BIO-BASED AND CIRCULAR BUILDINGS FOR HEALTHY, CLEAN CITIES

A Handbook to help cities reduce embodied carbon in construction

Healthy, Clean Cities
EU CINCO - **EU**ropean **CI**ties for climate-**N**eutral **CO**nstruction

July 2022

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Cover image:

The inspiration behind the cover page is 'Las Carolinas' building by Entrepatios co-designed by Satt architecture, the first eco-social housing cooperative with right of use in Madrid, built in Madrid in 2020. The HCC EU CINCO project collaborated with Entrepatios in several ways: as local experts on timber construction, as agents of connection with the territory's culture and networks, and to consolidate and build a community around bio-based materials and circular solutions. For Entrepatios, "The most important architectural part of the project is to build community."

https://www.entrepatios.org/las-carolinas/
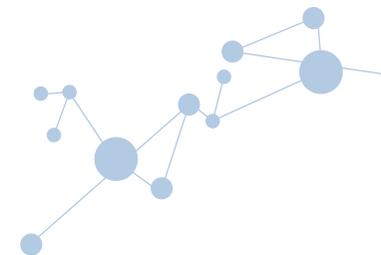
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The Healthy, Clean Cities: EUropean CIties for climate-Neutral COnstruction (EU CINCO) Handbook

Why this Handbook?

The aim of this Handbook is to share the lessons learned from the Healthy, Clean Cities: **EU**ropean **CI**ties for climate-**N**eutral **CO**nstruction (EU CINCO) (2021-2022) project, led by EIT Climate-KIC and funded by Laudes Foundation. Thirteen partners from several European countries worked on the project, which focused on bio-based, circular, and carbon-neutral construction in Madrid and Milan.

While the project aimed to position cities as market shapers, an interdisciplinary approach engaged multiple stakeholders across the entire construction value chain. In Madrid, we worked with private developer Distrito Castellana Norte (DCN) on the major regeneration site Madrid Nuevo Norte (MNN), as well as with Arup, Universidad Politécnica de Madrid through the Innovation and Technology for Development Centre (itdUPM), and Ayuntamiento de Madrid. In Milan, we carried out joint activities with real estate fund management Company and developer Redo Sgr, focussing on the C40 Reinventing Cities site L'Innesto, the city's first Carbon Neutral Area, and collaborated with Politecnico di Milano, Comune di Milano, and AMAT (Agenzia Mobilità e Territorio).

This Handbook provides a summary of the activities undertaken with these cities over the past two years. It aims to help stakeholders and decisionmakers in other cities take action to reduce embodied carbon in buildings.

Globally, buildings account for 39 per cent of carbon emissions, with the share of embodied carbon (arising from manufacturing, transportation, installation, maintenance, and disposal of building materials) becoming more dominant as energy efficiency increases and energy sources become less carbon intensive. Therefore, dramatically reducing this source of emissions in the construction sector is a priority.

Most construction takes place in urban areas, so cities have a key role to play. Using circular practices and bio-based materials (such as timber) are two key strategies to dramatically lower embodied carbon in construction, while offering the potential to secure multiple co-benefits for cities and regions. Examples of co-benefits deriving from circular construction (repurposing/reusing, repairing, recovering, recycling, and remanufacturing buildings and components), include de-risking material supply and minimising pollution connected with the extraction of raw materials. The use of timber creates less dust, noise and machinery emissions compared to concrete, leading to faster and less disruptive construc-

tion, quieter cities with lower air pollution, and healthier indoor environments. Both strategies increase the opportunity for new economic activities, including quality, future-orientated jobs.

These strategies have been proven in lighthouse and pioneer projects but are still far from becoming standard practice. For the shift to bio-based and circular buildings to be possible, the entire construction value chain must be restructured. The portfolio of activities presented in this Handbook is our response to this complex challenge.

The Handbook contains resources and step-by-step processes to help you align your local stakeholders' efforts around three interconnected objectives: :

- Reduce carbon emissions related to the raw material production, manufacturing, transportation, construction, use, and end-of-life of construction elements.

- Explore the potential for greater circularity in the built environment, repurposing buildings and minimising the use of raw materials through recovering, reusing, remanufacturing, and recycling of components.

