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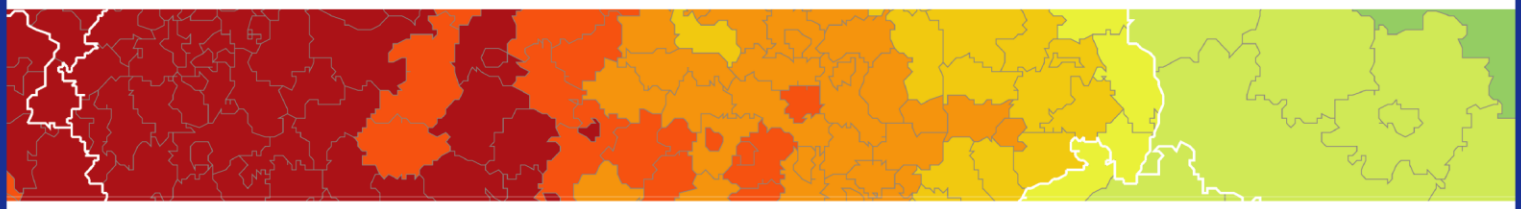

SDG localising tool: Localising and measuring Sustainable Development Goals in cities and regions

Final Report

Final Report

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Version 2021

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Abbreviations

EC	European Commission
ESPON	European Territorial Observatory Network
ESPON EGTC	ESPON European Grouping of Territorial Cooperation
EU	European Union
NUTS	Nomenclature of Territorial Units for Statistics
SDGs	Sustainable Development Goals

1 Introduction

The ESPON Sustainable Development Goal (SDG) benchmarking tool is a web application that offers support to regional governments in localising and achieving the SDGs. A simple, intuitive and user-friendly application informs stakeholders on regional disparities and inequalities and urges regional governments in all the countries participating in the ESPON 2020 Cooperation Programme to include the SDGs in local development plans and step-up actions.

The target group of this tool is policy-makers, in particular regional policy-makers and national policy-makers that want to gain better insight into the regional disparities and developments related to SDG-related policy areas such as climate action, the labour market and poverty alleviation, etc. A secondary purpose, to support the overall mainstreaming process, is informing citizens, civil society organisations, and possibly pupils and students, so that they may be more engaged with the SDGs.

The European Union has endorsed and actively supports the global efforts to achieve the SDGs. EUROSTAT, which cooperates with the UNSD (United Nations Statistics Division) in the framework of the Inter-Agency and Expert Group on SDG Indicators, recognizes the importance of sound statistical data at the global, national and subnational level. United Nations Economic Commission for Europe (UNECE), in 2017, in line with the above-mentioned considerations, proposed the development of national and sub-national indicators. EUROSTAT published a monitoring report on the progress towards the SDGs in 2018.

However, the data in the monitoring report only goes down to national data. ESPON, which fosters the European "territorial dimension in development and cooperation by providing evidence, knowledge transfer and policy learning to public authorities and other policy actors at all levels", is ideally placed to fill in this current gap in information at sub-national level and contribute to global localisation efforts.

Data for indicators measuring the SDGs at NUTS3 level appeared to be not sufficiently available. It was therefore decided to develop the SDG tool for data at NUTS2 level. As a consequence, the original name 'ESPON SDG localising tool' could be a bit misleading and raise expectations that cannot be fulfilled. To resolve this issue the tool was renamed into 'ESPON's SDG benchmarking tool' which seemed to be a better fit.

The SDG benchmarking tool is simple to use with a clear and apparent structure, but also includes a detailed level of data visualisation. To reach a wide public and support regional governments, use of the tool is self-explanatory and accompanied by clear guidance as well as communication material to ensure widespread adoption.

The final report is organised as follows: Chapter 2 describes the objective of the project. Chapter 3 summarises the overall approach. Chapter 4 describes the SDGs data feeding the tool. It presents the regional SDG indicators by SDG goal, describes the approach in setting the targets, the calculations to summarise data and the data gaps. Chapter 5 describes the stakeholders' involvement in validating the indicator framework and in co-designing/testing the SDG benchmarking tool. Chapter 6 describes the main functionalities of the tool itself . A user guide, administrator guide, guidance sheet and leaflet are available as separate documents.

2 Objective

The project aims to develop and implement a Sustainable Development Goal (SDG) benchmarking tool in the form of a web application that offers support to regional and national governments in localising and achieving the SDGs.

Questions it helps answer include:

- Is my region making progress towards achieving the SDG targets?
- Is my region lagging behind or leading in achieving SDGs compared to other similar regions?
- From which regions in Europe can I draw inspiration to progress towards the SDGs?
- Which regions would benefit from targeted support to help step up action to improve their progress and thus contribute substantially to the national progress on the SDGs?

A simple, intuitive and user-friendly application can inform stakeholders on regional disparities and inequalities and urge regional and national governments in all the countries participating in the ESPON 2020 Cooperation Programme to include the SDGs in local development plans and step-up actions.

The result informs regional, and national policy-makers and citizens alike on SDG-related policy areas.

3 Approach

The SDGs benchmarking tool presents indicators to measure, monitor and benchmark the SDGs at the regional level. The approach regarding the indicator framework for regions, the final selection of indicators and the tool is described briefly below.

Indicator framework

For the framework at NUTS 2 level we adopted EUROSTAT's SDGs reference indicator framework, which is used to monitor progress towards the SDGs in the EU context and

particularly at the national level.[1] This framework and associated indicator set is the result of a consultative process involving Commission services, Member States, Council Committees, users, NGOs, academia and international organisations. The initial set of indicators was adopted in April 2017 by the Working Group on SDG-related reporting of the Commission Services, mandated by the Inter Service Steering Group on SDGs, and received the favourable opinion of the European Statistical System Committee (ESSC) in May 2017. The criteria used for selecting indicators are policy relevance, admissibility requirements and quality grading. The framework limits the maximum number of indicators for each SDG to six, with it also being possible to have "multi-purpose indicators" to monitor progress towards more than one SDG. The EUROSTAT approach allows for new indicators to replace existing indicators, provided they better meet the criteria.

However, since the EUROSTAT framework applies at the national level we validated the proposed framework for its relevance at the regional level by consulting the approach of the OECD in its recently published report "A Territorial Approach to the Sustainable Development Goals" (henceforth referred to as the OECD report)[2] and by piloting the proposed framework with three EU regions.

Indicators

To select the indicators for the SDGs benchmarking tool, a three step approach has been followed.

