Transnational common sustainability indicators for harmonising built environment assessment systems in relation to SDGs

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Abstract. Common Sustainability Development Goals (SDGs) have been set by the 2030 Agenda of United Nations in 2015. The European Commission committed to implement the SDGs and now Member States are preparing National Sustainable Development Strategies for contributing in the SDGs achievement. At a lower government level, regions and cities are also implementing their local strategies. Concerning the SDGs dealing with the built environment, how would it be possible to connect the global and local level strategies? To measure the progress towards SDGs and relative targets, a global framework of indicators has been set by UN. Many UN indicators have been adopted by the European Commission. The value of global indicators depends on the results achieved at local level, consequently quality and reliable local disaggregated data are necessary for the measurement of the progress towards the common goals. In the building sector, rating and assessment systems at building, urban and territorial scale can play a key role in this sense. The implementation and adoption of a core set of key performance indicators (KPIs), based on common metrics, in the existing and future assessment systems would allow to aggregate the information from the single building to the global level connecting the indicators trough the spatial scales. Common KPIs would also allow to compare the performance reached by buildings certified with different systems in relation to SDGs. The paper will illustrate the core sets of indicators elaborated and tested in 10 European countries by CESBA (Common European Sustainable Built Environment Assessment) in collaboration with iiSBE (international initiative for a Sustainable Built Environment) through two European Interreg projects at building, urban and territorial scale, in the form of a built environment Passport for the harmonization of assessment systems in relation to SDGs.

1. SDGs Indicators and Multi-Level Governance

The 2030 Agenda for Sustainable Development is a world-wide “plan of action for people, planet and prosperity” approved on 25 September 2015 by Heads of State and Government at a special UN summit. The Agenda contains 17 Sustainable Developments Goals (SDGs) and 169 targets adopted by all UN Member States. SDGs are global in nature and universally applicable. All countries share the responsibility to achieve the SDGs. The 2030 Agenda integrates all the three dimensions of sustainable development, economic, social and environmental, and it is based on the concept of global partnership.

To monitor and measure the progress towards the 17 SDGs and 169 targets, a set of global indicators has been developed. Each target is linked to one or more indicators. The global indicator framework was developed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) and agreed at the 47th session of the UN Statistical Commission held in March 2016. The global
framework contains 232 individual indicators. In reality, the total number of indicators listed in the global framework is 244, since nine indicators repeat under two or three different targets.

The European Union (EU) fully committed itself to implement the 2030 Agenda through its internal and external polices, as outlined in the reflection paper ‘Towards a Sustainable Europe by 2030’. In 2017, the European Commission issued a reference indicator framework to monitor the SDGs in the EU context, as requested by the Communication COM(2016) 739 final "Next steps for a sustainable European future". The EU SDG indicators set serves as the basis for Eurostat’s annual monitoring report on progress towards the SDGs in an EU context. Eurostat is the statistical office of the European Union and its mission is to provide high quality statistics for Europe. The EU SDG set is aligned as far as appropriate with the UN list of global indicators. The UN indicators were selected for global level reporting and are therefore not always relevant for the EU. The EU SDG indicator set is structured along the 17 SDGs and limited to 6 indicators per SDG.

The Agenda 2030 is under implementation in EU Member States through the National Sustainable Development Strategies. The National Strategies specify additional targets and relative indicators that are relevant at country level in addition to the ones of the 2030 Agenda. In the case of large countries, the National Strategy generates Regional Strategies. For instance, Italy (one of the largest EU Member States) delivered in 2017 a National Strategy for Sustainable Development, defining the national targets and relative indicators. The Italian Regions are now preparing Regional Strategies for Sustainable Development to contribute at the National Strategy and to specify additional regional targets and relative indicators.

National and Regional strategies usually contain a sub-set of the global and EU SDGs targets, the ones considered more meaningful for each context, plus a set of additional indicators. It is evident the need to maintain a coherence among the 2030 Agenda indicators and the ones adopted in the National and Regional Strategies to avoid confusion and uncertainty. The aggregation of results achieved locally allows to monitor and measure the achievement of global targets and SDGs.