- Make use of urban projects (new construction and retrofit, buildings, infrastructure, and public space) to influence changes in the supply chain, increase the use of bio-based and more sustainable materials (such as wood), reduce pollution, sequester carbon, and maximize other co-benefits.
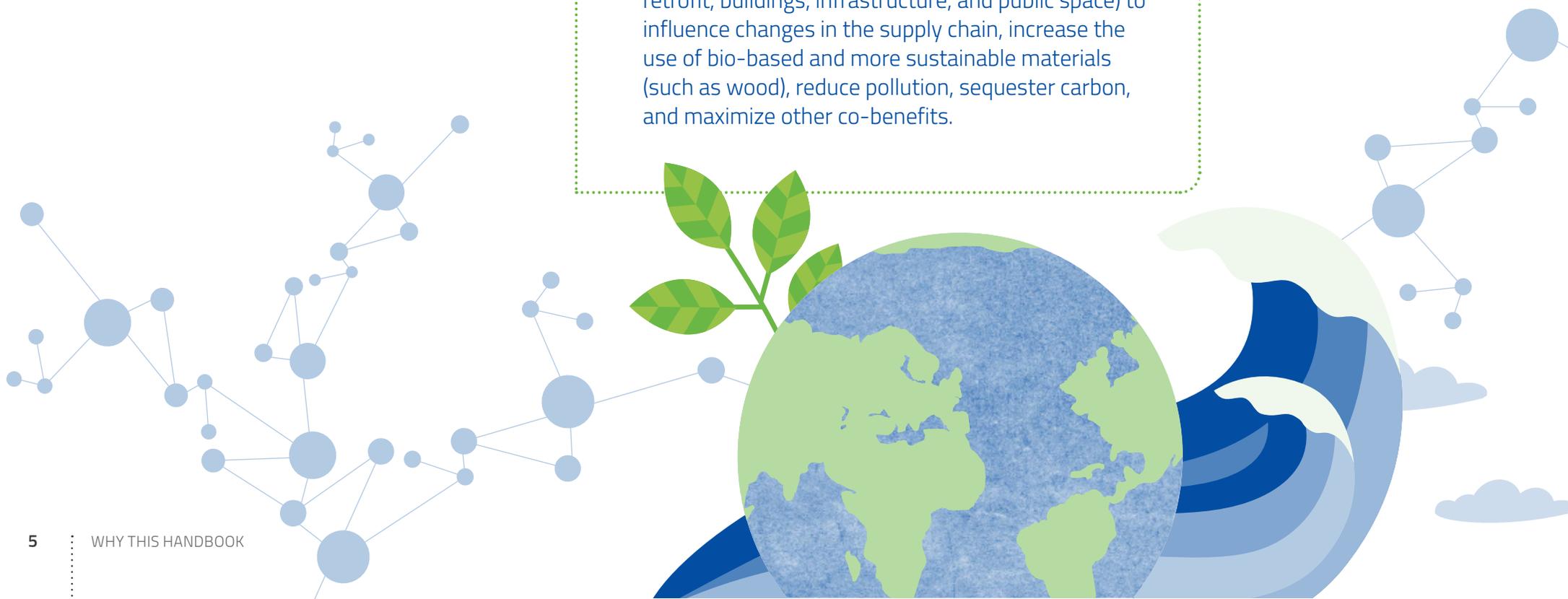
The Healthy, Clean Cities: EUropean CIties for climate-Neutral COnstruction (EU CINCO) Handbook

How to use this Handbook

The Handbook is designed to be an interactive manual and a tracking instrument. It has been developed so that anyone can download a copy and fill it out individually. There is space for notes and instructions for editing, adding and (re)designing activities to tailor the Handbook to specific cities/projects. This guide has been produced to provide in:

- **Understanding metrics used by different actors and using them to create benchmarks, as well as tracking and evaluating their development over time,**

- **Visualising processes and understanding how they need to evolve to lead to different outcomes,**

- **Creating models for collaborative decision-making.**

The Handbook systematises learning and methods from the Healthy, Clean Cities initiative supported by the Laudes Foundation in Madrid and Milan. It structures information that is generic enough to be applicable in many European and international contexts. However, it also includes practical examples so that you and your stakeholders can dig deeper into the technical aspects of the activities presented. These activities summarise what we consider useful to other cities - based on our experience. We recommend that cities follow a process similar to that undertaken in the HCC EU CINCO project to create an enabling framework for zero embodied carbon construction. However, we recognise that cities will have different starting points - some of the steps may be more or less relevant depending on their starting point. The activities undertaken by the project can be classified in two interconnected phases: 'Map, Analyse and Design', followed by 'Test, Learn and Iterate'. Each activity is presented in detail. We have added a page of additional activities that could also be considered.

