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Sustainable Development Goals (SDGs) Evaluation for Neighbourhood Planning and Design

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Abstract. The UN 2030 Agenda and the Sustainable Development Goals (SDGs) highlight the central role of cities and urban settlements for the implementation of sustainable development policies and actions at the local level. In this paper we investigate how neighbourhood sustainability contribute to the achievement of SDGs through the analysis of their correlations with project evaluation criteria used in existing assessment tools like LEED Cities and Communities (LEED v4.1). In particular, we illustrate a method for evaluating these correlations, both in qualitative and in quantitative terms. The results of this analysis highlight some open questions in the SDGs implementation at the neighbourhood level, and the potential role of current assessment practices in SDG localization and operationalization procedures. In conclusion, we argue that despite these challenges and open questions, the NSA frameworks have the potential to guide neighbourhood planning and design towards the sustainability transition but only if they are better aligned with the SDG framework.

Keywords: SDGs localisation · Urban sustainability · Neighbourhood sustainability · Assessment tools · Evaluation models

1 Introduction

The development and use of urban sustainability indicators and assessment tools have gained significant attention during the last decade, especially since the 2030 Agenda for Sustainable Development and their 17 Sustainable Development Goals (SDGs) entered into force. National governments are invited to establish SDGs monitoring systems and to report "Voluntary Local Reviews" (VLRs) in order to evaluate the overall implementation effectiveness and to give indications to review and follow up the progress towards these objectives. In this context, an increasing number of city administrations around the world, that have the primary responsibility for achieving many SDGs targets, are engaging with their VLR through the collection of different data sets concerning many urban issues that should be consistent with local needs and priorities [1].

However, these reviews did not yet produce significant data and information for policy-making, planning and design at the neighbourhood level which is the most adequate spatial unit for the assessment of many sustainability aspects [2–4]. The main practical problems include the prevailing interest in urban questions that can be addressed through long-term policies and large investment projects, while the role of shorter term and smaller sized transformation processes are often neglected. This requires to define development objectives according to daily life problems that can bring direct tangible benefits to the quality of life of many people [5–7]. These transformations take place on the scale of the neighbourhood where, not surprisingly, efforts have been concentrated in recent decades to define common guidelines for the implementation of sustainability initiatives in communities [8, 9]. Certification rating systems and protocols, such as the Neighbourhood Sustainability Assessment (NSA) tools, have spread rapidly, as tools to measure performance of urban sustainability at suburban and neighbourhood level. In particular, NSA tools propose clear, relevant, representative and measurable indicators for an objective assessment, useful to simplify complex urban phenomena into easily understandable and valuable elements, by integrating different aspects in the design process, including environmental, economic, social and institutional issues [10–12].

This approach would seem to be consistent with the systemic framework of targets and indicators defined by the 17 SDGs. Despite one of the SDGs, the Goal 11 "Sustainable Cities and Communities", is specifically focused on urban perspective, "urban goals" go far beyond the sole Goal 11 because many sustainability dimensions covered by other goals, – such as SDG 1 (poverty reduction), SDG 3 (Health and wellbeing), SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDG 8 (economic growth) and SDG 13 (climate action) – have implications for urban planning and policy. Thus, a more integrated approach is crucial to express the transformative potential of SDGs and for their effective implementation [13, 14].

Following these considerations, the aim of this paper is to evaluate the potential contribute of the NSA Tools to SDGs localization. For this, we report our analysis of one of the most prominent NSA tool, the last version of the Leadership in Energy and Environmental Design (LEED) rating system for "Cities and Communities" (i.e., LEED v4.1) developed by the US Green Building Council (USGBC), that allows to test the proposed methodology to a relevant case study. With this analysis, he main question this paper wishes to address is: which LEED planning and design criteria have impacts on the achievement of different SDGs, and what is the weight of those impacts?

The paper is structured as follows: next section describes the materials and methods used in this study; Sect. 3 presents the applied methodology and shows the results of data analysis. Then, Sect. 4 discusses these results in light of the objective of the paper and offers some concluding remarks.

