Interreg
CENTRAL EUROPE

Co-funded by
the European Union

MESTRI-CE

D.2.1.3 Assessment of integration of Level(s) indicators to analysed building frameworks

Version 2

03/2024

Contents

A. Introduction

The central Europe region faces a very uneven energy transition due to unbalanced economic development, distribution of technology and finance flows. Buildings, both public and private, account for 43% of the final energy consumption in EU and have been singled out in the European Green Deal as key drivers of energy transition. Nevertheless, CE countries are confronted with low building renovation rates, lack of internal capacities of the building stock managers, difficulties in gathering data on the building performance. Policies towards climate neutrality are already in place in several CE countries, but national/regional building schemes and regulations are not always efficiently translated into concrete projects. The ambitious EU energy and climate targets require therefore appropriate and effective methodologies to support the building sector towards climate neutrality.

One of the main objectives of the MESTRI-CE project is the definition of a working methodology that will enable, also by developing specific supporting tools, the dissemination and successful application of the new European framework on energy efficiency and sustainability in buildings in the partner countries. The MESTRI-CE Sustainable Building Methodology will enhance the design of new buildings and the renovation of existing ones based on sustainability and climate-neutrality criteria harmonised at CE level. Harmonisation and upgrade of the actual building standards and of the methodologies applied to assess and report on the energy and sustainability performance of buildings are the focus of WP2 activities.

Deliverable D.2.1.3 present a third step in achieving the overall WP2 goals. The purpose of deliverable is to evaluate the integration of Level(s) indicators into the national building frameworks of six European countries (Austria, Croatia, Germany, Italy, Poland, Slovenia). This involves preparing a draft structure for the MESTRI-CE Sustainable Building Methodology, assessing the alignment of the Level(s) framework with existing national standards and reporting instruments, identifying possibilities and risks associated with its integration, and evaluating indicators with a focus on those utilizing Life Cycle Assessment (LCA) methodology. Overall, this deliverable aims to provide insights into the feasibility and implications of integrating the Level(s) framework into national building frameworks, contributing to the development of a comprehensive sustainability assessment methodology.

The information gathered in this deliverable will allow us to identify, for each of the partner countries, the current building regulatory framework and which of the building assessment schemes in use, whether compulsory or voluntary, should be updated or strengthened to be in line with the actual and upcoming European framework on energy efficiency and sustainability in buildings.

The MESTRI CE Sustainable Building Methodology will act as support to the existing building standards and guidelines by integrating them with Level (s) and other European building regulations and initiatives (e.g. EU taxonomy, EPBD recast, GPP, New European Bauhaus). The Level(s) initiative, providing a common framework in Europe for sustainability indicators for buildings, both in terms of metrics to be used to analyse the building`s performance and of methodology to describe it unambiguously, will be the main reference to achieve the WP2 project´s objectives.

B. Report summary

The aim of this deliverable 2.1.3 is to collect and illustrate the first results of the work carried out in the first project period on WP2. Desk research involving all partner countries has explored the current strategic and regulatory frameworks for energy efficiency and sustainability of buildings and the standards, guidelines and certification schemes in use in Central Europe.

For each of the six CE countries represented in the MESTRI-CE project (Austria, Croatia, Germany, Italy, Poland and Slovenia) an overview has been provided by the partners regarding:

- national or regional strategies, plans and policy framework for energy efficiency and climate with a special focus on buildings
- regulatory framework and mandatory or voluntary standards and certification schemes applied at national and regional level in the field of energy efficiency and sustainability of buildings

Each project partner has also identified the schemes, standards, guidelines for the energy efficient and sustainable construction or renovation of buildings that are relevant for the respective geographical context and area of competence. The standards, guidelines or certification schemes for energy efficiency and sustainability in buildings selected for a first analysis are:

- the klimaaktiv building certification scheme for Austria
- the national mandatory standard for the energy performance certification of buildings (EPC) and the Green Deal Design Project Guidelines for Croatia
- the Passivhaus, the BNB and the DGNB building certification schemes for Germany
- the national mandatory standard for the energy performance certification of buildings (EPC), the Minimum Environmental Requirements for public buildings, the CasaClima R and the CasaClima Nature building certification schemes for Italy
- the national mandatory standard for the energy performance certification of buildings (EPC) and the Green Building Standard for Poland
- the Slovenian indicators of sustainable construction based on the Level(s) framework for Slovenia

For each analysed scheme, a table highlights its scope, the type of buildings to which it can be applied and for which type of interventions, its compulsory or voluntary application, its impact in terms of assessed/certified projects as well as other general information on the governance, the update frequency and the possibility for project partners to further develop and adapt the scheme. A second table collects basic information on the evaluation/certification process and the stakeholders involved.

The criteria/indicators used in the selected schemes to assess the sustainability performance of buildings have been analysed both in relation to the dimensions of sustainability and the thematic areas covered. In the first case the analysis shows that the environmental dimension is still the prevailing one in terms of number of indicators in use in nearly all the schemes, followed by the social dimension. More than half of the schemes, however, uses criteria/indicators that also investigate the economic dimension to assess the sustainable performance of a building.

With respect to the thematic areas addressed, this first analysis highlights significant differences between the selected schemes, with the national mandatory standards, the Passivhaus and the CasaClima R schemes focusing on few thematic areas (energy efficiency, emissions and IEQ) while the BNB and the DGNB schemes, the Green Deal Design Project Guidelines, the Slovenian Indicators of sustainable construction and the Italian Minimum Environmental Criteria use indicators covering a large amount of the thematic areas that contribute to the sustainable performance of buildings.

