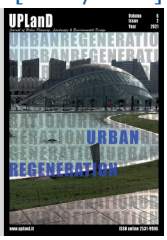
UPLanD – Journal of Urban Planning, Landscape & environmental Design, 6(1), 35-44 [2021/2022]

UPLanD
Journal of Urban Planning, Landscape & Environmental Design



Research & experimentation
Ricerca e sperimentazione

Coherence analysis for Abruzzo Regional Planning: selection of indicators for performance evaluation.

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Highlights

- Coherence analysis to check whether there are explicit or implicit convergences between the objectives of the Abruzzo Region's Plans and those of 2030 Agenda.
- Selection of a set of indicators for the Abruzzo Region, starting from the sustainability indicators proposed by the Italian National Institute of Statistics (ISTAT) and the Italian Institute for Environmental Protection and Research (ISPRA).

Abstract

The new challenges posed at the European level, with the Next Generation EU, and at the national level, with the National Recovery and Resilience Plan, increase the priority of measuring spatial transformation through specific indicators. For this purpose, it is crucial to measure the effect of the transformations provided by current planning with respect to the goals of 2030 Agenda to assess their sustainability/unsustainability and, if necessary, propose improvements in the field of territorial planning. The work presented describes a research experience developed in collaboration with the Abruzzo Region, in Southern Italy, to support regional activities for the drafting of the Regional Sustainable Development Strategy (RSDS). The proposed methodology consists of a dynamic analysis through which it is possible to assess the positioning of regional planning in relation to the National Sustainable Development Strategy (NSDS) and the 17 Sustainable Development Goals (SDGs). Such position can be evaluated by carrying out a coherence analysis between the objectives of the Abruzzo Region's Plans and those of 2030 Agenda together with the selection of a set of indicators useful for monitoring the sustainability of territorial transformations expected by regional planning. In particular, the first recognition of the sustainability indicators was carried out from the ones proposed by the Italian National Institute of Statistics (ISTAT) and the Italian Institute for Environmental Protection and Research (ISPRA).

Article history

Received: July 15, 2022
Reviewed: August 30, 2022
Accepted: October 10, 2022
On line: November 30, 2022

Keywords

Sustainable Development Goals
Indicators
Urban transformations
Abruzzo Region
Sustainability

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1. Introduction

The Sustainable Development Goals (SDGs) represent an extraordinary achievement for humanity as a moment of fundamental global agreement of purposes and efforts by the world's institutions for a better future. In fact, they identified and outlined the changes that the nations and peoples of the world need to implement for significant improvement in the quality of life, and most importantly, they committed to realize these actions by 2030. All this thanks to a global consensus, which seemed unreachable and was instead obtained through a long, complex and difficult process of international and interdisciplinary discussions and cooperations. In particular, the 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015 and it consists of 17 Sustainable Development Goals and 169 Targets. In the next years, these Goals and Targets will inspire actions by all Member States for sustainable development in all aspects, i.e. social, economic and environmental. The 17 Goals are organized by 5 strategic areas of the sustainable strategy (5Ps): People, Planet, Prosperity, Peace and Partnership. However, these priority areas should not be considered separately because they are strongly interconnected and, in fact, their integrated nature is crucial to ensure the main goal of the 2030 Agenda, which is to move the world toward a more sustainable and resilient path (UN, 2015; OECD, 2015). In Italy, the implementation of the 2030 Agenda has been done with the adoption of the National Sustainable Development Strategy (NSDS), approved by the Inter-ministerial Committee for Economic Programming (CIPE - Comitato Interministeriale per la Programmazione Economica) in December 2017 in accordance with the provisions of Law 221/2015 (MATTM, 2002; MATTM, 2017). Therefore, this contribution aims to address a topical issue, focusing attention on the use of sustainability indicators and on how they represent an important tool for monitoring transformative phenomena and for measuring the effects of human activities on quality of life, ecosystems services and habitat degradation (Shen et al., 2011; Huovila et al., 2019; Anderson et al., 2022). The use of indicators in the field of territorial, environmental and social policies is becoming increasingly frequent, taking inspiration from fields with more consolidated familiarity in this regard, such as the economic and health sectors. Moreover, it should be noted that, in more than half of a century of Italian urban planning, based first on national law (L. 1150/42) and then on the numerous regional regulatory documents, occasionally there have been effective procedures for measuring, monitoring and analytical diagnosis of the effects of the various operational tools. On the contrary, right now, there is a marked shift in approach and a clear increase in interest in parametric restitution of phenomena, together with improved capabilities for understanding and transferring the results obtained. In this context, particular emphasis has been placed on the process of land transformation because they currently provide effects on natural capital and, consequently, a high impact to the sustainability of the planet. The urban transformations, especially in Italy, showed particular and unusual characteristics in terms of growth speed, high dispersion and settlement typology (Romano et al., 2017). All this highlights the need of continuous monitoring of these transformations with shared and homogenous indicators and parameters that allow an objective measure of the analyzed phenomena. The paper describes the work developed by the research group of the Department of Civil, Construction-Architectural and Environmental Engineering (DICEAA) of the University of L'Aquila in collaboration with the Abruzzo Region (DPC002 Environmental Assessment Service). This research is aimed at selecting a set of indicators for monitoring regional planning instruments and giving support to the drafting of the Regional Sustainable Development Strategy (RSDS). The research involved: the recognition of a set of sustainability indicators and the analysis of the SDGs integration in regional planning instruments. The purpose was to provide a complete overview of the current status of the territorial planning to the Abruzzo Region and to support it in identifying the most suitable parameters for monitoring the sectoral instruments within its sphere of competence. Planning tools for transformative monitoring, together with effective regulatory laws, are clearly necessary to orient urban planning and land policies toward a rapid containment of land take. So, this research is an innovative contribution to support the Abruzzo Region in ensuring the sustainable management of natural resources and therefore to the achievement of the main challenges both globally and at the European level, for example, contributing to: Sustainable Development Goals (i.e. Halting land consumption and desertification)