Firstly, to achieve alignment with the EUROSTAT approach in terms of the conceptual choices made by goal an examination of the availability of indicators included in EUROSTAT's SDGs & me tool has been conducted. The considerations made to select the indicators considered:

(1) Availability at national level: if an indicator covers large EU countries at national level only alternatives were considered

(2) Availablity at regional level: If an indicator is available for less than 70% of the regions alternatives were considered

Secondly, the indicator framework has been checked for its relevance at the regional level in two ways:

(1) By cross checking the approach and selection of indicators of the OECD report "A Territorial Approach to the Sustainable Development Goals": The two approaches from the perspective of indicators put forward appear conceptually aligned. Some interesting indicators proposed in the latter report even if not aligned with EUROSTAT have been considered for the tool e.g. the difference between land consumption rate and

[1] http://www.sinanet.isprambiente.it/gelso/rassegna-degli-strumenti-di-sostenibilita-per-gli-enti-locali/20190108__EU_SDG_indicator_set_2019_review_final_report.pdf

[2] https://www.oecd.org/cfe/a-territorial-approach-to-the-sustainable-development-goals-e86fa715-en.htm

population growth rate using satellite imagery data for goal 11 as an alternative to the settlement area using the LUCAS database.

(2) By piloting the indicator framework with three regions: 1) Eastern and midland (IE), 2) Catalonia (ES) and 3) Eastern Slovenia (SI).

Thirdly, in the case of remaining gaps compared to EUROSTAT's SDGs & me and OECD indicators, RACER criteria (Relevant, Acceptable, Credible, Easy and Robust) (DEVCO, 2016) were considered for the selection of alternative indicators:

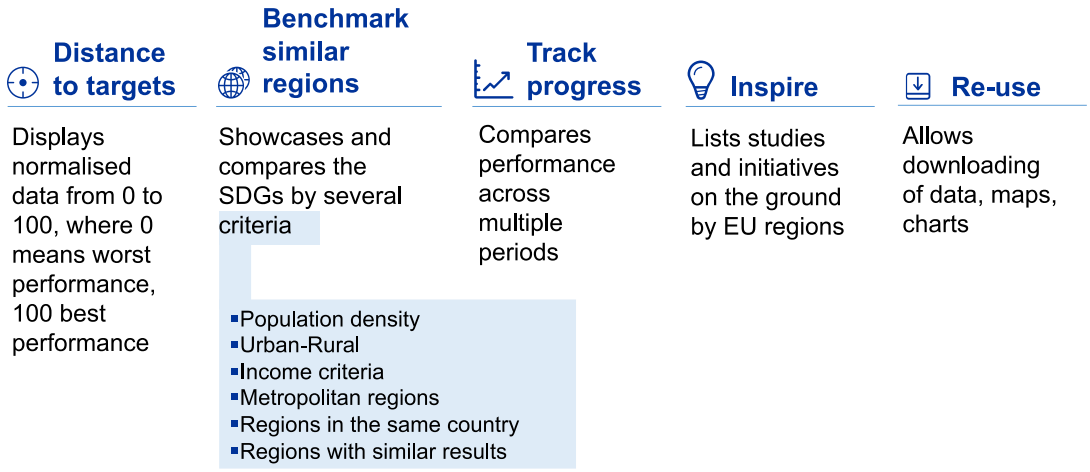
1) Relevance: The indicator should have a strong correlation with the SDGs. Indicators /good proxies of the EUROSTAT approach at regional level fulfil the criterion.
2) Acceptable: The indicator must be easily understood and should be accepted by all stakeholders. Indicators /good proxies of the EUROSTAT approach at regional level fulfil the criterion.
3) Credible: The indicators must be accessible to non-experts, unambiguous and easy to interpret. Indicators /good proxies of the EUROSTAT approach at regional level fulfil the criterion.
4) Easyness: It should be possible to collect the data with available resources for the updates of the SDGs benchmarking tool.
5) Robustness: The indicators should be sensitive enough to monitor changes; therefore it is important to select them according to the time lag between the action and the expected change that points to current progress towards long-term or future improvements. It is therefore important not to rely on i) old data; ii) indicators that, having been developed to compare countries or situations, are not suitable for monitoring changes; iii) variables influenced by long-term impacts; iv) variables that are deeply affected by uncontrolled short-term changes hiding the expected long-term changes.

Tool

The tool contributes to the accessibility of indicators and information to localise the SDGs, to measure progress of the SDGs in regions and reflect on differences across regions in Europe. The functionalities deemed most relevant for regions include the distance to SDG targets, benchmarking with similar regions, tracking of progress in time, inspiration from regional initiatives and studies and the possibility to re-use all the raw data (see

Figure 1). The overall technical objective was to create a modern and user-friendly web system by following the latest online standards in web development. More specifically, the aim has been to: keep the highest standards of user-friendliness; visually attract online visitors; enhance the process of transferring good practices by providing space for an easy information dissemination.

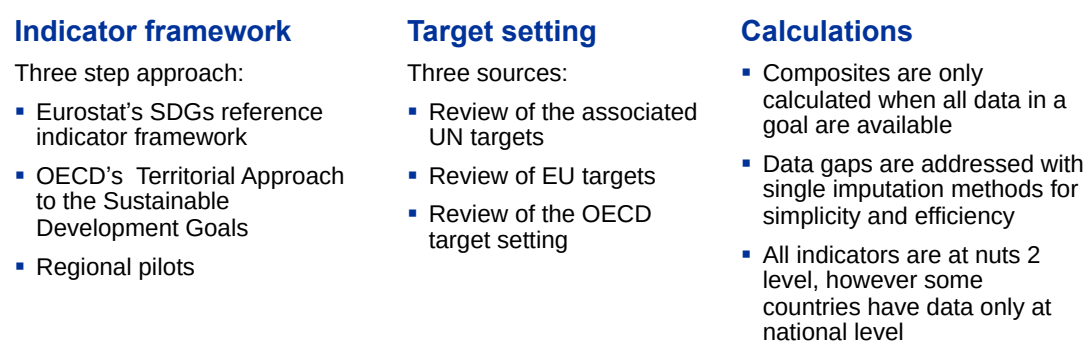
Figure 1 Functionalities to diagnose and monitor performance in SDGs



4 SDG indicators and calculations

The methodological choices made with respect to the indicator framework, target setting and calculation are described in Figure 2 and further explained in sub-sections 4.1, 4.2 and 4.3 respectivelly.

Figure 2 Methodological Choices



4.1 SDG indicator framework

The final list of indicators and sources is described in Table 1. Currently the 17 goals are considered at EU28 level including Iceland, Switzerland, Norway and Liechtenstein.