MESTRI-CE's goal within D.2.1.3 is to evaluate the framework and national standard and framework for 6 European countries (Austria, Croatia, German, Italy, Poland, Slovenia) in order to assess the integration of Level(s) indicators to national building frameworks.

The overall goals of the D.2.1.3 are to:

- prepare a draft structure of MESTRI-CE Sustainable Building Methodology;
- evaluate how well the Level(s) framework is aligned with already existing national standards and reporting instruments;
- identify possibilities and risks with the Level(s) framework;
- evaluate the indicators, and specially focusing on indicators using LCA methodology.

The integration of Level(s) indicators within national building standards and frameworks plays a crucial role in promoting sustainable building practices and achieving regional sustainability objectives. This report assesses the degree of integration of Level(s) indicators within the national standards and frameworks of the MESTRI-CE countries and identifies opportunities and risks associated with the Level(s) framework.

The assessment involved analyzing two key aspects: the dimensions of sustainability covered in national standards and frameworks, and the covered indicators for the design stage based on these frameworks. Data were collected from official documents, regulations, and reports from the MESTRI-CE countries.

From the aspect of dimensions of covered sustainability, the analysis revealed varying degrees of coverage of sustainability dimensions within national standards and frameworks across the MESTRI-CE countries. Countries such as Austria, Italy, and Slovenia demonstrate comprehensive coverage of environmental, social, and economic dimensions, aligning well with the objectives of the Level(s) framework. In contrast, some countries exhibit gaps in coverage, particularly in areas such as social and economic sustainability.

The assessment of covered indicators for the design stage highlighted the presence of Level(s) indicators within national standards and frameworks. Level 1 indicators, representing common assessment criteria, are prevalent across multiple countries, indicating efforts to establish standardized methodologies for sustainability assessment. However, the integration of Level 2 indicators, enabling comparative analysis and benchmarking, is less common, with notable variations among countries.

1. Level(s) framework

1.1. The framework

Level(s) is a voluntary reporting framework based on existing standards, with the primarily aim to describe and potentially improve the sustainability performance of buildings.

The goal outline that Level(s) shall provide a common EU approach to the assessment of sustainability performance in the built environment. The sustainably performance covered by Levels(s) compose of environmental performance — which is the focus — together with health and comfort, life cycle cost and potential future risks related to the building. This common EU approach enable actions to be taken at building level that can make a clear contribution to broader European environmental policy objectives. Level(s) framework contains of:

- **Macro-objectives**: An overarching set of six macro-objectives for the Level(s) framework that contribute to EU and Member State policy objectives in areas such as energy, material use and waste, water and indoor air quality.
- **Core Indicators**: A set of 9 common indicators for measuring the performance of buildings which contribute to achieving each macro-objective.
- **Life cycle tools**: A set of 4 scenario tools and 1 data collection tool, together with a simplified Life Cycle Assessment (LCA) methodology, that are designed to support a more holistic analysis of the performance of buildings based on whole life cycle thinking.
- **Value and risk rating**: A checklist and rating system provides information on the reliability of performance assessments made using the Level(s) framework (Dodd, N. et al. 2017).

The users of the Level(s) framework will be able to work with data and calculation methods at three defined levels as defined below depending on the purpose of the reporting (summed up text from different part reported found in Dodd et al 2017a):

- **Level 1 The common assessment**: The common performance assessment is intended to provide a common reference point for the performance assessment of buildings across Europe. Common units of measurement and basic, reference calculation methodologies are provided. These can be used directly by professionals but are also intended to be readily adoptable by building assessment schemes, investor reporting tools and the public sector.
- **Level 2 The comparative performance assessment**: This level is for professionals that wish to make meaningful comparisons between functionally equivalent buildings. The framework lays down rules to support the comparability of results at national level or building portfolio level. This can include the need to fix certain key parameters and the input data used for calculations. This second level requires provision of a reference measurement and reporting method, which could ultimately enable comparison, benchmarking and target setting.

- **Level 3 The optimised performance assessment**: This is the most advanced use of each indicator. The framework provides guidance to support professionals that wish to work at a more detailed level to model and improve performance. This detailed calculation includes more object specific data, in order to achieve greater representativeness and precision from calculations, and thereby close the gap between design and actual performance.

The Level(s) framework is therefore designed so that each indicator for an individual building and its impact can be summarized to describe the priorities for sustainability at macro-level for a country or ultimate at the European Union level. The quantitative assessment of the environmental impacts of a building using Life Cycle Assessment (LCA) is recognised at EU level as the best method to achieve this.

1.2. Core indicators

The reporting format includes core indicators and common metrics for measuring the performance of buildings along their life cycle.

The basic reference unit to be used throughout the Level(s) framework is one square metre (m2) of useful internal floor area. To more accurately measure the resource intensity of an office building may besides this core reference units also 'per area of workspace occupied by each full-time person equivalent' be used. The reference study period to be used for all buildings assessed according to the Level(s) framework is set to 60 years.

This focuses the Level(s) user on a manageable number of essential concepts and indicators at building level that contribute to achieving EU and Member State environmental policy goals. These six macro-objectives and their related performance indicators1 are listed below. Depending on what level you aim to report, different indicators are used.

