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SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

2019 SDG Index and Dashboards Report

EUROPEAN CITIES

PROTOTYPE VERSION

2019

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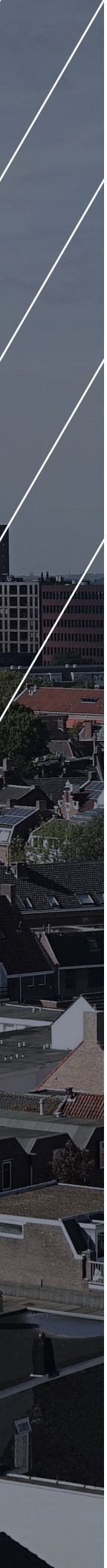
The 2019 SDG Index and Dashboards Report for European Cities (prototype version)

Prepared by the Sustainable Development Solutions Network (SDSN) and the Brabant Center for Sustainable Development (Telos, Tilburg University)

Table of contents



Acknowledgements

This *2019 SDG Index and Dashboards Report for European Cities (prototype version)* provides an overview of the performance of 45 capital cities and large metropolitan areas on the Agenda 2030 and 17 Sustainable Development Goals (SDGs) adopted by global leaders in September 2015 at the UN Sustainable Development Summit. It builds on previous work conducted by SDSN to monitor the SDGs at national and subnational levels (Sachs et al. 2018; Espey, Dahmm, and Manderino 2018) and on TELOS' scoping study "Sustainability Monitoring of European Cities" (2014) prepared in collaboration with the European Commission's Directorate-General for Environment (Zoeteman et al. 2014).

The report was prepared by teams of independent experts at the SDSN Secretariat and TELOS. Lead writers at SDSN include Guillaume Lafortune and Grayson Fuller under the direction of Guido Schmidt-Traub. Lead writers at TELOS include Kees Zoeteman, Rens Mulder and John Dagevos. The views expressed in this report do not reflect the views of any organizations, agencies or programmes of the United Nations. Additionally, they may not reflect the opinions of SDSN's Leadership Council members and their host institutions.

The report compiles the results from data collection and analyses produced by various European and non-European institutions. These include the European Commission via Eurostat, the European Environment Agency, the European Energy Agency, the Joint-Research Centre (JRC) and the Organisation for Economic Co-operation and Development (OECD). We are grateful to the Joint Research Centre and the OECD for their comments and technical feedback on the indicator selection.

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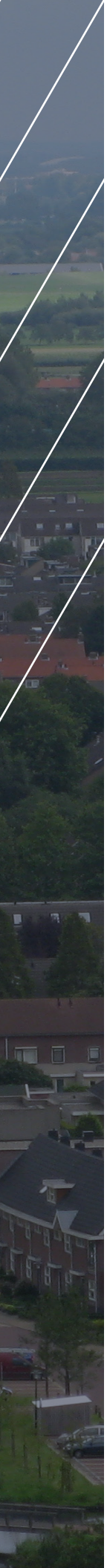


Foreword

We are pleased to launch the *2019 SDG Index and Dashboards Report for European Cities (prototype version)*. This is the first report comparing the performance of capital cities and a selection of large metropolitan areas in the European-Union (EU) and European Free Trade Association (EFTA) on the 17 Sustainable Development Goals (SDGs). In total, results for 45 European cities are presented in this first prototype version. The report was prepared by a team of researchers from the Sustainable Development Solutions Network (SDSN) and the Brabant Center for Sustainable Development (Telos, Tilburg University). It builds on SDSN's experience in designing SDG indicators for nations and metropolitan areas. The report also builds on TELOS' previous work on "Sustainability Monitoring of European Cities" (2014) prepared in collaboration with the European Commission's Directorate-General for Environment (Zoeteman et al. 2014) which led to the development of an interactive platform on request of the Dutch Ministry of Interior and Kingdom Relations (Zoeteman et al. 2016)[1].

This report comes at a key opportunity for Europe to increase its focus on the SDGs, with the election of the new European Parliament in May, the new Presidency of the Council of the EU moving to Finland in July, and the arrival of a new European Commission by the end of the year. The European Union can and should strengthen its policy measures to achieve all of the SDGs. In that context, the European Commission's January 2019 Reflection Paper "Towards a sustainable Europe by 2030" highlights various scenarios to support the SDGs over the next decade. The report by the European Commission highlights the opportunities to address the SDGs as part of the next EU Urban Agenda.

Achieving the SDGs will require, at the local level, deep transformations in transportation, energy and urban planning and new approaches to address poverty and inequalities in access to key public services including health and education. The SDSN estimates that about two-thirds (65%) of the 169 SDG targets underlying the 17 SDGs can only be reached with the proper engagement of, and coordination with, local and regional governments (SDSN 2015). Similarly, UN-Habitat estimates that around one-third of all SDGs indicators have a local or urban component[2]. The Urban Agenda for the European Union launched in May 2016 (Pact of Amsterdam), recognizes the crucial role of cities in achieving the SDGs. Over two-thirds of EU citizens live in urban areas while about 85% of the EU's GDP is generated in cities (European Commission 2019). The urban population in Europe is projected to rise to just over 80% by 2050 (European Commission 2016).

1 www.sustainablecitiesbenchmark.eu

2 https://unhabitat.org/un-habitat-for-the-sustainable-development-goals/

This 2019 SDG Index and Dashboards for European Cities (prototype version) finds that no European capital city or large metropolitan area has of yet fully achieved the SDGs. Nordic European cities – Oslo, Stockholm, Helsinki and Copenhagen – are closest to the SDG targets but still face challenges in achieving one or several of the SDGs. Overall, the cities in Europe perform best on SDG 3 (Health and Well-Being), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure). By contrast, performance is lowest on SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 15 (Life on Land).

As always, our analysis is constrained by the availability, quality and comparability of data. These data constraints are even greater at the subnational level. Despite the ground breaking work conducted by the European Commission – notably via Eurostat and the Joint Research Centre – to define territorial levels and metropolitan areas and to standardize subnational data and indicators, major gaps remain to monitor all of the SDGs. A table summarizing some of these major gaps is included in this report.

The need to expand and strengthen SDG monitoring in regions and municipalities across Europe in the coming years was raised extensively in the consultation made by SDSN as part of its 2019 study on "Exposing EU policy gaps to address the Sustainable Development Goals" prepared in collaboration with the European Economic and Social Committee (Lafortune and Schmidt-Traub 2019) . This was also one of the recommendations made by ESAC during the consultation phase for the "2017 Sustainable development in the European Union — Monitoring report on progress towards the SDGs in an EU context" (European Statistical Advisory Committee (ESAC) 2017).

We hope this first *2019 SDG Index and Dashboards Report for European Cities (prototype version)* will help to identify the major SDG priorities in urban Europe. All data and analyses included in this report are available on SDSN's and TELOS' data portals (www.sdgindex.org and www.telos.nl). Individual city profiles are accessible online. We very much welcome comments and suggestions for filling gaps in the data used for this index and for improving the analysis and presentation of the results. Please contact us at info@sdgindex.org or telos@uvt.nl.

Jeffrey Sachs,
Director SDSN

Geert Duijsters,
Dean Tilburg School of economics,
Tilburg University - Telos

Executive Summary

In 2015, global leaders adopted a common vision for sustainable development with goals and targets to be achieved by 2030 (Agenda 2030, SDGs, Paris Climate Agreement). These goals and targets were adopted by national governments but with a clear recognition that regions and municipalities would play a crucial role in implementing these goals.

The *2019 SDG Index and Dashboards Report for European cities (prototype version)* presents the first distance to target assessment for capital cities and large metropolitan areas in the European-Union (EU) and the European Free Trade Association (EFTA) for the SDGs. The report builds on the approach and methodology used by the SDSN and the Bertelsmann Stiftung to measure SDG performance globally (Jeffrey D. Sachs et al. 2018; Lafortune et al. 2018). The 2019 SDG Index approach and methodology are currently being audited by the European Commission Joint Research Centre. The report also builds on TELOS' previous work on "Sustainability Monitoring of European Cities" (2014) - prepared in collaboration with the European Commission's Directorate-General for Environment - and on integrated sustainability assessment of EU cities (Zoeteman et al. 2016) – supported by the Dutch Ministry of Interior and Kingdom Relations.

This 2019 report presents Index scores and detailed dashboards for each goal for 45 European cities. Three Nordic European cities are at the top of the Index this year – Oslo, Stockholm and Helsinki. Yet, even for these top performing cities major challenges remain in order to achieve all 17 SDGs.

The 2019 SDG Index and Dashboards for European Cities (prototype version) generates five major findings:

1 No capital cities and large metropolitan in Europe has achieved the SDG's

The best performing city – Oslo – obtains an overall score of 74.8 which means that the city is on average 74.8% of the way to the best possible outcome across the 17 SDGs. Nordic cities (Oslo, Stockholm, Helsinki and Copenhagen) obtain the highest scores but all face important challenges in one or several goals and in particular on SDG 13 (Climate Action). Athens is the only European city with an overall SDG Index score which is below 50%.

2 There are persistent challenges related to SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 15 (Life on Land)

European cities obtain their lowest scores and highest number of "red" ratings on the dashboards denoting "major achievement gaps" on the

environmental goals. All European cities perform poorly on SDG 13 (Climate Action) measured by tonnes of CO2 emissions per person. Poor performance on SDG 12 (Responsible Consumption and Production) is driven by low shares of ground and surface water with good chemical status in many European cities. Lack of green spaces and the high percentage of soil sealing explains for the most part poor performance on SDG 15 (Life on Land).

3 Decarbonizing transportation in cities and providing access to affordable housing remain major policy priorities

All European cities covered in this report emit more than 4 tonnes of CO2 per inhabitant per year. Cities such as Copenhagen and Stockholm (among others) have set ambitious local targets towards net zero emissions by 2025 and 100% renewable energy by 2040 respectively. There are also persistent issues related to access to housing. Rent overburden is high and has increased in many European cities in the past five years while people's satisfaction with housing varies greatly calling for further efforts to strengthen policies related to affordable and quality housing for all.

4 Compared to the US Cities Index, better nutrition, diet and a more active life style in Europe drive higher performance on SDG 2 (No Hunger) and SDG 3 (Health and Well-Being)

European cities perform much better than cities in the United-States on SDG 2 (No Hunger) -which includes targets on malnourishment - and SDG 3 (Good Health and Well-Being). This is due, in part, to healthier lifestyles that help prevent excessive weight gain and various chronic and preventable diseases. Yet, performance does vary across European cities on these two goals

5 Inequalities in economic and social outcomes and international spillover effects from consumption in cities require better data

Data availability and comparability to assess income and wealth inequalities and disparities in access to key services within cities (by income groups or area of residence for instance) is still very limited. Comparable data on homelessness and accessibility of services for handicapped people is also missing. Improving the availability of data to track the "Leave-No-One-Behind" component of Agenda 2030 will be key. This can be achieved by improving the availability and quality of geo-spatial data. Similarly, it is very difficult to evaluate the international impact of urban consumption in Europe on the rest of the world.

Detailed city profiles and all underlying data are accessible online (www.sdgindex.org). Section 2 in this report presents the full methodolog

Figure 1 The 2019 SDG scores for European Cities

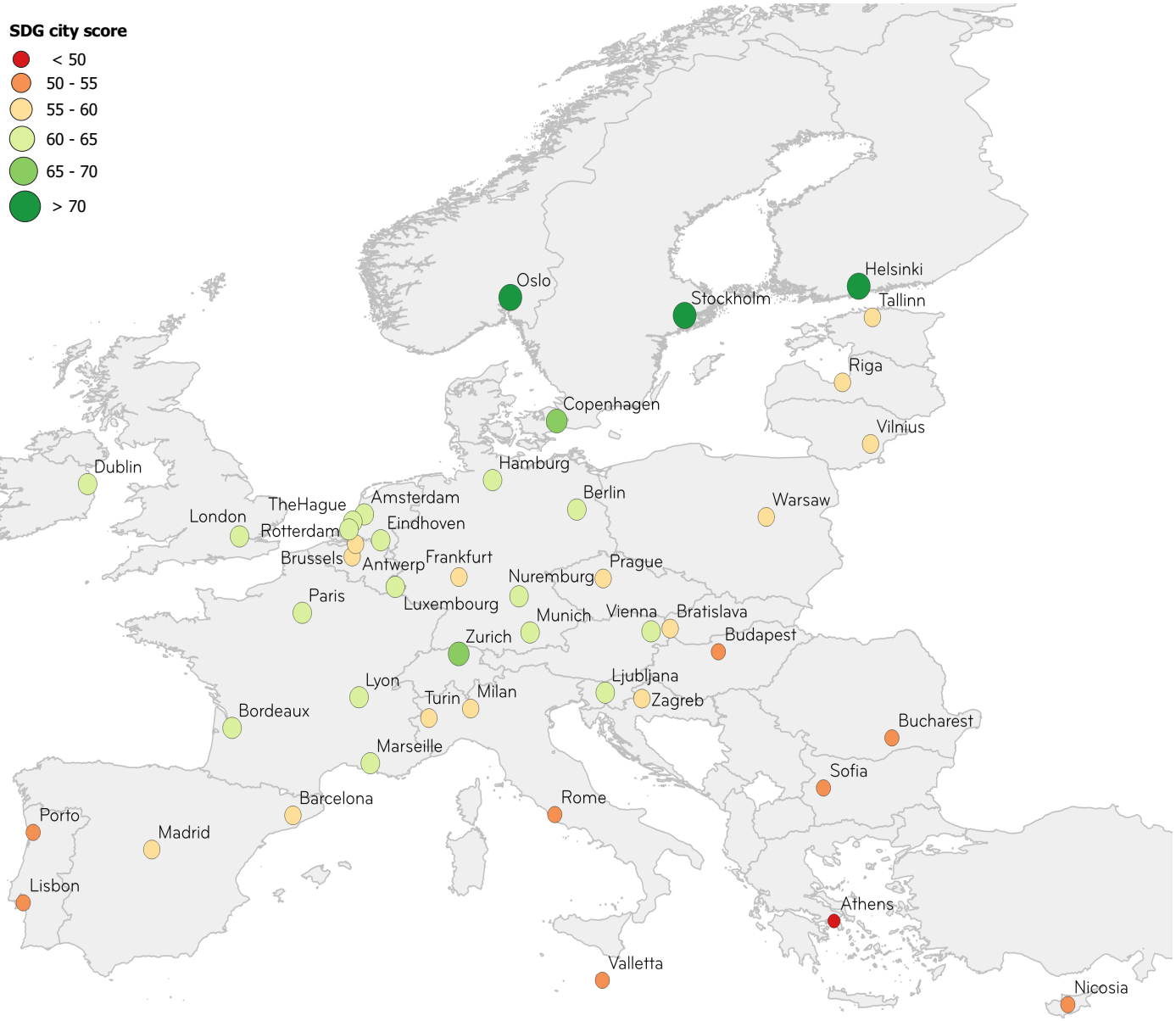
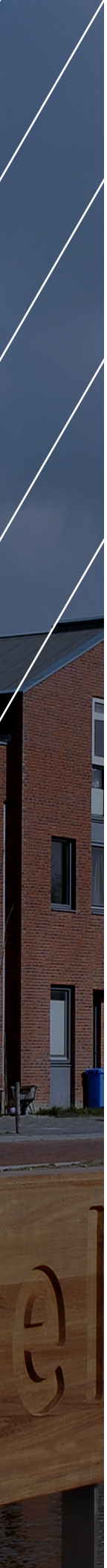