We wish you all the best on your journey to carbon neutrality!

Systems Innovation / Systemic Change approach
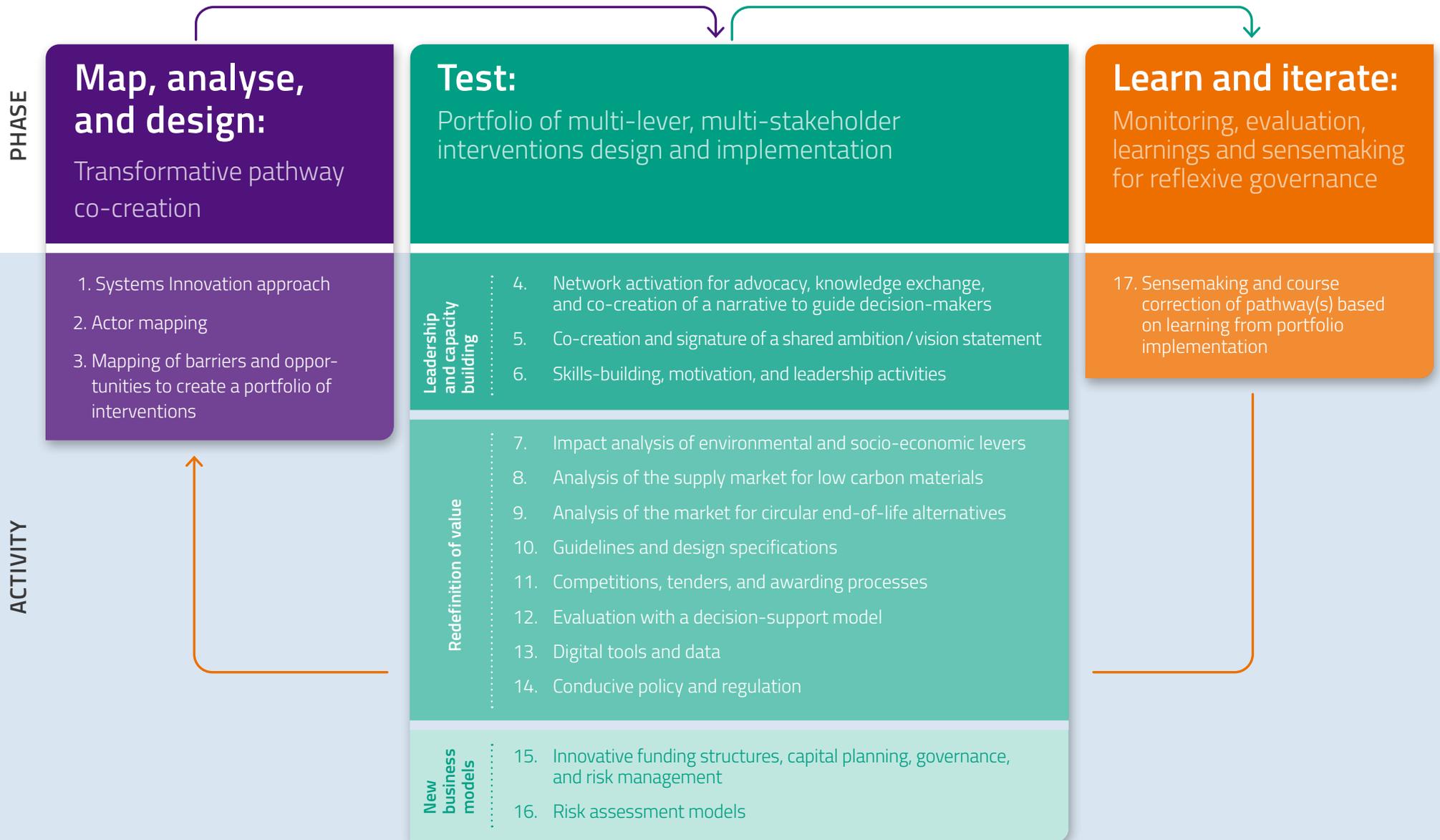
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ACTIVITY

(Step 1–3)

Map, analyse, and design:

Transformative pathway co-creation

1. Systems Innovation approach

WHAT IS IT FOR?

