

Chapter 27

SDGs and the SBTool^{PT} Urban Assessment Method: A Conceptual Analysis of Urban Sustainability Indicators to Assess the Circular Economy in the Built Environment



Genesis Camila Cervantes Puma and Luis Bragança

Abstract The Sustainable Development Goals (SDGs) and the SBTool^{PT} Urban assessment method can be used together to assess the circular economy in the built environment and promote urban sustainability. In this conceptual analysis, the focus is on developing urban sustainability indicators that can help to assess the circular economy in the built environment. SBTool^{PT} Urban includes a set of tools that are designed to help to align operations and activities with the SDGs. These indicators should be aligned with the SDGs and the SBTool^{PT} Urban assessment method, which provides a comprehensive framework for assessing sustainability in urban areas. Using these indicators, the SBTool^{PT} Urban can become an assessment method for projects that are wished to be implemented based on the SDGs. Through these indicators, urban areas can be assessed on their sustainability and circular economy performance and opportunities for improvement can be identified as well. This can help to promote sustainability and circular economy in the built environment and contribute to the achievement of the SDGs related interconnected and provide a comprehensive framework for achieving sustainable development and addressing the world's most pressing environmental, social, and economic challenges.

Keywords Circular economy · Sustainable development goals · Urban sustainability · SBTool^{PT} urban

G. C. Cervantes Puma · L. Bragança (✉)

University of Minho, ISISE, ARISE, Department of Civil Engineering, Guimarães, Portugal
e-mail: braganca@civil.uminho.pt

G. C. Cervantes Puma
e-mail: cami_cervantes@hotmail.com

27.1 Introduction

It is well known that Circular Economy indicators are not fully defined because the scope and magnitude of their approach are extremely broad this leaves more freedom to generate criteria with the basic concepts of Circular Economy. Circular Economy has three main principles. The first is based on preserving and enhancing natural capital by creating a balance in the flow of renewable resources. The second is to optimize the circular use of resources by calculating their highest level of usefulness, both technically and biologically. Finally, the third one consists in stimulating the efficiency system by trying to exclude all external negative points on the first two points [1].

This study took into account these three parameters to study the sustainable development goals (SDGs) and to take those that are compatible with SBTool^{PT} Urban [2] to establish this new scope of the evaluation. SBTool^{PT} Urban is a Sustainable Building Assessment Tool that promotes sustainable design, construction, and operation of buildings and urban areas. SBTool^{PT} Urban evaluation parameters must be analysed based on Sustainable Developments Goals (SDGs) [3] since they are general objectives at a global level. With this, it is possible to have a much greater scope of an evaluation system, and in SBTool^{PT} Urban, that is why this research tries to build upon an already created evaluation system, generate new categories to broaden the scope and make its use much easier at a global level. It has to be taken into account that innovation in these issues is implemented progressively, this will always leave a gap to be able to implement new parameters in any evaluation method.

The urban circular economy is a concept that focuses on applying the principles of the circular economy to urban environments, intending to promote sustainable and resilient cities. In the context of the circular economy, urban areas are seen as hubs of economic activity and innovation, where resources can be used more efficiently and waste can be minimized through circular systems of production, consumption, and waste management.

The urban circular economy can be seen as a key strategy for promoting sustainable urban development and achieving several of the SDGs, by integrating environmental, social, and economic considerations into urban planning and management. Overall, the urban circular economy can contribute to more sustainable and livable cities, by promoting resource efficiency, reducing waste and pollution, and creating new economic opportunities and jobs.

In addition, it is known that after eight years of implementation of the 2030 agenda [4] with three fundamental principles Inclusion, Participation, and Accountability, several countries are making efforts to incorporate new sustainable development practices. Therefore, UN DESA [5] and UNDP [6] have developed a theoretical and analytical framework to enable all governments and stakeholders to generate a greater scope with essential facilities that play a critical role in supporting countries in achieving sustainable development goals, promoting human development, and addressing critical global challenges.

27.2 Literature Review

27.2.1 *Urban Circular Economy*

There are research that present an overview of CE strategies in different scopes and from different perspectives, and importance. [7]. Urban circular economy is an approach to resource management in urban areas that aims to create a more sustainable and resilient economy. It involves designing out waste and pollution, keeping products and materials in use for as long as possible, and regenerating natural systems. The concept is based on the principles of the circular economy, which is an economic model that promotes the use of resources in a more sustainable and efficient way.