TABLE 1 THE 2019 SDG INDEX FOR EUROPEAN CITIES: RANKING AND SCORES

RANK	CITY	SCORE		RANK	CITY	SCORE
1	Oslo	74.8		26	Bratislava	60.2
2	Stockholm	74.2		27	Prague	60.1
3	Helsinki	71.3		28	Madrid	59.7
4	Copenhagen	68.7		29	Tallinn	59.5
5	Zurich	67.5		30	Barcelona	59.1
6	Lyon	64.9		31	Warsaw	57.8
7	Paris	64.7		32	Zagreb	57.1
8	Munich	64.2		33	Vilnius	56.8
9	The Hague	63.7		34	Milan	56.8
10	Eindhoven	63.5		35	Turin	56.4
11	Amsterdam	63.5		36	Riga	56.3
12	Rotterdam	63.4		37	Budapest	55.4
13	Luxembourg	63.0		38	Sofia	55.2
14	Hamburg	63.0		39	Lisbon	55.1
15	Bordeaux	62.6		40	Rome	55.0
16	Vienna	62.5		41	Bucharest	54.4
17	Ljubljana	62.5		42	Valletta	53.8
18	Berlin	62.1		43	Nicosia	53.7
19	London	62.0		44	Porto	53.5
20	Nuremburg	61.9		45	Athens	48.6
21	Antwerp	61.7				
22	Dublin	61.6				
23	Marseille	61.4				
24	Frankfurt	61.2				
25	Brussels	60.4				



1 The 2019 SDG Index and Dashboards Report for European Cities (prototype version)

1.1 Introduction

The global community adopted in 2015 a common vision and goals for sustainable development (Agenda 2030, SDGs, Paris Climate agreement). Urban and local actors are key for achieving this transformative agenda. SDG 11 recognizes the central role of urbanization in sustainable development and calls for "mak[ing] cities and human settlements inclusive, safe, resilient and sustainable". Beyond this dedicated Goal, most SDGs require the involvement of all levels of government, including urban and local actors, for success by 2030. The Sustainable Development Solutions Network (SDSN) estimated in 2016, that as much as 65% of the SDG agenda may not be fully achieved without the involvement of cities. Addressing extreme poverty, unemployment and socio-economic disparities, unsustainable patterns of consumption and production, and climate change and environmental degradation requires deep involvement of mayors and local leaders.

For mayors and local leaders that are working to improve the quality of life in urban environments, the SDGs provide a roadmap for more balanced and equitable urban development. The SDGs provide a long-term and non-partisan framework for a more sustainable vision of urban development, one that provides equal opportunities to all inhabitants, promotes healthy living environments with access to green spaces, and is resilient in the face of everyday disasters and climate risks.

The SDGs also provide a report card to track progress and ensure accountability. While the goals were adopted by national governments, various municipalities and urban associations are using the SDGs as a framework for tracking their progress towards sustainable development. The OECD has been closely monitoring the SDGs from the beginning, and has used Telos' knowledge to make an inventory of indicators and monitoring practices for green growth at the city level (Zoeteman 2016). The SDSN secretariat and geographic networks have been working since the adoption of the goals with researchers and urban associations to produce SDG Indices to track the implementation of the goals in cities in the United States, Italy and Spain. Based on the work conducted in the United States, a "Guide to Implementing the SDGs" in cities was released by SDSN in March 2019 highlighting 10 major steps to support sustainable development planning in U.S. Cities.

The SDGs matter for European cities for three reasons. Firstly, over two-thirds of EU citizens live in urban areas and about 85% of the EU's GDP is generated in cities (European Commission 2019). In fact, the urban population in Europe is projected to rise to just over 80% by 2050 (Eurostat, 2016). As such, achieving the SDGs requires the mobilization of mayors and local actors.

Secondly, available evidence suggests that Europe is not on track to achieve the SDGs by 2030, which calls for further action at all levels of government. There are particular challenges related to the achievement of SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life Below Water) and SDG 15 (Life on Land) (Jeffrey D. Sachs et al. 2018). Fighting against income and wealth inequalities and disparities in access to and quality of public services across population groups is also key to "Leave-no-one-behind" in Europe. Latest data suggests that CO2 emissions and air pollution have been rising in several European countries since 2015 (European Energy Agency 2018). Income and wealth inequalities have also increased significantly in the past three decades and there are persistent gaps in health and education outcomes by population groups in the EU and EFTA countries (European Commission 2017; Forster, Kentikelenis, and Bambra 2018). The perception that economic and social inequalities are rising in Europe is leading to public discontent and growing political polarisation in many parts of Europe (Winkler 2019).

Thirdly, regions and cities in Europe possess significant policy and investment levers to drive the necessary transformations towards sustainable development. Regions and cities in the European Union enforce environmental legislation and manage about 43% of public

investments in the EU including a large proportion of the European Structural and Investment Funds. Subnational public investment (as a percentage of total public investment) reaches more than 50% in Austria, Belgium, Denmark, Finland, Germany, the Netherlands, Poland, Spain and Sweden (European Committee of the Regions 2018). It exceeds 20% in the majority of European countries.

Several major European cities have started using the SDGs as a tool for planning and accountability. In 2018, mayors from 10 European cities – including the mayors of Barcelona, Copenhagen, London, Milan, Paris and Stockholm – signed a letter addressed to the Vice-President of the European Commission and to the Commissioner for Climate and Energy in favour of an ambitious European long-term strategy (Box 1). The city of Copenhagen aims to be the world's first carbon-neutral capital city by 2025. Stockholm aims to achieve 100% renewable energy by 2040. Amsterdam is working towards being free of natural gas use by 2050. Other cities have launched specific projects related to the SDGs such as "Building Neighbourhoods 2030" in Madrid and "Global Goals City" in Utrecht. The city of Strasbourg is currently mapping its budget and indicator system to the content of the SDGs.

In this context, the *2019 SDG Index and Dashboards Report for European Cities (prototype version)* not only helps major capital cities and a selection of large metropolitan areas in Europe benchmark their progress, but also facilitates peer-to-peer exchanges of best practices. This is the first time such a report is being produced in Europe. Yet, past experience working with U.S. cities demonstrates an active uptake of the SDGs at the urban level throughout the U.S. (Box 2, Nilda Mesa). This uptake is made possible through networks like the U.S. Conference of Mayors and groups of cities such as Orlando, New York and San Jose that are working with SDSN to pursue the SDGs. Similarly, reports coordinated by the SDSN secretariat and local networks in Italy and Spain caught the attention of policymakers and media and are used regularly as a conversation starter for workshops and exchanges of best practices on the implementation of the SDGs at the subnational level.

Box 1: Cities in the EU, engines of an ambitious European long-term strategy

An open letter to Vice-President Maroš Šefčovič & Commissioner Miguel Arias Cañete; July, 9th 2018

Mr. Vice-President of the European Commission,
Mr. Commissioner for Climate and Energy,

We, the mayors of ambitious European cities, unite our voices in support of the European Commission's mission to develop a European strategy for long-term greenhouse gas reduction in accordance with the Paris Agreement. We urge the European Commission to set the 1.5°C and net-zero emissions goals of the Paris Agreement as objectives of this strategy to be achieved by 2050.

We believe this is a fantastic opportunity for the European Union, a historical climate pioneer, to showcase its global leadership on climate action, and encourage the European Union to lead by example in the implementation of the Paris Agreement.

This year and next are critical for our planet: to keep global temperature rise below 1.5°C, greenhouse gas emissions must peak by 2020 and decrease until reaching carbon neutrality by 2050. To achieve this, all countries have to prepare more ambitious NDCs, and put in place appropriate long-term strategies towards emissions neutrality. The IPCC Special Report on 1.5°C to be released in October 2018 will provide the latest available science to support the development of these long-term strategies.

With its decision to develop a long-term strategy, the EU is sending the right political message, but it needs to adopt the 1.5°C and net-zero emission objectives of the Paris Agreement and couple the strategy with consistent and Paris-compatible economic and energy policies, a coherent post-2020 EU budget for climate action (including measures to phase out fossil fuel) as well as an enhanced 2030 emissions reduction target.

In this endeavour, we encourage you to take in consideration the ambitious climate commitments that so many European cities have taken, as well as the solutions they can contribute.

As Mayors, it is our duty to deliver our fair share of the Paris Agreement. Cities in Europe are big GHG emitters, and our residents are already affected by the impacts of climate change, including floods in Paris, London or Copenhagen, extreme weather events in Oslo and Stockholm and heat waves in Milan and Barcelona.

Along with over 9,000 cities, we have joined the Global Covenant of Mayors for Climate and Energy, and within this framework, are undertaking transparent and measurable climate action, helping to meet and exceed the Paris agreement's objectives. As signatories of the EU Covenant of Mayors, we are committed to reduce our GHG emissions by 40% by 2030

- some of us are going even further - and to design equally ambitious adaptation strategies to address the impacts of climate change.

But considering the worrying increase of EU emissions in 2017, we recently decided to step up our ambition, and have pledged to become emissions neutral by 2050. Conscious that this means increasing our ambition also in the mid-term, we are working on defining new sectoral targets for 2030, towards zero-emission transport, net-zero buildings, 100% renewable energy, and zero waste, that will bring big benefits to our residents, including clean air, green jobs, more efficient housing and many more.

Achieving this vision will only be possible if cities, regions and national governments work together and follow a shared roadmap and mutually supportive policies to accelerate action on the short and long terms. We know the EU can be the political driving force that sets us in this direction, and cities stand ready to contribute to the effort.

We hope this will inspire you to maintain your ambition and give you confidence that emissions-neutrality by mid-century is achievable, not only necessary and desirable. We encourage you to take this responsibility, and we, the Mayors, will share the invaluable task of implementing it, for the benefit of European citizens and the world.

Anne Hidalgo - Mayor of Paris
Karin Wanngård - Mayor of Stockholm
Giuseppe Sala - Mayor of Milan
Ada Colau - Mayor of Barcelona
Eckart Würzner - Lord Mayor of Heidelberg
Frank Jensen - Lord Mayor of Copenhagen
Sadiq Khan - Mayor of London
Ashok Sridharan - Mayor of Bonn
Minna Arve - Mayor of Turku
Robert Cornells Nordi - Mayor of Arendal

Source: https://www.c40.org/blog_posts/eu-long-term-strategy

Box 2: The SDGs as a planning and monitoring framework for cities

Nilda Mesa, Director of Equity, Sustainability and Planning, Center for Sustainable Urban Development, Columbia University

The SDG framework can help cities identify priorities and set long-term goals. This applies to both cities in developing countries but also to cities in developed countries including in the U.S. and in Europe.

Cities large and small across the U.S. and Europe share common goals such as providing safety and security, good schools, good jobs, decent housing, access to health care, clean water and air, and reliable and direct transport systems. They aim to provide steady future, well-being to all residents and the promise of a ladder up for recent arrivals, as well as long-term residents. No matter a city's size, climate, economic health, or geography, these goals provide a remarkably relevant framework for policy planning and monitoring at the local level. Mayors, city councils and local communities are crucial for making the SDGs a success.

As former Director of the Mayor's Office of Sustainability in New York City, where I was notably in charge of designing the *OneNYC* program, I witnessed how the principles of sustainable development can help shape policies at the local level in New York City and in other cities across the U.S.

In the U.S., cities and states have taken on more and more of a leadership role since the 2016 national elections. For example, cities and states have continued to push for the Paris climate goals at the local level, in spite of dramatic federal policy reversals. A number of city networks and associations are well-established, and those long-standing relationships make it easier for U.S. cities to exchange information and act jointly to advance common goals. While the Sustainable Development Goals (SDGs) initially were seen by many cities as not connected to their own priorities, over the last few years this view has evolved and developed significantly, with the momentum to adapt and follow common goals quickening and flourishing.