The sustainable construction challenge is comprehensive and systemic, which means that our response must reflect similar principles. To address the interconnectedness between supply chain, regulation, data, procurement, and financial levers in the construction sector, we aim to pursue 'systemic change' (or 'systemic innovation)': whole system transformation addressing complex problems by acting on the interdependence between multiple levers of change – such as capacity and capability building; culture, participation, and social innovation; governance, policy, and regulation; finance and business models; and technology.

We start by trying to understand the system that needs transformation: who are the actors, what are their roles, and what kind of interfaces exist between them. This is called 'systems thinking': understanding and analysing problems focusing on how the parts of a system relate to each other. Then, we map the change we wish to see, identifying barriers between the current status of the system and the target outcome. Building a full picture of the cross-sectoral and interdisciplinary key problems / barriers allows us to identify which actor(s) have agency to act on which barrier, that is to say, access to which opportunity.

This awareness enables us to co-create a portfolio of coordinated, multi-stakeholder and multi-lever interventions aimed at dismantling barriers, for example exploiting 'breakthroughs' or 'tipping points' identified across the interfaces between actors. To do so, we work with local and international partners with complementary skills and capabilities. With this portfolio-based approach, we aim to 'learn by doing', putting into practice a methodology to develop, test, learn and scale (where appropriate) a set of interventions (identified and designed in Activity 3) that are complementary and can shift complex systems by focusing on multiple points of intervention at a given time.

Collectively, these interventions can be called a 'transition pathway', a platform for strategic learning and for action. Transition pathways can and must be refined over time. Systemic innovation can and will have unpredictable impacts due to 'domino-effects' and mutually influencing parameters, which cannot all be modelled and understood before they are activated (due to both complexity and lack of data). It is therefore essential to take a reflexive approach to the project's governance, with a 'plan, test, iterate' approach that helps to build confidence in the direction of travel, as well as to enable shaping the work as it develops (see Activity 17). For example, establishing processes for extracting rapid learning from small experiments and using them to inform future action.

WHEN DO WE CALL IT A SUCCESS?

Systemic innovation is the most advanced approach to designing a project. At the same time, it is challenging and complex to put into practice. It is a long term, iterative process without a clear cut 'start' or 'end'. Outcomes are not measured (only) with 'traditional' Key Performance Indicators. Existing governance and funding structures need to be rethought to allow for systemic innovation projects to take place.

CASE STUDY

The HCC EU CINCO project is integrated within the framework of EIT Climate-KIC's Deep Demonstrations. The impacts of the initiative - neutralizing embodied carbon in buildings - are aligned with a subset of targets within an overall mission to achieve a climate-neutral, inclusive, just, and circular society.
https://www.climate-kic.org/programmes/deep-demonstrations/

1. Systems Innovation approach

WHO IS LEADING?
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TO DO

○ If you are not familiar with systems innovation, start by researching the concept and build a core team of individuals who understand how to work through this approach. The resources listed on this page are a good starting point for capability building, but it will be through practical application that skills are acquired.

RESOURCES:

- Mission-oriented innovation - a handbook from Vinnova (2022)
- Mazzucato, M. (2021). Mission economy: A moonshot guide to changing capitalism. Penguin UK.
- Governing Missions: Governing Missions in the European Union (2019)
- OECD System Innovation: Synthesis Report (2015)

2. Actor mapping

WHAT IS IT FOR?

In this activity, we apply 'systems thinking' to understand the system that needs transformation: who are the actors, what are their roles, and what kind of interfaces exist between them? When we start working on a new topic, it is easy to miss something or someone important (even if we are already experts in the field). It is vital to talk to as many actors in the field as possible to understand the context, the challenges, the potential solutions, and the resources (among many other things).