Table 1 SDG indicators

Goal ID	Indicator	Source
1.1	People at risk of poverty or social exclusion	EU SILC
1.2	People in work at-risk-of-poverty	EU SILC
1.3	Lack of adequate heating	EU SILC
1.4	Overcrowded living conditions	MPI/European Quality of Institutions Index and DG Regio own computations
2.1	Insufficient food	EU SILC
2.2	Change to organic farming	ESS
2.3	Organic farming	EUROSTAT
3.1	Life expectancy at birth	ESS
3.2	General good health status	EU SILC
3.3	Death rate due to tuberculosis, HIV and hepatitis	EUROSTAT
3.4	Unmet need for medical examination and care	EU SILC
4.1	Early leavers from education and training	EUROSTAT
4.2	Tertiary educational attainment	EUROSTAT
4.3	Employment rates of young people not in education and training	EUROSTAT
4.4	Participation rates of young people in education	EUROSTAT
5.1	Female students enrolled in tertiary education	EUROSTAT
5.2	Employment rates of young females not in education and training	EUROSTAT
5.3	Female early leavers from education and training	ESS (LFS)
6.1	Drinking water quality	Gallup
6.2	Lack of toilet in dwelling	EU-SILC
6.3	Sewage treatment	European Environment Agency
7.1	Household energy consumption per capita	ESPON LOCATE project
7.2	Share of renewable energy in heating and cooling of buildings	ESPON LOCATE project
7.3	Inability to keep home adequately warm	EU SILC
8.1	Regional gross domestic product	EUROSTAT
8.2	Employment	EUROSTAT
8.3	Long-term unemployment	EUROSTAT
8.4	People in work at-risk-of-poverty	EU SILC
9.1	Intramural R&D expenditure (GERD)	EUROSTAT
9.2	Total R&D personnel	EUROSTAT
9.3	Public transport vehicles	EUROSTAT
10.1	Disposable income of private households per inhabitant	EUROSTAT
10.2	Disposable income of private households relative to national average	EUROSTAT
10.3	People at risk of poverty or social exclusion	EU SILC
11.1	Overcrowded living conditions	EU SILC
11.2	Settlement area per capita	ESPON SUPER project
11.3	Victims killed in road accidents	DG MOVE
11.4	Air pollution – pm 2.5	EEA, DG REGIO
12.1	Municipal waste	EUROSTAT
12.2	Energy consumption per capita	ESPON LOCATE project
12.3	Uncollected sewage	European Environment Agency
13.1	Air pollution - pm 10	EEA, DG REGIO
13.2	Air pollution - pm 2.5	EEA, DG REGIO
13.3	Air pollution - ozone	EEA, DG REGIO
13.4	Air pollution - NO2	EEA, DG REGIO
14.1	Marine sites protection	EEA
15.1	Forest area protection	LUCAS
15.2	Land covered by artificial surfaces	EEA
15.3	Nature area protection	EEA
16.1	Crime	EU-SILC (ad-hoc extraction from HS160)

Goal ID	Indicator	Source
16.2	Trust in the legal system	EU-SILC ad-hoc Quality of Life module
16.3	European Quality of Government	Transparency International
16.4	Trust in the EU	DG COMM
16.5	Trust in the police	EU-SILC ad-hoc Quality of Life module
17.1	Online interaction with public authorities	EUROSTAT
17.2	Innovative SMEs collaborating with others	Regional Innovation Scoreboard
17.3	Broadband at home	EUROSTAT
17.4	Public-private co-publications	Regional Innovation Scoreboard
17.5	International scientific co-publications	Regional Innovation Scoreboard

4.1.1 Data collected and shortcomings

The process of data collection involved the following steps:

1) Assessment of the data coverage by region

2) Assessment of the availability of time series: As one of the objectives of the tool is to show progress in time we are relying on time series of the selected indicators. Two periods are constructed 2011-2013 and 2014-2016. As we are relying on data from the EU SPI we need to follow the same approach in defining the periods.

3) imputation of data based on the typology of gaps.

We identified three main typologies of data gaps: (1) indicators for which regional data is not available, (2) gaps in some countries which do not report any regional data and (3) gaps in time series. We addressed the gaps as follows:

- No indicator available at regional level matching the EUROSTAT indicator: In our proposed set of indicators we include alternative indicators which are good proxies of the indicators selected by EUROSTAT to include in the SDGs & Me tool. As such we opt for selecting indicators that fulfil our criteria on geographic coverage rather than regionalising or imputing data.
- No regional breakdown available for some countries: In the case of indicators for which some countries do not report the regional breakdown or allow the publication of regional data we will only present the national level indicator. However, if an indicator covers large EU countries at national level only alternative indicators are proposed. The objective is to avoid using national level indicators.

Considering that the availability of data varies by indicator we used three years averages to show the progress from period to period. This helps to address any missing values as well as smooth out fluctuations in indicator values which might be misleading.

The 17 goals are described below in more detail, showing data availability per period, coverage in terms of data gaps and alternative indicators proposed.

Table 2 Final data availability time series and gaps

Goal ID	Indicator	Source	Period 2011-2013 used	Period 2014-2016 used
1.1	People at risk of poverty or social exclusion	EU SILC	2011-2013	2014-2016
1.2	People in work at-risk-of-poverty	EU SILC	2011-2013	2014-2016
1.3	Lack of adequate heating	EU SILC	2011-2013	2017-2018
1.4	Overcrowded living conditions	MPI/European Quality of Institutions Index and DG Regio own computations	2011-2013	2017-2018
2.1	Insufficient food	EU SILC	2011-2013	2017-2018
2.2	Change to organic farming	ESS	missing	2016
2.3	Organic farming	EUROSTAT	2013	2016
3.1	Life expectancy at birth	ESS	2011-2013	2014-2016
3.2	General good health status	EU SILC	2011-2013	2017-2018
3.3	Death rate due to tuberculosis, HIV and hepatitis	EUROSTAT	2011-2013	2014-2016
3.4	Unmet need for medical examination and care	EU SILC	2011-2013	2017-2018
4.1	Early leavers from education and training	EUROSTAT	2011-2013	2014-2016
4.2	Tertiary educational attainment	EUROSTAT	2011-2013	2014-2016
4.3	Employment rates of young people not in education and training	EUROSTAT	2011-2013	2014-2016
4.4	Participation rates of young people in education	EUROSTAT	only 2013	2014-2016
5.1	Female students enrolled in tertiary education	EUROSTAT	only 2013	2014-2016
5.2	Employment rates of young females not in education and training	EUROSTAT	2011-2013	2014-2016
5.3	Female early leavers from education and training	ESS (LFS)	2011-2013	2014-2016
6.1	Drinking water quality	Gallup	missing	2020
6.2	Lack of toilet in dwelling	EU-SILC	2011-2013	2018-2019
6.3	Sewage treatment	European Environment Agency	2010	2016 2014 for IT
7.1	Household energy consumption per capita[3]	ESPON LOCATE project	2002	2012
7.2	Share of renewable energy in heating and cooling of buildings[4]	ESPON LOCATE project	2002	2012

[3] This indicator was provided at NUTs 3 level. In order to aggregate this indicator to NUTs2 level we used the following approach:
1. Total household energy consumption of the NUTS3 region in kwh =the values at NUTS3 per capita (in kwh) * population at NUTs3 level
2. Total household energy consumption NUTS2 in kwh = aggregate sum of all NUTS3 regions within a NUTS2 region
3. Household energy consumption per capita = Total household energy consumption NUTS2 in kwh / population of the NUTS 2 region

[4] This indicator was provided at NUTs 3 level. In order to aggregate this indicator to NUTs2 level we used the following approach:

1. Renewable energy in heating and cooling of buildings in kwh per NUTS3 region = proxy of the share of renewable energy in heating and cooling of buildings at NUTs 3 level in Total household energy consumption of the NUTS3 region in kwh