and No net land take 2050 (UN, 2015; EC, 2016). Although this is a case study developed for the Abruzzo Region, it is particularly significant and replicable. In fact, it must be considered that, in Italy, the role of the Regions in achieving the sustainability goals is fundamental because, still now, there is a lack of legislation to regulate land take at the national level.

2. Study area

Abruzzo is a region of Southern Italy, and it covers a surface of about 10,830 square kilometers. It is characterized by the presence of numerous protected areas including three national parks and one regional park (Figure 1).
In recent years, Abruzzo is one of the regions that, in terms of percentage increase, has undergone one of the most intense urban conversion of soils among those in Italy. The latest ISPRA report on soil consumption in Italy (ISPRA, 2021) showed that the highest percentage values are in Lombardy (12.08 %), Veneto (11.87 %) and Campania (10.39 %). In general, 14 Regions exceeding the value of 5 percent of soil consumed in 2020 and the Abruzzo Region is just below this value with about 4.98 % (relating to 53,768 ha of land transformed to urban use). However, the significant data for this region is the value of land take evaluated in terms of percentage increase over the previous year's artificial area. In fact, in this case the highest values are recorded for the Abruzzo region with about +0.46 %, followed by Molise (+0.37 %), Sardinia (+0.32 %) and Veneto (+0.31 %). In the analysis of the obtained values, it is important to take into account the different conditions that characterize the Italian regions from the morphological, historical, socio-economic point of view and from the different pattern of urban evolution of the territory.
For the evaluation of urban transformation dynamics, another relevant aspect is the measure of land consumption in relation to the demographic needs of each territory. Also in this case, reference can be made to the ISPRA 2021 report (ISPRA, 2021), which shows the results obtained from several indicators, including soil consumed per capita. The values obtained for per capita soil consumption, limited to annual growth (2019-2020), show that Molise (about 2.15 m^2/inhab) and Abruzzo (about