Set up interviews with a wide range of people, from community organizations, public and private sector, foundations, cooperatives, unions, free-lancers, etc. Understanding concerns and mapping the challenges of the problem 'owners', of other stakeholders, and of those proposing solutions is a way to catalogue and create relationships from a different point of view that can help identify common goals and interests.

WHEN DO WE CALL IT A SUCCESS?

When we have:
- A baseline of the ecosystem showing the key actors, barriers, resources, etc.
- A diverse set of semi-structured interviews with actors from different backgrounds (public sector, private sector, community, local experts, national professionals, etc.). The number of interviews will vary depending on the complexity of the topic, the ecosystem, and the stability of the sector.
- A map of the challenges and solutions, categorized and defined according to previous research and the interviews. These categories should be linked to the actors affected by those challenges and those proposing solutions. This is a good way to show the context and help the ecosystem visualize common concerns, capacities and resources and help anyone (from inside or outside the topic) to look at it from a proactive perspective (who is doing what and who is facing which barriers).

CASE STUDY

In HCC EU CINCO project, an active network of workers, advocates and communities in Madrid is connecting actors developing skills and sharing opportunities. These connections are laying the foundation for co-creating a vision and mission to aid in interdisciplinary value-chain alignment.

2. Actor mapping

WHO IS LEADING?

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○ List organisations and actors already working in the field to engage. Is there genuine, strong, and diverse representation from those who have historically held less decision-making power?

○ Organize targeted workshops and meetings around detected barriers in order to 1) set a common framework (and narrative) around them, 2) define very specific action to "untangle the issues" and 3) use this space to create useful connections and rooted relationships.

○ Hold pre- and post-engagement surveys and/or structured interviews and compare with baseline to determine whether actors see their position in the value chain as increasingly influential and their experience as increasingly valuable. Also inquire about perceived value of the social connections that are being built.

RESOURCES:

Some references of actor mapping that can be of example:

- Civic Tech Investors
- EJAtlas - Global Atlas of Environmental Justice
- The global flow of people
- Community gardens in Madrid
- One week of conversations at Twitter Co. from 2/15/13 to 2/22/13
- Precious Plastic Community
- Democratic Society Actor Types and Interactions

3. Mapping of barriers and opportunities to create a portfolio of interventions

WHAT IS IT FOR?

As we have seen, the urban construction value chain connects actors from different sectors: policymakers, developers, material manufacturers and suppliers, designers, investors, owners and many more. These actors make decisions that lead to or away from the use of circular and bio-based approaches in construction. The impact of these decisions affects other decision-makers, directly or indirectly. Success in addressing embodied carbon therefore depends on aligning and facilitating collaboration between as many of these actors as possible.

A fundamental principle is to first understand the problem(s) in scope of the portfolio of activities, both in terms of GHG emissions and in terms of the structural, technical, institutional, socioeconomic, and cultural barriers to change. In this activity, cities and their partners will therefore first be asked to identify the current barriers to transformative change, and then the potential systemic solutions or innovations to implement and learn from throughout the initiative.

WHEN DO WE CALL IT A SUCCESS?

In this activity we map the change we wish to see, focusing on identifying barriers between the current status of the system and the target outcome. We build a full picture of the cross-sectoral and interdisciplinary key problems / barriers and identify which actor(s) have agency to act on which barrier. The aim is the co-creation of a portfolio of coordinated, multi-stakeholder and multi-lever interventions aimed at dismantling these barriers by exploiting potential 'breakthroughs' or 'tipping points' across interfaces.

CASE STUDY

The table in the next page shows how the Healthy, Clean Cities EU CINCO project mapped barriers, opportunities, and risk mitigation strategies with local partners, to set the basis for the design of the portfolio of interventions. Other categories or classifications can be chosen depending on the specific context that is being assessed. Fig. 1 shows a simplified map of actor's interactions that helped us visualize intervention points.
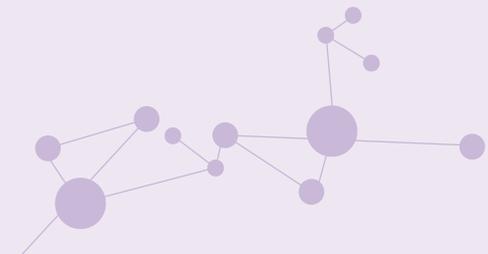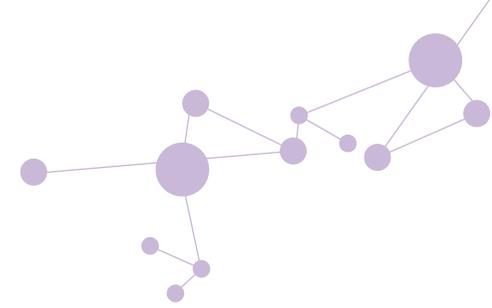
3. Mapping barriers and opportunities to create a portfolio of interventions