SDGs ask for an integrated and coherent Multi-Level Governance approach. Strategies are implemented by administrations at different government levels that must coordinate themselves for connecting the different strategies. The importance to maintain a global - local integrated approach was underlined during the SDG summit in September 2019 when Heads of State and Government gathered at the United Nations Headquarters in New York to discuss about the progress in the
implementation of the 2030 Agenda. The event was the first summit on the SDGs since the adoption of the 2030 Agenda in 2015. The main result of the SDG Summit was the adoption of the Political Declaration “Gearing up for a decade of action and delivery for sustainable development”, calling for a decade of action to deliver the SDGs by 2030. The General Assembly endorsed the Political Declaration on 15 October 2019. The Political Declaration contains several commitments for delivering the SDGs by 2030. In particular, the commitment to:
- solve challenges through international cooperation and enhancing the global partnership. It is recognized that the integrated nature of the Sustainable Development Goals requires a global response and that it is necessary to find new ways of working together;
- bolster local action to accelerate SDGs implementation. Cities, local authorities and communities will be empowered and supported in pursuing the 2030 Agenda.

2. Indicators and the built environment
The achievement of SDGs depends from the progress reached in the different sectors (e.g. agriculture, industry, mobility, etc.). For measuring the progress in each sector, specific indicators must be defined in relation to the global ones. This is valid also for the built environment that relates to more than half of the 2030 Agenda SDGs:
- SDG 3: Good Health and Well-Being. The health of citizens and buildings’ occupants also depends on the quality of the built environment;
- SDG 6: Ensure availability and sustainable management of water and sanitation for all. The built environment contributes to a responsible and efficient use of water resources;
- SDG 7: Affordable and Clean Energy. Buildings, neighborhoods and cities are producers and consumers of energy;
- SDG 8: Decent Work and Economic Work. Building sustainable infrastructure can create new job opportunities;
- SDG 9: Industry, Innovation and Infrastructure. The improvement of the built environment boosts research and innovation;
- SDG 11 Sustainable Cities and Communities. The built environment constitutes a core element for sustainable communities and cities;
- SDG 12 Responsible consumption and production. A sustainable built environment promotes the circular principles;
- SDG 13 Climate action. A sustainable built environment generates lower emissions and can contribute to climate change adaptation;
- SDG 15: Life on Land. A sustainable built environment contributes in preserving biodiversity, reducing the land consumption.

Built environment sustainability indicators shall be developed for the all the spatial scales: building, neighborhood, city and territory. They can be integrated by public administrations at all government levels in policies and policy instruments related to sustainable built environment, as: building codes, urban and territorial plans, funding programs, green public procurement, etc. Only the availability of an integrated multi-scale framework of indicators can make possible an integrated multi-level policy approach addressing the whole spatial continuum of the built environment.

In table 1, it is showed an example of built environment indicators at different spatial scales connected to the global indicator 7.2.1 “Renewable energy share in the total final energy consumption” of target 7.2 “By 2030, increase substantially the share of renewable energy in the global energy mix”.

Table 1.

| SDG | 7. Ensure access to affordable, reliable, sustainable and modern energy for all |
| Global Target | 7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix |
| Global Indicator | 7.2.1 Renewable energy share in the total final energy consumption (%) |

| Built Environment Indicators connected to Indicator 7.2.1 |
| Building | Share of renewable energy in final thermal energy consumptions (%) |
| | Share of renewable energy in final electric energy consumption (%) |
| Neighbourhood | Share of renewable energy on final thermal energy consumption for building operations in the neighbourhood (%) |
| | Share of renewable energy on final electric energy consumptions for building operations in the neighbourhood (%) |
| City | Share of renewable energy on final electric energy consumptions for outdoor lighting (%) |
| Territory | Degree of renewable energy consumed (%) |

The value of global level indicators (e.g. 7.2.1) depends on the results achieved at lower level (country, region), consequently quality, reliable and aggregable local values are necessary for measuring the progress towards the global SDGs. To connect the global and the local level, a transnational framework of core indicators for the built environment has to be established. For each target relevant for the built environment, one or more sectorial indicators have to be connected with the global indicator (as showed in table 1). The indicators for the built environment must then be adopted the policies, policy instruments and strategies at national and regional level.

The use of transnational common indicators for the built environment would facilitate the cooperation among countries and regions and avoid uncertainty and confusion. Common indicators, calculated with the same metric, would allow to compare the results achieved in the different countries and regions and to aggregate / combine them for measuring the progress towards the EU SDGs and the Global SDGs. If different metrics would be used in each country this opportunity would be lost.