1: Greenhouse gas emissions along a building's life cycle

1.1.1 Primary energy demand, kWh/m2yr

1.1.2 Delivered energy demand, kWh/m2yr

1.2 Life cycle Global Warming Potential (GWP100 GHG), kg CO2e/m2yr

2: Resource efficient and circular material life cycles

2 2.1 Life cycle tools: Building bill of Materials (BoM), 99% of built-in construction reported in kg per Eurostat four material category

2.2 Life cycle tools: scenarios for building lifespan, adaptability and deconstruction as given below,

2.2.1 Scenario 1: Building and elemental service life planning3 2.2.2 Scenario 2: Design for adaptability and refurbishment3 2.2.3 Scenario 3: Design for deconstruction, reuse and recyclability3

2.3 Construction and demolition waste, kg/m2 useful floor area reported for the construction, demolition and end-of-life stage separately 2.4 Cradle to grave Life Cycle Assessment, 7 LCIA core indicators

3: Efficient use of water resources 3.1 Total water consumption, m3 of water per occupant per year

4: Healthy and comfortable spaces

4.1.1: Good quality indoor air, parameters for ventilation [rate of air change], CO2 concentration [ppm] and relative humidity [%]

4.1.2: Target air pollutants, emissions from construction products and external air intake.

4.2 Time outside of thermal comfort range, %

4.3.1 Light and visual comfort, aspect suggested for future inclusion)

4.3.2 Acoustic and protection against noise, aspect suggested for future inclusion)

5: Adaptation and resilience to climate change Scenarios for projected future climatic conditions: Protection of occupier health and thermal comfort, Simulation of the building's projected time out of thermal comfort range for the years 2030 and 2050.

6: Optimised life cycle cost and value rating of reported results 6.1 Life cycle costs, €/m2yr 6.2 Valuation influence and reliability rating of reported results, a checklist approached, or reliability ratings evaluation of selected aspects related to the reported performance.

Two life cycle approached tools are used as support to assess some of these performance indicators. The life cycle approached tools used are:

- Life Cycle Assessment (LCA), with calculation methods defined is defined in the standards ISO 14040/44, EN 15804 and EN 15978.
- Life Cycle Cost Assessment (LCCA), with calculation methods is defined in the standards EN 16627 and ISO 15686-5.

The setting of the LCA system boundaries shall follow the “modularity principle” according to the EN 15978 and Level(s) is therefore designed to make use of Environmental Product Declarations (EPD) for any resource used for a construction works as defined in the core product category rules for construction products EN15804:2012+A2:2013.

LCA can be potentially used as tool to assess the following indicators;

1.1.1 Primary energy demand,

1.1.2 Life cycle Global Warming Potential (GWP100 GHG),

2.1 Life cycle tools: Building bill of Materials,

2.2.3 Scenario

3: Design for deconstruction, reuse and recyclability,

2.3 Construction and demolition waste,

2.4 Cradle to grave Life Cycle Assessment.

1.3. Understanding LCA

1.3.1. Full control of source data is basic for high quality LCA

In order to fully exploit the sustainability aspect of a building, the calculation of Life Cycle Assessment (LCA) is practically “a must” have. LCA is a methodology used to assess the environmental impacts associated with all stages of a product's life cycle, from raw material extraction through production, use, and disposal. It takes into account various factors such as resource consumption, energy use, emissions, and waste generation to provide a comprehensive understanding of a product's environmental footprint. This analysis helps in identifying opportunities for reducing environmental impacts and improving the overall sustainability of products, processes, and systems. LCA is widely used in various industries, including manufacturing, construction, agriculture, and energy, to support decision-making and promote sustainable practices.

The accuracy of an LCA calculation hinges on the quality of the source data utilized. Fundamentally, in LCA, controlling the reference flow—essentially, all resources utilized throughout the life cycle of assessed construction projects—is imperative. Digitalization plays a crucial role in ensuring comprehensive data coverage and accurately mapping these resources, alongside describing their environmental impact through LCA data. Currently, the most reliable input for such LCA calculations for new buildings is the data gathered for cost calculation, which typically encompasses between 5000 to 15,000 items defining the bill of resources (BoR) for the construction phases (A1-A5). These cost calculations are conducted using specialized software or other BIM applications.

In the European Commission (EC) context, digitalization is recognized as a vital component of the overarching roadmap for enhancing sustainability in the construction sector. In 2012, the Commission published a Communication Strategy for the sustainable competitiveness of the construction sector and its enterprises as part of the Europe 2020 initiative. This strategy focuses on creating favorable market conditions for sustainable growth in the construction sector. It addresses five key areas:

1. Financing and digitalisation: especially for energy efficient investments in the renovation of buildings and for research and innovation in a smart, sustainable, and inclusive environment
2. Skills and qualifications: workforce and management training for job creation through up-skilling and apprenticeships to meet demands for new competencies
3. Resource efficiency: focusing on low emission construction, recycling and valorisation of construction, and demolition waste
4. Regulatory framework: emphasis on reducing the administrative burden for enterprises, and particularly SME
5. International competition: encouraging the uptake of Eurocodes and promoting the spread of new financial tools and contractual arrangements in non-EU countries.

While Level(s) aligns with or contributes to the objectives of most of these strategies, it notably lacks emphasis on digitalization (listed as No. 1 in the aforementioned list). The documentation only briefly touches upon digitalization and automation of EPD and LCA tasks, as well as their implementation in construction sector processes and tools like Building Information Modeling (BIM). When BIM is referenced, it is not portrayed as a promising approach; rather, it is stated that the calculation of a building's environmental profile based on BIM is easier but lacks control over results and the ability to identify any anomalies.