Adoption and implementation of the SDGs in U.S. cities is largely an independent effort, aided by the striking independence that U.S. cities have within the country's system of government. SDG implementation at the

city level is not directed by the federal government, which gives the U.S. effort some real advantages. The U.S. Constitution grants states powers independent of the national government, which is unlike the structure in many other countries. States have their own authority over many matters separate and apart from whatever authority they may be granted by the federal government. Cities' authorities are derived from those granted to them by their states. As a result, each city has a unique set of jurisdictions, with some having a great deal of authority, while others are more limited. Overall, however, compared to cities in many countries, U.S. cities have a great deal of freedom to take independent action, for example, to set standards such as building and energy codes and land use, as well as taxing authority. As seen in the case of immigration and other disputes with the federal government, cities at times may choose not to cooperate with federal policies that rely on local implementation. Organizations such as the U.S. Conference of Mayors and the Urban Sustainability Directors Network provide platforms for cities to convene and set priorities of their own, apart from federal priorities, as well as exchange knowledge and develop collaborative partnerships.

New York City was the first city to explicitly tie the SDGs to its own long-term sustainability plan, *OneNYC*. *OneNYC* was developed concurrently with the SDGs, and close communications between the two efforts aimed at providing consistency and support for common goals. While *OneNYC* was released in April, and the SDGs were ratified in September of 2015, this close communication and collaboration made it possible for *OneNYC* to provide a model for other cities to apply, adapt and adopt the many SDG goals shared with city goals. In addition, an analysis of goals set annually by the U.S. Conference of Mayors demonstrated that their priorities mapped closely with the SDGs. With support from SDSN, cities including Baltimore, Los Angeles and San Jose took on their own SDG processes, mapping existing efforts to the SDGs, identifying gaps, and adapting the goals to match their own conditions and values. Other cities such as New Orleans and Orlando have since followed suit. Last year, New York tracked its progress meeting the SDGs and released its Voluntary Local Review, a first for U.S. cities, and others are now developing their own VLRs. The March 2019 SDSN Guide for U.S. Cities is a practical guide for city policymakers that lays out strategies and guidance, based on the experience of these early adopters, and was widely distributed.

U.S. cities are increasingly seeing the SDGs as a useful template, providing a shared language with other cities globally, as well as identifying gaps in their own policy and budgeting processes. Cities are making the SDGs their own.

1.2 Objectives of the report

The *2019 SDG Index and Dashboards Report for European Cities (prototype version)* aims to provide the most relevant, robust and timely data to gauge the performance of European cities on the SDGs. In this first edition, considerable effort was undertaken by SDSN and TELOS to map the most relevant data and consult with major stakeholders on the final indicator selection and on thresholds to denote goal achievement. The report provides an overview of the main strengths and weaknesses of 45 capital cities and large metropolitan areas in the EU and EFTA countries.

This report also aims to identify major data gaps at the subnational level to track the SDGs. A table is provided in the methodology section highlighting the major data gaps and limitations identified as part of this exercise. By highlighting missing data at the city level and major indicator gaps, the report aims to inform the data and statistical agenda for the SDGs in Europe in the coming years. This is relevant to policy leaders, local stakeholders but also to international organisations and researchers using alternative data sources such as big data, satellite imagery, censors, telecoms and other innovative data collection techniques and tools. The report complements on-going efforts taking place in Europe and at the OECD to improve and harmonize metrics to track the SDGs (Box 3 and 4).

The report also aims to generate peer-to-peer and learning exchanges among urban leaders and stakeholders. It can enable cities to identify peers struggling with similar challenges and help facilitate a European-wide dialogue on how to accelerate progress. Based on similar exercises conducted in the United States, Italy, and Spain, these reports are also advocacy tools that can help foster interest in the SDGs among mayors and other local government leaders on the relevance and utility of the SDG framework.

As is the case with any other index, the *2019 SDG Index and Dashboards Report for European Cities (prototype version)* is a simplification of reality and highly depends on the quality of the underlying data pooled together. This report does not provide a detailed review of cities' strategies and policies on the SDGs. In fact, many data points are pre-SDG period and many cities may have started implementing ambitious sustainable development plans which may not be reflected in the report. SDSN and TELOS did not collect themselves any of the data points presented in the report. Both organisations recognize that the availability and comparability of data at the subnational level to track the SDGs is sometimes limited. This is underlined in the methodology section. The Nomenclature of Territorial Units for Statistics (Nuts3) classification is used in cases where city level data is not available. Nuts 2 and Nuts 3 data are most often used. This calls for prudence in interpreting small differences in scorings and rankings. Full details on territorial levels covered by each indicator is provided in the Report and available online.

Box 3: The SDGs at local level: JRC's work to measure EU cities' contribution

Alice Siragusa, Project Officer, European Commission - Joint Research Centre

Pilar Vizcaino Martinez, Consultation at the European Commission - Joint Research Centre

The 2030 Agenda recognizes the key role of cities for sustainable development and dedicates a specific SDG to Sustainable Cities and Communities (SDG11). Cities have been the object of one of the first implementing agenda of the 2030 Agenda, the New Urban Agenda approved by the United Nations in 2016. And the European Union is committed to support and boost the collective potential of European cities to contribute to the SDGs, through the Urban Agenda for the EU.

Indeed, in Europe as in the rest of the world, cities will be key in the achievement of the SDGs as is where most citizens live, where the biggest share of the GDP is generated. Cities is where a large part of EU policies and legislation are implemented and where a significant share of EU funds are spent. Even though cities are clearly at the heart of the process of the Agenda 2030, it is hard to monitor the achievement of the SDGs at local scale, and even harder to quantify cities' contributions to the achievement of the SDGs at country level.

The URBAN2030 project – jointly developed by the Joint Research Centre (JRC) and the Directorate General for Regional and Urban Policy of the European Commission – aims at supporting local and regional authorities in measuring their achievement towards a sustainable development in a

comparable way. The project will produce a Handbook that aims at helping European cities in: assessing the current city situation, highlighting the major challenges and priorities, and identifying the already available harmonized indicators at local scale that can be used for the monitoring of the SDGs. In doing so, the Handbook will rely on existing datasets produced by several providers and institutions. At European level, data and indicators provided by the Urban Data Platform of the European Commission will be the basis for benchmarking and assessments. Unconventional and proxy data will also be presented, underlining the potential use of sources alternative to traditional official data, highlighting also the main constrains and limitations in their usage. Application to cities outside Europe will be possibly considered in the frame of the FOCUS-Africa (Future Of Cities and Urban Spaces for Africa) project of the JRC.

The overview of the existing and potential data will help local authorities in including the assessment and monitoring phase of their strategies for the achievement of the SDGs and for the preparation of the Voluntary Local Reviews (VLRs). The handbook will also include case studies of cities, local authorities and networks of local governments already taking actions in rising awareness about the SDGs – such as the Association of the Flemish Cities and Municipalities – but also cities that assessed their situation and starting point, such as Spanish cities of Madrid and La Coruña.

The key challenges for the assessment of cities' contribution to the achievement of the SDG are data availability and coverage, as well as consistent time series to track progress over time. Comparability and data relevance at local scale are other challenges, the latter of which is not straightforward.

The latter and probably most relevant challenge is the opportunity and capacity to link indicators to specific projects and investments, especially when it comes to understanding when and how to measure their effectiveness.

The JRC will launch the publication and related online platform at the World Urban Forum 2020 in Abu Dhabi. The JRC is working on the preparation on the Handbook in partnership with other institutions already involved in the localization of the SDGs, taking stock of their experiences and knowledge. In this direction, the JRC welcomes the effort of the SDSN to propose the first SDG Index and Dashboards Report for European Cities (prototype version), which highlights pressing challenges and data gaps and that will serve as an indication of the areas in which alternative, proxy and unconventional data are most needed.

1.3 Main findings and results

The European Union (EU), its institutions and member states have played a key role in the adoption of the Agenda 2030, the SDGs and Paris Climate Agreement. In particular, the EU and its member states were critical in the push for an integrated, universal agenda that continues the Millennium Development Goals' (MDGs) focus on extreme poverty in all its forms and adds the critical issues of environmental sustainability, social inclusion, economic development, and governance challenges (European Commission 2015). Yet, the absence of an overarching EU 2030 Strategy for sustainable development is an important impediment for greater integration of the SDGs into EU governance, budgeting and monitoring instruments and mechanisms at the national and subnational level.

The SDGs provide a useful and operational tool for policy action at the city level. Although the SDGs were adopted by national governments, many of the targets are applicable at the subnational level (regions, provinces, cities) and the implementation and investments for achieving goals are often managed by subnational governments. The involvement of mayors and local leaders across Europe will be key for addressing persistent challenges and achieve the SDGs by 2030.

The *2019 SDG Index and Dashboards Report for European Cities (prototype version)* provides an overview of European cities' performance on the SDGs. This year, cities from Northern Europe are at the top of the ranking – Oslo, Stockholm, Helsinkiand Copenhagen. Yet even these cities are facing significant challenges in particular with environmental goals (SDG 12-15). No European city has achieved the SDGs and some of the goals will require major transformations to yield results by 2030.

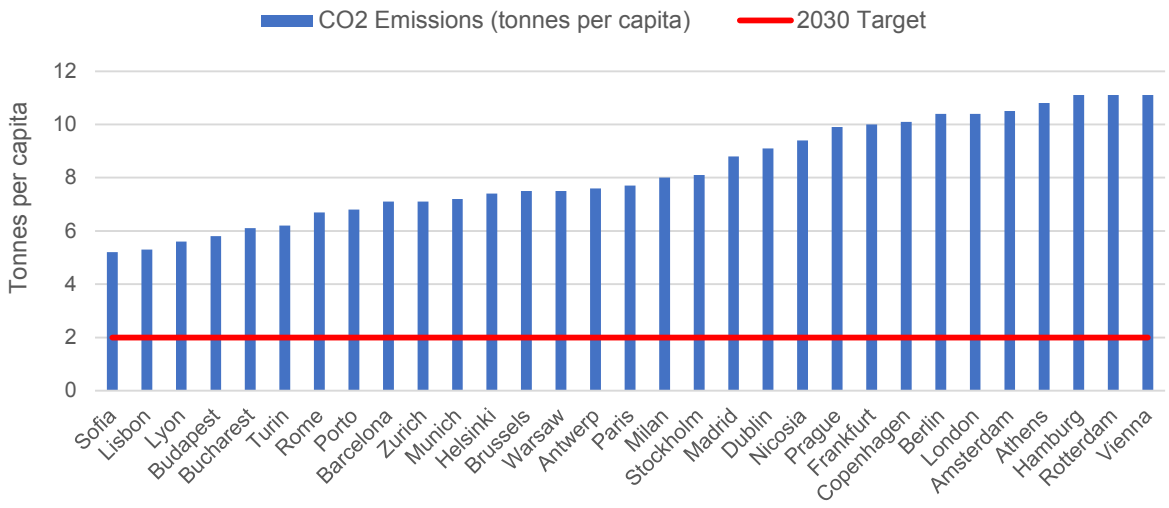
Overall, European cities perform relatively well on SDG 2 (No Hunger), SDG 3 (Good Health and Well-Being), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure). Although datasets are somewhat different, it seems safe to state that Europe performs much better than U.S. cities on SDG 2 (No Hunger) and SDG 3 (Good Health and Well-Being) partly due to better diet, lower rates of obesity and active lifestyles. Still, there are notable differences across European cities even for these goals and current data availability does not allow to differentiate gaps in health or other outcomes within a city for instance by income or by area of residence.

Major performance gaps persist on environmental goals. Especially on SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 15 (Life on Land). The EU and EFTA countries are among the highest emitters of CO2 per capita in the world. At the city level, all cities perform poorly SDG 13 (Climate Action). Further efforts are needed to achieve zero net CO2 emissions or very close to zero net emissions by 2030. There are large variations across European cities. On a per capita basis, cities such as Hamburg, Rotterdam and Vienna emit twice as much as cities such as Sofia or Lisbon. Reducing air pollution also represents a major challenge and policy objective in most European cities. The

concentration of particulate matter (2.5) in the air varies from 5.5 µg/m3 in Stockholm to 30.2 in Milan.

Access to affordable and quality housing is also a persistent issue in most European cities. Under goal 11 (Sustainable cities and communities), target 11.1 calls for policymakers to ensure access to adequate, safe and affordable housing by 2030[3]. Currently, the urban population living in a household where the total housing costs (net of housing allowances) represent more than 40% of the total disposable household income (net of housing allowances) and exceeds 10% in half of the EU and EFTA countries. The share of housing cost overburden has increased slightly over the past 5 years in the EU28 (+0.1 p.p) with significant increases in Bulgaria, Greece, Luxembourg, and the United Kingdom. With its campaign "Housing for All" and the contribution to the UN Habitat III conference, Housing Europe has emphasized the need to address persistent issues related to housing in urban Europe and called policymakers to adopt housing policies that promote sustainable development. Similarly, in 2017, the European Federation of National Organisations Working with the Homeless released a report highlighting alarming trends in homelessness in cities in Europe (FEANTSA 2017).