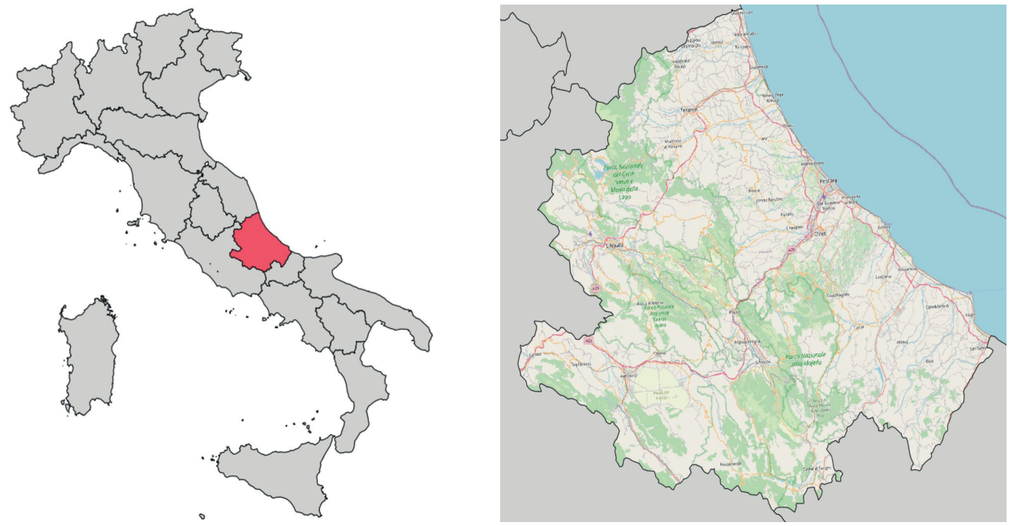

Figure 1: The Abruzzo Region study area. *Source: own elaboration.*

1.91 m²/inhab) are the regions with the highest values, more than double the national rate (about 0.87 m²/inhab). Furthermore, the marginal land consumption indicator shows that, in a historical period of population decrease, regions with high values of land consumption and population decrease return the negative values, which represent a condition of lower sustainability. In this case, most regions (17 out of 20) show negative values but only Veneto (about -1250 m²/inhab) and Abruzzo (about -368 m²/inhab) with negative values above the national value (about -295 m²/inhab), sign of high land take in the presence of population decreases.
Finally, it is possible to refer to the indicator Ratio of land consumption rate to population growth rate to assess situations of significant imbalance between consumption and population. Also in this case Abruzzo, with a value equal to -0.89, is characterized by the worst situation showing the lowest negative value in Italy, because it is characterized by a decrease in resident population of more than 6700 inhabitants and an increase in consumed land of almost 2.5 square kilometers.

3. Materials and Methods

As support for the Abruzzo Region planning, in the drafting of the Regional Strategy Document for Sustainable Development of the Abruzzo Region, a specific methodology is developed.
Figure 2 shows the methodological scheme for the identification of the coherence matrix with SDGs for Abruzzo Regional Planning and which consists of the following three steps:

1. Sustainability Indicators: analysis of sustainability indicators (ISTAT and ISPRA institutional datasets) and creation of a uniform and selectable database with respect to the SDGs, the 5Ps of the NSDS and the sustainability vectors (ref. subsection 3.1);

