)
RE score:		95% (Excellent)	95% (Excellent)	100 % (Excellent)
	STAKEHOLDER ENGAGEMENT			
SE1.	PLAN FOR STAKEHOLDER ENGAGEMENT AND PUBLIC PARTICIPATION			
SE1.1	Is a stakeholder mapping exercise being undertaken to determine all stakeholders directly and indirectly affected by and/or interested in the project?	4	3	5
SE1.2	Is a stakeholder engagement plan (including public participation) being developed, that takes into account the specific needs of each stakeholder, and considers the broad range of project issues that need to be addressed?	4	3	5
SE1.3	Are stakeholder engagement and public participation metrics being established to measure the effectiveness and inclusiveness of the stakeholder engagement and public participation process and metrics, and to measure the specific outcomes achieved as a result of the process?	2	3	3
SE1.4	Is an independent oversight committee responsible for overseeing and monitoring the effectiveness of the stakeholder engagement and public participation process, and the publication and dissemination of project information being established?	2	3	5
SE1 score:		55% (Satisfactory)	50% (Satisfactory)	88% (Excellent)
SE2.	MAXIMISE STAKEHOLDER ENGAGEMENT AND PUBLIC PARTICIPATION			
SE2.1	Are the stakeholder engagement and public participation plan(s) throughout the project's lifecycle, in an effective, timely and inclusive fashion being in place and implemented?	3	3	5
SE2.2	Are members of the public, including environmental defenders, able to express their views and participate freely without fear of being penalized, persecuted or harassed for their involvement?	5	5	5
SE2.3	Is stakeholder feedback being:			
SE2.3.1	incorporated into project plans, designs, processes and/or influenced decision-making?	5	5	5
SE2.3.2	treated fairly and equitably, and according to the principles of social and environmental justice?	5	5	5
SE2.3.3	sought from stakeholders as to their satisfaction with the engagement and public participation process(es) and the resulting decisions made based on their feedback?	4	4	5
SE2 score:		83% (Excellent)	83% (Excellent)	100% (Excellent)

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SE3.	PROVIDE TRANSPARENT AND QUALITY PROJECT INFORMATION			
SE3.1	Is quality and pertinent information about the project relative to the PPP for the SDGs outcomes being made readily available to all stakeholders, including members of the public, and being provided in a transparent, timely, understandable and accessible fashion, and incorporated in the PPP contract?	4	4	5
SE3.2	Are regular reports summarising the substantial outcome of general stakeholder engagement meetings being published and are they accessible to all stakeholders, including members of the public?	5	5	3
SE3 score:		85% (Excellent)	85% (Excellent)	80% (Excellent)
SE4.	MANAGE PUBLIC GRIEVANCES AND END USER FEEDBACK			
SE4.1	Are a process and mechanisms to manage public grievances and end-user/customer feedback being set up?	5	5	5
SE4.2	Are public grievances and end-user/customer feedback being successfully addressed and/or resolved?	5	5	5
SE4.3	Are public grievances and end-user/customer feedback, including outcomes being tracked and made available subject to personal data protection regulations?	5	5	5
SE4 score:		100% (Excellent)	100% (Excellent)	100% (Excellent)
SE score:		79% (Good)	79% (Good)	94% (Excellent)

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