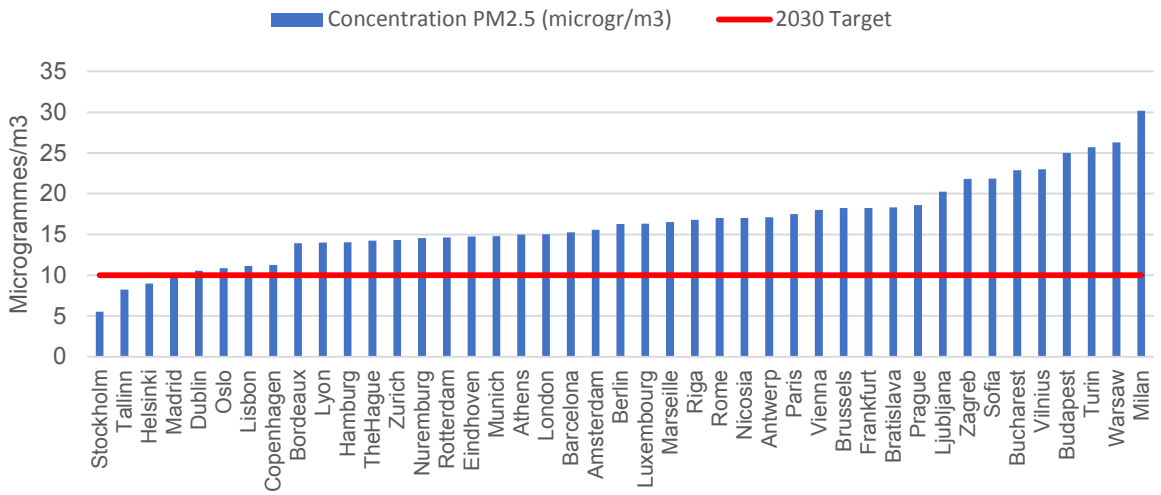
Figure 1.1 CO2 emissions in European cities, 2015



Note: Data not available for Bordeaux, Bratislava, Eindhoven, Ljubljana, Luxembourg, Marseille, Nuremburg, Oslo, Riga, Tallinn, The Hague, Valletta, Vilnius, Zagreb.
Source: Global Gridded Model of Carbon Footprints (Moran et al, 2018

3 "11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums"

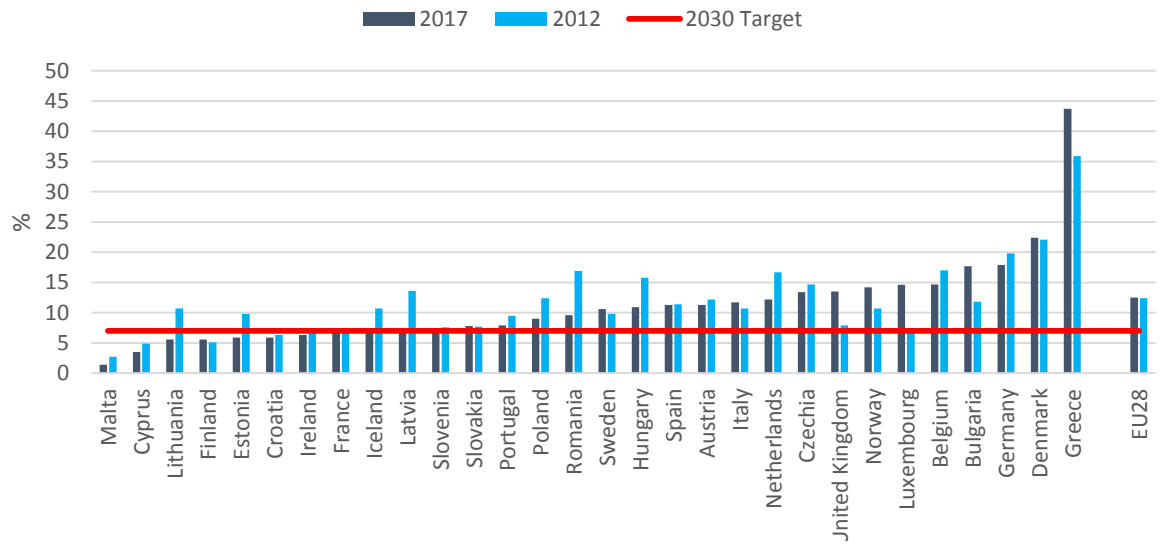
Figure 1.2 Air pollution in European cities (PM2.5 concentration), 2013



Note: Data not available for Porto and La Valetta

Source: European Environment Agency (EEA), Interpolated air quality data

Figure 1.3 Housing cost overburden rate in cities, 2012 and 2017



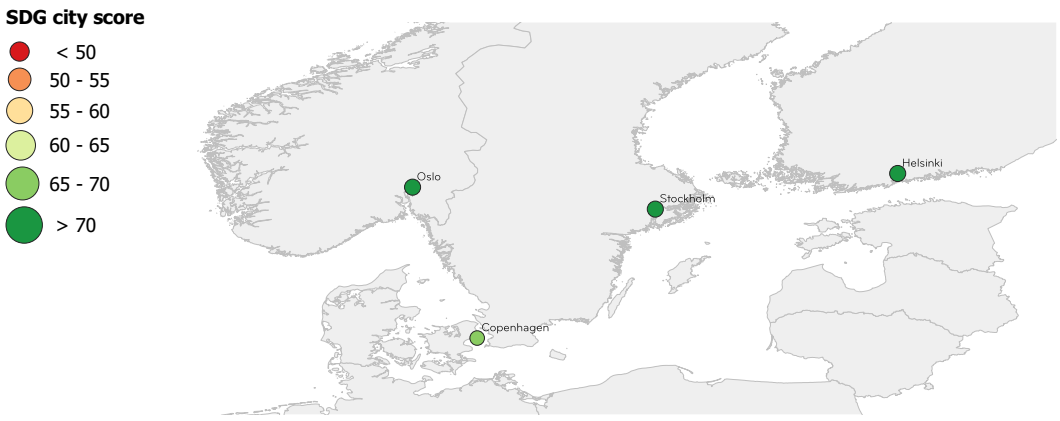
Source: EU Survey of income and living conditions (EU-SILC)

1.3.1 Northern Europe

Copenhagen, Helsinki, Oslo and Stockholm

Northern European cities are at the top of the *2019 SDG Index and Dashboards Report for European Cities (prototype version)*. These cities combine low levels of poverty and income inequalities with high levels of access to and quality of key public services such as health and education. Except for Helsinki, more than half of the energy consumed in these cities comes from renewable energy sources.

Yet, major challenges lie ahead. Except for Oslo, all Northern European cities obtain a "red" rating on SDG 11 (Sustainable cities and communities) and SDG 13 (Climate Action). This is primarily due to air pollution, housing overburden rate and high CO2 emissions. Copenhagen and Stockholm have set highly ambitious carbon emissions targets. The poor chemical and ecological status of surface water leads to poor performance on SDG 12 (Responsible consumption and production) and SDG 15 (Life on Land) in Copenhagen as well as in Helsinki and Stockholm.

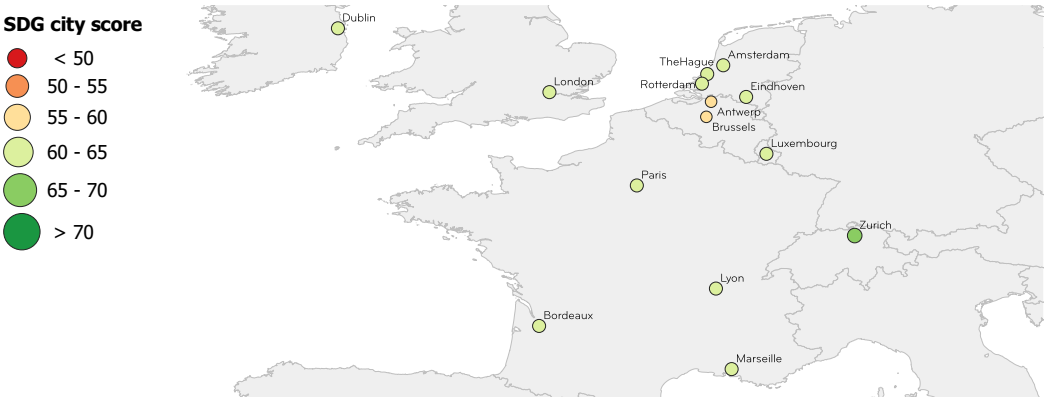


1.3.2 Western Europe

Amsterdam, Antwerp, Bordeaux, Brussels, Dublin, Eindhoven, London, Luxembourg, Lyon, Marseille, Paris, Rotterdam, The Hague, Zurich

The performance of Western European cities ranges from Zurich ranked number 5 to Brussels ranked number 25. Apart from a few exceptions, these cities perform relatively well on SDG 1 (No poverty), SDG 2 (No Hunger) and SDG 3 (Good Health and Well-Being). On SDG 6 (Clean Water and Sanitation), as for most other European cities, the share of wastewater treated is very high and connection to sewage systems is close to universal.

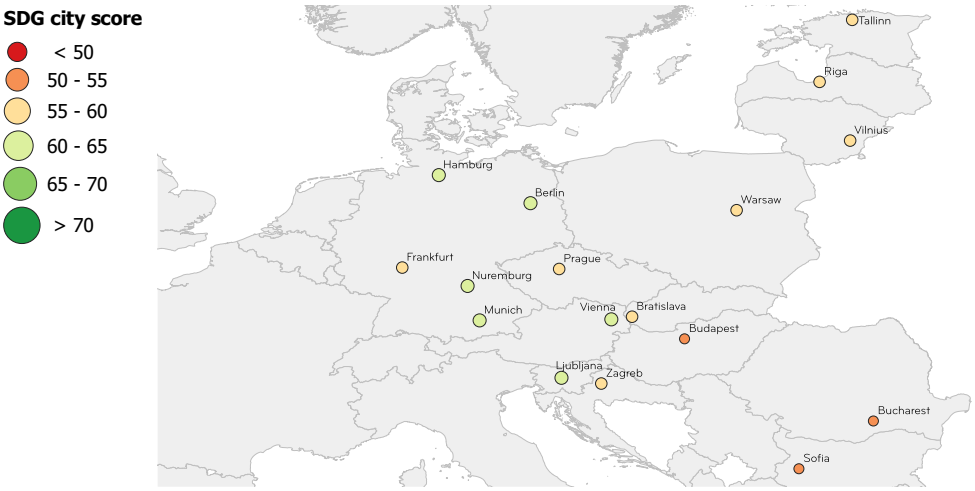
Environmental goals (SDGs 12-15), affordable and quality housing (SDG 11) and equity (SDG 5 and SDG 10) are persistent challenges in Western European cities. Most Western European cities obtain an "orange" rating on SDG5 (Gender Equality) due to persistent employment and pay gap between men and women. As for other European cities, housing affordability is a major policy challenge.



1.3.3 Central and Eastern Europe

Berlin, Bratislava, Bucharest, Budapest, Frankfurt, Hamburg, Ljubljana, Munich, Nuremburg, Prague, Riga, Sofia, Tallinn, Vienna, Vilnius, Warsaw and Zagreb

The performance of Central and Eastern European cities ranges from Munich ranked number 8 to Bucharest ranked 41. Except for cities in Germany, access and quality of key public services such as education (SDG 4) is somewhat lower and there are persistent challenges related to gender equality (SDG 5) and access to and quality of infrastructure (SDG 6 and SDG 9). For instance, 18% of the population in Bucharest is not connected to sewage treatment whereas it is universal or very close to universal in most European cities. Vienna is the city where CO2 emissions per capita are the highest across all 45 cities covered in the Index.



1.3.4 Southern Europe

Athens, Barcelona, Lisbon, Madrid, Milan, Nicosia, Porto, Rome, Turin and Valletta

The performance of Southern European cities ranges from Madrid ranked number 28 to Athens ranked number 45. Compared to the rest of urban Europe, the performance on SDG 1 (No poverty), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure) is generally lower. There are also major performance gaps on all environmental goals (SDG 12 to 15). Depending on the cities there are also significant challenges related to affordable housing (SDG 11) and good governance and security (SDG 16). Cities in Greece record the highest share of housing overburden.

Table 2 The 2019 SDG Dashboards for European Cities[4]

4 Green = "SDG achieved". Yellow = "Challenges remain". Orange = "Significant challenges remain". Red = "Major challenges remain". Grey = "No data available".

Box 4: Towards an OECD localised indicator framework for SDGs

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Marco Díaz Ramírez, Statistician, Centre for Entrepreneurship (CFE), OECD

Sustainable development is a shared responsibility across levels of government. Cities and regions, which are closer to citizens and their needs, have different capacities and competences alongside national governments to ensure no one is left behind. This is why understanding where they stand against the SDGs is essential, not only to shed light on regional disparities that exist and persist beyond national averages, but also to provide the evidence needed to guide local action for policy improvement.

From an extensive analysis of the Goals and Targets of the 2030 Agenda, the OECD estimates that 100 out of the 169 SDGs targets – at least – require the full engagement and participation of subnational governments to deliver the intended outcomes. These targets – which often relate to core public policies discharged by subnational governments – are generating a demand for reliable and comparable statistics to monitor progress of cities and regions towards the 2030 objectives. Such granular data and evidence is critical to enhance multi-level governance and multi-stakeholder dialogue, and to guide the design and implementation of place-based policies for sustainable development.

Measuring progress is indeed emerging as a priority for subnational governments implementing the SDGs: 58% of the respondents to the Committee of Regions-OECD Survey (2019)[5] that are currently implementing the SDGs reported using indicators to monitor progress. The most commonly used indicators are the ones provided by local and regional governments (26%) followed by the ones provided by national governments (19%). Fewer than 15% of respondents reported using EU or UN-level indicators. It is interesting to note that SDGs indicators provided by the EU (Eurostat) and the official UN indicators are much less used as a reference by cities and regions than existing local indicators. This can be explained by the fact that the national monitoring of SDGs does not easily accommodate context-specific realities and constraints and that the underlying data are not always available at subnational level.

