

Urban sustainability metrics

How can cities measure their sustainability performance to provide actionable information to reach their goals?

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Introduction

Cities are multi-featured entities that vary in size, population density, climate, legal competencies and population needs in physical, social, economic and emotional terms. Cities are also the key in the transition to a sustainable future. Municipal governments can use their mandate to embark on a sustainability pathway, which will require a deep understanding of what sustainability is, a diagnosis of the current state of sustainability within the city and a prioritization of the dimensions and areas that require more urgent attention.

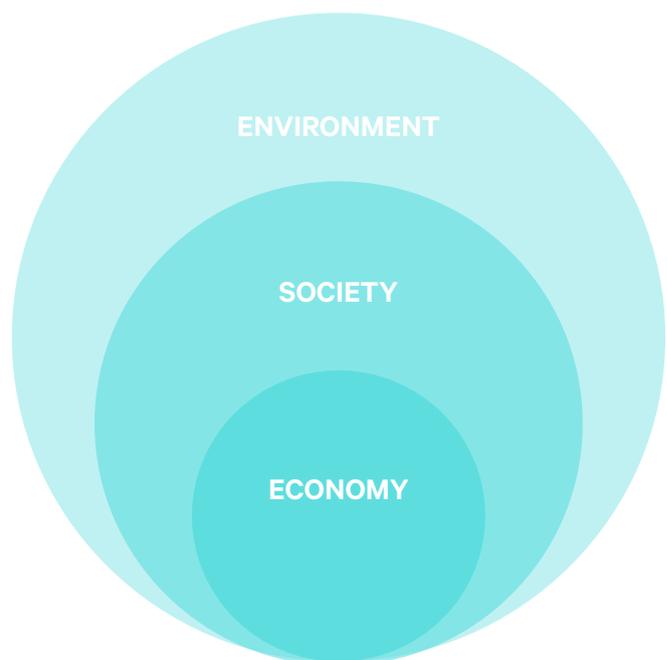
This factsheet extracts different approaches to urban sustainability metrics from literature and reporting frameworks to offer an overview of how cities can measure their sustainability performance, what they can expect from such a process and examples of deployment of urban sustainability metric systems.

Measuring urban sustainability

An urban sustainability framework provides an overview of the municipal state and progress in terms of sustainability. An adequate depiction of the performance of a city can potentially be used to inform theories of change aimed at supporting the sustainability transition.

Cities can use sustainability indicators to identify their main weaknesses and where action is needed to optimally improve in performance. Indicator-based systems for sustainability assessment and reporting have been used in cities since the 1990s (Feleki et al., 2018), and they often structure information in at least three themes: environment, society and economy (Ameen & Mourshed, 2019; Feleki et al., 2018; Huovila et al., 2019; Verma & Raghubanshi, 2018). These themes can be

Figure 1. Nested hierarchy according to Fischer et al. (2007)



expanded with additional themes such as governance, culture and heritage, and space (Garau & Pavan, 2018; Kaur & Garg, 2019; Shen & Zhou, 2014). To be fully actionable, indicators should be specific, measurable, achievable, relevant and time-bound (SMART). Although themes are often treated as if they had similar weight, Fischer proposed in 2007 a nested hierarchy that treats economy within society, which in turn is within environment (Figure 1) (Fischer et al., 2007).

The frameworks used to assess urban sustainability use two different strategies to convey the results of their assessment: **indexes** and **indicator systems**. Indexes, such as BREEAM

communities (BRE Global, 2017) and LEED for Neighborhood Development (U.S. Green Building Council, 2018), aggregate the values of each indicator into either a single or several numbers that represent different areas. This second form of aggregation is called a scorecard. Indexes and scorecards often attribute different weights to different metrics before the aggregation to express the comparative differences in importance of the indicators. Indexes can be used to easily compare cities' performances with each other. This practice needs every city under assessment to fill in all the required sections and, therefore, flexibility is limited in terms of citizen needs and cities' own approach to sustainability. However, the sustainability foci and requirements, and therefore the relevance and weighting of different indicators, can be different from one city to another (Ameen & Mourshed, 2019; Verma & Raghubanshi, 2018; Waltré et al., 2022), so the use of very stringent indexes can lead to skewed results. The second option, indicator systems, just reports the results for each indicator separately, which makes it difficult to compare cities with each other and makes data analysis more work intensive. On the other hand, it is easier to tailor the sustainability framework to the specificities of each city and more difficult to overlook the parts that compose the urban system.

fill gaps from the urban frameworks. All indicators have been reviewed and duplicates have been discarded. Indicators were then distributed into themes and categories as shown in Figure 2 with metrics added to each indicator.