2 LEED ND v4.1 and SDGs Localization

2.1 Materials

To contribute to the exploration of explore the potential employment of NSA tools for SDGs localization, we have evaluated the degree of correspondence between selected

SDGs targets and the selected NSA tool. We have analyzed the LEED scheme, a voluntary rating system among the most widely used tools to evaluate and certify the sustainability of the built environment, both building and neighborhood level. The first pilot version for neighbourhoods – LEED ND – was launched in 2007 whilst its present version, named "LEED for Cities and Communities" (LEED v.4.1), was released in April 2019 [15–18]. Compared to the previous editions, the current release focuses more on improved social equity, quality of life and standard of living. In general, the number of criteria has been reduced but the number of thematic areas has been expanded, offering a broad spectrum of sustainability issues, according to SDGs framework. The system was adapted for city and community (neighbourhood) level and, furthermore, for two different types of interventions, regeneration projects (existing) and new developments (plan and design). In this paper we consider the scheme adapted for existing neighbourhoods.

2.2 Methods

The assessment procedure was divided in three main steps (Fig. 1): (1) the analysis of the SDGs targets in order to select the most related with planning and design issues, defined as "urban targets"; (2) the analysis of the selected NSA tool – LEED v4.1 – credits and prerequisites; (3) the evaluation of the degree of correspondence between LEED v4.1 and selected SDGs "urban targets".

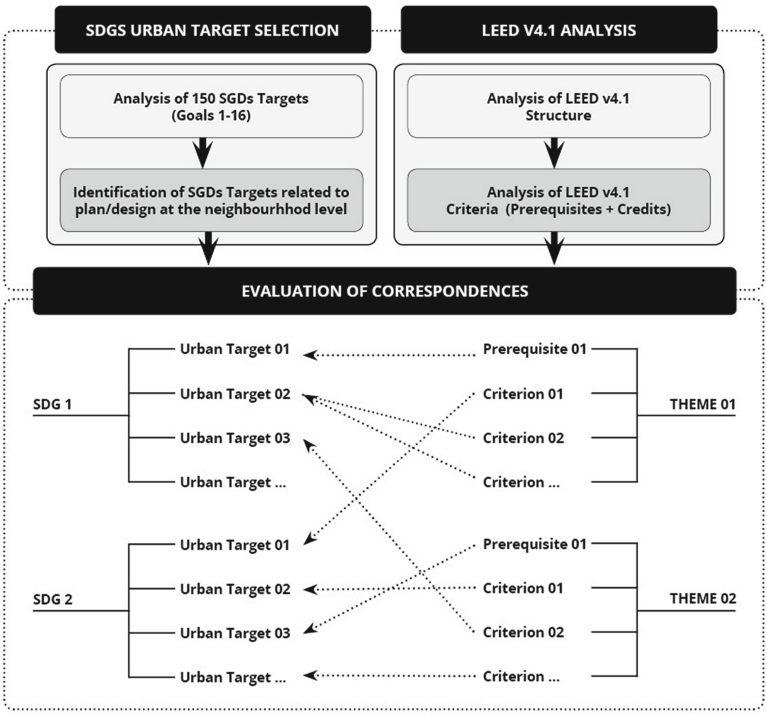

Fig. 1. Schematic representation of the proposed method.

3 Results

In the Step 1, we have analyzed the 150 SDGs targets, excluding SDG 17 which is related to the means of implementation of all the others targets. Then, we have selected the 52 most related with relevant project theme areas present in SDGs framework using the key words method (Table 1). We defined these "urban targets".

Table 1. SDGs "urban targets".

SDGs urban targets	SDGs project theme areas	Main planning and design issues
1.5, 11.5, 11.6, 11.B, 13.1, 13.2, 13.3	Resilience and risks	Climate change mitigation and adaptation
2.4, 6.6, 11.4, 14.4, 14.5, 15.1, 15.4, 15.5, 15.9	Ecosystem protection	Agriculture; water-related, mountain, coastal, terrestrial and inland freshwater ecosystems; reforestation; degraded land and soil, Biodiversity
6.4, 6.5, 7.1, 8.4, 9.1, 9.4, 11.C, 12.1, 12.2, 12.5	Resources efficiency	Water, Energy, built environment footprint, consumption and production patterns, waste
3.4, 3.6, 6.3, 11.2, 12.4, 14.1	Health and Safety	Mental health and wellbeing, Road traffic accidents, Pollution, chemical, waste, land base activities
4.4, 4.7, 4.a, 8.3, 8.9, 9.5, 12.8, 12.b	Education, Awareness, Job	Skills, Sustainable lifestyles, Education facilities, Job opportunities, Innovation, Sustainable tourism
1.4, 1.5, 2.3, 5.a, 6.b, 10.2, 10.3, 11.1, 11.3, 11.A, 16.4, 16.6	Equity and Justice	Basic services, Public Spaces, Land and other properties, Social inclusion, Equal opportunities, Participation