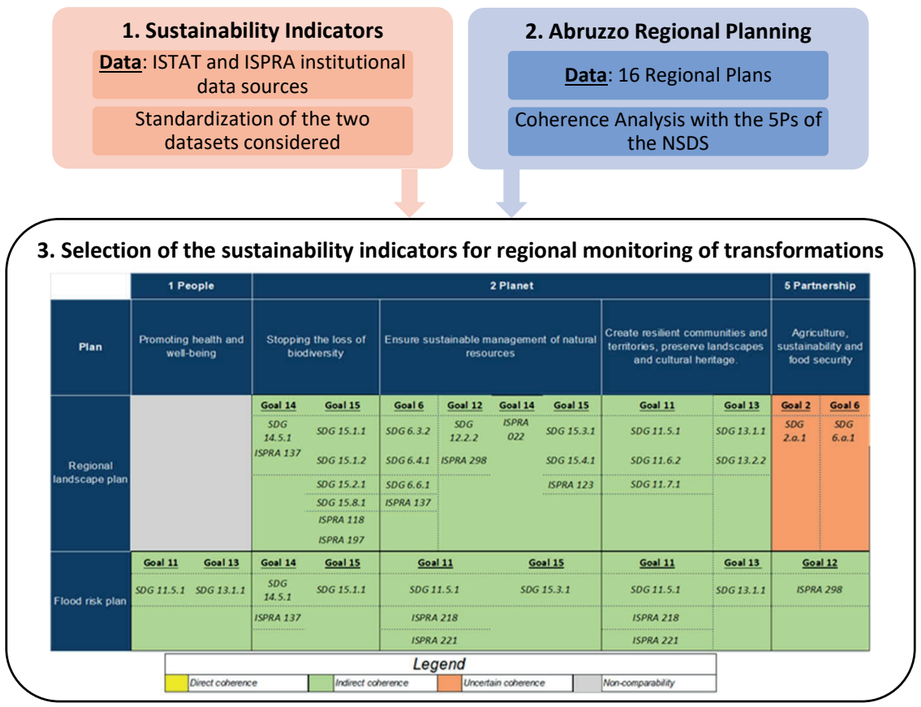

Figure 2: Methodology flowchart. *Source: own elaboration.*

2. Abruzzo Regional Planning: analysis of the regional planning and its coherence with respect to the goals of the National Strategy of development goals and the 17 goals of the 2030 Agenda (ref. subsection 3.2);

3. Selection of the sustainability indicators for regional monitoring of transformations and linking between these selected indicators and the coherence matrix of plans (ref. subsection 3.3).

3.1 Sustainability Indicators

As the first step of the work, institutional data sources (ISTAT and ISPRA) were considered to for the identification of the sustainability indicators, in order to create a homogenous and queryable database, which could be a useful tool for the selection of indicators compared to the Goals of 2030 Agenda. In fact, in developing this database, an important aspect to take into account is to relate each indicator both to the individual SDGs and to the different 5Ps of the sustainable strategy, so that they are directly associated with the NSDS. This process was automatic for the ISTAT indicators, which are already originally organized with respect to the Goals, while for the ISPRA indicators it was necessary to proceed with an interpretation and standardization action. In particular, the following indicators were analyzed:

- ISTAT data: in this case, ISTAT databases were considered, and they can be accessed directly at the following link: https://www.istat.it/it/benessere-e-sostenibilit%C3%A0/obiettivi-di-sviluppo-sostenibile/gli-indicatori-istat. In addition, the “SDGs 2020 Report - Statistical information for the 2030 Agenda in Italy” was consulted (ISTAT, 2020). In detail, ISTAT has identified more than 300 statistical measures for about 130 indicators UN-IAEG (https://unstats.un.org/sdgs/iaeg-sdgs/) considered. But it should be taken into account that some of these statistical measures are replicated for different Goals. This because they are essential to monitor the SDGs against different areas of the strategy itself, such as the measure on "Population exposed to landslide risk by region and in provincial capitals" associated with both Goal 11 (11.5.1) and Goal 13 (13.1.1) or the measure on "Number of deaths and people missing due to landslides" associated with the following 3 Goals: Goal 1 (1.5.1), Goal 11 (11.5.1) and Goal 13 (13.1.1).

- ISPRA data: likewise with the ISTAT data, the ISPRA database was consulted both through the “Environmental Data Yearbook 2020” (ISPRA, 2020) and at the following link: https://annuario.isprambiente.it/sys_ind/macro. More than 300 indicators are collected in this Database, which gives information on the state and quality of the environment in Italy. These indicators are organized by environmental topics, grouped into the three macro areas: i) Drivers and economic activities (Farming and forestry, Energy, Industry, Fishery and aquaculture, Transport and Tourism); ii) Environmental Conditions (Atmosphere, Biosphere, Geosphere, Hydrosphere, Noise, Natural hazards, Non-Ionizing Radiations, Waste and material flow); iii) Protection and Prevention (Chemical Agents, Environment and wellbeing, Environmental culture promoting and spreading, Environmental certification, Environmental planning measures, Environmental assessment and authorizations). All ISPRA indicators are related and linked to the main national and international sustainability policies, with attention to the following core sets: (a) 2014-2020 Italy Partnership Agreement, (b) SDGs Indicators, (c) 7th Environment Action Programme (7EAP) - Environment Data, (d) EEA Core set of indicators (CSI), (e) Resource Efficiency Scoreboard, (f) Headline for monitoring the objectives of the EU Strategy “Europe2020”, (g) Green growth OECD, (h) Sustainable Development in the European Union – 2015 (EUSDI) and (i) Environmental Action Strategy for Sustainable Development in Italy. It should be noted that the correlation between indicators and reference core sets is not always unique. In some cases, there are single ISPRA indicators that correspond to more than one core set, for example the "Total energy consumption by primary sources" (ISPRA 034) associated with 5 core sets (Green growth OECD, Headline for monitoring the objectives of the EU Strategy “Europe2020”, EEA Core set of indicators (CSI), 7th Environment Action Programme (7EAP) - Environment Data and SDGs Indicators) while, in other cases, several ISPRA indicators are linked to a single core set. All these details can be found

in the above-mentioned ISPRA annual report. In this case, since ISPRA database was not directly linked to the SDGs, a homogenization of the data was performed by introducing a new code for each indicator and associating them with the connection to the NSDS.