Contrary to this assertion, our experience indicates the opposite: manually calculating an LCA for a building is excessively time-consuming and yields poor-quality results due to numerous simplifications made during the process. These simplifications lead to LCA results that are unsuitable for use in public procurements or for comparative purposes. The inherent limitation lies in the inability to conduct a complete calculation without a digital process, rendering the results incomparable.

Comparatively, the required cut-off for an EPD for construction products, as outlined in EN 15804, only allows for a maximum 5% data gap, which is rarely encountered in practice due to the utilization of proxy data when data gaps exist. This same cut-off rule applies to LCAs for any construction works, as specified in EN 15978. Therefore, it is imperative to recognize the critical role of digitalization in ensuring the accuracy and reliability of LCA results, aligning with the stringent standards set forth in EN regulations.

The most promising digital approach currently available for generating comprehensive LCAs for construction projects involves leveraging the results from existing cost calculation tools utilized by companies. These tools produce a bill of resources (BoR) encompassing elements, construction products, intermediate products like ready-made concrete, energy usage, various construction services required for the construction and installation process, as well as waste generated at the construction site. This approach serves as the preferred data source for digitally calculated LCAs. Skanska has been conducting such digital LCA calculations since 2007, as documented by Erlandsson et al. (2007) and Heikkilä and Erlandsson (2011). This method is also recommended as the first generation of digitalized LCAs for construction works by the Swedish research program Smart Built Environment (Erlandson, 2017).

In Level(s), the bill of materials (BoM) is mentioned as a potential output from a CAD application. However, this list is limited, covering only the materials involved in the final construction works. As a result, it lacks completeness and applicability for a thorough LCA calculation, as it does not account for waste, construction services, energy usage processes, etc. An alternative is to utilize a bill of objects (or elements) from the CAD application. Nevertheless, a drawback of this approach is that the inherent content of elements or the recipe (i.e., resources used for the construction and installation process, including construction products) is not always integrated into the element properties (or a BIM object). However, there are now several initiatives emerging where CAD and cost calculation tools are integrated as open BIM tools, such as VICO11, suggesting promising developments in this area.

LCC is related to the macro-objective 6 indicators: Note that the same source data from for instance a construction cost calculation tool and its bill of resources could potentially be used as source data as needed for the LCA calculations as well as the initial data for the LCC. Such combined bill of resources that can be used for both LCA and LCC is not pointed out in the Levels(s) report but in practice this can be used to streamline the indicator approach in level calculated with LCA and LCC.

1.3.2. General agreed settings supporting high quality LCA in a market context

The current problem with LCA in general for construction works including buildings is that the most ambitious LCA will include more parts of a building and more parts of the life cycle, and therefor also result in a higher environmental impact compared to a less ambitious LCA. In a market competition situation when the LCA and its scope is not considered, this means in practice that the one that provides a full LCA will be punished if the scope and data quality of the calculations are not considered.

A drawback with the Level(s) methodology settings are the flexibility allowed without limits, which is expressed as follows (Dodd et al 2017, p 8, first bullet in Table 1.1) “It provides flexibility in the level of detail at which sustainability aspects can be addressed in the design process”. For internal use of results, simplified LCA with flexible rules is acceptable and can be enough in order to make improvements within the limited scope covered For beginners and when the LCA is used internally without external comparisons it is fine not to require a full LCA and that the LCA use commonly established settings for the scenarios (A4, A5, stage B and C and module D). However, as comparative information for market and communication purpose including public procurement, it is required to use the same methodology and common rules for scenarios settings, in order to achieve a fair comparison of different construction works.

Level(s) users will be able to work with data and calculation methods at three defined levels of expertise and comprehensiveness – a common level (Level 1), a comparative level (Level 2) and a performance-optimised level (Level 3) – with each in turn requiring an increased level of competence and expertise in data handling and competent analysis.

The stepwise first “level” is when the use of LCA on buildings will be applicable for knowledge learning on how an LCA can be made and what results it generate. Such approach is typically used in the internal learning process and used for hot spot identification within the analysed system and its scope. In this case is the significant requirement that all LCA data used must be founded on the same methodology. Besides this the rules and specification need for this kind of LCA is very limited, but the scope of the inventory will limit what conclusions that can be drawn.

The second level for use of LCA is to make improvements. Most efficient it is often to start with the hot spot identified, such as the materials in the building frame. The aim of this second level is to compare our own building before and after changes performed or evaluated. This use of LCA is in fact what the most common way to implement it in building classification schemes like BREEAM and LEED (and the Swedish system Miljöbyggnad). Since the improvement is made within the boundary settings made by the organisation responsible for the LCA and not used to compare with others, the boundary settings and scenario specifications etc can be very flexible. You can make improvements compared to yourself. This is how LCA is most useful for Skanska at present time.

To be able to do this kind of improvement including product comparisons, representative data for commercially available construction products are needed. This is handled in practice by use of product specific EPD meaning the data is ideally representative for a specific product from a manufacturer and the actual site where it is manufactured. In order to assess the EPD to meet this representativeness, the EPD must be complemented with quality (Q) metadata (see e.g. Erlandsson 2018).