OECD economic and well-being data at the subnational level confirm that national averages can misrepresent realities on the ground and mask large regional disparities. For example, while SDG indicator 11.6.2 about exposure to "fine particulate matter 2.5" seems to have been achieved in Australia at the country level in 2017 (value lower than 10 micrograms per cubic metre according to the WHO), four cities of Australia appear to be lagging behind in this indicator –the worst off city being 5 micrograms per cubic metre above the suggested levels and 6.5 points above the national average.

Another important issue is that of comparability (notably across cities and regions), which calls for a harmonised indicator framework that can localise the achievements related to SDGs at city and regional scale. To address this pressing need, the OECD Programme on A Territorial Approach to SDGs[6], launched at the HLPF 2018, seeks to support cities and regions in measuring progress on SDGs through a harmonised indicator framework. The programme is also advising selected cities and regions on how to use the SDGs to rethink sustainable development from the ground up and providing tailored guidance to work across levels of government. Finally, it is promoting peer learning and the exchange of experiences and good practices among subnational governments.

The localised indicator framework for OECD cities and regions that is under development should cover over 1 000 subnational units through 100+ indicators monitoring progress in 60 out of the 100 targets identified as very relevant for OECD cities and regions. Although it is meant to cover the broad spectrum of all 17 SDGs – thus going beyond the specific SDG 11 devoted to cities and human settlements – the coverage in terms of indicators can vary widely across SDGs. Whereas goals 3 and 8 have indicators for at least 80% of the selected targets, goals 12, 13 and 14 have indicators for less than one third of the selected targets.

5 https://cor.europa.eu/en/news/Pages/SDGs_survey.aspx

6 Several cities and regions are actively involved as pilots for this programme. They are: the regions of Southern Denmark (Denmark) and Flanders (Belgium), the cities of Kitakyushu (Japan), Bonn (Germany), Moscow (Russia), the municipality of Kópavogur (Iceland), the County of Viken (Norway), the Province of Córdoba (Argentina) and the State of Parana (Brazil)

In addition to data sources from the OECD Regional and Metropolitan databases[7], new sources of information can help to bridge the SDGs data gaps at the subnational level. For example, the OECD is developing protected areas statistics at the subnational level using UNEP World Database on Protected Areas and is currently leveraging the potential of earth observation and geospatial information to produce SDGs indicators disaggregated by geographical location. For instance, through available population and built-up area gridded data, it is possible to estimate SDG indicator 11.3.1 "Ratio of land consumption rate to population growth rate" which aims at guiding in the achievement of "Inclusive and sustainable urbanisation" (SDG Target 11.3).

The forthcoming OECD localised SDGs indicator framework – and its visualisation web tool – will provide benchmarks among peer cities and regions within and across countries, and help subnational governments to assess where they stand against national averages and the UN global goals. At the same time, a wide range of local and regional specific indicator also help to provide richer context-specific information and can complement internationally comparable indicator frameworks.

The OECD localised indicator framework will support national, regional and local governments' efforts to use them as a tool for policy dialogue and take evidence-based decisions to make the SDGs happen on the ground. In a nutshell, the 2030 Agenda provides a unique opportunity to expand the statistical frontier on subnational indicators and guide better local policies for a better planet and better lives.

1.4 Looking forward

This 2019 SDG Index and Dashboards for European cities (prototype version) is a first attempt to track European cities performance on the SDGs. It aims to help identify policy priorities but also to identify major data gaps in the context of the SDGs at the subnational level. SDSN and TELOS are willing to frequently update the report and database and add new features and cities over time. The main priorities for next editions are:

- Integrate progress over time (trends) in the country profiles and the analysis: Currently the report provides a snapshot at one point in time. Yet, cities' trajectories matter also to evaluate progress and commitments to the goals. Data availability over time at the subnational level is limited and therefore the next iteration might focus on a few "headline" measures collected on a regular basis.

7 http://www.oecd.org/regional/regional-policy/regionalstatisticsandindicators.htm

- Increase the number of cities covered: Currently the report focuses on 45 EU and EFTA cities. These represent all capital cities plus a selection of large metropolitan areas. In the future, the report could cover all EU and EFTA large metropolitan areas included in the OECD classification. There is also a possibility to explore the inclusion of additional cities that would be interested in comparing themselves to other large European cities.

- Continue to work closely with strategic partners to improve data availability and quality: SDSN, via its thematic networks on sustainable cities[8] and data and statistics[9], and TELOS are strongly committed to supporting data availability, quality and comparability at the subnational level from official and non-official data sources. The two organizations will continue to work closely with key partners including the OECD, the European Commission Joint Research Centre and various municipalities and research centers to fill data gaps and promote evidence-based policymaking at city level.

- Enhance the presentation of the results and develop a user interactive interface: Over time, the objective will be to have a reader friendly report accompanied by a dedicated website and data visualisation tool to improve communication around the SDGs at the urban level.

- Track local government efforts and policies to achieve the SDGs. Data presented in this report, and more generally in international data platforms, usually have a time lag of one or two years. Beyond outcome indicators, qualitative data is needed to map the existence of long-term targets and related pathways and evaluate policy actions at local level that may pave the way for long term economic, social and environmental transformations.

SDSN and TELOS are seeking champions and partners to support the future developments of the SDG Index and Dashboards for European cities (prototype version). Please contact sdgindex@unsdsn.org or telos@uvt.nl should you have any comments or want to get involved.

8 Thematic Network 9: Sustainable Cities: Inclusive, Resilient, and Connected. http://unsdsn.org/what-we-do/thematic-networks/sustainable-cities-inclusive-resilient-and-connected/

9 Thematic Network 12: TReNDS – Data and Statistics for Sustainable Development. http://unsdsn.org/what-we-do/thematic-networks/trends/

2 Methodology

The *2019 SDG Index and Dashboards Report for European Cities (prototype version)* uses the best metrics available at the time to evaluate SDG achievement gaps across 45 European Cities.

2.1 City coverage

The 2019 SDG *Index and Dashboards Report for European Cities (prototype version)* covers 45 European cities that are geographically diverse and representative of the European regions. These were selected primarily based on their status (e.g. capital cities), their size (large metropolitan areas) and data availability. Some cities are smaller, with a population of 100,000 while others have more than 2 million inhabitants. The index covers all the largest EU cities and all the EU capital cities, in addition to a selection of EFTA cities (Oslo and Zurich). While the first version of the *2019 SDG Index and Dashboards Report for European Cities (prototype version)* covers 45 municipalities, future versions of the report will aim to include more cities for which there is good data coverage.

As for countries, cities may have different characteristics (population size, coastal or non-coastal, industrial or service-oriented etc.). In this report we analyzed findings only by European regions (Northern, Southern, Western and Central/Eastern European cities) but we encourage researchers and other stakeholders to further analyze the results using any clusters they may find useful.

2.2 Indicator selection

The indicators in the report measure, when possible, official SDG targets endorsed by the UN Statistical Commission. To close data gaps, the report uses other metrics from both official and unofficial providers. We used three criteria for determining measures appropriate for the Index.

Relevance: Measures had to be relevant to monitoring SDG achievement in the context of European cities. They must be comparable across cities or territorial levels and allow for direct benchmarking of performance across the selected cities. Most importantly, the indicator allows for measuring some sort of outcome for which a quantitative performance threshold can be established.

Quality: Metrics had to represent the most up to date and best available measure for a specific issue and be published by official sources such as Eurostat or other reputable sources, such as

peer-reviewed publications. No imputations of data reported directly by local officials are included.

Coverage: Data had to be available for at least 80% cities for inclusion. Exceptions were made in the case of some crucial metrics, where regional imputations (typically Nuts 2 and Nuts 3) were performed in the case of many missing values.

Indicators come from a mix of official and non-official data sources. Most of the data come from the European-Commission via Eurostat, but also from the European Environmental Agency, the Joint Research Centre and the Eurobarometer, which all have extensive and rigorous data validation processes. Other data sources include the OECD (Regional and Large Metropolitan Areas databases), the European Social Survey and peer-reviewed papers.

2.3 Territorial levels

The main unit of analysis in this report is cities. When city-level data is available these were used systematically. Yet, in many instances, city-level data did not exist for some cities or for an entire indicator. In these cases, closest territorial levels (TL) were used following Eurostat's Nomenclature of territorial units for statistics (Nuts). The NUTS classification is the official EU system for dividing EU territories into specific statistical units for the purpose of collecting, harmonizing and analysing data, in addition to defining EU regional policy.

Overall, about half of the metrics included correspond to city-level data. When not available, the Nuts classification (typically Nuts 3 or Nuts 2) was used to impute closest proxies. This was also the approach retained by TELOS in the 2014 and 2016 studies on the sustainability of European cities prepared in collaboration with DG Environment and the Dutch Ministry of Interior and Kingdom Relations. Certain indicators use a mix of territorial levels depending on countries. The smallest level of disaggregation was used when possible which corresponds to NUTS3 data. When not available, Nuts 2 or Nuts 1 data were imputed. In rare cases, such as for the obesity rate and CO2 emissions, we have sometimes used national level datapoints as imputations for a few cities with missing data. This was done in cases where we considered that, given the indicator's importance, we would rather cope with the bias of using a datapoint from a larger agglomeration than the bias of having no datapoint at all. Ultimately, one of the primary objectives of this EU Index for cities is to highlight major data gaps and support the development of better and more standardized data at city level to track the SDGs. The tables and detailed codebook accessible online provide full transparency on data sources and territorial levels used for each indicator.

2.4 Method for constructing the Index

This report builds on the methodology developed by SDSN and Bertelsmann to track countries' performance on the SDGs since 2016 (Bhattacharya et al. 2016; J.D. Sachs et al. 2017, 2018; Lafortune et al. 2018). The methodology is currently being audited by the European-Commission Joint-Research Center. Due to lack of data availability at the subnational level, SDG 14 (Life Below Water) and SDG 17 (Partnerships for the Goals) are not considered in this first prototype report.

The methodology for the index can be divided into three primary steps. The first is to censor extreme values in the distribution of the indicators. The second is to rescale the data so that performance is comparable across indicators. The third is to aggregate indicator scores into goal scores and an overall SDG Index Score.

The lower bound for the data was most often derived from the 2.5th percentile, used to censor extreme values on the lower end of the distribution. In cases where the data was highly skewed, an intermediate value was picked between the lowest outlier and the highest value within the normal distribution. Censoring was performed only in a few cases on the upper tail of the distribution because of the aspirational or pre-defined SDG Targets.

The upper bound for normalization was determined using a five-step decision tree.

1. Use official SDG targets: These concern principles of zero poverty, universal secondary completion, universal access to water and sanitation, full gender equality, for example.
2. Apply "Leave no one behind" principal to measures associated with extreme poverty (e.g. wasting), public service coverage, access to basic infrastructures.
3. Use sciences-based targets where they exist, e.g. 100% Sustainable management of fisheries
4. Where several countries already exceed an SDG target, use the average of the top 5 performers (e.g. child mortality)
5. For all other indicators, we use the average of the top performers.

In cases where the top performers were used to generate the upper bound, we took the top 5 cities of all those included in the dataset, minus clear outliers. These targets are ambitious and focus attention where cities are lagging behind. As such, the top 5 cities in the sample represent optimal performance possible for European municipalities.

Once the upper and lower bounds for normalization have been established, the indicators were transformed on a linear scale from 0 to 100 using a classic min-max equation where 100 represents optimal performance. In this way, the normalized data can be interpreted as distance to the optimum. A score of 50 denotes the half-way point between the worst performance to the best.

Once normalized indicator scores have been calculated, we aggregate the indicator scores into goal scores using a simple average. We similarly aggregate the goal scores into the index score using a simple average. When an entire goal score is missing, the simple average of cities within the same region (Northern Europe, Southern Europe, Western Europe and Central and Eastern Europe) was used for calculating the overall Index score but no goal score is reported in the tables to highlight data gaps while addressing the potential bias in the calculation of the index score of missing goals. Generally, we did not impute scores for cities on specific indicators except in a few circumstances where the missing data generated critically biased results. This can happen for example when cities perform universally poorly on an indicator, as with CO2 emissions per capita. Missing data on such an indicator will positively bias the scores of those cities that lack data.

The framework of the SDGs does not assign greater importance to any goals or targets over others. Consequently, for aggregating the goal scores we assigned equal weighting to all goals and similarly to all indicators underneath a goal. Implicitly this means that the weighting of indicators in the overall index score is disproportional to the number of indicators within a goal. The only exceptions to equal weighting come from indicators taken from the JRC's Cultural and Creative Cities Monitor for SDGs 9 and 11. On SDG 9, an indicator of cities "accessibility" was constructed by using potential road accessibility and direct trains. Both indicators have half the weight of the rest of the indicators within SDG9. Similarly, an indicator of "cultural activities" was constructed by using three indicators – sights & landmarks (per 100,000), museums (per 100,000) and concerts & shows (per 100,000). Each of these indicators have a weight of one third compared to the rest of the indicators within SDG11. This was made to avoid that "cultural activities" end up weighting more under SDG11 than pollution or access to housing.

2.5 Method for constructing the Dashboards

The methodology for building the dashboards consists of establishing quantitative thresholds to classify cities' performance on indicators into a traffic light table. The indicator-level dashboard ratings are then aggregated into an overall dashboard rating by goal.

To assess a city's progress on an indicator, we use four bands. These bands are based on the green thresholds, which denote SDG achievement, and the red thresholds, which denote major challenges to SDG achievement. The green and red thresholds were retained from the Global SDG Index and Dashboards where relevant, and they were determined by the mean and standard deviation, other SDG Index reports or expert-judgement when no global thresholds were applicable.

The thresholds and bands used for the dashboard ratings can be found in Annex 3. Thresholds are always specified in absolute terms and apply to all cities.