The inclusion in National and Regional Sustainable Development strategies of a transnational core set of common indicators would allow to move from the global to the local level and vice-versa (Figure 2). In this way, the global and the local levels result connected and a multi-level governance approach possible. Measuring the impact of local actions and policies using the transnational indicators makes possible the aggregation of results and the measurement of the global progress towards SDGs. At regional level, additional built environment indicators could be added to the global ones in relation to the targets indicated in the National and Regional Sustainable Development strategies.
3. Harmonization of building assessment systems in relation to SDGs

A key role in measuring the progress’ of the built environment towards SDGs can be played by the rating and certification systems at the different spatial scales (e.g. BREEAM, LEED, HQE, Protocollo ITACA, etc.). Actually, the matter is that the existing assessment systems produce results not comparable. They have different methodologies, physical and time boundaries, indicators and metrics, number of criteria, scoring systems, etc. To be functional as tools for measuring the progress of the built environment towards 2030 Agenda targets, the sustainability assessment systems need to be harmonised.

The harmonization of building assessment systems can’t consist in their convergence in a unique common system. For two reasons. The first is to respect the “contextualization” principle. Building practices, environmental, social and economic priorities are different in each region and the assessment system must reflect them. The second is that the assessment systems are owned and managed by different public or private organizations. It would be impossible to have all of them converging in one system.

To address this issue, the European initiative CESBA (Common European Sustainable Built Environment Assessment) has been launched in 2011 by public and private organisations from more than 15 European countries. In collaboration with iiSBE (international initiative for a Sustainable Built Environment), CESBA elaborated the idea of the Passport for the built environment. The CESBA harmonisation strategy is based on the development of a transnational framework of common core indicators (Key Performance Indicators - KPIs) at different spatial scales relevant for all countries and regions. For each KPI, a common metric (calculation / assessment procedure) is defined to maximise the comparability of the performances reached by buildings, neighbourhoods, cities and territories in different regions and countries. The integration (plug-in) of CESBA KPIs in the existing and future assessment systems would guarantee the possibility to compare the results concerning the global sustainability issues.
The indicators included in the CESBA framework at the different spatial scales have been selected because connected with the targets of UN SDGs and EU SDGs. The targets represent the transnational issues that have be taken in account in any country and region. If the core set of KPIs is integrated in the existing assessment systems, these ones would act as tools for monitoring the achievement of SDGs at local level and at global level.

The use of common metrics allows to aggregate the assessment results to produce a global picture. Sharing an indicator among the assessment systems and the relative unit of measure isn’t enough for comparing the results. It is also necessary to share the scope and calculation method to obtain comparable and aggregable values. For instance, it is not enough to share an indicator for buildings such as “emissions of CO2 eq. per m2 of useful area” if its value is calculated adopting divergent scopes (e.g. including or not the emissions due to indoor lighting) or calculation algorithms. Common metric means that the characterization of an indicator is carried out exactly in the same way in all assessment systems to obtain comparable values that is possible to aggregate and compare. The progress towards the global SDGs depends on actions that are implemented locally, following the famous principle of “think globally, act locally”. The possibility to aggregate the results reached locally is fundamental to verify the results achieved at global level. To aggregate the results, it is necessary to use the same metrics in the different regions and countries. If different metrics are used, the aggregation wouldn’t be possible, and the measurement of the global progress would be impossible.

The frameworks of CESBA KPIs have been elaborated through two European projects that ended in 2019: CESBA MED – Sustainable Cities and CESBA Alps – Sustainable Territories. Public and private stakeholders from 15 European countries were directly involved through a participatory process. The intent was to elaborate global indicators adopting a bottom-up approach. Several international organisations were consulted, as UN Environment and DG Environment. For each KPI, a common metric for calculating its value has been defined. The common metric specifies the scope of the indicator, the unit of measure and the calculation process. A set of SDGs related indicators has been produced for the building, neighbourhood and territorial scale. Table 2 and 3 shows the indicators developed for the building and neighbourhood scale. The description of the common metrics is available in specific project’s deliverables.
Table 2.  