The most sophisticated use of LCA is for comparison and comparative assertion. When a comparison of different designs that fulfils the same requirements (as expressed in the brief) are asked for, is it crucial that the LCA is complete, with a quality that allows comparison based on common rules for scenario settings etc. These kind of specifications is not part of the scope of Level(s) but it is needed if the goal is to add up the LCA result from individual buildings to macro level that is mentioned in the application example of the Level(s) system. The state of development on the market is to achieve such rules and boundary settings, but we are only in the beginning of this development.

1.3.3. Setting the scope defines what the LCA can be used for

Setting the scope of Level(s) delineates its utility in assessing the performance of construction products. According to Regulation (EU) No 305/2011, a "level" is the outcome of evaluating a product's performance concerning its essential characteristics, typically expressed numerically. While the market may perceive the level approach as a classification system akin to the EC labeling system (A to F), Level(s) aims not to establish new certification schemes or benchmarks but to summarize indicators for individual buildings to describe sustainability performance at a macro-level.

Level(s) is structured to integrate life cycle environmental impacts of buildings, primarily focusing on describing and enhancing their sustainability performance. The scope includes a building, its foundations, and all external works within the building site area. However, the boundary setting may limit comparisons by focusing only on specific parts of the building, omitting elements such as foundation substructure, earthworks, and supplementary constructions.

The system accounts for both new construction and major renovations. However, it may overlook minor renovations, maintenance, and replacements in the existing building stock, constituting a significant data gap. While Swedish LCA calculations suggest substantial impact percentages, Level(s)' voluntary nature diminishes incentives for market adoption.

The system's design and boundary setting constrain its use for other purposes, such as creating a classification system or facilitating comparative environmental performance assessments. Instead, we propose emphasizing Level(s) as a common European method for building declaration, incorporating sustainable indicators and supported by EC and CEN standards (EN15804 and EN 15978). The absence of a European building declaration system contributes to trade barriers due to varying national requirements and complicates market access for contractors. Additionally, national building classification schemes impede cross-border trade for contractors.

2. Critical Assessment: Integration Levels of Level(s) Indicators in Analyzed Building Frameworks

The "Assessment of Integration of Level(s) Indicators into Analyzed Building Frameworks" report presents findings from an evaluation of the Level(s) framework and national building standards in six European countries: Austria, Croatia, Germany, Italy, Poland, and Slovenia. The primary objective was to assess the **degree of integration** of Level(s) indicators within national building standards & frameworks and to identify opportunities and risks associated with the Level(s) framework.

The assessment utilized a comprehensive approach, combining desk research and expert consultations. Data on national building frameworks, including regulations, standards, and reporting instruments, were collected and analysed. Criteria for evaluation included alignment with the Level(s) framework, identification of opportunities and risks, and assessment of indicators, with a particular focus on those using Life Cycle Assessment (LCA) methodology.

Sustainability dimensions and thematic areas

A comprehensive overview of the sustainability dimensions and thematic areas covered within the national standards and frameworks of the MESTRI-CE countries is presented in Table 1. It reveals notable trends and variations in the extent to which different dimensions of sustainability are prioritized across these countries.

Environmental sustainability emerges as a common priority across all countries, with indicators addressing key aspects such as energy efficiency, emissions reduction, sustainable materials usage, waste management, and considerations for health and comfort within buildings. This alignment underscores a shared recognition of the importance of mitigating environmental impacts and promoting resource efficiency in building design and construction practices.

Furthermore, the inclusion of thematic areas related to adaptation and resilience to climate change highlights a growing acknowledgment of the need to address climate-related risks and vulnerabilities within the built environment. Countries like Germany, Italy, and Slovenia demonstrate a particularly strong emphasis on climate resilience, reflecting their proactive approach to integrating climate adaptation measures into their national standards and frameworks.

However, while there is a robust focus on environmental sustainability, variations exist in the coverage of social and economic dimensions across the MESTRI-CE countries. Austria, Croatia, Italy, and Slovenia exhibit a more comprehensive approach by incorporating indicators that address social equity, economic viability, and community well-being within their national standards and frameworks. This suggests a broader understanding of sustainability that encompasses not only environmental considerations but also social and economic aspects of development.

Moreover, the differences in coverage of thematic areas such as water management highlight potential gaps in sustainability planning and implementation. With only Croatia, Italy and Slovenia explicitly addressing water sustainability within their national standards, there is an opportunity for other countries to strengthen their focus on water conservation and management practices in building projects.

Additionally, the inclusion of thematic areas such as life cycle costing, management strategies, transportation considerations, site planning, accessibility, and adaptability underscores the interconnectedness of sustainability principles across various stages of the building lifecycle. Countries like Austria, Italy, and Slovenia demonstrate leadership in adopting a holistic approach that integrates a broader range of sustainability considerations into their national standards and frameworks.

While the MESTRI-CE countries exhibit a strong commitment to environmental sustainability in building practices, there are opportunities to enhance the integration of social, economic, and water-related dimensions within national standards and frameworks. By adopting a more comprehensive approach that addresses a broader range of thematic areas, these countries can further advance sustainability goals and promote resilient, inclusive, and resource-efficient built environments.

Degree of integration of Level(s) indicators in(to) national standards and frameworks

The table provides insights into the integration of Level(s) indicators within the national standards and frameworks of the MESTRI-CE countries, indicating whether specific indicators are already established or aligned within their respective frameworks. The Level(s) framework categorizes assessment levels into Level 1, Level 2, and Level 3, each representing different degrees of sophistication and detail in performance assessment methodologies.