In the Step 2, we have analyzed the structure of LEED v4.1 (see Table 2). In total, there are 9 theme areas and 40 criteria, divided in 5 prerequisites (the mandatory requirements that must be fulfilled for a project before proceeding to the certification) and 35 credits that were designed to address impacts on specific project theme areas. Then, we analysed LEED v4.1 credits and prerequisites in order to evaluate their distribution across different theme areas and the related weight, both in terms of number and of maximum score assigned.

Table 2. LEED v4.1. The structure of the scheme adapted for Existing Communities.

LEED v4.1 theme areas		Prerequisites	Credits	Criteria		Score	
				Total number	Weight	Total points	Weight
IP	Integrative process	0	2	2	5%	5	4.5%
NS	Natural System and Ecology	1	4	5	12.5%	9	8.2%
TR	Transportation and Land Use	0	6	6	15%	15	13.6%
WE	Water Efficiency	1	4	5	12.5%	11	10%
EN	Energy and GHG Emissions	1	5	6	15%	30	27.2%
MR	Materials and Resources	1	5	6	15%	10	10%
QL	Quality of Life	1	7	8	20%	20	18.1%
IN	Innovation	0	1	1	2.5%	6	5.4%
RP	Regional Priority	0	1	1	2.5%	4	3.6%
		5	35	40	100%	110	100%

Finally, in the Step 3, we verified the direct and indirect correspondences between the 40 LEED v4.1 criteria with SDGs urban targets (see Table 3).

Table 3. LEED v4.1 and SDGs correspondences.

Theme areas	Project issues	SDGs directly related	SDGs indirectly related
IP	Integrative Planning, Green Building Policy and Incentives	11, 16	4–9, 10, 12,13
NS	Ecosystems, Green Spaces, Natural Resources, Light Pollution, Resilience Planning	11, 15, 13	1, 3, 6, 8, 9, 14
TR	Public Transport, Mixed Use Development, Pollution and Environmental Impact of Transport, Priority Locations	9, 11	1, 3, 6, 8, 10, 12, 13, 15
WE	Equitable Access to Water and Sanitation Services, Water Management, Stormwater Management,	1, 6, 9, 13	3, 8, 10–12, 15
EN	Equitable Access to Power, Zero Energy and Emissions, Energy Efficiency, Renewable Energy, Low Carbon Economy, Consumers Participation	1, 7, 13, 16	3, 8, 9, 11, 12
MR	Waste Management, Material Recycle, Circular Economy	12	3, 8, 9, 11, 13
QL	Living Standards, Equitable Economic Prosperity, Equitable Access to Community Services, Environmental Pollutants, Affordable Housing, Community Participation, Civil and Human Rights	1, 3, 10, 11, 16	2, 4–6, 8, 12,13, 15
IN	Exceptional and innovative performances	9	3, 4, 6–8, 11–13
RP	Local socio-economic and environmental priorities	11	1, 5, 10, 13–16

Figure 1 shows the distribution of credits into various SDGs displayed as a histogram. There are two bars for each SDG, one for the score weight (black) and one for credits weight (color). The first value is calculated as the sum of points assigned by LEED to various credits correlated with different Goals divided by the maximum score possible and multiplied by 100 to attain percentage scores; the second as the number of credits correlated with different Goals divided by the total number of credits defined by the tool (Fig. 2).