	BARRIER	INTERFACE	OPPORTUNITIES AND (CO-)BENEFITS	RISK MITIGATION
	Limited access to sustainably sourced timber.	Supplier / Manufacturer ⇕ Investor / Designer	Stepping up production of sustainably sourced timber will increase carbon storage and provide economic opportunities for (local) forest owners and managers.	Framework agreements to ensure stable demand, including certification and verification of benefits and impacts (e.g., to avoid unintended impacts such as biodiversity loss).
	Lack of technical, economic, and environmental performance data.	All interfaces	Establishing a system for data gathering and management (e.g., through disclosure requirements in tender and procurement processes) will increase stakeholder knowledge, encourage the research and design of new solutions that meet performance requirements, and introduce new tools (such as BIM) for increased efficiency.	Provide strong data governance systems and digital tools for information management and support SMEs in this process.
	Unfavourable regulation and construction policies.	Investor / Designer ⇕ Policymakers / Regulators	Use data to help develop a portfolio of policies to support embodied carbon-neutral building, e.g.by transparently setting baselines, targets, benchmarks and thresholds.	Define standards and methodologies to facilitate comparison and ensure a level playing field for actors along the value chain.
	Lack of design expertise, leading to concern about the performance of timber in terms of fire, noise and moisture compared to concrete, for example.	Investor / Designer ⇕ Client	Revise and update technical specifications and design guidelines, educate and reskill professionals along the value chain, increase competitiveness in local markets.	Engage civil society and educational institutions to raise awareness and establish new narratives in the community.
	Higher mortgage and insurance premiums for timber construction compared to concrete and steel.	Investor ⇕ Insurer	Engage financial stakeholders to develop green financial instruments (e.g., Outcome-Linked-Loans) to increasingly align capital flows with the Sustainable Development Goals (SDGs).	Ensure adequate evaluation and verification mechanisms and streamline processes.

3. Mapping barriers and opportunities to create a portfolio of interventions

DATA FOR DECISION-MAKING

Value attribution

Investors, clients and developers

Leadership

Scenario analysis

Baselines, benchmarks, targets

Multicriteria decisionmaking and digital tools

Investors, clients and developers

Society

Market analysis

Thresholds

Quantitative and qualitative indicators, specifications

Suppliers and manufacturers

Skills

Bids, offers, certification

Real values

Value attribution

Policymakers and regulatory bodies

FIG 1   Multi-stakeholders, cross-sectoral activities interface flowchart (indicative)
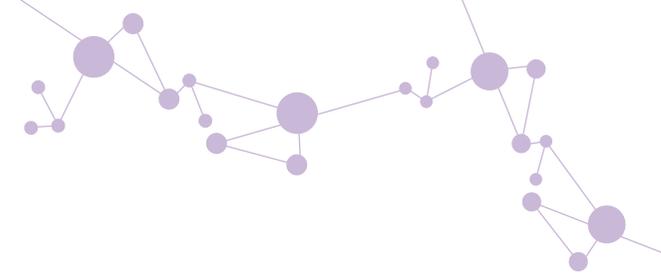
3. Mapping barriers and opportunities to create a portfolio of interventions

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TO DO

○ As we have seen in Activity 2, stakeholder consultations / interviews and data collection are useful to establish a starting point. The contextual aspects of the challenge space can help to surface the predominant mindsets / world views of those in the system. In these strategic conversations we want to understand how each person's reality is framed, what informs it, and how these perspectives contribute to the complexity of the problem. This can help to develop a multidimensional representation of the problem.