Across the MESTRI-CE countries, Level 1 indicators represent the common assessment level, focusing on establishing standardized units of measurement and calculation methodologies. The presence of Level 1 assessments for indicators such as Use Stage Energy Performance, Life Cycle Global Warming Potential, and Bill of Quantities, Materials, and Lifespan suggests a collective effort to establish a common baseline for sustainability assessment within national frameworks.

At Level 2, denoting the comparative performance assessment level, countries aim to enable meaningful comparisons between buildings by establishing rules for result comparability. While Level 2 assessments are less common, Italy's assessment of Use Stage Energy Performance at Level 2 signals a commitment to facilitating more nuanced comparisons, potentially supporting benchmarking and target setting initiatives within the country.

Notably, the absence of Level(s) framework assessments for certain indicators in some countries, as indicated by "none" entries in the table, raises considerations. For instance Germany, and Poland lack Level(s) framework assessments for various indicators, indicating potential gaps in alignment with European-wide sustainability assessment practices or a lack of available data for assessment.

The table highlights the varying degrees of integration of Level(s) indicators within the national standards and frameworks of the MESTRI-CE countries. While Level 1 indicators are more prevalent, indicating a common baseline for sustainability assessment, Level 2 assessments represent a progression toward enabling comparative analysis and benchmarking. Moving forward, enhancing alignment with the Level(s) framework and addressing gaps in indicator coverage could further promote sustainability goals and facilitate cross-border collaboration in sustainable building practices within the MESTRI-CE region.

Table 1: Overview of the sustainability dimensions and thematic areas covered within the national standards and frameworks of the MESTRI-CE countries

Indicators and Tools for Design stage	MESTRI-CE countries					
	Austria	**Croatia**	**Germany**	**Italy**	**Poland**	**Slovenia**
Dimension of sustainability covered in the scope of national standards and framework						
Environmental	yes	yes	yes	yes	yes	yes
Social	yes			yes		yes
Economic	yes	yes	yes	yes		yes
Thematic area of sustainability covered in the scope of national standards and framework						
Energy	yes	yes	yes	yes		yes
Emissions	yes			yes		yes
Materials	yes	yes	yes	yes		yes
Waste	yes	yes		yes		yes
Water				yes		yes
Health and comfort (IEQ)	yes	yes		yes		yes
Adaptation and resilience to climate change	yes	yes	yes	yes		yes
Life Cycle Costing	yes	yes		yes		yes
Management	yes			yes		yes
Transport	yes			yes		yes
Site	yes			yes		yes
Accessibility		yes				yes
Adaptability	yes	yes		yes		yes
Biodiversity		yes		yes		yes

Table 2: The integration of Level(s) indicators within the national standards and frameworks of the MESTRI-CE countries

Covered indicators for Design stage based on national standards and framework	MESTRI-CE countries					
	Austria	Croatia	Germany	Italy	Poland	Slovenia
Indicator 1.1 Use stage energy performance: - 1.1.1 Primary energy demand - 1.1.2 Delivered energy demand	Level 1	Level 1	Level 1	Level 2	Level 1	Level 1
Indicator 1.2: Life cycle Global Warming Potential	Level 1	none	none	Level 1	none	Level 1
Indicator 2.1: Bill of quantities, materials and lifespan	Level 1	none	none	Level 1	none	Level 1
Indicator 2.2: Construction & demolition waste and materials	Level 1	Level 1	none	Level 1	none	Level 1
Indicator 2.3: Design for adaptability and refurbishment	Level 1	Level 1	none	Level 1	none	Level 1
Indicator 2.4: Design for deconstruction, reuse and recyclability	Level 1	Level 1	none	none	none	Level 1
Indicator 3.1: Use stage water consumption	none	Level 1	none	none	none	Level 1
Indicator 4.1 Indoor air quality - 4.1.1: Good quality indoor air conditions - 4.1.2: Target air pollutants	Level 1	Level 1	none	Level 1	none	Level 1
Indicator 4.2: Time outside of thermal comfort range	Level 1	none	none	Level 1	none	Level 1
Indicator 4.3: Lighting and visual comfort	Level 1	Level 1	none	Level 1	none	Level 1
Indicator 4.4: Acoustics and protection againts noise	none	Level 1	none	Level 1	none	Level 1
Indicator 5.1: Protection of occupier health and thermal comfort	Level 1	Level 1	none	Level 1	none	Level 1
Indicator 5.2: Increased risk of extreme weather events	none	Level 1	none	none	none	Level 1
Indicator 5.3: Increased risk of floof events	none	Level 1	none	none	none	Level 1
Indicator 6.1: Life cycle costs	Level 1	Level 1	none	Level 1	none	Level 1
Indicator 6.2: Value creation and risk factors	Level 1	Level 1	none	Level 1	none	Level 1

3. Draft structure of MESTRI-CE Sustainable Building Methodology

MESTRI-CE Sustainability Building Methodology (SBM) will address certain priority areas that will be supported by the indicators. The priority/core opportunities defining sustainability aspect in the scope of MESTRI-CE Sustainability Methodology can be e.g. energy, carbon, materials and water. For each of the four priority opportunities predetermined "stepping stones" across the Green zone define where each project is mapped on the Color Palette, scaling from Vanilla to Deep Green.