Figure 2. Example of data structure



The findings from our review

We reviewed 16 urban sustainability frameworks and urban green and sustainability bonds frameworks, along with common business sustainability frameworks (Annex 1). Business sustainability frameworks have been included to compare and

Overall, our research resulted in 310 indicators distributed in 44 single categories, four of them repeated in two different themes, and four themes: environment, social, economy and governance. Table 1 contains an overview.

Table 1. Overview of themes and categories

Themes and categories			
Environment	Social	Economy	Governance
Agriculture	Community	Economy	Communities
Air Quality	Crime	Employment	Crime
Biodiversity	Culture	Supply Chain	Culture
Buildings	Demographics	Equality	Data
Circular Economy	Education	Business	Finance
Climate Change	Emergency	Business Support	Infrastructure
Disaster	Employment	Business Infrastructure and Attractiveness	Participation
Education	Equality		Planning
Energy	Government		Transportation
Light Pollution	Health		
Natural Environment	Housing		
Noise Pollution	Migration		
Renewable Energy	Poverty		
Soil	Transportation		
Waste	Utilities		
Water and Wastewater	Work Health and Safety		

How to use the indicator list

The proposed system is aimed at providing a better basis for decision-making and follow-up of the decisions made by municipal officials and other stakeholders. The path towards sustainability should be defined by the goals the municipalities set and their strategic theory of change to achieve those goals. The theory of change would be used as a base to design the activities and projects intended to achieve the municipalities' objectives.

Our take on the process for assessing sustainability in cities complements that of Verma & Raghubanshi (2018) by including an indicator pathway (Figure 3) that can be used for continued assessment of sustainability metrics. The process would be cyclical, which means that the end of the analysis would retro feed the first step, inform it and restart the process.

As collecting data and reporting on all these categories and indicators would be quite onerous for municipal governments, we propose that cities use the themes, categories, indicators and metrics as guidance for assessing sustainability initiatives, and utilize our shortlisting at three different times: baseline,

ex-ante impact assessment and ex-post impact assessment to check the development of the changes and their alignment with the forecasted measure.

- The assessment of the current scenario would provide the baseline from which to compare the performance of the sustainability initiatives.
- When a project or initiative is in the planning phase, each relevant indicator should get a defined pathway: how the baseline value will be affected and change thanks to the initiative. The activity will have an input, which in turn may have an output, which will result in an outcome that will have the proper impact (Huovila et al., 2019).
- After the project is completed, that performance needs to be measured and an ex-post metric of the impact reported. In the case of large projects, more continuous monitoring might be necessary to ensure the positive development of the impact.

All indicators can be measured with different metrics, but the baseline and the impact should use the same metrics and units to be comparable, as in the example in Table 2.