As mentioned before, this initial set of indicators is not definitive and has been structured to be dynamic and upgradeable through the recognition of other sustainability indicators from various public or private research centers (Fiorini et al., 2018; Song et al., 2019; Bonnet et al., 2021).
Moreover, these indicators are functional for assessing the coherence of regional planning with respect to the SNSvS.

3.2 Abruzzo Regional Planning and its coherence with the 5Ps of the NSDS

At the same time as the revision of sustainability indicators, a coherence analysis of regional planning with the different strategic areas was developed. In particular, the work was conducted by analyzing goals and actions planned for each Regional Plan with respect to the various strategic choices of which the 5Ps of the NSDS are composed, together with the sustainability vectors. This analysis was carried out, in agreement with the Abruzzo Region, for the following 16 Regional Plans:

1. Regional Landscape Plan
2. Flood Risk Management Plan
3. Basin Master Plan for Hydrogeological Structure
4. Flood Defense Master Plan
5. Regional Reference Framework
6. Maritime Domain Plan
7. Coastal Defense Plan
8. Water Protection Plan
9. Regional Mining Plan
10. Regional Plan for Air Quality Protection
11. Regional Plan for Integrated Waste Management
12. Regional Energy Plan
13. Regional Wildlife Plan
14. Gran Sasso and Monti della Laga National Park Plan
15. Majella National Park Plan
16. Abruzzo, Lazio and Molise National Park Plan

General information was collected for each plan such as: date of approval of the plan, approving authority, duration of the plan, mandatory drafting of the plan, monitoring for the strategic environmental assessment, and others. Once all this information about the plans was collected within a comprehensive database, the consistency analysis was carried out to determine the position of regional planning in relation to the SDGs and the NSDS.
The analysis developed between the specific objectives of all Plans and the sustainability goals showed, beyond the case of incomparability, the presence of the following three types of coherence:

- direct coherence: if there is an explicit reference to NSDS objectives in the Plan;
- indirect coherence: if there is only an implicit reference to NSDS objectives in the Plan;
- uncertain coherence: if the Plans contain only generic measures and thus their coherence with the NSDS depends on how they are enforced through more specific planning instruments.

3.3 Selection of the sustainability indicators for regional monitoring of transformations

In this last step of the developed methodology, a coherence matrix linked to the relevant sustainability goals was created, starting from the database of sustainability indicators (subsection 3.1) and the coherence analysis (subsection 3.2).
Figure 2 shows a partial extraction of this coherence matrix; it reports for all 16 plans (rows) the coherence information relative to the 5Ps of the NSDS and the sustainability vectors organized in total 26 strategic choices (columns).
Directly within this matrix and in correspondence with the levels of coherence recorded for the strategic choices, the most useful ISTAT and ISPRA sustainability indicators for monitoring of the territorial transformations were assigned for each plan. Being a dynamic tool, the proposed coherence matrix is therefore a first level of RSDS implementation.
In fact, this approach makes it possible to monitor the action of the plans in relation to the sustainable strategy and, when necessary, provide for update and improve the actions of plans according to the objectives of the 2030 Agenda.