From Vanilla to Deep Green:

- **Vanilla = Compliance**. The building renovation process and product performance follow applicable laws, codes and standards.
- **Green = Beyond Compliance**. The construction process and/or product performance is beyond compliance, but not yet at a point where it can be considered to have a near-zero environmental impact.
- **Deep Green = Future Proof**. The building renovation process and our product performance have a near-zero impact on the environment and thereby future proofs our projects.

Figure 1: Draft structure of MESTRI-CE Sustainable Building Methodology.

The SBM addresses core areas. Based on chosen indicators in the upcoming activities in WP2, the project(s) will be given certain level of compliance. The draft concept assumes that overarching goal for a building is to be „net zero" – energy, waste, carbon, etc.

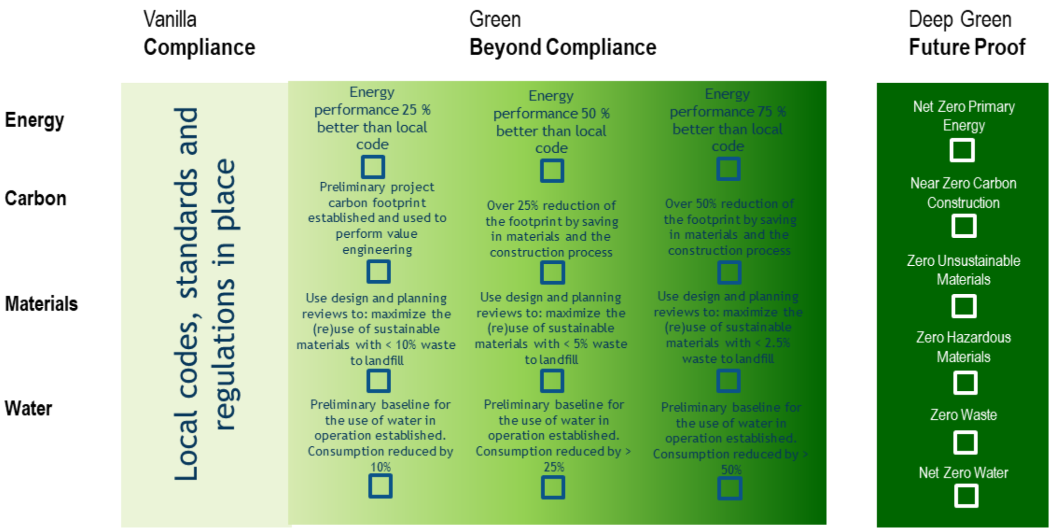

Figure 2: Draft structure of MESTRI-CE Sustainable Building Methodology supported by the indicators.

Each of the identified and chosen core areas will be supported by the Level(s) and possible other sustainability indicators. The overall goal of this deliverable D.2.1.3 is to identify to which level partner countries are already actively or passively calculation certain indicators. Furthermore, it will give a clearer picture where are the biggest gaps.

Based on the results from the previous section, MESTRI-CE SBM will probably be structured differently for different countries. What is clear is that sustainability assessment requires from the partners to choose several core areas that tackle not only environmental aspect, but also other ones, e.g. social, financial.

C. Conclusion

The pursuit of climate neutrality by 2050, as set by the EU, necessitates the decarbonization of the building stock across partner countries and regions. Ambitious timelines, such as Austria and South Tyrol aiming for decarbonization by 2040 and Germany by 2045, underscore the urgency of this endeavor. To this end, robust strategies and plans have been formulated at both national and regional levels, focusing on the construction of high-efficiency buildings and the energy renovation of existing structures. These efforts are complemented by various initiatives aimed at supporting the energy transition in the building sector.

Slovenia, Poland, Croatia, and Italy have demonstrated significant commitment to promoting energy efficiency and sustainability in their respective building sectors. In Slovenia, comprehensive measures outlined in the National Energy Efficiency Action Plan aim to increase the energy performance of buildings and reduce greenhouse gas emissions, aligning with the country's goal of achieving climate neutrality by 2050. Poland's Sustainable Development Strategy emphasizes green building practices and incentivizes energy retrofitting projects and renewable energy integration in buildings. Similarly, Croatia and Italy have enacted policies and initiatives to enhance energy efficiency, reduce environmental impact, and drive the adoption of sustainable building practices through financial incentives, energy labeling schemes, and awareness campaigns.

Collectively, the efforts of Austria, South Tyrol, Germany, Slovenia, Poland, Croatia, and Italy reflect a shared commitment to advancing sustainable building practices and contributing to EU climate neutrality objectives. Through strategic planning, policy implementation, and targeted initiatives, these countries are making significant strides towards decarbonizing their building stock, fostering a more resilient and environmentally friendly built environment across Europe.

The purpose of deliverable D.2.1.3 within MESTRI-CE is to assess the integration of Level(s) indicators into the national building frameworks of six European countries (Austria, Croatia, Germany, Italy, Poland, Slovenia). **This evaluation aims to prepare a draft structure of the MESTRI-CE Sustainable Building Methodology while examining the alignment of the Level(s) framework with existing national standards and reporting instruments**. Additionally, the deliverable seeks to identify potential opportunities and risks associated with the Level(s) framework and evaluate specific indicators, with a focus on those utilizing Life Cycle Assessment (LCA) methodology. Through these objectives, D.2.1.3 contributes to advancing sustainable building practices and fostering alignment with EU sustainability goals across the MESTRI-CE partner countries.