Goal ID	Indicator	Source	Period 2011-2013 used	Period 2014-2016 used
7.3	Inability to keep home adequately warm	EU SILC	2011-2013	2017-2018
8.1	Regional gross domestic product	EUROSTAT	2011-2013	2014-2016
8.2	Employment	EUROSTAT	2011-2013	2014-2016
8.3	Long-term unemployment	EUROSTAT	2011-2013	2014-2016
8.4	People in work at-risk-of-poverty	EU SILC	2011-2013	2014-2016
9.1	Intramural R&D expenditure (GERD)	EUROSTAT	2011-2013	2014-2016
9.2	Total R&D personnel	EUROSTAT	2011-2013	2014-2016
9.3	Public transport vehicles	EUROSTAT	2011-2013	2014-2016
10.1	Disposable income of private households per inhabitant	EUROSTAT	2011-2013	2014-2016
10.2	Disposable income of private households relative to national average	EUROSTAT	2011-2013	2014-2016
10.3	People at risk of poverty or social exclusion	EU SILC	2011-2013	2014-2016
11.1	Overcrowded living conditions	EU SILC	2011-2013	2017-2018
11.2	Settlement area per capita	ESPON SUPER Project	2012	2018
11.3	Victims killed in road accidents	DG MOVE	2011-2013	2014-2016
11.4	Air pollution – pm 2.5	EEA, DG REGIO	2011-2013	2017
12.1	Municipal waste	EUROSTAT	2012	2014,2016
12.2	Energy consumption per capita	ESPON LOCATE Project	2002	2012
12.3	Uncollected sewage	European Environment Agency	2010	2016
13.1	Air pollution - pm 10	EEA, DG REGIO	2011-2013	2016
13.2	Air pollution – pm 2.5	EEA, DG REGIO	2011-2013	2016
13.3	Air pollution - ozone	EEA, DG REGIO	2011-2013	2017
13.4	Air pollution - NO2	EEA, DG REGIO	Missing, new to EU SPI edition	2017
14.1	Marine sites protection	EEA	2012	2018
15.1	Forest area protection	LUCAS	2012	2015
15.2	Land covered by artificial surfaces	EEA	2012	2015
15.3	Nature area protection[5]	EEA	2012	2018
16.1	Crime	EU-SILC (ad-hoc extraction from HS160)	It was tested for the 2016 edition but discarded after statistical assessment	2017-2018

2. Aggregate sum of Renewable energy in heating and cooling of buildings in kwh per NUTS3 region within a NUTS2 region
3. Aggregate sum of Total household energy consumption of the NUTS3 region in kwh within a NUTS2 region
4. Share of renewable energy in heating and cooling of buildings at NUTs2 level = Step 2./ Step 3.

[5] Recently EEA clarified the availability of data at the NUTS2 level (https://www.eea.europa.eu/data-and-maps/dashboards/natura-2000-data-viewer). The indicator to add will be "total NATURA km^2 as share in total land cover [lan_lcv_art]"

Goal ID	Indicator	Source	Period 2011-2013 used	Period 2014-2016 used
16.2	Trust in the legal system	EU-SILC ad-hoc Quality of Life module	2013	2020
16.3	European Quality of Government	Transparency International	2013	2017
16.4	Trust in the EU	DG COMM	missing	2015
16.5	Trust in the police	EU-SILC ad-hoc Quality of Life module	2013	2020
17.1	Online interaction with public authorities	EUROSTAT	2013	2019
17.2	Innovative SMEs collaborating with others	Regional Innovation Scoreboard	2011-2013	2014-2016
17.3	Broadband at home	EUROSTAT	2011-2013	2014-2016
17.4	Public-private co-publications	Regional Innovation Scoreboard	2011,2013	2015,2016
17.5	International scientific co-publications	Regional Innovation Scoreboard	2011,2013	2015,2016

The following shortcomings with indicators are noted:

1. Gallup indicators are not provided for the period 2011-2013 by DG REGIO due to the restrictions of the current agreement with the provider of statistics Gallup.
2. EU SILC indicators are partly provided by DG REGIO: DG REGIO has obtained a tailor-made extraction from EU-SILC, following an ESTAT consultation of the National Statistical Institutes.

4.2 Target setting

Target setting is provided quantitatively by indicator to help regions assess their performance in terms of the distance to the target. Ideally, targets should correspond to a formal target set by the European Commission. However, in the absence of targets across all SDGs and indicators included in the tool, a second best approach has been developed described below in the three step approach:

1. **Review of the OECD target setting**: specifically the targets defined in the report "A Territorial Approach to the Sustainable Development Goals". The majority of them, with a few exceptions, apply a best performer approach to set the boundaries. While this approach is methodologically fully legitimate, the project team felt this would not fully integrate the specific SDG targets and would not holistically reflect the reality of EU regions. Therefore the team have suggested the most suitable approach for boundaries setting for each indicator based on associated targets (see step 2).
2. **Review of the associated UN targets**: a typology based on the language used has been created distinguishing predominantly between: reduce by half, ensure e.g. equal access, substantantially increase, end e.g. hunger, double, universal/full and sustain. The latter typology allows us to build on the definition of a quantifiable target. While the

UN language is the reference the final target needs to be tailored to the EU reality (see step 3).

3. **Review of EU targets**: a non exhaustive review of EU targets has ben performed by examining EU strategy documents (e.g. Green deal, Europe 2020 targets, the 2030 climate & energy framework etc.). Targets that are quantified are directly used. Given the limited resources for an in depth examination of EU targets (examine relevant regulation, white papers, strategy documents) and given the timing (end of Europe 2020 and targets yet to be defined for 2030), the ESPON EGTC is recommended to carry out a more exhaustive review of EU targets as soon as EU targets have been defined for 2030.

In several cases a best performer approach has been used in particular when UN or EU targets were not identified. A best performer approach is based on the OECD approach i.e. based on an unweighted average estimate using the top performing region of each country. This is a second best approach given the lack of quantitative targets for all the indicators. The value of the target should be interpreted with caution as the best performer value may represent an underestimation or overestimation of the associated target described qualitatively.

For each indicator the UN target, typology based on the language used in the UN target and the proposed target are provided in Table 3. The baseline period used is the first period 2011-2013.