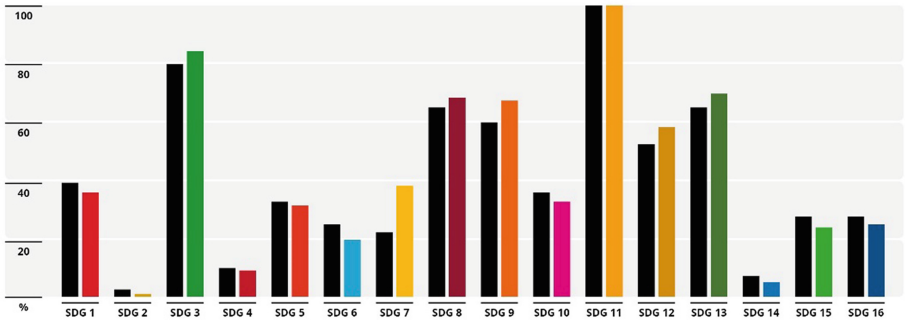

Fig. 2. Correspondences between SDGs and LEED v4.1 credits and score weights: the black bar shows the score weight and the colored bar the number of criteria weight.

4 Discussion and Concluding Remarks

The results of this study allow us to verify the possible impact of LEED v4.1 credits on different SDGs. There are many planning and design guidelines at the neighborhood scale, expressed by different credits and their related indicators, that can contribute to the achievement of Goals 3, 13, 8 and 9, while only few credits address issues related to Goals 2, 14 and 4. This means that in its current formulation LEED v4.1 provides fewer operational indications for the localization of these SDGs at the neighborhood scale, especially for SDG2 "zero hungry", SDG4 "quality education", SDG5 "gender equality", SDG14 "life below water". There is no credit that directly addresses these issues and few consider them indirectly. This limitation can be overcome by integrating specific criteria that outline the project performance in these areas.

Moreover, the study shows that SDGs have different weighting in the overall score. In general, a high number of criteria correspond to a higher score, but there are many cases in which this does not happen, such as for the Goal 7. In this case, the LEED theme area 5 "energy and greenhouse emissions" provides 6 criteria, the 15% of totals, and assigns 30 maximum points corresponding to the 27,2% of total score, as reported in the Table 2. Three of these criteria have the direct objective to increase energy efficiency, while the others focus on environmental and social goals that can be achieved through energy related measures, as well as the equitable access to power (EN 01), the reduction of the environmental and economic harms associated with fossil fuels and greenhouse gas emissions (EN 04), and the consumer participation in energy use optimization (EN 06).

Despite some specific considerations on the tool analyzed, this study reveals that the NSA tools can constitute an operational framework from which to start defining design guidelines for the SDGs achievement at the small-scale of the neighbourhood [19–21]. Further developments of this research must be focused on the comparison of different NSA tools, to define a comprehensive set of criteria useful for the better implementation of all SDGs. This could lead to the development of an assessment tool to be used in everyday practice at the local level. In particular, urban planning offices are expected to track and evaluate the impacts of their policies and interventions towards SDGs, in order to provide objective information on projects effectiveness and define improvement

measures. This could support the institutionalization of neighbourhood sustainability assessment allowing for a more widespread use of this kind of tools, currently used mainly by agencies and private companies for the evaluation of a few and selected projects. This process is critical to the success of the 2030 Agenda that explicitly calls for evaluation methods for assessing and monitoring the progress on the SDGs at the local level. Such an institutionalization of the evaluation practices could also contribute to collaboration between public administrations, policy makers, planners, citizens' groups, businesses, and other local stakeholders in achieving sustainability goals. Changes in current urban planning and design practice, in fact, require a shared knowledge and a collective vision for the future of local places, and this implies to improve municipal statistical offices, awareness and education on urban sustainability, and to establish a permanent dialogue between different actors.