○ After guiding stakeholders through a process that diagnoses the current complexity and framing of an issue, we can reposition preferred alternatives and 'new' ways of seeing the challenge, revealing core dynamics that need to change. This will seed thinking about what might be done to pursue preferred realities on the ground (i.e., experiments / interventions), articulating a preferred alternative reality to set a direction for portfolio development.

○ Participants could use e.g., Lego or other pieces as a medium to create physical maps to show how the system would behave and act differently if specific shifts occurred.

○ Resources listed in this page will help design a process to co-create a portfolio of interventions.

RESOURCES:

- UNDP System Change: A Guidebook (2022)
- IDEO.ORG, 'Design Kit'
- Pecknold, K. and Sherwin, D. 'The Collective Action Toolkit Quick Start Guide', frog design
- Peterson, T., '10 ways to reframe problems ... rather than challenges',
- Thunderhead Works, 8 August 2017; and Gray, D., Liminal Thinking: Create the Change You Want by Changing the Way you Think (2016).
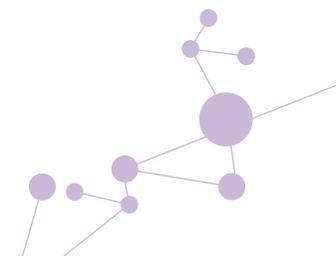
Test:

Portfolio of multi-lever, multi-stakeholder interventions design and implementation

- Leadership and capacity building (step 4–6)

- Redefinition of value (step 7–14)

- New business models (step 15–16)

4. Network activation for advocacy, knowledge exchange, and co-creation of a narrative to guide decision-makers

WHAT IS IT FOR?

After the MAP AND ANALYSE phase, this is the first activity in our LEARN AND ITERATE phase. We designed this activity because it is hard to transform an internal routine and behaviour if the actors/ community/group remain the same. Transformative change can appear threatening. Actors can feel disempowered by perceived or real isolation or distance from where decisions are made. Social relationships provide a foundation for open and direct communication between actors who should be connected as part of the same system. This activity is meant to understand engage actors such as employees, civil servants, students, champions/ advocates, and communities in an active network, so that they can connect with each other, share narratives, create synergies, recognise, and see value in their respective roles and the group as a whole. They can map barriers and opportunities from their perspective, and this can be used as a basis for action and to hold decision-makers to account.

WHEN DO WE CALL IT A SUCCESS?

When we have:
- A platform that allows meetings between actors from different backgrounds.
- A consolidated routine of information exchange among a variety of actors.
- An agreement about a set of challenges and a list of actors ready to face those challenges in a transversal and common way.

CASE STUDY

In Madrid, we have started working on the narrative development, through an action-based approach, to gain a better understanding of the perception around bio-based construction. For example, Democratic Society is working with the Polytechnic University of Madrid to update architecture students' curricula (the professionals of tomorrow) to reflect the need for systemic transformation towards bio-based and circular buildings.
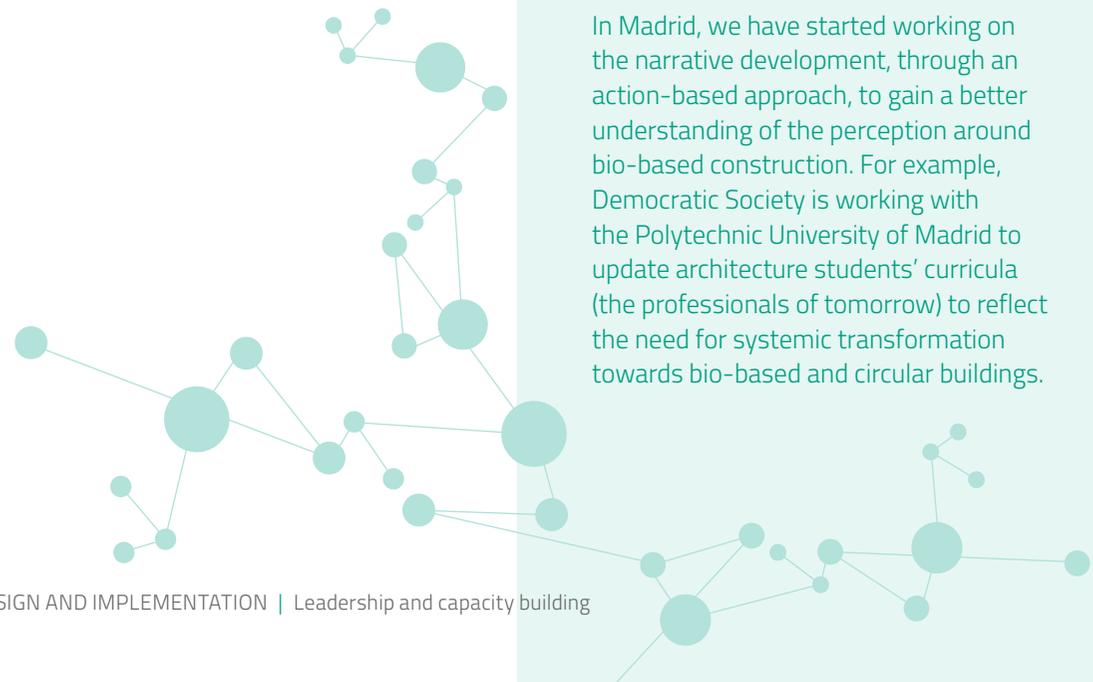
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WHO IS LEADING?