**Building scale indicators**

| Indicator                                                                 | SDG  |
|---------------------------------------------------------------------------|------|
| TVOC concentration in indoor air                                          | 3    |
| Ventilation rate normalized per useful floor area                         | 3    |
| Thermal comfort index (PPD)                                               | 3    |
| Potable water consumption per occupant per year                           | 6    |
| Water annual cost per usable floor area                                   | 6    |
| Primary energy demand per internal useful floor area per year             | 7    |
| Delivered thermal energy demand per internal useful floor area per year   | 7    |
| Delivered electric energy demand per internal useful floor area per year  | 7    |
| Share of renewable energy in final thermal energy consumptions            | 7    |
| Share of renewable energy in final electric energy consumption            | 7    |
| Embodied non-renewable primary energy                                     | 7    |
| Energy annual cost per usable floor area                                  | 7    |
| Ratio of the number of collectable solid waste categories within a convenient distance from the building’s entrance | 11   |
| Weight of recycled materials on total weight of materials                 | 12   |
| Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed | 12   |
| CO2 equivalent emissions per internal useful floor area per year          | 13   |

Table 3.  

**Neighbourhood scale indicators**

| Indicator                                                                 | SDG  |
|---------------------------------------------------------------------------|------|
| Annual potable water consumption per inhabitant                           | 6    |
| Annual water consumption per m2                                            | 6    |
| Aggregated annual operating energy cost per aggregated indoor useful floor area | 7    |
| Aggregated annual total final thermal energy consumption per aggregated indoor useful floor area | 7    |
| Aggregated annual total final electric energy consumption per aggregated indoor useful floor area | 7    |
| Aggregated annual total primary energy consumption per aggregated indoor useful floor area | 7    |
| Annual total thermal energy consumption from on-site renewable energy sources / annual total final thermal energy consumption | 7    |
| Share of renewable electric energy in final electric energy consumptions  | 7    |
| Area of permeable surfaces on total neighbourhood area                     | 11   |
| Number of days exceeding the daily limits in a year (PM 10)               | 11   |
| Percentage of inhabitants that are within 400 meters walking distance of at least one public transportation service stop | 11   |
| Total walkway meters of dedicated pedestrian paths and meters of bicycle path and “shared space” per 100 inhabitants. | 11   |
| Percentage of inhabitants that are within 800 meters walking distance of at least 3 key services | 11   |
| Level of involvement of citizens in urban planning                        | 11   |
| CO2 equivalent emissions per useful internal floor area per year           | 13   |
| Area of undeveloped land with ecological or agricultural value / area of the neighbourhood | 15   |

To facilitate the communication of KPIs values, it has been elaborated a transnational reporting document, the CESBA Passport. A template of Passport has been developed and tested for buildings, neighbourhoods and territories. The Passport contains a description of the building/neighbourhood/city/territory assessed, context related information (e.g. climatic conditions, demography, etc.), pictures, plans, maps, the list of KPIs and relative values.
4. Next Steps

At building scale, the same CESBA approach for the harmonization of building assessment systems was proposed in the EC COMM (214) 445 on resource efficiency opportunities in the building sector. From the Communication 445 started the process to define an EU common framework of core sustainability indicators for office and residential buildings, named Level(s). CESBA and iiSBE are actively contributing in the development, test and implementation of Level(s) providing the knowledge related to the CESBA KPIs at building scale. Level(s) will be issued in 2020 and the CESBA Passport will be updated to include the final set of indicators.

Concerning the neighbourhood scale, the CESBA KPIs and the Passport have been presented to UN Environment as tool to promote the adoption of SDGs by cities. A collaboration was started with UN Environment/MAP. CESBA KPIs have been used to upgrade the application form of the 2019 UN Istanbul Environment Friendly City Award. The CESBA KPIs are now in use in the SBE Urban Challenge 2020 process managed by iiSBE to be further consolidated in a world level generic framework (SNTool) that will be tested in neighbourhoods from about 15 countries in Europe, America and Asia. A dialog has been started by iiSBE and CESBA with several transnational networks of cities (MedCities, EuroCities, Energy Cities, Districts 2030) for using the CESBA KPIs as common metrics for monitoring the progress of the member cities. Several regions, with the support of CESBA and iiSBE, are now studying how to integrate the CESBA KPIs at urban and territorial level in their strategies for sustainable development and adaptation to climate change.

In the next period CESBA and iiSBE, in cooperation with transnational organisations, universities and public authorities, will follow the process for establishing a global framework of built environment indicators to support the movement towards the SDGs for the built environment. The process is open to all the interested experts and organisations and based on a co-creation approach.

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