Table 3 SDG Targets

Goal ID	Indicator	Measurement Unit	Target proposed	Language used with UN target	Associated UN target
1.1	People at risk of poverty or social exclusion	%	Reduce number of Europeans living below national poverty lines by 25% (following: Europe 2020) baseline period= period A 2011-2013	Reduce at least by half	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.2	People in work at-risk-of-poverty	%	Reduce at least by half	Reduce at least by half	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3	Lack of adequate heating	%	All (following: UN)	Ensure equal access	By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
1.4	Overcrowded living conditions	%	Reduce by half baseline period= period A 2011-2013	Reduce at least by half	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
2.1	Insufficient food	%	Zero (following: UN)	End hunger	By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round

Goal ID	Indicator	Measurement Unit	Target proposed	Language used with UN target	Associated UN target
2.2	Change to organic farming	Growth rate	Zero change	Ensure	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
2.3	Organic farming	%	25% of European agricultural land under organic farming by 2030	Ensure	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
3.1	Life expectancy at birth	%	UN predictions for Europe (ESPON 32 countries average)	Ensure	Ensure healthy lives and promote well-being for all at all ages
3.2	General good health status	%	Best performer(s)	Ensure	Ensure healthy lives and promote well-being for all at all ages
3.3	Death rate due to tuberculosis, HIV and hepatitis	Rate	Zero (following UN)	End	End the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases
3.4	Unmet need for medical examination and care	%	Zero (following: UN)	Universal	Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all
4.1	Early leavers from education and training	%	10% (following: Europe 2020)	Ensure - all	Ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes
4.2	Tertiary educational attainment	%	At least 40% having completed tertiary education (following: Europe 2020)	Substantially increase	Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex
4.3	Employment rates of young people not in education and training	Rate	At least 75% employment rate (following: Europe 2020 represents the wider EU employment target)	Substantially increase	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
4.4	Participation rates of young people in education	Rate	Completion (100%) (following: UN)	Ensure	Ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes
5.1	Female students enrolled in tertiary education	%	50% (following: UN)	Ensure equal access/substantially increase	By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university

Goal ID	Indicator	Measurement Unit	Target proposed	Language used with UN target	Associated UN target
5.2	Employment rates of young females not in education and training	%	At least 75% employment rate (following: Europe 2020)	Substantially reduce/ increase	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
5.3	Female early leavers from education and training	%	Less than 10% (following: Europe 2020)	Ensure - all	Ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes
6.1	Drinking water quality	%	All (following: UN)	Universal	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.2	Lack of toilet in dwelling	%	All (following: UN)	Universal	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3	Sewage treatment	%	All (following: EU Urban Wastewater Treatment Directive)	Universal	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
7.1	Household energy consumption per capita	Energy consumption (GWh) per capita	Best performer		Espon to inform if a better approach is recommended
7.2	Share of renewable energy in heating and cooling of buildings	%	Increase share of renewable energy in final energy consumption to 32% (following: 2030 climate & energy framework)	Increase substantially	By 2030, increase substantially the share of renewable energy in the global energy mix
7.3	Inability to keep home adequately warm	%	All (following: UN)	Ensure equal access	By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
8.1	Regional gross domestic product	%	Sustain ESPON 32 countries average	Sustain	Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 percentagegross domestic product growth per annum in the least developed countries
8.2	Employment	Rate	At least 75% employment rate (following: Europe 2020)	Full	By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
8.3	Long-term unemployment	%	At least 75% employment rate (following: Europe 2020)	Full	By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
8.4	People in work at-risk-of-poverty	Rate	Reduce at least by half	Reduce at least by half	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

Goal ID	Indicator	Measurement Unit	Target proposed	Language used with UN target	Associated UN target
9.1	Intramural R&D expenditure (GERD)	%	3% of GDP in R&D (Europe 2020)	Enhance	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
9.2	Total R&D personnel	%	Increase/best performer	Enhance	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
9.3	Public transport vehicles	Number per 1000 inhabitants	Best performer		Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
10.1	Disposable income of private households per inhabitant	PPS per inhabitant	60% of national median equivalised disposable income (ESPON 34 countries) (following EUROSTAT at-risk-of-poverty rate)	Reduce at least by half	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
10.2	Disposable income of private households relative to national average	PPS per inhabitant		No target applies	
10.3	People at risk of poverty or social exclusion	%	Reduce at least by half	Reduce at least by half	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
11.1	Overcrowded living conditions	%	All (following: UN)	Ensure equal access	By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
11.2	Settlement area per capita	Area per capita	Maintain zero % change relative to 2011-2013 level.	No target applies	
11.3	Victims killed in road accidents	Number of persons killed per million inhabitants	Use all ESPON 32 countries average reduced by half	Reduce by half	By 2020, halve the number of global deaths and injuries from road traffic accidents
11.4	Air pollution – pm 2.5	µg/m3	Reduce to current target of 25 µg/m3 (EU Air Quality Directive)	Reduce	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
12.1	Municipal waste	Waste measured by cubic metres per capita	Use all ESPON 32 countries average	Reduce by half	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

Goal ID	Indicator	Measurement Unit	Target proposed	Language used with UN target	Associated UN target
			reduced by half		
12.2	Energy consumption per capita	GWh	National average		By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
12.3	Uncollected sewage	%	zero (Urban Waste Water Treatment Directive)	Reduce	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
13.1	Air pollution - pm 10	µg/m3	pm10: Reduce number of days with level exceeding 50 µg/m3 to 35	Reduce	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
13.2	Air pollution - pm 2.5	µg/m3	pm2.5: Reduce to current target of 25 µg/m3	Reduce	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
13.3	Air pollution - ozone	µg/m3	ozone: Reduce number of days with level exceeding 120 µg/m3 to 25 (Air Quality Directive)	Reduce	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
13.4	Air pollution - NO2	µg/m3	Reduce to 40 µg/m3 (Air Quality Directive)	Reduce	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
14.1	Marine sites protection	%	Increase/best performer	Reduce, halt, protect	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
15.1	Forest area protection	%	Increase/best performer	Reduce	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
15.2	Land covered by artificial surfaces	Growth share	zero change with 2011-2013 period	Reduce, halt, protect	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
15.3	Nature area protection	%	increase/best performer	Reduce, halt, protect	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
16.1	Crime	%	EU average reduction by 2/3	Significantly reduce	Significantly reduce all forms of violence and related death rates everywhere
16.2	Trust in the legal system	%	Increase/best performer	Ensure	Ensure responsive, inclusive, participatory and representative decision-making at all levels
16.3	European Quality of Government	%	Increase/best performer	Ensure	Ensure responsive, inclusive, participatory and representative decision-making at all levels

Goal ID	Indicator	Measurement Unit	Target proposed	Language used with UN target	Associated UN target
16.4	Trust in the EU	%	Increase/best performer	Promote	Promote the rule of law at the national and international levels and ensure equal access to justice for all
16.5	Trust in the police	%	Increase/best performer	Promote	Promote the rule of law at the national and international levels and ensure equal access to justice for all
17.1	Online interaction with public authorities	%	Increase/best performer	Ensure	Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements
17.2	Innovative SMEs collaborating with others	Normalised scores	Increase/best performer	Enhance	Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism
17.3	Broadband at home	%	Increase/best performer	Significantly increase	9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020
17.4	Public-private co-publications	Share in total publications	Increase/ best performer	Enhance	Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism
17.5	International scientific co-publications	Share in total publications	Increase/best performer	Enhance	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

4.3 Calculations

4.3.1 Data imputation

Imputation is used to address the time series gaps. For the purpose of this project the single imputation method is proposed which is considered the most suitable method, due to its simplicity and efficiency.