Urban circular economy can be applied to a wide range of economic activities in cities, including construction and demolition, transportation, energy, food production and consumption, and waste management. Some of the key elements of urban circular economy include Resource Efficiency, Reuse and Recycling, Regenerative Systems and Collaboration and Innovation.

Urban circular economy can play a crucial role in achieving the SDGs by promoting sustainable resource use, reducing waste, creating green jobs and economic opportunities, and reducing the negative impact of economic activities on the environment and society in urban areas. It can help create more livable and sustainable cities and contribute to the transition towards a more sustainable and equitable global economy.

27.2.2 *Sustainable Developments Goals (SDGs)*

The Sustainable Development Goals (SDGs) are a set of 17 global goals established by the United Nations General Assembly in 2015 [8] as a universal call to action to end poverty, protect the planet, and ensure peace and prosperity for all by 2030. The SDGs are designed to be a blueprint for a better and more sustainable future, with the aim of creating a world that is more equitable, just, and sustainable for all people and the planet. The scope of the Sustainable Development Goals (SDGs) is broad and comprehensive, covering a wide range of social, economic, and environmental issues that are critical for achieving sustainable development. These goals are interconnected and interdependent, and they address various aspects of sustainable development, such as poverty reduction, health and education, gender equality, environmental protection, and sustainable economic growth. The SDGs are designed to be universal and apply to all countries, regardless of their level of development, and they aim to balance economic, social, and environmental sustainability to create a better world for present and future generations.

27.2.3 *SBTool^{PT} Urban*

SBTool^{PT} Urban is a sustainability assessment and certification system developed in Portugal for urban areas. It focuses specifically on the sustainability of neighborhoods, districts, and cities, and assesses the performance of these areas against a set of sustainability criteria, such as environmental quality, energy efficiency, mobility and accessibility, water and waste management, social cohesion and inclusion, and economic development and innovation. The goal of SBTool^{PT} Urban is to support decision-making processes related to sustainability and promote sustainable urban development in Portugal. It also supports the implementation of sustainability policies and strategies at the local level, fostering a more sustainable and livable urban environment.

SBTool^{PT} Urban is organized into Dimensions, Categories, and Indicators. These categories have an optimal life cycle analysis based on EN 15,942:2021 [9]. In addition, there are additional criteria for Sustainable Buildings and Environmental Management, which are intended to reward urban areas that possess additional attributes to those already established. This method is intended to clarify the relevance of the scale of intervention to establish an evaluation of urban areas. The evaluation process is graded in 3 stages: the first one where the performance is quantified by indicators, the second one where the performance of categories is graded, and the last one where the development by dimensions is graded. After this, the sustainability certificate can be issued [10].

The categories defined in Dimensions intend to add a set of indicators related to the verification of sustainability in the Environmental, Social, and Economic areas. Where in the Environmental Dimension the contributions to the sustainability of the environment, use of energy, water, metals, and waste, among others, are assessed. The Social Dimension manages the improvements to the aspects related to the users' quality of life like safety, accessibility, and mobility, among others. And the Economic Dimension seeks to identify the economic expenditure to generate implementations reducing costs, promoting the local economy and local employment.

27.3 Materials and Methodology

To evaluate the SDGs and SBTool^{PT} Urban's as a tool for Urban Sustainability to assess a Circular Economy, the first step is the literature review. The research was carried out on the following scientific databases: Web of Science, Scopus, Science Direct, United Nations Goals, and Google Scholar. It addressed the keywords 'Urban Sustainability', 'Sustainability Developments Goals', 'Urban growing', 'Circular Economy', 'Urban Impact on Economy' and 'urban sustainability assessment method'. This information is taken into the following main subjects: Sustainability Development Goals, Circular Economy, Urban Sustainability, Impact of Urban growth on the Cities Economy. Then the second step is to make an in-depth study

of the SBTool^{PT} Urban indicators. This analysis focuses on how many indicators could be parameterized by Sustainability Development Goals (SDGs). Based on the literature review, the main potential is to make a combination between the SBTool^{PT} Urban indicators and Sustainability Development Goals (SDGs) to make a better method of asses Circular Economy. Finally, a simplified framework of indicators is proposed according to the Indicators of SBTool^{PT} Urban and Sustainability Development Goals. The indicators that we are going to use are discussed in the following section.