Once the dashboard rating for an indicator is established, the indicator ratings are aggregated across goals to generate an overall SDG dashboard color. Averaging across all indicators within a goal might hide specific policy challenges if a city performs well on most of the metrics included but has major issues on one or two measures. Therefore, the SDG dashboards for European Cities aggregate indicator ratings by taking the two worst performing indicators under a goal. Mathematically, each indicator is assigned a value on a score between 0 to 3 that corresponds to its dashboard rating. A score from 0 to 1 corresponds to red, 1 to 1.5 to orange, 1.5 to 2 to yellow, and 2 to 3 to green. A value of 0 corresponds to the worst value for normalization, 1 to the red threshold, 1.5 to the value halfway between the green and red thresholds, 2 to the green threshold and 3 to the technical optimum. The scores are calculated linearly within the bands, but the 0 to 3 scale is not linear across the entire scale.

We used the average of the two worst rescaled metrics in order to derive the overall goal rating. This strict methodology is meant to focus attention to those areas lagging behind and underline that good performance on some indicators cannot compensate bad performance on others. We added the additional rule that all indicators had to be green under a goal in order for the goal's overall rating to be green. In the same vein, an overall red rating was applied to an SDG only when the two worst indicators were both red.

2.6 Major data gaps and limitations

The prototype of the EU Cities SDG Index is one of the first robust efforts to evaluate European Cities on SDG performance. In general, there is much less internationally comparable data for cities than there is for countries. There are a few key data gaps where certain important aspects of SDG performance cannot be covered given data availability.

One such example of major data gaps is spillover metrics at the city level – while researchers are increasingly using extensions on input-output tables to track spillovers from consumption, or harms that are embodied ("hidden") in trade –, these data remain largely in the development stage at the city level (Gómez-Paredes and Malik 2018; Zheng et al. 2019). The impact of urban consumption on other countries is an important area of research which will be integrated into the Report as data becomes available.

Another key dimension for which there tends to be poor data coverage is the "Leave no one behind" agenda, which seeks to disaggregate key indicators by geographic areas, different communities, gender, and socioeconomic groups etc. to ensure that certain groups are not being systematically forgotten under the umbrella of aggregate metrics.

Finally, while this report is available to include major environmental metrics and estimates such as PM2.5 and CO2 emissions we seek to include more

robust measures of environmental harm and degradation in future editions (e.g. SO2, nitrogen, etc.).

Table 2.1 Major data gaps

SDG	DESIRED METRICS
SDG 1: No poverty	Homelessness
SDG 2: No Hunger	Food loss and food waste More comparable overweight and obesity data
SDG 3: Good Health and Well-Being	Affordability of care Gap in health outcomes by income and area of residence
SDG 4: Quality Education	Student performance Gap in education outcomes by income and area of residence
SDG 5: Gender Equality	Violence against women Gender gap in minutes spent doing unpaid work Share of women in local assemblies
SDG 6: Clean Water and Sanitation	Quality of drinking water Imported groundwater depletion – scarcity weighted (international spillover)
SDG 7: Affordable and Clean Energy	More comparable data on renewable energy use Affordability of electricity
SDG 8: Decent Work and Economic Growth	Imported trade in fatal accidents (international spillover)
SDG 9: Industry, Innovation and Infrastructure	Gaps across population groups in access to infrastructures
SDG 10: Reduced Inequalities	Income and wealth inequalities
SDG 11: Sustainable Cities and Communities	Access to safe public transports Accessibility of public transports and other services for handicapped people
SDG 12: Responsible Consumption and Production	Production based SO2 emissions Net imported SO2 emissions (international spillover) Reactive nitrogen footprint Net imported reactive nitrogen emissions (international spillover)
SDG 13 : Climate Action	Climate change vulnerability Imported CO2 emissions (international spillover)
SDG 14: Life Below Water	Impact of high-seas and cross border fishing (coastal cities) Protected areas by level of protection (coastal cities) Impact of urban consumption on fisheries and marine's ecosystems (international spillover)
SDG 15: Life on Land	Access to green spaces
SDG 16: Peace, Justice and Strong Institutions	Access to justice Civic participation
SDG 17: Partnerships for the Goals	Cities' international cooperation projects and initiatives


BERKENFLAT
PUNBOOM
LIJN BUS
LIJN BUS

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Annexes

Annex 1: List of indicators

SDG	INDICATOR	LEVEL	SESCRIPTION
1	Severe material deprivation rate in cities (%)	City	Severely materially deprived persons have living conditions severely constrained by a lack of resources, they experience at least 4 out of 9 following deprivations items: cannot afford i) to pay rent or utility bills, ii) keep home adequately warm, iii) face unexpected expenses, iv) eat meat, fish or a protein equivalent every second day, v) a week holiday away from home, vi) a car, vii) a washing machine, viii) a colour TV, or ix) a telephone.
1	People at risk of poverty or social exclusion (%)	Country/Nuts1/ Nuts2	Persons who are at risk of poverty or severely materially deprived or living in households with very low work intensity. Persons are considered to be at risk of poverty after social transfers, if they have an equivalised disposable income below the risk-of-poverty threshold, which is set at 60 % of the national median equivalised disposable income.
2	Obesity rate (BMI <30), %	City/Nuts2/Nuts3	A person with a body mass index (BMI) of 30 or more is considered obese. The body mass index is a person's weight (in kilograms) divided by the square of his or her height (in metres).
3	Traffic fatalities (per 10,000 population)	City	The number of people killed in road accidents is defined as the number of deaths caused by road accidents and which occur within 30 days from the date of the accident. The number includes drivers and passengers, in motorised vehicles and on bicycles, as well as pedestrians involved in road accidents. For this indicator, the regional average was imputed to avoid critical missing data bias.
3	Infant mortality rate (under 1) per 1,000 births	City	The ratio of the number of deaths of children under one year of age during the year to the number of live births in that year. The value is expressed per 1 000 live births. For this indicator, the regional average was imputed to avoid critical missing data bias.
3	Physicians or doctors per (100,000 pop)	Nuts1/Nuts2/Nuts3	Data on physicians should refer to those "immediately serving patients", i.e. physicians who have direct contact with patients as consumers of health care services. In the context of comparing health care services across Member States, Eurostat considers that this is the concept which best describes the availability of health care resources. However, Member States use different concepts when they report the number of health care profes-sionals. For this indicator, the regional average was imputed to avoid critical missing data bias.
3	Life expectancy (years)	Nuts2	Life expectancy at birth is defined as the mean number of years that a new-born child can expect to live if subjected throughout his life to the current mortality conditions (age specific probabilities of dying). For this indicator, the regional average was imputed to avoid critical missing data bias.
3	Daily smokers (%)	Nuts1/Nuts2/Nuts3	Proportion of people who smoke (manufactured and hand-rolled) cigarettes daily. For this indicator, the regional average was imputed to avoid critical missing data bias.
3	Active lifestyle (%)	Nuts1/Nuts2/Nuts3	Proportion of people who report regulare exercise. For this indicator, the regional average was imputed to avoid critical missing data bias.
4	Early leavers from education (% 18-24)	Nuts2	The percentage of the population aged 18 to 24 having attained at most lower secondary education and not being involved in further education or training.

SDG	INDICATOR	LEVEL	SESCRIPTION
4	Adults with upper secondary education (% 25-64)	Nuts2	The percentage of the population aged 25 to 64 having attained at least upper secondary education or post-secondary non-tertiary education (ISCED levels 3 and 4) .
4	NEET rate (% 15-24)	Nuts2	The percentage of the population aged 15 to 24 that is not employed and not involved in further education or training.
4	Satisfaction with schools (%)	City	The percentage of people who are rather satisfied or very satisfied with schools in their city.
4	Four year-olds in early childhood education (%)	Nuts2	Participation rate of four year-olds in education.
4	Adult partici-pation in learning (%)	Nuts2	Proportion of adults aged 25 to 64 years old that participated in life long learning in the past 4 weeks.
4	University appearances in rankings	City	Average number of universities' appearances in four different university rankings: QS, Shanghai, Leiden and Times. (JRC, Creative Cities)
5	Gender wage gap (% male wage)	Nuts1	The gender pay gap is calculated as the difference between average earnings of men and women as a percentage of average earnings of men.
5	Women in regional assem-blies (%)	Nuts2	Proportion of women in local legislative branches of government.
5	Gender gap in unemployment (%)	Nuts2	The indicator measures the difference between the employment rates of men and women aged 20 to 64. The employment rate is calculated by dividing the number of persons aged 20 to 64 in employment by the total population of the same age group.
6	Waste water treated (%)	City	Percentage of waste water treated. For this indicator, the regional average was imputed to avoid critical missing data bias.
6	Population connected to Sewerage Treatment (%)	Nuts2	Population connected to wastewater collection and treatment systems. For this indicator, the regional average was imputed to avoid critical missing data bias.
7	Renewable energy generated (%)	City	Percentage of energy consumption reported by cities from sources that do not emit green house gas gases. For this indicator, the regional average was imputed to avoid critical missing data bias.
8	GDP per capita (€/capita)	City	The indicator is calculated as the ratio of real GDP to the average population of a specific year. GDP measures the value of total final output of goods and services produced by an economy within a certain period of time. It is a measure of economic activity and is also used as a proxy for the development in a country's material living standards. However, it is a limited measure of economic welfare.
8	5 year average of Annual real GDP Growth Rates	Nuts2/3	The annualized average rate of of real gdp growth over the last five year period.
8	Long term unemployment Rate (%)	Nuts2	The indicator measures the share of the economically active population aged 15 to 74 who has been unemployed for 12 months or more. Unemployed persons are defined as all persons who were without work during the reference week, were currently available for work and were either actively seeking work in the last four weeks or had already found a job to start within the next three months.
9	R&D expenditure (%)	Nuts2	Public expenditure as a share of GDP on creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications.
9	Access to Internet at Home (%)	Nuts2	Percentage of households where any member of the household has the possibility to access the internet from home.

SDG	INDICATOR	LEVEL	SESCRIPTION
9	Patent applicants (per million pop)	Nuts2	Applications filed directly under the European Patent Convention or to applications filed under the Patent Co-operation Treaty and designated to the EPO (Euro-PCT). Patent applications are counted according to the year in which they were filed at the EPO and are broken down according to the International Patent Classification (IPC).
9	Community design applications (per million pop.)	Nuts3	Three-year average number of Community Design applications filed to the Office for Harmonization in the Internal Market (OHIM) divided by the total population and then multiplied by 1 million.
9	Potential road accessibility	City	Indicator computed based on road network data by RU Groningen within a project commissioned by DG REGIO. Weighted one half of other indicators
9	Direct trains to other cities (per million pop.)	City	Average hourly number of departures between 6:00 and 20:00 of direct trains to other cities or greater cities divided by the total population and then multiplied by 1 million. Weighted one half of other indicators.
10	Gini Coefficient (1-100)	City/Nuts2	A measure of statistical dispersion to represent the income or wealth distribution of a locality's residents. It measures how far a locality's wealth or income distribution deviates from a totally equal distribution.
11	Concentration PM2.5 (microgr/m3)	City	Annual mean concentrations of fine particulate matter (PM2.5). Particulates whose diameters are less than 2.5 micrometers can be carried deep into the lungs where they can cause inflammation and exacerbate the condition of people suffering heart and lung diseases.
11	Emission of nitrogen oxides (kg/km2)	City	Annual mean concentrations of nitrogen oxides. Excessive levels of the oxides of nitrogen, particularly nitrogen dioxide (NO2), can cause death in plants and roots and damage the leaves of many agricultural crops. NO2 is the damaging component of photochemical smog. Breathing high levels of oxides of nitrogen can cause rapid burning, spasms and swelling of tissues in the throat and upper respiratory tract, reduced oxygenation of tissues, and a build up of fluid in the lungs.
11	Satisfaction affordable housing (%)	City	The percentage of people who somewhat or strongly agree that it is easy to find good housing at a reasonable price in their city.
11	Housing cost overburden rate in urban areas (%)	Country	This indicator is defined as the percentage of the population living in a household where the total housing costs (net of housing allowances) represent more than 40% of the total disposable household income (net of housing allowances) presented by degree of urbanisation.
11	Recharging stations (per 10,000 people)	Nuts3	The number of charging stations for electric vehicles per 10,000 population.
11	Satisfaction public transport (%)	City	The percentage of people who are somewhat or rather satisfied with the public transportation in their city.
11	Satisfaction cultural facilities (%)	City	The percentage of people who are somewhat or rather satisfied with the cultural facilities in their city.
11	Sights & landmarks (per 100,000)	City	Points of historical, cultural and or artistic interest, such as architectural buildings, religious sites, monuments and statues, churches and cathedrals, bridges, towers and fountains, amongst other things, divided by the total population and then multiplied by 100,000. Weighted one third of other indicators in goal.
11	Museums (per 100,000)	City	Number of museums that are open to the public divided by the total population and then multiplied by 100,000. Weighted one third of other indicators in goal.
11	Concerts & shows (per 100,000)	City	Number of theatres and other music venues (concert halls, clubs, etc.) and current shows divided by the total population and then multiplied by 100,000. Weighted one third of other indicators in goal.
12	Municipal waste (kg/capita)	Nuts2	Amount of waste generated by households and businesses standardized per capita.