Several typologies of data gaps have been identified. In order to impute the missing values in a data set for two periods 2011-2013 and 2014-2016 at NUTS2 level, we propose the following methods:

1. If the data for the chosen period is available only for one year, we will use only this year;

2. If the data for the chosen period is available only for two years with/without a one-year gap between two reported years, an interpolation of high quality can be assumed. We will replace missing values with the average of the two values adjacent and calculate the average for the chosen period;

3. If at least 50% of the indicator is observed at the NUTS2, then the indicator can be included in the SDG benchmarking tool. The NUTS1 or national values will be assigned to all the missing NUTS2 regions within the country. This approach means that the within-country variability of the Index at goal level is underestimated.

4. An alternative approach to the "50% rule", mentioned above, is the use of backward or forward values in case of missing data in either one of the periods. In the case of consecutive missing values, the carry forward method uses the next preceding non-missing value and the carry backward the next succeeding non-missing value. The main advantage of this method is the possibility to show the variability among different regions in time, however, at the same time it can introduce bias in the analysis and perform poorly when data has a visible trend. Missing values should not be apart further than one year. This approach has been discussed with EUROSTAT and received the final approval for the utilisation. It was recommended to clearly document any changes related to this approach in the metadata and distinguish visibly estimated data from data retrieved from EUROSTAT, flagging such data with an 'e' = estimated.

5. We also used the following approach proposed by Regional Innovation Scoreboard (2019)[6]: If regional data are available for the previous year, the ratio between the corresponding NUTS level and that at a higher aggregate level (NUTS 1 for NUTS 2 regions, country level for NUTS 1 regions) for the previous year is multiplied with the current value at the higher aggregate level. If regional data for the previous year are not available, the same procedure as in step 2 is applied using the ratio between the corresponding NUTS level and that at a higher aggregate level.

4.3.2 Data standardisation and recalibration to the SDGs targets

The indicators scoring is scaled 0 to 100, where 0 means worst performance, 100 best performance. The maximum scaled value (100) for each of 50 indicators is usually set based on a theoretical perfect performance (for example, the best possible school enrollment is 100% of students) or, where there is no such theoretical maximum, the best performance of any region in the last 10 years. To obtain a better understanding of the global SDG challenge we

6 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=2ahUKEwiRidH-t8fnAhWNzaQKHQhZC84QFjACegQIBBAB&url=https%3A%2F%2Fec.europa.eu%2Fdocsroom%2Fdocuments%2F35946%2Fattachments%2F1%2Ftranslations%2Fen%2Frenditions%2Fnative&usg=AOvVaw2LPlUJugI2ZHqSz_nSVvyh

recalibrated the maximum (100) scores to correspond with the SDG targets and produced an SDG progress score for each of the NUTS2 regions. The following formula has been used:

$x_{normalised} = (x-min(x))/(max(x) - min(x)) * 100$

Where:

x = original indicator value;
$x_{normalised}$ = normalized indicator value at a scale from 0-100;
min(x) = worst performing region over all years available;
max(x) = target value defined.

Following the aforementioned methodology, the composite indicators are constructed as a simple average of individual indicator scores adjusted to corresponding target settings. The composite indicator for a region is calculated only in case if all indicators within the goal are available.

5 Stakeholders involvement

5.1 Interviews for the tool's functionalities

To design a user centric tool, consultations with final users, i.e. representatives of regional and national governments were performed.

At regional level three interviews were performed complemented by information from four interviews undertaken with policy advisors in regional (provincial) governments in the Netherlands on their views concerning online dashboard tools.

Moreover, insights gained during the peer learning event of the Pilot Project "Measuring what matters to EU Citizens: Social Progress in European Regions" focusing on the comparability issue in indexes have also been taken into account.

The outcome of this consultation is presented in Table 4 in which functionalities are rated as follows:

1=must have	*2=nice to have*	*3=not so useful for my reporting, monitoring.*

Table 4 consultations with final users on the funcitionalities of the SDGs benchmarking tool

FUNCTIONALITIES	PT Centro	NL	EU SPI project	IE Eastern & Midland	ES Catalonia	SI (country)
Customisable and interactive maps by indicator	1	3	na	1	3	1
Display similar regions to showcase and compare your status based on criteria (population, income, geography …)	1	2	1	1	1	1
Choose the regions you want to be compared to	2	2	1	3	1	2

Compare your development over time on the SDGs with that of other regions	1	2	na	1	2	2
Display only regions within your country	3	3	1	2	2	1
Display distance to your targets	1	3	na	2	1	1
Insert your own national/regional/local target	na	3	na	1	2	3
Display a ranking of regions	2	3	1	2	2	2
'Generic' recommendations by goal	2	3	na	3	2	1
Downloading and printing of customised maps and charts	1	1	1	1	2	1
Downloading the data in order to produce own graphs.	1	1	1	1	1	1

At national level an interview with the Lithuanian Ministry of Environment has been conducted. Further consultations with national stakeholders were performed via participation to outreach events such as the European Week of Regions and Cities, the EU Social Progress Index project and the ESPON TNO Programme event with the Estonian and Lithuanian governments.

5.2 Pilots for the indicator framework and targets

The following three regions have acted as pilots: 1) Eastern and midland (IE), 2) Catalonia (ES) and 3) Eastern Slovenia (SI).

The pilot study has been conducted in two steps:

1) The stakeholders from regional authorities were asked to test the indicator framework. The objective was to validate the relevance at the regional level and the acceptance and credibility of the proposed indicator framework.

2) The pilot regions were requested to test, evaluate and informally report back on their experience and observations about the beta-version of the tool. Further adjustments of the tool were applied based on the regions' feedback.

An excel file with the indicator framework and corresponding targets was shared with the regions and written feedback within the excel has been inquired namely by stating the 1) relevance (low, medium, high) of the indicators, 2) indicator gaps and 3) suitability of the target.

In summary, the insights from the pilots can be summarised as follows:

- Between 40-60% of the indicator framework is assessed as being highly relevant and between 70-80% as medium/high level of relevance
- The relevance of indicators varies depending on the local characteristics of regions and also own interpretation of SDGs when designed internally
- Low relevance is mostly associated with indicators that do not fully capture the dimensions of the goal that are of high relevance (such as the inclusion of bathing sites with excellent water quality instead of more climate change indicators such as preparation against future droughts, water consumption per capita, etc.) to the regions.

It is also related to challenges cities have resolved to a good extent e.g. sewage treatment. Also the use of perception based indicators from the EU SILC survey is often considered to be a second best option

- Target setting could go beyond the suggested targets for individual regions. This is a combination of the level of advancement of a region and of political priorities
- For many of the indicators target setting is performed at national level

5.3 Testing of the tool

The tool has been tested in several instances by different stakeholders: 1) The ESPON TNO team together with the Lithuanian Ministry of Environment organised a training on the tool with ca. 70 participants; 2) Participants of the European Week of Regions and Cities attended a dedicated seminar led by ESPON EGTC; 3) A presentation was given for the regions represented in the EU SPI project. During the events feedback was provided on the indicator framework and the tool itself (functionalities, data visualisation, etc.). Most of the requests could be accounted for by enriching the tool's user guide.

6 SDG benchmarking tool

The SDG benchmarking tool homepage, benchmarking and library are briefly described and visualised in the subsequents sections. The user guide, guidance sheet, leaflet and administrator guide have been provided as separate documents. The tool is available here: https://sdg.espon.eu/.