27.4 Results and Discussion

The literature review shows that the objective is to perform an analysis of the parameters of the Urban SBTool^{PT} based on the SDGs, to have a greater scope on the 2030 goals of the United Nations, generating an evaluation method for new SDG projects.

While the SDGs and SBTool^{PT} Urban differ in their scope and focus, they share a common goal of promoting sustainable development. In fact, many of the goals and targets of the SDGs are relevant to the sustainability criteria of SBTool^{PT} Urban, such as sustainable cities and communities, clean water and sanitation, affordable and clean energy, and more. Therefore, the implementation of SBTool^{PT} Urban can contribute to achieving the SDGs at the local level, especially in urban areas.

Although there is a remarkably clear link between SDGs and SBTool^{PT} Urban, there is no study conducted on the linkage of these urban sustainability parameters. On the other hand, there are project initiatives that bring the objectives of the SDGs and urban sustainability methods into use throughout the world. There are several types of urban sustainability assessment, such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment's Environmental Assessment Method), and DGNB (German Sustainable Building Council), of which the first two focus more on environmental aspects, while DGNB is a method adapted for commercial buildings, and provides performance metrics for commercial buildings [11].

There are several SDGs that work with SBTool^{PT} Urban because this tool promotes sustainable practices in buildings and urban areas, which can significantly contribute to the achievement of some of the Sustainable Development Goals. The reviewed literature has shown that there are seven SDGs, which maintain an entire relationship with SBTool^{PT} Urban.

By assessing the environmental, social, and economic performance of buildings and urban areas, SBTool^{PT} Urban can help to achieve several SDGs, including SDG 6 (Clean water and sanitation), SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation, and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 12 (Responsible Consumption and Production), SDGs 13 (Climate Action) and SDGs 15 (Life on Land).

For all the above mentioned in the previous analysis, several SDGs were selected that work in the same scope as SBTool^{PT} Urban. The selected SDGs are listed in Table 27.1.

The SBTool^{PT} Urban's dimensions were taken to generate a greater link between each one. The dimensions are divided between Environmental, Social and Economic. After the reviewed literature, SDG 11, SDG 15, SDG 6, and SDG 7 are considered environmental close related because they are all related to protecting and preserving the natural environment, which is essential for sustaining life in the planet. SDG 12 and SDG 13 are considered social goals because they focus on promoting sustainable development and addressing issues related to social and economic well-being, while also taking into account environmental concerns. SDG 9 is considered an economic goal because it focuses on promoting sustainable economic growth and development, while also addressing issues related to infrastructure and innovation.

To justify this division, an analysis of several projects like Solar Heat for Industrial Process towards Food and Agro Industries commitment in Renewables (SHIP2FAIR) aims to foster the integration of solar heat in industrial processes of the agro-food industry [13]; "Calvo Residuo Cero" aims of sustainably valuing all the waste generated in its activity and reducing single-use materials [14], that have already been implemented or are in the process of implementation was carried out, which allowed for the identification of the area of work of each of the SDGs collected.

27.4.1 Environmental Dimension

In the environmental dimension, there are SDGs 11, 15, 7 and 6, due to their impact on urban form, land use, ecology, water, energy and materials and waste. Following, it is intended to show several projects according to each SDGs.

SDG 11 is focused on creating sustainable cities and communities. Is credited with several projects such as: Smart grids and energy management systems such as bus rapid transit (BRT), light rail transit (LRT), and bike-sharing programs, that help reduce energy consumption, while smart traffic management systems reduce traffic congestion and air pollution; Promoting the use of energy-efficient buildings can reduce energy consumption and greenhouse gas emissions and can also save money on energy costs for building owners and tenants.

SDG 15 focuses on protecting, restoring and promoting sustainable use of terrestrial ecosystems, sustainably managing forests, combating desertification, halting and reversing land degradation, and biodiversity conservation: Establishing protected areas and wildlife conservation programs can help protect biodiversity and preserve ecosystems; Restoring degraded land through reforestation, wetland restoration, and other restoration techniques can help promote biodiversity, reduce soil erosion, and restore ecosystem functions.