4. RESULTS

A first result obtained comes from the coherence analysis developed between the Abruzzo Regional Planning and the strategic choices of the 5Ps of the NSDS with the sustainability vectors, with respect to the case of incomparability or to the three types of coherence defined and described in subsection 3.2.
As shown in Figure 3: none of the 16 Regional Plans analyzed has direct coherence with the 5Ps of the NSDS. This depends on the fact that more than half of these Plans (i.e. 10 out of 16) were approved before 2015 (the year of adoption of the 2030 Agenda). And the other 6 Plans, although approved after 2015, are affected by the delay in updates to regional and national laws. In fact, all Plans were drafted according to outdated laws (such as Abruzzo Urban Regional Law no. 18 of 1983, "Framework Law on Protected Areas" Law no. 394 of 1991). Instead, all the Regional Plans are characterized by indirect coherence with the goals of the NSDS. In this case, high percentages of indirect coherence are recorded for all strategic choices in the Planet area, for some strategic choices in the Prosperity and Partnership areas and in 2 strategic choices for the sustainability vectors.
Moreover, in 3 Plans (Regional Landscape Plan, Coastal Defence Plan and Water Protection Plan) there is uncertain coherence because these plans contain only generic measures with reference to the correlated 3 strategic areas (Agriculture sustainability and food security, Environment, climate change and energy for development and the preservation of cultural and natural heritage), all in the Partnership area.
Thus, their coherence with the NSDS depends on how the regional directions are implemented by the detailed plans. In fact, it must be considered that there is hierarchical planning in Italy, and a key role is played by subordinate public bodies such as municipalities (Romano et al., 2019).
Finally, the case of incomparability concerns all Plans for more than 50 percent of the 26 strategic choices considered. From the 5Ps areas point of view, the coherence analysis highlights that total

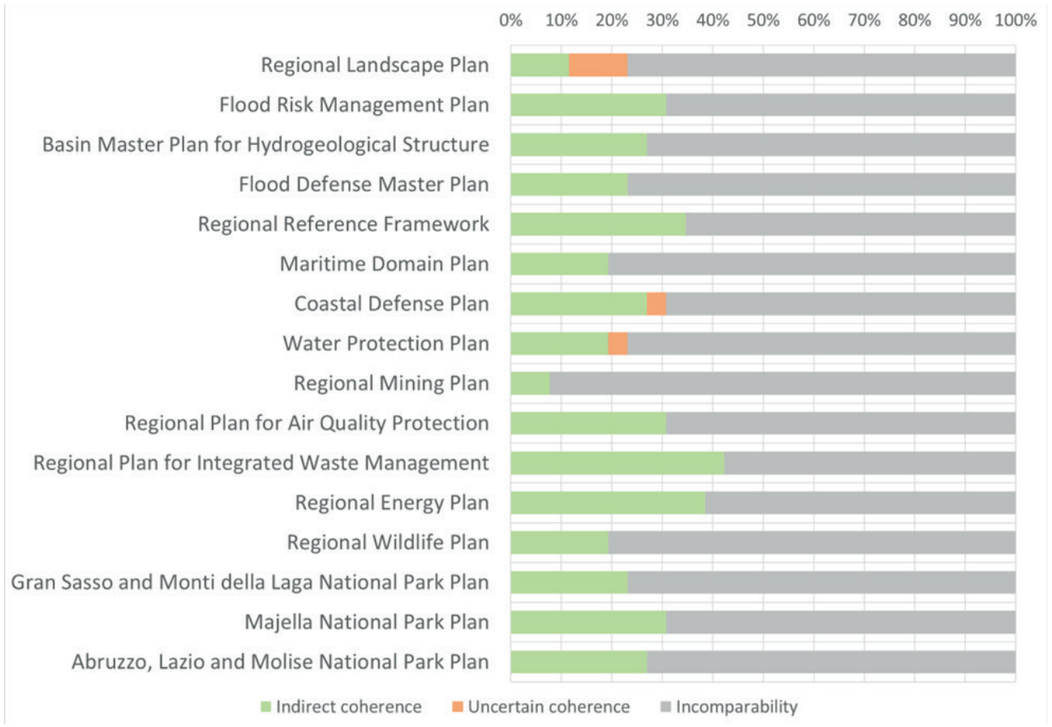

Figure 3: Graph of the coherence analysis. *Source: own elaboration.*

incomparability is found for 9 strategic choices in Person, Peace, Partnership and sustainability vectors; due to the different issues addressed by the regional plans analyzed.
Other interesting results were obtained from the selection of sustainability indicators and their connection with the NSDS (subsection 3.3).
Figure 4 shows the number of ISTAT and ISPRA indicators assigned to each plan for monitoring transformation, but it should be specified that they are often the same (i.e. SDG 13.1.1, SDG 11.6.2 and SDG 15.1.1). In fact, from the selected indicators frequency analysis, it is possible to see that a major part of the indicators combined with the consistency matrix are associated at the following SDGs:

- SDG 11 - Make cities and human settlements inclusive, safe, resilient and sustainable
- SDG 13 - Take urgent action to combat climate change and its impacts
- SDG 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

These results show that reference the objectives concerning sustainable cities, climate change, and biodiversity is predominant.