6.1 Homepage

The design of the SDG benchmarking tool homepage is presented below. Two entries to the tool are provided:

1. 'Tool' button in the top, bottom right, left side menu and
2. 17 SDG buttons in the centre of the homepage with an option to choose directly a Goal of interest

Using the 'About' button the user may find a brief description about what the tool is and why to use followed by a link to download the report. The 'find out more' button downloads the guidance sheet. The 'Library' button is provided in the top and bottom right menu of the homepage directing the user to the library of regional initiatives and studies.

6.2 Benchmarking

The tool is split in two parts the map and the two charts (radar and box plot) which visualise distance to targets and progress. The map appears as soon as one selects an SDG and an indicator. The charts appear as soon as the user selects the benchmark group.

6.2.1 Benchmark groups

The following territorial typologies are available in the tool that allows the user to conduct a European wide SDGs benchmarking exercise:

- Population density
- Urban-rural
- Metropolitan regions
- Income
- Regions in the same country
- Regions with similar results

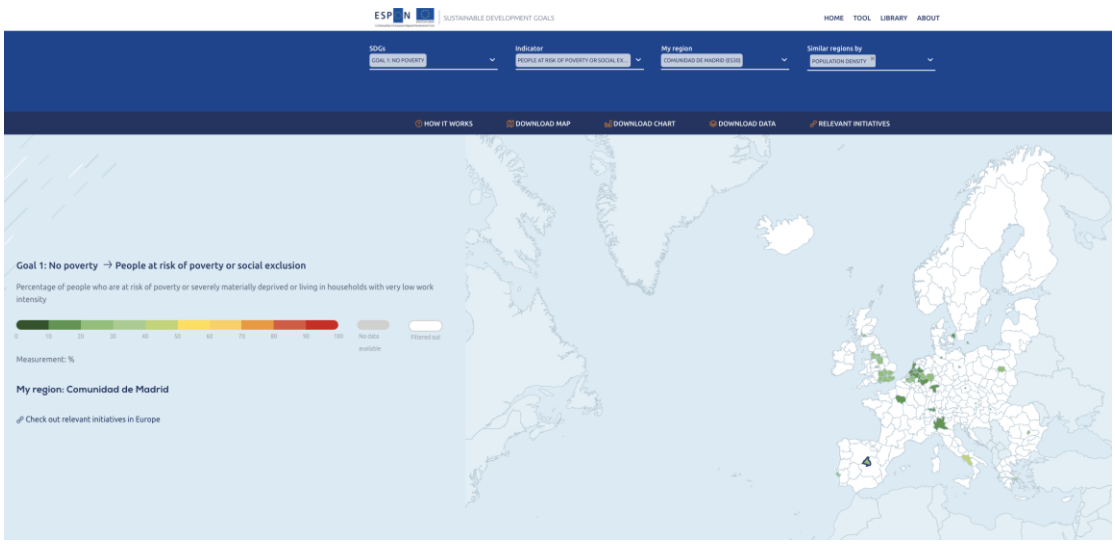
In the tool the user is able to make combinations of the above territorial typologies (for instance showcase regions withing the same grouping in terms of population density and income). The tool filters for similar regions for the combined typologies providing the corresponding regions only in the map, the radar plot and the progress tracker.

Table 5 Territorial typologies sources and method

Typology	Source	Method
1.Population density	EUROSTAT [TGS00024]	Metric: Persons per square kilometer Bands: 1. ≥ 3.4 to 56.9 2. ≥56.9 to 85.8 3. ≥85.8 to 126.1 4. ≥127 to 212.2 5. ≥213.2 to 410.6 6. ≥413.2 Level: Nuts2
2.Urban-Rural	EUROSTAT [urt_d3area] and own compilation for NUTS2 https://ec.europa.eu/eurostat/cache/metadata/en/reg_typ_esms.htm	1. predominantly urban region 2. intermediate region 3. predominantly rural region
3.Metropolitan regions	EUROSTAT and own compilation for NUTS2	1. metropolitan region 2. non-metropolitan
4. Income	EUROSTAT [reg_eco10]	1. less developed with less than 75% 2. regions in transition between 75% and 90% 3. developed regions with GDP per capita over 90% of the EU average
5.Regions in the same country		
6.Regions with similar results	Based on SDGs dataset	Quartiles based approach[7]

6.2.2 Map

The map visualises the selected indicator on a scale between 0 (worst case) and 100 (best case). The indicator selected is shortly explained. In addition, one has the possibility to select a specific region to focus on and which similar regions one want to use for benchmarking purposes. Only after selecting a specific region the two charts become available.

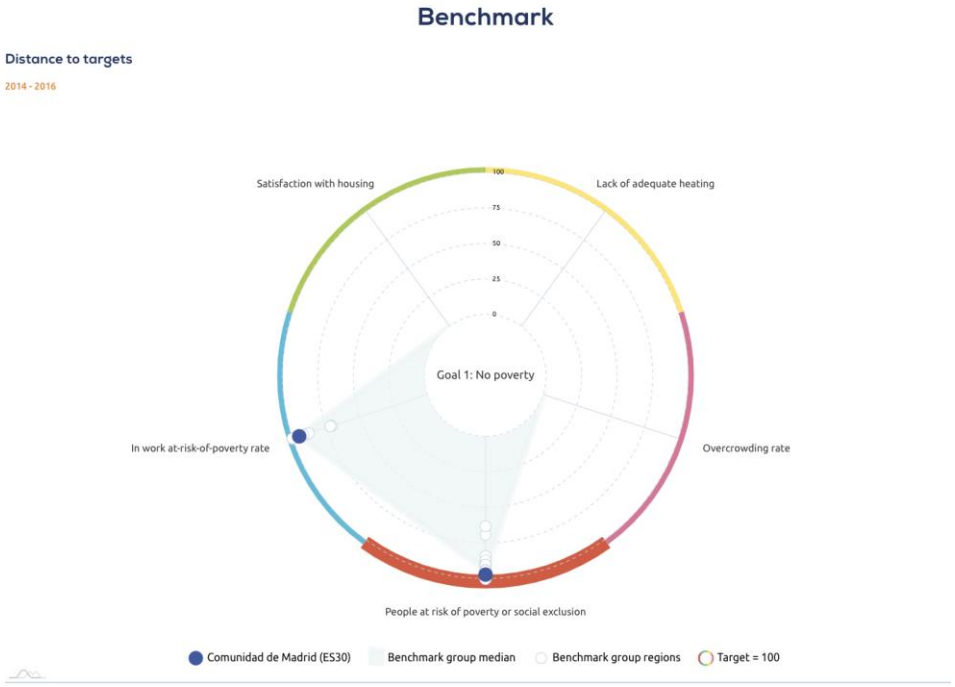


6.2.3 Distance to targets

After selecting 'my region' one can scroll down the map where the radar plot shows all the indicators of the goal selected. It simultaneously benchmarks the region's to the median of the group of similar regions (highlighted in light blue colour) and the distance to the targets (the