Figure 3. Indicator pathway

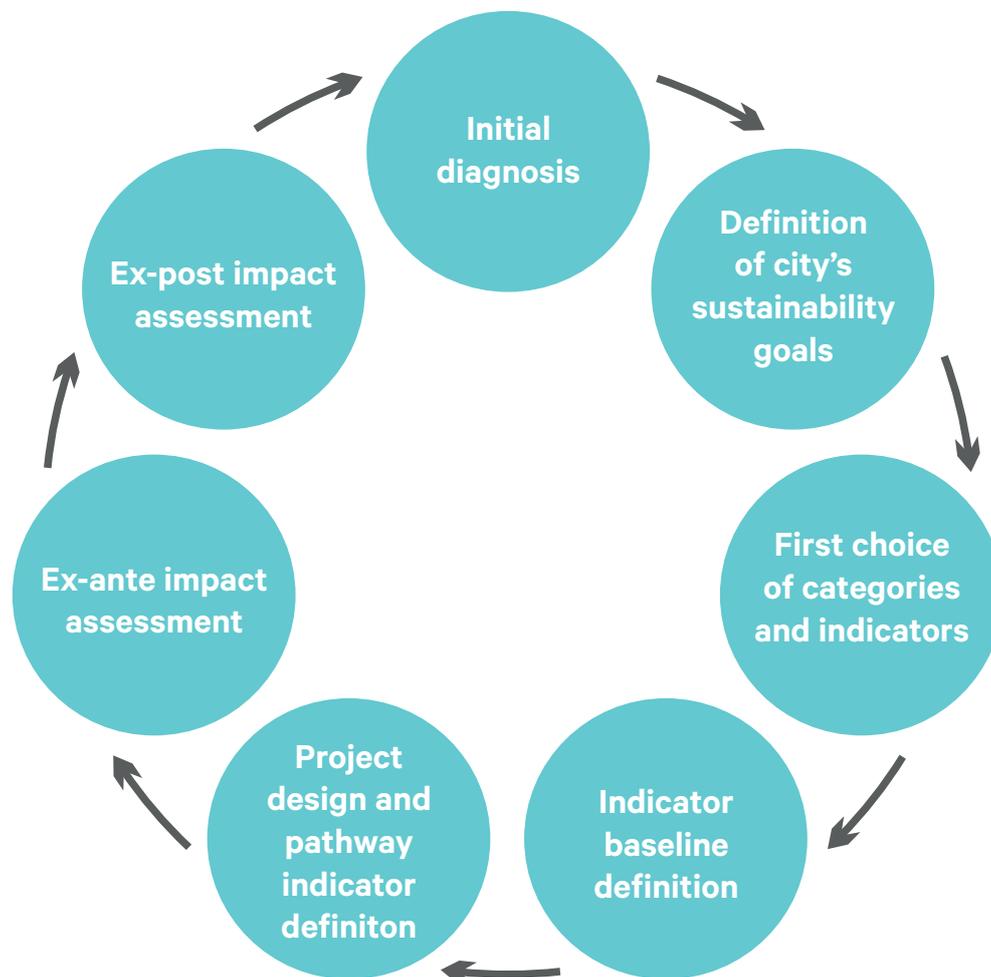


Table 2. Example impact pathway

Indicator level	Input	Activity	Output	Outcome	Impact
(Baseline, ex ante impact assessment and ex post)	Amount of money: SEK 50,000	Number of training sessions given	Number of people trained	Number of people driving less	NOx level reduction

Examples of use of urban sustainability metrics

Swedish cities report on sustainability aspects (Waltré et al., 2022) through many different channels.

Sustainability-related indicators can be found, among other places, in sustainability plans and the information that is used in Kolada, an open database for municipalities and regions in Sweden (RKA, n.d.), and the official centre for statistics, Statistics Sweden (SCB, n.d.). The statistical gathering of information provides some degree of comparability between the municipalities in terms of individual indicators, but as mentioned above, the different approaches to sustainability, with different priorities in terms of goals and categories, hinders full comparison. In addition, city goals are sometimes measured qualitatively instead of quantitatively, which provides challenges for their comparability.

Other countries may choose to use an index or a scorecard to show their performance, such as Mexico in the City Resiliency Index, which provides a graphic overview of the current situation in the city. However, many indicators are not SMART and therefore the information can be ambiguous (City Resiliency Index, n.d.).

Overall, there is an important trend towards increasing sustainability performance measuring and monitoring at a municipal level. However, the lack of commonly accepted criteria for the reporting of sustainability aspects, such as the choice of system, the number of indicators to be reported and even whether metrics are quantitative or qualitative, leaves room for improvement.

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Annex 1 – overview of the reviewed frameworks

The main frameworks to measure overall urban sustainability are the Urban Sustainability Framework, LEED for Neighborhood Development certification, BREEAM Communities and City Resilience Index. The Urban Sustainability Framework is an indicator system, whereas LEED and BREEAM are certifications and therefore they require an overall index, and the City Resilience Index shows performance indexes for different city goals.

We suggest reading the ICMA's principles for green, social and sustainable bonds.

The frameworks used for this factsheet are:

- Urban and regional frameworks:
 - Sustainability Framework for Best-in-Class Municipality Investment (BNG Bank, 2019)
 - BREEAM Communities (BRE Global, 2017)
 - City Prosperity Index (UN Habitat, 2016)
 - City Resilience Index (City Resiliency Index, n.d.)
 - Comunidad de Madrid Sustainability Bond (Comunidad de Madrid, n.d.)
 - LEED for Neighborhood Development certification (U.S. Green Building Council, 2018)
 - North Rhine-Westphalia Sustainability Bond (North Rhine-Westphalia, 2021)
 - UN Sustainable Development Goal 11 (UN DESA, n.d.)
 - Urban Sustainability Framework (Global Platform for Sustainable Cities & The World Bank, 2018)
- Investment frameworks:
 - Equator Principles (Equator Principles, 2020)
 - A Practical Guide to Measuring and Managing Impact (EVPA, 2015)
 - Green Bond Principles (ICMA, 2018a)
 - Social Bond Principles (ICMA, 2021)
 - Sustainability Bond Guidelines (ICMA, 2018b)
 - Principles for Responsible Investment (PRI, n.d.)
 - Principles of Sustainable Insurance (UNEP, n.d.)
 - Recommendations of the Task Force on Climate-related Financial Disclosures (Task Force on Climate-related Financial Disclosures, 2017)
 - The Principles for Positive Impact Finance (UNEP Finance Initiative, 2017)
- Business frameworks:
 - In Search of Impact: Cambridge Impact Framework (University of Cambridge Institute for Sustainability Leadership, 2019)
 - Future Fit Business Benchmark (Future Fit Foundation, 2021)
 - Greenhouse Gas Protocol (World Business Council for Sustainable Development & World Resources Institute, 2005)
 - GRI Standards (Global Reporting Initiative, 2021)
 - IFC Performance Standards (International Finance Corporation, 2012)
 - IRIS+ (The Global Impact Investment Network, n.d.)



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