SDG 6 is focused on ensuring access to clean water and sanitation for all and improving water quality and efficiency. Environmental projects that can help achieve this goal include: Improving sanitation infrastructure and promoting safe

Table 27.1 Chosen sustainable developments goals

Goals	Purpose	Analysis
SDG 6: Clean water and sanitation	Ensure availability and sustainable management of water and sanitation for all	Where energy efficiency and wastewater treatment can be introduced to boost their level of sustainability
SDG 7: Affordable and clean energy	Ensure access to affordable, reliable, sustainable and modern energy for all	The aim is to improve energy use, decrease the use of fossil fuels and implement better energy use to increase the use of renewable energies
SDG 9: Industry, innovation, and infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Which addresses the implementation of innovative ways of approaching new construction and implementing new industry methods
SDG 11: Sustainable cities and communities	Make cities and human settlements inclusive, safe, resilient and sustainable	The parameters are introduced which help to form new ways of achieving sustainable cities, which are important in the urban growth of these cities
SDG 12: Responsible consumption and production	Ensure sustainable consumption and production patterns	Which introduces us to the responsible use of it for the optimization of Circular Economy strategies, generating less waste and emissions
SDGs 13: Climate Action	Take urgent action to combat climate change and its impacts	Recognizes that climate change is one of the biggest challenges facing humanity, and that addressing it will require action at all levels, from individuals to governments and international organizations
SDGs 15: Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Focused on protecting, restoring, and promoting sustainable use of terrestrial ecosystems, forests, and biodiversity. The goal recognizes the crucial importance of preserving life on land for both current and future generations

Source United Nations and Author [12]

and hygienic sanitation practices can help improve health outcomes and reduce water pollution; Capturing and using rainwater can help reduce water waste, increase water availability, and promote sustainable water use.

SDG 7 is focused on ensuring access to affordable, reliable, sustainable, and modern energy for all: Building smart grids and investing in energy storage technologies can help integrate renewable energy sources into the grid, reduce energy waste, and increase energy efficiency; Encouraging the development and use of renewable energy sources such as solar, wind, and hydropower can help reduce greenhouse gas emissions and promote sustainable energy production.

27.4.2 Social Dimension

In the Social Dimension, there are SDGs 12 and 13, due to their impact on Exterior Comfort, Safety, Amenities, Mobility, Local and Cultural Identity. Following, it is intended to show several projects according to each SDGs.

SDG 12 is focused on promoting sustainable consumption and production patterns and reducing waste: Implementing circular economy initiatives such as product life extension, product sharing, and material recovery can help promote sustainable consumption and production while also creating new economic opportunities; Encouraging sustainable waste management practices such as recycling, composting, and reducing waste generation can help reduce the environmental impact of consumption and production.

SDG 13 is focused on taking urgent action to combat climate change and its impacts: Implementing measures to reduce greenhouse gas emissions, such as promoting renewable energy, improving energy efficiency, and reducing emissions from transportation and industry; Engaging communities in climate action, such as through citizen science projects, participatory planning, and community-led initiatives.

27.4.3 Economic Dimension

In the Economic Dimension, there is SDGs 9, due to their impact on Employment and Economic Development. Following, it is intended to show several projects according to each SDGs.

SDG 9 is focused on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation: Providing support for SMEs, such as access to finance, business development services, and technology transfer, can help promote economic growth and job creation; Investing in infrastructure, such as transportation networks, communication systems, and energy systems, can promote economic growth and improve access to basic services.

Table 27.2 Division of categories according to SDGs

Sustainable developments goals	Dimension	Category
SDG 11: Sustainable cities and communities	Environmental	C1—Urban form C2—Land use and infrastructure
SDGs 15: Life on land		C3—Ecology and biodiversity
SDG 6: Clean water and sanitation		C5—Water
SDG 7: Affordable and clean energy		C4—Energy C6—Materials and waste
SDG 12: Responsible consumption and production		C7—Exterior comfort C8—Safety C9—Amenities C10—Mobility
SDGs 13: Climate action		C11—Local and cultural identity
SDG 9: Industry, innovation, and infrastructure	Economic	C12—Employment and economic development

Source Author

The reviewed literature has shown that it is possible to integrate SBTool^{PT} Urban as an evaluation method for the SDG based projects to be implemented at the international level. SBTool^{PT} Urban is an evaluation method that can generate many benefits when used as an evaluation method not only at the urban scale but also when implementing projects based on improving the urban circular economy of a region. The division of the chosen goals is summarized in Table 27.2.