SDG	INDICATOR	LEVEL	SESCRIPTION
12	Municipal recycling rate (%)	Country	The indicator measures the tonnage recycled from municipal waste divided by the total municipal waste arising. Recycling includes material recycling, composting and anaerobic digestion.
12	Ground water of good chemical status (%)	River Basin Districts	Percentage of ground water with good or excellent chemical status. Measure of water pollution.
12	Surface water of good chemical status (%)	River Basin Districts	Percentage of surface water with good or excellent chemical status. Measure of water pollution.
13	CO2 Emissions (tonnes per capita)	City	Estimated carbon footprint in tonnes per capita for urban agglomerations modeled using national carbon footprints, subnational carbon footprints, household spending patterns, and a gridded population model. For this indicator, the regional average was imputed to avoid critical missing data bias.
15	Natura 2000 Area in good quality (%)	City	Natura 2000 is a network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right. This indicator measures those sites that are keep in good status.
15	Urban green area (%)	City	Percentage of green area in cities.
15	Soil sealing (%)	City	Percentage of ground area covered by an impermeable material. Soil sealing is one of the main causes of soil degradation in the EU. Soil sealing often affects fertile agricultural land, puts biodiversity at risk, increases the risk of flooding and water scarcity and contributes to global warming.
15	Surface Water of Good Ecological Status (%)	River Basin Districts	Percentage of surface water in good ecological status, according to an assessment of the quality of the structure and functioning of surface water ecosystems. It shows the influence of pressures (e.g. pollution and habitat degradation) on the identified quality elements.
16	Burglaries (per 100,000)	Nuts3	Number of burglaries per 100,000 population. Burglary is getting unauthorized access to a building or other premises for theft or intent of theft — with or without forcing locks, doors, windows, etc.
16	Robberies (per 100,000)	Nuts3	Number of robberies per 100,000 people. Robbery means stealing from someone by using physical force, weapon or threat, such as mugging or robbery (eg bank, shop or van).
16	Intentional homocides (per 100,000)	Nuts3	Number of intentional homicides per 100,000 people.
16	Perception of neighborhood safety (%)	City	Proportion of people who somewhat or strongly agree that they feel safe in their city.
16	Quality of local government	Country/Nuts1/ Nuts2	Computed indicator measuring the quality of government in three areas of public services: education, healthcare and law enforcement.

Annex 2: Descriptive statistics

SDG	INDICATOR	OBS	MEAN	STD.DEV.	MIN	MAX
1	Severe material deprivation rate in cities (%)	45	6.64	4.64	0.00	23.40
1	People at risk of poverty or social exclusion (%)	42	20.11	5.48	8.60	31.10
2	Obesity rate (BMI <30), %	45	17.68	6.39	7.00	29.10
3	Traffic fatalities (per 10,000 population)	42	0.24	0.11	0.04	0.54
3	Infant mortality rate (under 1) per 1,000 births	42	2.93	0.75	1.63	4.52
3	General practitioners per (100,000 pop)	44	435.37	133.65	246.76	920.18
3	Life expectancy (years)	45	81.30	2.49	74.90	85.20
3	Daily smokers (%)	34	19.98	4.60	9.60	29.53
3	Active lifestyle (%)	33	32.67	8.24	8.48	52.51
4	Early leavers from education (% 18-24)	45	8.36	3.56	1.60	17.70
4	Adults with upper secondary education (% 25-64)	45	80.61	11.68	42.00	97.60
4	NEET rate (% 15-24)	45	8.98	3.83	2.00	18.20
4	Satisfaction with schools (%)	38	66.24	11.58	47.00	86.00
4	Four year-olds in early childhood education (%)	45	88.85	15.02	29.50	100.00
4	Adult participation in learning (%)	45	13.55	8.11	1.30	35.50
4	University appearances in rankings	41	5.15	5.44	0.00	26.75
5	Gender wage gap (% male wage)	45	16.27	7.21	0.66	40.98
5	Women in regional assemblies (%)	43	32.63	10.92	9.10	49.80
5	Gender gap in unemployment (%)	45	8.79	4.30	0.40	22.50
6	Waste water treated (%)	33	99.08	5.30	69.55	100.00
6	Population connected to Sewerage Treatment (%)	25	97.29	4.49	82.40	100.00
7	Renewable energy generated (%)	19	50.43	28.67	8.20	98.00
8	GDP per capita (€/capita)	45	39071.11	17874.32	13000.00	90000.00
8	5 year average of Annual real GDP Growth Rates	42	0.77	2.41	-3.83	10.32
8	Long term unemployment Rate (%)	45	3.14	2.72	0.50	16.70
9	R&D expenditure (%)	42	2.15	1.04	0.48	4.59
9	Access to Internet at Home (%)	44	88.52	7.37	71.00	99.00
9	Patent applicants (per million pop)	45	145.37	231.53	0.63	1430.11
9	Community design applications (per million pop.)	40	81.45	79.34	5.67	376.67
9	Potential road accessibility	29	21400000	3362884	13700000	25300000
9	Direct trains to other cities (per million pop.)	26	20.73	31.06	1.14	162.43
10	Gini Coefficient (1-100)	45	32.00	3.51	25.40	37.90
11	Concentration PM2.5 (microgr/m3)	43	16.50	5.06	5.51	30.18
11	Emission of nitrogen oxides (kg/km2)	43	7.94	6.10	2.45	31.53
11	Satisfaction affordable housing (%)	40	24.93	15.88	3.00	66.00

SDG	INDICATOR	OBS	MEAN	STD.DEV.	MIN	MAX
11	Housing cost overburden rate in urban areas (%)	45	11.65	6.70	1.50	43.70
11	Recharging stations (per 10,000 people)	44	0.99	1.52	0.03	6.96
11	Satisfaction public transport (%)	40	73.33	14.92	30.00	97.00
11	Satisfaction cultural facilities (%)	37	39.00	16.59	13.00	80.00
11	Sights & landmarks (per 100,000)	45	159.56	161.08	11.00	795.00
11	Museums (per 100,000)	45	81.24	70.05	9.00	311.00
11	Concerts & shows (per 100,000)	45	45.69	63.87	2.00	333.00
12	Municipal waste (kg/capita)	38	457.75	91.02	293.83	643.91
12	Municipal recycling rate (%)	45	42.68	14.93	6.40	67.60
12	Ground water of good chemical status (%)	39	66.81	24.31	13.30	100.00
12	Surface water of good chemical status (%)	39	55.85	37.13	0.00	99.50
13	CO2 Emissions (tonnes per capita)	31	8.25	1.89	5.20	11.10
15	Natura 2000 Area in good quality (%)	34	42.93	26.37	3.24	100.00
15	Urban green area (%)	45	19.83	12.73	3.56	63.72
15	Soil sealing (%)	45	38.60	15.18	10.98	73.73
15	Surface Water of Good Ecological Status (%)	39	29.75	21.59	0.00	73.40
16	Burglaries (per 100,000)	43	364.95	243.00	49.54	967.90
16	Robberies (per 100,000)	43	176.75	202.38	18.25	849.82
16	Intentional homocides (per 100,000)	39	1.38	1.03	0.17	5.96
16	Perception of neighborhood safety (%)	38	84.32	10.37	56.00	98.00
16	Quality of local government	43	21.11	100.83	-259.80	163.07

Annex 3: Indicator thresholds

SDG	INDICATOR	BEST (VALUE = 100)	GREEN	YELLOW	ORANGE	RED	WORST (VALUE = 0)	RATIONALE BEST	RATIONALE GREEN
1	Severe material deprivation rate in cities (%)	2	≤4	4 < x ≤ 8	8 < x ≤ 12	>12	20	Top 5 performers	Mean (7) - 1/2SD (5)
1	People at risk of poverty or social exclusion (%)	0	≤15	15 < x ≤ 24	24 < x ≤ 33	>33	45	Leave no one behind	Mean - Std Dev
2	Obesity rate (BMI <30), %	2.8	≤10	10 < x ≤ 17.5	17.5 < x ≤ 25	>25	35.1	SDG Index	SDG Index
3	Traffic fatalities (per 10,000 population)	0	≤0.3	0.3 < x ≤ 0.8	0.8 < x ≤ 1.3	>1.3	1.1	Top 5 performers	Global Index (0.84) US City (0.477) (adjusted for EU cities)
3	Infant mortality rate (under 1) per 1,000 births	0	≤4	4 < x ≤ 5	5 < x ≤ 6	>6	11	Top 5 performers	Mean
3	Physicians or doctors per (100,000 pop)	675	≥300	300 > x ≥ 237.5	237.5 > x ≥ 175	<175	124	Top 5 performers	Mean, rounded (300)
3	Life expectancy (years)	84.5	≥80	80 > x ≥ 78.5	78.5 > x ≥ 77	<77	70	Top 5 performers	Expert judgement
3	Daily smokers (%)	10	≤20	20 < x ≤ 22.5	22.5 < x ≤ 25	>25	37	SDG Index	SDG Index
3	Active lifestyle (%)	45	≥25	25 > x ≥ 20	20 > x ≥ 15	<15	10	Top 5 performers - outliers	Mean, Rounded (25)
4	Early leavers from education (% 18-24)	0	≤5	5 < x ≤ 10	10 < x ≤ 15	>15	23	Leave no one behind	Mean - 1 std dev
4	Adults with upper secondary education (% 25-64)	100	≥90	90 > x ≥ 78	78 > x ≥ 66	<66	48	SDG Target	Mean(78) + SD(12)
4	NEET rate (% 15-24)	8.1	≤10	10 < x ≤ 12.5	12.5 < x ≤ 15	>15	28.2	SDG Index	SDG Index
4	Satisfaction with schools (%)	86.8	≥72	72 > x ≥ 64	64 > x ≥ 56	<56	46.3	Top 5 performers	Mean (67) + (1/2)SD (11)
4	Four year-olds in early childhood education (%)	100	≥95	95 > x ≥ 84.5	84.5 > x ≥ 74	<74	50	Leave no one behind	Mean(88) + 1/2SD(14)
4	Adult participation in learning (%)	32.8	≥18	18 > x ≥ 13	13 > x ≥ 8	<8	1	Top 5 performers	Mean(11) + SD (7)
4	University appearances in rankings	12	≥6	6 > x ≥ 4	4 > x ≥ 2	<2	0	Top 5 performers (- outlier, London	Mean(3) + SD(3)

SDG	INDICATOR	BEST (VALUE = 100)	GREEN	YELLOW	ORANGE	RED	WORST (VALUE = 0)	RATIONALE BEST	RATIONALE GREEN
5	Gender wage gap (% male wage)	0	≤7.5	7.5 < x ≤ 11.25	11.25 < x ≤ 15	>15	28	SDG Target	Global Index
5	Women in regional assemblies (%)	50	≥40	40 > x ≥ 30	30 > x ≥ 20	<20	6	Technical Optimum	Global Index
5	Gender gap in un-employment (%)	0	≤5	5 < x ≤ 9	9 < x ≤ 13	>13	23	Technical Optimum	Mean(10) - SD(5)
6	Waste water treated (%)	100	≥98	98 > x ≥ 89	89 > x ≥ 80	<80	58	SDG Index	Mean
6	Population connected to Sewerage Treatment (%)	100	≥96	96 > x ≥ 92	92 > x ≥ 88	<88	67	No one left behind	Mean(96)
7	Renewable energy generated (%)	100	≥55	55 > x ≥ 36.5	36.5 > x ≥ 18	<18	2.4	Top 5 performers	US City Index
8	GDP per capita (€/ capita)	29000	≥24000	24000 > x ≥ 17500	17500 > x ≥ 11000	<11000	7000	Mean	Mean - SD
8	5 year average of Annual real GDP Growth Rates	2	≥1.5	1.5 > x ≥ 0.75	0.75 > x ≥ 0	<0	-3	Top 5 performers - outliers	Mean(0) + 1.5
8	Long term un-employment Rate (%)	0.5	≤5	5 < x ≤ 7.5	7.5 < x ≤ 10	>10	26	SDG Index	SDG Index
9	R&D expen-diture (%)	3.7	≥3	3 > x ≥ 2	2 > x ≥ 1	<1	0.3	Global optimum	EU 2020 target
9	Access to Internet at Home (%)	100	≥90	90 > x ≥ 84	84 > x ≥ 78	<78	67	Top 5 performers	Mean(86) + 1/2SD (8)
9	Patent appli-cants (per million pop)	300	≥200	200 > x ≥ 118	118 > x ≥ 36	<36	0	Top 5 performers - outliers	Mean(95) + SD(118)
9	Community design appli-cations (per million pop.)	90	≥96	96 > x ≥ 54	54 > x ≥ 12	<12	1	Top 5 performers	Mean(40) + SD(56)
9	Potential road accessibility	25000000	≥21000000	21000000 > x ≥ 17000000	17000000 > x ≥ 13000000	<13000000	0	Top 5 performers	Mean(18.5) + SD(5.5)
9	Direct trains to other cities (per million pop.)	28	≥18	18 > x ≥ 10.5	10.5 > x ≥ 3	<3	0	Top 5 performers	Mean(8) + SD(10)
10	Gini Coeffi-cient (1-100)	20	≤30	30 < x ≤ 35	35 < x ≤ 40	>40	60	Top 5 performers - SD	SDG Index
11	Concen-tration PM2.5 (microgr/m3)	6.3	≤10	10 < x ≤ 17.5	17.5 < x ≤ 25	>25	87	SDG Index	SDG Index