The integration of Level(s) indicators within national building standards and frameworks plays a crucial role in promoting sustainable building practices and achieving regional sustainability objectives. This report assesses the degree of integration of Level(s) indicators within the national standards and frameworks of the MESTRI-CE countries and identifies opportunities and risks associated with the Level(s) framework.

The assessment involved analysing two key aspects: the dimensions of sustainability covered in national standards and frameworks, and the covered indicators for the design stage based on these frameworks. Data were collected from official documents, regulations, and reports from the MESTRI-CE countries.

Based on the analysis, detailing the dimensions of sustainability covered in national standards and frameworks, as well as the covered indicators for the design stage within those frameworks, several conclusions can be drawn regarding the integration of Level(s) indicators and associated opportunities and risks:

1. **Degree of Integration of Level(s) Indicators:**

- The results indicate varying degrees of integration of Level(s) indicators within the national building standards and frameworks of the MESTRI-CE countries.
- Countries such as Austria, Croatia, Italy, and Slovenia demonstrate a more comprehensive coverage of sustainability dimensions and indicators, including those aligned with Level(s) framework requirements. This suggests a higher degree of integration of Level(s) indicators within their national standards.
- Conversely, Germany and Poland show fewer Level(s) indicators integrated into their frameworks, indicating potential gaps in alignment with European-wide sustainability assessment practices.

2. **Identified Opportunities:**

- The presence of Level(s) indicators within national standards and frameworks presents opportunities for harmonization and convergence towards a common approach to sustainability assessment.
- Countries with more advanced frameworks, such as Austria, Italy, and Slovenia, may leverage the integration of Level(s) indicators to drive sustainability agendas, influence building regulations, and promote best practices in sustainable building design and construction.
- Opportunities for knowledge exchange and collaboration exist, with countries able to share insights and experiences to enhance sustainability assessment methodologies and foster mutual learning within the MESTRI-CE region.

3. **Identified Risks:**

- Discrepancies in the integration of Level(s) indicators among MESTRI-CE countries may pose risks to the effectiveness and consistency of sustainability assessments across the region.
- Countries with limited integration of Level(s) indicators may face challenges in meeting EU sustainability goals and directives, potentially hindering progress towards achieving broader sustainability objectives.
- Risks associated with incomplete alignment with Level(s) framework requirements include reduced comparability of results, inefficiencies in sustainability assessments, and missed opportunities for cross-border collaboration and knowledge exchange.

In conclusion, while the integration of Level(s) indicators within national building standards and frameworks represents a positive step towards advancing sustainability goals, there is a need for continued efforts to enhance alignment, address gaps, and mitigate associated risks. By leveraging opportunities for collaboration and knowledge sharing, MESTRI-CE countries can work towards a more cohesive and effective approach to sustainability assessment, ultimately contributing to the creation of more resilient, resource-efficient, and sustainable built environments across the region.

Additional insights to complement the analysis can be summed up as next topics:

- **Alignment with Level(s) Framework**: The presence of Level(s) indicators within the national standards and frameworks indicates a degree of alignment with European-wide sustainability assessment practices. Countries with a higher number of Level(s) indicators integrated into their frameworks may demonstrate stronger alignment with EU sustainability goals and initiatives.
- **Implications for Policy and Practice**: The extent to which Level(s) indicators are incorporated into national standards and frameworks can have significant implications for policy development and implementation. Countries with comprehensive coverage of Level(s) indicators may be better positioned to drive sustainability agendas, influence building regulations, and promote best practices in sustainable building design and construction.
- **Opportunities for Knowledge Exchange**: Discrepancies in the integration of Level(s) indicators among MESTRI-CE countries present opportunities for knowledge exchange and collaboration. Countries with more advanced frameworks can share insights and experiences with those seeking to enhance their sustainability assessment methodologies, fostering mutual learning and capacity building within the region.
- **Challenges in Implementation**: The absence of Level(s) framework assessments for certain indicators in some countries may highlight challenges in implementation, such as limited resources, technical capacity, or institutional support. Addressing these challenges will be crucial for ensuring consistent and effective implementation of sustainability assessment practices across the MESTRI-CE countries.
- **Potential for Harmonization**: As countries continue to refine their national standards and frameworks, there is potential for harmonization and convergence towards a common approach to sustainability assessment. Harmonization efforts can streamline processes, enhance cross-border comparability of results, and facilitate the exchange of best practices, ultimately contributing to more efficient and effective sustainability assessments across the MESTRI-CE region.
- **Monitoring and Evaluation**: Regular monitoring and evaluation of the integration of Level(s) indicators within national frameworks will be essential for tracking progress towards sustainability goals and identifying areas for improvement. Establishing robust monitoring mechanisms can help countries assess the effectiveness of their sustainability initiatives, make informed policy decisions, and drive continuous improvement in sustainability performance.

By considering these additional insights, stakeholders can gain a deeper understanding of the implications of the integration of Level(s) indicators within national standards and frameworks and identify opportunities for advancing sustainable building practices within the MESTRI-CE region.

List of literature

Deliverable D1.2.1. Requirements for the creation of the MESTRI-CE Smart Data Hub

Deliverable D2.1.1. Report on current building standards and framework for energy efficiency and sustainability in CE

Deliverable D2.1.2. Comparative analysis of current building standards and framework for energy efficiency (EE) and sustainability in Central Europe (CE)

https://environment.ec.europa.eu/topics/circular-economy/levels_en