5. Conclusions

In light of the initial results obtained in this work, the importance of expanding the regional strategy by updating current planning instruments has emerged. In fact, Regional Plans should be more and explicitly oriented toward current sustainability policies and the goals of the 2030 Agenda. This can be achieved first by explicitly declining sustainability goals in Plans characterized by indirect or uncertain coherence, and second by adding actions related to topical issues such as urban regeneration, urban resilience, biodiversity conservation, ecosystem services, and combating climate change. For this reason, public bodies need to be provided with tools, such as the one developed in this contribution, useful for the regular monitoring of the effects caused by planned territorial transformations (Zanon et al., 2013).
The sustainability indicators, included in the proposed coherence matrix and selected for monitoring regional planning performance, are an initial

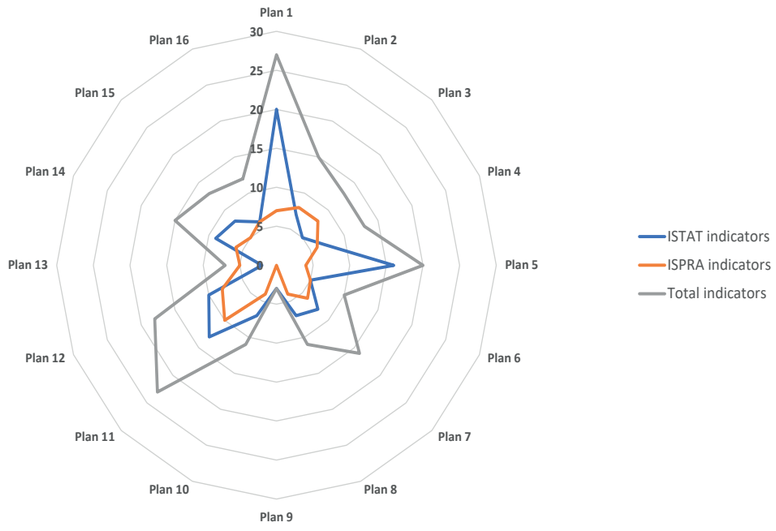

Figure 4: Number of the ISTAT and ISPRA indicators selected for each Regional Plan considered (the number of the Plan in the graph refers to the index of the Plans in subsection 3.2). *Source: own elaboration.*

dataset consisting of basic indicators. As mentioned before, this database is dynamic, integrable and can be modified with respect to specific needs, making it easily queryable according to their characteristics (i.e. the SDGs, the 5Ps of the NSDS and sustainability vectors). So, it can be enriched with additional information, referring to the indicators already present, or expanded with indicators from other public/private sources, or developed ad hoc to monitor specific parameters. It is possible to refer to other activities that are being carried out in collaboration with the Abruzzo region, such as the " Sost.EN.&Re" project and the " Abruzzo Regione del benessere" project, which involve different partners such as other Universities, the National and Regional Parks present in the regional territory and ARTA Abruzzo. Particular attention will have to be paid to the addition of sustainability indicators from other sources or developed ad hoc, because they will have to be taken into account to meet the fit against the Goals and areas of the strategy for uniformity to the current database.
The methodology developed for this research is a useful tool to support the region in drafting the RSDS. This initial collaboration with the Region was mainly based on the collection and homogenization of indicators from institutional sources (ISTAT and ISPRA) to select the most suitable ones to monitor the performance of regional planning.. The choice to use the ISTAT and ISPRA data sources depends on the need to determine an institutional and common language, already in this first stages of the Regional Sustainable Development Strategy. In this way it is possible to have effective interoperability between different bodies and more opportunities to compare monitoring with other Italian Regions and/or with other States (Janoušková et al., 2018; Miola & Schiltz, 2019; Toth et al., 2022). For future development of the work, it is also important to carry out an identification of cut-off values. Such cut-off values are essential for both efficient monitoring of the analysed phenomena and for assessing their effects in terms of sustainability.

Attributions

All the parts of this paper have been discussed and approved by all the authors.
However, the §§ 1, 2 and 5 are by Lorena Fiorini and the §§ 3 and 4 are by both the authors.

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