References

1. Fox, S., Macleod, A.: Localizing the SDGs in cities: reflections from an action research project in Bristol, UK. Urban Geogr. **0**, 1–21 (2021). https://doi.org/10.1080/02723638.2021.1953286
2. UN-Habitat, UCGL: Guidelines for Local Voluntary Reviews. A comparative analysis of Existing VLRs (2020)
3. Sala Benites, H., Osmond, P., Rossi, A.M.G.: Developing low-carbon communities with LEED-ND and climate tools and policies in São Paulo, Brazil. J. Urban Plan. Dev. **146**, 04019025 (2020). https://doi.org/10.1061/(ASCE)UP.1943-5444.0000545
4. Sharifi, A., Dawodu, A., Cheshmehzangi, A.: Neighborhood sustainability assessment tools: a review of success factors. J. Clean. Prod. **293**, 125912 (2021). https://doi.org/10.1016/j.jclepro.2021.125912
5. Vaidya, H., Chatterji, T.: SDG 11 sustainable cities and communities. In: Franco, I.B., Chatterji, T., Derbyshire, E., Tracey, J. (eds.) Actioning the Global Goals for Local Impact. SSS, pp. 173–185. Springer, Singapore (2020). https://doi.org/10.1007/978-981-32-9927-6_12
6. Saiu, V.: Evaluating outwards regeneration effects (OREs) in neighborhood-based projects: a reversal of perspective and the proposal for a new tool. Sustainability **12**, 10559 (2020). https://doi.org/10.3390/su122410559
7. Banchiero, F., Blečić, I., Saiu, V., Trunfio, G.A.: Neighbourhood park vitality potential: from Jane Jacobs's theory to evaluation model. Sustainability **12**, 5881 (2020). https://doi.org/10.3390/su12155881
8. Dawodu, A., Akinwolemiwa, B., Cheshmehzangi, A.: A conceptual re-visualization of the adoption and utilization of the pillars of sustainability in the development of neighbourhood sustainability assessment tools. Sustain. Cities Soc. **28**, 398–410 (2017). https://doi.org/10.1016/j.scs.2016.11.001
9. Saiu, V.: The three pitfalls of sustainable city: a conceptual framework for evaluating the theory-practice gap. Sustainability **9**, 2311 (2017). https://doi.org/10.3390/su9122311
10. Huovila, A., Bosch, P., Airaksinen, M.: Comparative analysis of standardized indicators for Smart sustainable cities: what indicators and standards to use and when? Cities **89**, 141–153 (2019). https://doi.org/10.1016/j.cities.2019.01.029
11. Sharifi, A.: A typology of smart city assessment tools and indicator sets. Sustain. Cities Soc. **53**, 101936 (2020). https://doi.org/10.1016/j.scs.2019.101936
12. Morano, P., Tajani, F., Guarini, M.R., Sica, F.: A systematic review of the existing literature for the evaluation of sustainable urban projects. Sustainability **13**, 4782 (2021). https://doi.org/10.3390/su13094782

13. Allen, C., Metternicht, G., Wiedmann, T.: Initial progress in implementing the sustainable development goals (SDGs): a review of evidence from countries. Sustain. Sci. **13**(5), 1453–1467 (2018). https://doi.org/10.1007/s11625-018-0572-3
14. Abastante, F., Lami, I.M., Gaballo, M.: Pursuing the SDG11 targets: the role of the sustainability protocols. Sustainability **13**, 3858 (2021). https://doi.org/10.3390/su13073858
15. Diaz-Sarachaga, J.M., Jato-Espino, D., Castro-Fresno, D.: Evaluation of LEED for neighbourhood development and envision rating frameworks for their implementation in poorer countries. Sustainability **10**, 492 (2018). https://doi.org/10.3390/su10020492
16. USGBC: LEED v4.1 Cities and Communities. https://www.usgbc.org/sites/default/files/2021-09/Guide%20to%20Certification%20in%20LEED%20v4.1%20for%20Existing%20Cities.pdf
17. Talen, E., et al.: LEED-ND as an urban metric. Landsc. Urban Plan. **119**, 20–34 (2013). https://doi.org/10.1016/j.landurbplan.2013.06.008
18. Dall'O', G., Zichi, A.: Green protocols for neighbourhoods and cities. In: Dall'O', G. (ed.) Green Planning for Cities and Communities. RD, pp. 301–328. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-41072-8_13
19. Saiu, V., Blecic, I., Meloni, I.: Making sustainability development goals operational at neighbour-hood level: potentials and limitations of neighbourhood sustainability assessment tool. Environ. Impact Assess. Rev. (Forthcoming)
20. Saiu, V., Blecic, I., Cocco, G., Meloni, I.: Urban Sustainability and SDGs implementation between regional strategy and local practice: case of Sardinia. In: Filho, W.L. (ed.) Implementing the SDGs in the European Region. Springer (Forthcoming)
21. Saiu, V., Blečić, I., Meloni, I., Piras, F., Scappini, B.: Towards a SDGs based neighbourhood sustainability evaluation framework: a tool for assessing sustainability at the urban micro-scale. In: Abastante, F., et al. (eds.) Urban Regeneration Through Valuation Systems for Innovation. Springer (Forthcoming)