SDG	INDICATOR	BEST (VALUE = 100)	GREEN	YELLOW	ORANGE	RED	WORST (VALUE = 0)	RATIONALE BEST	RATIONALE GREEN
11	Emission of nitrogen oxides (kg/ km2)	1	≤4	4 < x ≤ 9	9 < x ≤ 14	>14	32	Top 5 performers	Mean(9) - 1/2SD(8)
11	Satisfaction affordable housing (%)	64	≥49	49 > x ≥ 35.5	35.5 > x ≥ 22	<22	4	Top 5 performers	Mean(31) + SD(18)
11	Housing cost overburden rate in urban areas (%)	5	≤7	7 < x ≤ 12	12 < x ≤ 17	>17	25.6	SDG Index	SDG Index
11	Recharging stations (per 10,000 people)	2	≥1.2	1.2 > x ≥ 0.7	0.7 > x ≥ 0.2	<0.2	0	Top 5 performers - outliers	Mean(.7) + 1/2SD(1)
11	Satisfaction public transport (%)	94	≥72	72 > x ≥ 57.5	57.5 > x ≥ 43	<43	32	Top 5 performers	Global Index
11	Satisfaction cultural facilities (%)	60	≥39	39 > x ≥ 31	31 > x ≥ 23	<23	14	Top 5 performers - outliers	Mean (39)
11	Sights & landmarks (per 100,000)	330	≥179	179 > x ≥ 104	104 > x ≥ 29	<29	4	Top 5 performers - outlier	Mean(104) + 75
11	Museums (per 100,000)	124	≥84	84 > x ≥ 49	49 > x ≥ 14	<14	2	Top 5 performers - outliers	Mean(36) + SD(48)
11	Concerts & shows (per 100,000)	51	≥27	27 > x ≥ 18	18 > x ≥ 9	<9	1	Top 5 performers - outliers	Mean(18) + 1/2SD(18)
12	Municipal waste (kg/ capita)	250	≤350	350 < x ≤ 450	450 < x ≤ 550	>550	700	Top 5 performers	Mean(450) - SD(100)
12	Municipal recycling rate (%)	57	≥52	52 > x ≥ 38	38 > x ≥ 24	<24	10	Top 5 performers	Mean(38) + SD(14)
12	Ground water of good chemical status (%)	100	≥85	85 > x ≥ 65	65 > x ≥ 45	<45	20	Top 5 performers	Mean(65) + SD(20)
12	Surface water of good chemical status (%)	100	≥85	85 > x ≥ 65	65 > x ≥ 45	<45	0	Top 5 performers	Mean(45) + SD(40)
13	CO2 Emissions (tonnes per capita)	0	≤2	2 < x ≤ 3	3 < x ≤ 4	>4	15.6	SDG Index	SDG Index
15	Natura 2000 Area in good quality (%)	60	≥55	55 > x ≥ 33	33 > x ≥ 11	<11	0	Top 5 performers	Mean(38) + SD(27)
15	Urban green area (%)	60	≥38	38 > x ≥ 25.5	25.5 > x ≥ 13	<13	1	Top 5 performers	Mean(21) + SD(17)
15	Soil sealing (%)	1	≤23	23 < x ≤ 30	30 < x ≤ 37	>37	56	Top 5 performers	Mean

SDG	INDICATOR	BEST (VALUE = 100)	GREEN	YELLOW	ORANGE	RED	WORST (VALUE = 0)	RATIONALE BEST	RATIONALE GREEN
15	Surface Water of Good Ecological Status (%)	70	≥46	46 > x ≥ 31	31 > x ≥ 16	<16	0	Top 5 performers	Rounded up : Mean(26) + SD(20)
16	Burglaries (per 100,000)	7	≤204	204 < x ≤ 301.5	301.5 < x ≤ 399	>399	780	Top 5 performers	Mean
16	Robberies (per 100,000)	1	≤70	70 < x ≤ 151	151 < x ≤ 232	>232	304	Top 5 performers	Mean (rounded)
16	Intentional homocides (per 100,000)	0	≤1.5	1.5 < x ≤ 2.25	2.25 < x ≤ 3	>3	5	Top 5 performers	SDG Index
16	Perception of neighborhood safety (%)	97	≥84	84 > x ≥ 79	79 > x ≥ 74	<74	60	Top 5 performers	Mean
16	Quality of local government	162	≥109	109 > x ≥ 16.5	16.5 > x ≥ -76	<-76	-167	Top 5 performers	Mean(16) + SD(93)

Annex 4: City scores for each SDGs

CITY	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 15	SDG 16
Amsterdam	75.0	72.8	66.7	76.8	60.4	100.0	13.2	97.3	66.7	79.5	75.7	73.5	32.7	15.5	52.5
Antwerp	61.1	65.3	64.2	66.5	64.5	98.8	34.5	85.2	67.2	76.8	53.6	44.9	51.3	21.8	47.8
Athens	15.4	31.6	74.2	42.4	55.4	100.0	29.7	53.8	23.9	60.0	57.9	15.3	30.8	5.0	34.9
Barcelona	67.3	62.5	71.7	52.8	63.0	100.0	82.9	82.5	52.8	59.5	60.3	45.6	54.5	36.9	52.5
Berlin	66.3	70.9	66.6	60.9	61.4	99.4	25.0	85.5	86.3	70.8	76.7	76.3	33.3	28.0	65.3
Bordeaux	73.2	68.4	60.0	69.0	74.0	98.1	34.5	76.7	37.2	63.0	52.5	54.8	45.4	50.8	72.1
Bratislava	84.1	45.2	72.4	53.2	47.4	91.8	25.0	96.8	34.0	83.8	39.4	61.8	46.0	65.6	67.4
Brussels	61.1	70.0	65.7	56.1	61.6	99.7	34.5	70.6	54.1	56.5	52.4	64.6	51.9	35.5	31.1
Bucharest	38.1	39.0	64.6	43.8	57.2	37.1	25.0	84.7	31.8	60.3	45.0	61.5	60.9	32.2	58.4
Budapest	52.2	19.2	48.2	54.7	26.0	90.3	25.0	73.2	42.9	74.0	58.7	51.1	62.8	36.4	55.7
Copenhagen	74.3	67.2	73.0	72.5	54.4	100.0	62.1	87.5	76.7	79.3	57.5	47.1	35.3	36.8	55.0
Dublin	73.9	30.3	70.5	70.1	46.8	86.4	34.5	96.9	42.2	70.5	60.3	65.3	41.7	44.9	67.7
Eindhoven	78.4	70.6	65.9	73.1	49.3	100.0	34.5	89.9	89.7	79.5	68.5	42.1	45.4	10.6	60.7
Frankfurt	77.9	63.2	74.3	62.7	45.4	99.5	25.0	85.7	76.4	70.8	57.8	75.2	35.9	28.9	65.4
Hamburg	71.7	76.2	79.6	57.8	53.8	98.8	44.1	89.5	78.3	70.8	72.1	72.9	28.8	37.4	67.9
Helsinki	85.8	39.9	83.4	74.0	65.4	100.0	30.4	76.9	97.8	82.3	55.7	73.0	52.6	50.3	87.5
Lisbon	56.9	18.6	68.6	52.1	61.8	100.0	57.0	63.6	31.0	61.3	49.7	52.6	66.0	31.3	54.1
Ljubljana	79.1	46.1	66.9	67.2	81.1	83.3	25.0	80.2	35.2	86.5	54.8	76.4	46.0	78.7	76.2
London	67.6	44.0	76.5	64.1	40.8	98.1	41.5	98.2	76.1	67.0	73.2	44.3	33.3	20.9	68.4
Luxembourg	76.1	38.7	67.9	63.1	62.5	98.1	6.8	88.0	63.0	65.5	47.3	81.5	45.4	60.6	79.7
Lyon	73.2	70.6	63.4	72.9	68.6	98.1	34.5	85.5	68.9	60.5	55.9	71.6	64.1	46.9	65.8
Madrid	66.0	62.5	73.2	55.9	66.1	100.0	60.9	82.0	57.2	59.5	60.5	70.9	43.6	51.0	55.3
Marseille	73.2	56.0	59.8	57.4	68.2	98.1	34.5	82.9	52.7	59.5	47.2	61.8	45.4	61.8	35.8
Milan	50.6	77.4	66.5	59.1	43.8	100.0	37.6	69.9	53.1	71.5	69.8	48.7	48.7	19.3	60.9
Munich	75.9	65.3	73.8	67.7	40.6	99.8	25.0	92.0	92.0	70.8	67.4	82.0	53.8	38.7	89.9
Nicosia	51.2	41.2	65.6	51.1	43.2	100.0	53.8	53.2	16.4	65.0	50.9	43.6	39.7	42.2	65.6
Nuremburg	68.0	65.3	69.0	62.1	40.3	99.8	25.0	92.6	76.8	70.8	67.0	68.8	46.0	26.8	88.3
Oslo	82.1	87.0	80.0	72.7	66.0	100.0	98.0	98.6	52.5	82.3	63.2	60.2	45.3	90.9	81.3
Paris	73.2	75.5	65.8	75.7	68.2	98.1	94.9	90.7	81.2	55.3	60.8	31.9	50.6	21.0	49.6
Porto	56.9	21.4	65.5	46.1	54.5	100.0	74.7	62.0	18.2	61.3	31.7	38.3	56.4	23.3	67.1
Prague	82.6	28.2	75.6	71.5	34.3	95.5	25.0	84.1	57.2	85.3	74.0	50.4	36.5	44.6	65.7
Riga	50.6	35.6	58.0	53.9	51.6	93.7	25.0	84.2	26.9	64.5	45.5	52.9	46.0	63.3	46.2
Rome	40.4	82.0	66.3	44.6	45.5	100.0	40.8	59.6	48.0	73.5	46.7	36.3	57.1	38.5	44.4
Rotterdam	75.0	59.4	67.2	77.3	50.7	100.0	16.0	84.6	66.9	79.5	60.3	71.2	28.8	36.7	80.0
Sofia	17.4	31.3	61.5	47.9	61.6	96.4	25.0	67.9	26.7	56.5	45.7	63.8	66.7	68.3	28.6
Stockholm	84.0	74.6	85.4	79.0	76.0	100.0	91.9	93.0	97.7	72.8	57.4	54.8	48.1	48.2	79.1
Tallinn	68.7	43.0	69.4	56.2	40.5	95.3	25.0	89.1	37.7	68.3	57.5	69.9	46.0	52.9	73.3
The Hague	75.0	59.8	65.0	76.1	50.7	100.0	34.5	81.2	63.6	79.5	75.9	72.6	45.4	36.2	49.3
Turin	48.1	80.5	63.6	46.5	51.3	100.0	46.7	68.5	52.6	70.0	55.4	50.1	60.3	21.0	50.4
Valletta	74.8	19.2	64.5	43.3	30.5	100.0	53.8	89.5	24.5	76.5	40.4	5.2	50.8	43.5	70.5
Vienna	56.7	61.6	72.2	73.0	54.9	93.7	25.0	74.1	68.5	82.0	72.5	98.9	28.8	59.7	62.9
Vilnius	41.6	27.2	60.7	51.7	63.0	97.1	25.0	82.0	26.8	56.5	48.9	88.5	46.0	56.7	42.2
Warsaw	71.7	37.2	60.5	60.4	61.1	91.0	5.9	88.1	52.2	69.8	49.0	58.7	51.9	20.6	63.8
Zagreb	53.4	46.7	59.6	44.2	65.3	83.6	25.0	55.4	25.4	72.3	53.3	48.3	46.0	77.8	65.4
Zurich	85.0	78.8	79.5	75.1	48.2	100.0	34.5	98.2	84.8	69.3	57.4	87.6	54.5	43.9	80.5

Annex 5: Missing values

CITY	COUNTRY	MISSING VALUES (%)	REGION
Amsterdam	Netherlands	16.07	Western Europe
Antwerp	Belgium	8.93	Western Europe
Athens	Greece	33.93	Southern Europe
Barcelona	Spain	14.29	Southern Europe
Berlin	Germany	8.93	Central and Eastern Europe
Bordeaux	France	12.50	Western Europe
Bratislava	Slovakia	17.86	Central and Eastern Europe
Brussels	Belgium	10.71	Western Europe
Bucharest	Romania	19.64	Central and Eastern Europe
Budapest	Hungary	12.50	Central and Eastern Europe
Copenhagen	Denmark	16.07	Northern Europe
Dublin	Ireland	33.93	Western Europe
Eindhoven	Netherlands	23.21	Western Europe
Frankfurt	Germany	14.29	Central and Eastern Europe
Hamburg	Germany	7.14	Central and Eastern Europe
Helsinki	Finland	12.50	Northern Europe
Lisbon	Portugal	17.86	Southern Europe
Ljubljana	Slovenia	19.64	Central and Eastern Europe
London	United Kingdom	25.00	Western Europe
Luxembourg	Luxembourg	28.57	Western Europe
Lyon	France	19.64	Western Europe
Madrid	Spain	10.71	Southern Europe
Marseille	France	12.50	Western Europe
Milan	Italy	26.79	Southern Europe
Munich	Germany	8.93	Central and Eastern Europe
Nicosia	Cyprus	32.14	Southern Europe
Nuremburg	Germany	17.86	Central and Eastern Europe
Oslo	Norway	30.36	Northern Europe
Paris	France	14.29	Western Europe
Porto	Portugal	28.57	Southern Europe
Prague	Czech Republic	12.50	Central and Eastern Europe
Riga	Latvia	23.21	Central and Eastern Europe
Rome	Italy	12.50	Southern Europe
Rotterdam	Netherlands	17.86	Western Europe
Sofia	Bulgaria	19.64	Central and Eastern Europe
Stockholm	Sweden	10.71	Northern Europe
Tallinn	Estonia	19.64	Central and Eastern Europe
The Hague	Netherlands	23.21	Western Europe
Turin	Italy	10.71	Southern Europe
Valletta	Malta	30.36	Southern Europe

CITY	COUNTRY	MISSING VALUES (%)	REGION
Vienna	Austria	10.71	Central and Eastern Europe
Vilnius	Lithuania	19.64	Central and Eastern Europe
Warsaw	Poland	16.07	Central and Eastern Europe
Zagreb	Croatia	26.79	Central and Eastern Europe
Zurich	Switzerland	30.36	Western Europe

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