27.5 Conclusions

The present research sought to improve the ranking of circularity indicators and ensure a complete evaluation. Combining the Sustainable Development Goals (SDGs) with SBTool^{PT} Urban can bring many benefits to individuals, organizations, and communities. By aligning with the SDGs and using SBTool^{PT} Urban, individuals and organizations can demonstrate their commitment to sustainable development and responsible business practices. This can enhance their reputation and credibility and help them attract and retain customers, investors and employees who value sustainability.

Also, the combination of the SDGs and SBTool^{PT} Urban can create opportunities for collaboration and partnership with other individuals, organizations and communities that share a commitment to sustainable development. This can lead to greater knowledge sharing, resource pooling and innovation, and create a collective impact greater than the sum of its parts. SDGs projects that are in the process of implementation can be a good study to validate their usefulness with SBTool^{PT} Urban, this achieve to generate an evaluation of projects of various SDGs to be implemented properly with an analysis of their impact in their various fields. Although the

implementation of SBTool^{PT} Urban as a method for evaluating SDG implementation projects needs a more detailed study, it is clear the benefits that would arise by being able to maintain standards and quantify the impact of each of them in society.

The assessment process can provide a clear picture of an urban area's sustainability performance and highlight opportunities for improvement, such as increasing the use of renewable energy, improving waste management, or enhancing social cohesion and inclusion. Finally, there are many benefits to using the SBTool^{PT} Urban to evaluate projects in the implementation phase, from enhancing reputation and credibility to contributing to a more sustainable and livable world. However, further research into the SBTool^{PT} Urban's scope is needed for its use at the local level to be more widely adopted for application in conjunction with urban circular economy development projects. The limitations that exist in these evaluation methods leave us a way to continue developing and creating new applications for these evaluation methods. Considering the importance of the SDGs, it is necessary to continue applying these evaluation methods to generate a wider scope and greater number of applications to generate more support within the emergence of the new concepts of circular economy.

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References

1. de Oliveira CT, Oliveira GGA (2023) What Circular economy indicators really measure? An overview of circular economy principles and sustainable development goals. *Resour, Conserv Recycl*, 190. <https://doi.org/10.1016/j.resconrec.2022.106850>
2. Braganca L, Mateus R (2018) Guia de avaliação SBToolPT Urban, V 2018; iiSBE Portugal. Sch Eng: Guimaraes, Portugal. ISBN 978–989–20–8969–0
3. THE 17 GOALS United Nations, <https://sdgs.un.org/goals>, Last Accessed 2023/02/18
4. The 2030 AGENDA for Sustainable Development, https://globalcompact.pt/index.php/pt/age_nada-2030, Last Accessed 2023/02/18
5. Williams L, Tahntinen L, Costa N, Karst L, Proden E (2020) Participación de Actores en la Agenda 2030 para El Desarrollo Sostenible. Naciones Unidas
6. The SDGS in Action UNDP Org, <https://www.undp.org/sustainable-development-goals>, Last Accessed 2023/02/18
7. Kalioujny B, Ermushko J, Zhavoronok A (2016). Establishment of a strategy of circular economy increasing the well-being of society: comparison of two national policies. <https://doi.org/10.1051/shsconf/20162801050>
8. United Nations Sustainable Development Summit (2015), <https://sustainabledevelopment.un.org/post2015/summit>, Last Accessed 2023/02/14
9. CEN EN 15942:2021. Sustainability of construction works—environmental product declarations—communication format—Business to Business, Brussels (2021)
10. Mateus R, Braganca L (2011) Sustainability assessment and rating of buildings: Developing the methodology SBToolPT-H. *Building and Environment*, 1962–1971, 46(10)
11. Ferreira A, Pinheiro MD, Brito J de, Mateus R (2023) A critical analysis of LEED, BREEAM and DGNB as sustainability assessment methods for retail buildings. *J Build Eng*, 66. <https://doi.org/10.1016/j.jobe.2023.105825>

12. Global indicator framework for the sustainable development goals and targets of the 2030 agenda for sustainable development goals and targets (from the 2030 Agenda for Sustainable Development) Indicators, <https://unstats.un.org/sdgs/indicators/Global>, Last Accessed 2023/02/18
13. SHIP2FAIR, <http://ship2fair-h2020.eu/#>, Last Accessed 2023/02/19
14. Calvo residuo cero, grupo calvo global compact, <https://www.grupocalvo.com/2022/02/24/calvo-residuo-cero-premio-goods/>, Last Accessed 2023/02/1

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