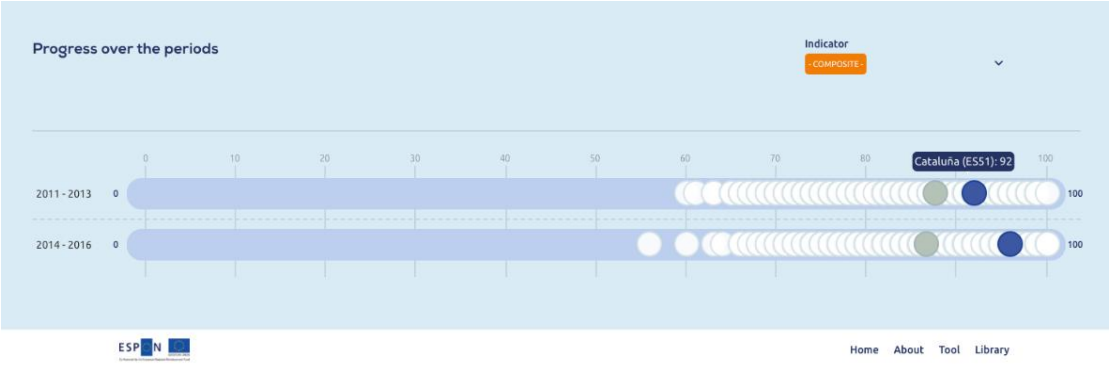
[7] Quartile is a statistical term which divides the data into quarters or four defined intervals. It basically divides the data points into a data set in 4 quarters on the number line.

outer coloured circle). The selected benchmark region is presented by a dark blue circle and is labeled as ‘My region’.



6.2.4 Progress

Further down, the box plot uses a filter to show indicator by indicator the growth by visualising the values in the different periods. The colour of the indicator corresponds to the colour of the indicator in the radar plot. The box plot displays ‘my region’, the median of the benchmark group and if another region is selected in the radar chart it also displays it with a different colour. In addition, there is the possibility to choose another indicator of interest by clicking on the coloured circle line of the radar chart and the result will be illustrated in the box plot with the identical colour of radar chart line.

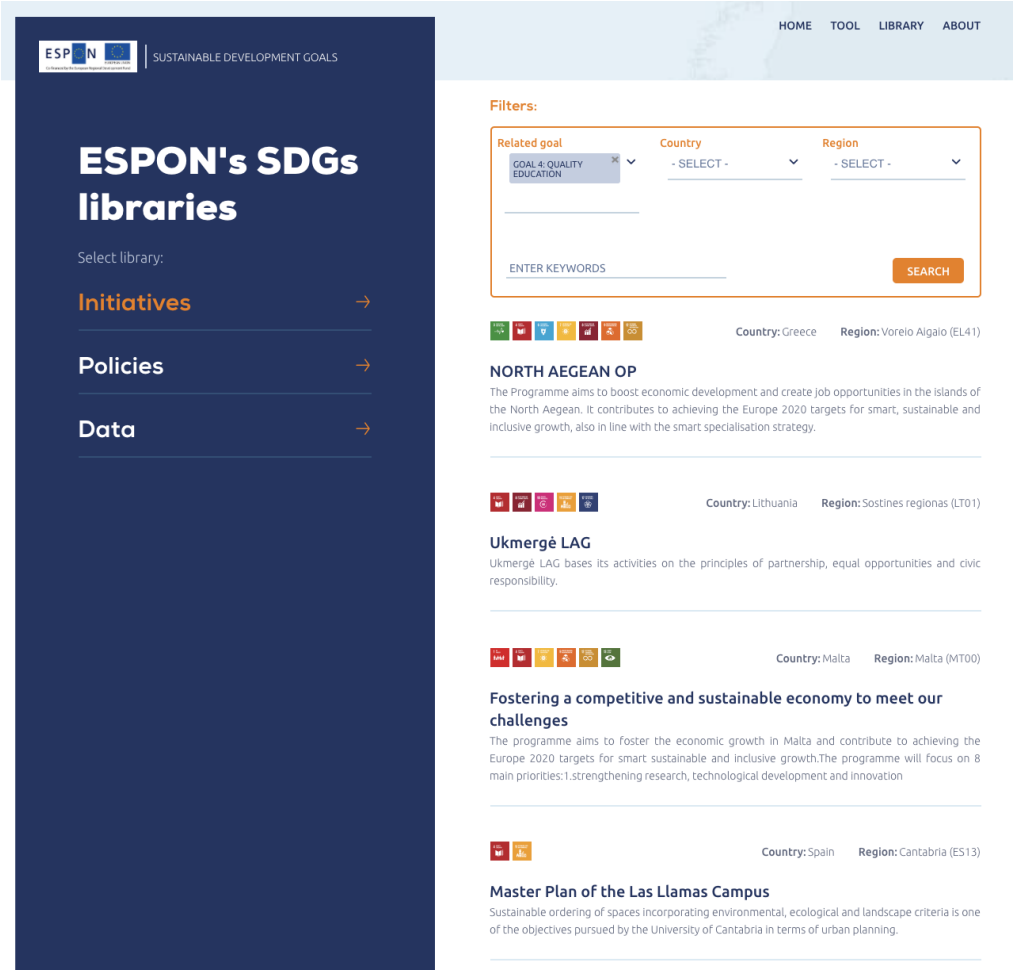


6.3 Library

Access to the library is provided through:

- Homepage: top right and bottom right corner taking the user to the library homepage with all SDGs

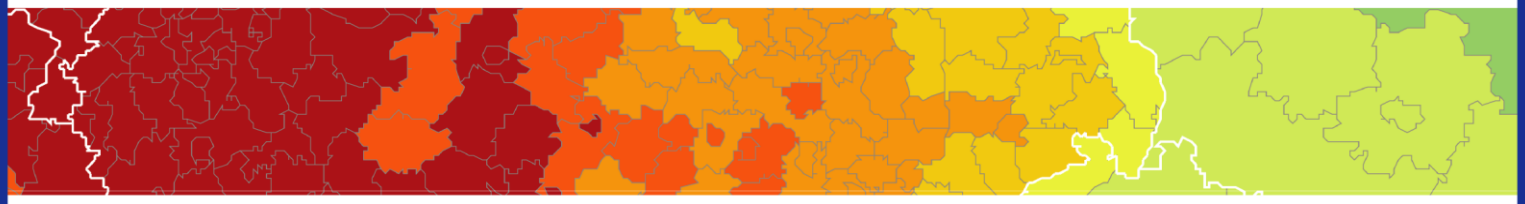
- In the tool: above the map a link is provided taking the user to all initiatives in the library that are relevant to the SDG selected



The library contains two types of documents:

- Initiatives of European countries or regions related to SDGs
- Policies including Studies on SDGs (namely those of EU institutions and of international organisations)

The content of the library and in particular that of the initiatives is tagged according to the 17 SDGs: Initiatives are tagged by all the relevant SDGs (hence one initiative may be tagged by more than one SDG).



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