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○ Determine platform (what form will meetings take?), frequency of exchanges, agenda and goals. Ensure ease of access and do not overwhelm participants with meetings that are too vague. Topics and format should be connected to the defined goal and the stage of the process.

○ Organize targeted workshops and meetings around detected barriers in order to 1) set a common framework (and narrative) around them, 2) define very specific action to untangle the issues and 3) use the workshops to create useful connections and rooted relationships.

○ Prepare knowledge exchange among the different groups (internal and public) in order to share learning, purposes and narratives.

○ Ensure actors are involved in the co-creation of a shared narrative. Check for the improvement of value chain alignment.

RESOURCES:

- Gordon, Eric, and Stephen Walter. 2019. "Meaningful Inefficiencies: Resisting the Logic of Technological Efficiency in the Design of Civic Systems."
- Hunt, Jamer. 2020. Not to Scale: How the Small Becomes Large, the Large Becomes Unthinkable, and the Unthinkable Becomes Possible.
- Kania, John, Mark Kramer, Peter Senge. 2018. The Water of Systems Change. FSG.
- Democratic Society Strategies for a Networked Approach
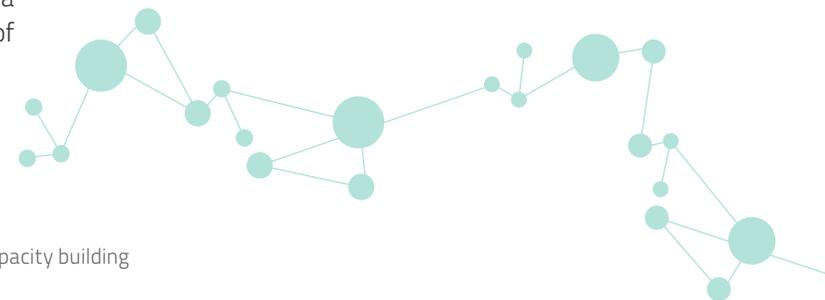
5. Co-creation and signature of a shared ambition / vision statement

WHAT IS IT FOR?

A statement to declare joint ambition and vision is an important milestone and a useful foundation for joint work on promoting carbon-neutral circular and bio-based construction. In order of priority, the statement should include at least the first point but ideally all the following:

- It should manifest trust, leadership, and commitment by defining shared priorities and describing a shared narrative.
- It should promote alignment by setting out the basic shared definitions, methods, and concepts that the partners agree to use (including standards and norms).
- Ideally, it should promote accountability by stating targets and benchmarks, and specify methods of evaluation and verification.

WHEN DO WE CALL IT A SUCCESS?

The statement of ambition should ideally be drafted and signed at the start of the project, at least by the participating partners. However, in principle, further signatories can be added at any time, strengthening the overall purpose of this important guiding document.

CASE STUDY

In Healthy, Clean Cities EU CINCO, senior leaders from the project partner organizations co-created and signed a shared document stating their aligned vision towards bio-based and circular buildings within the first four months of engagement. A link to the document is provided in the Resources section on page 21.
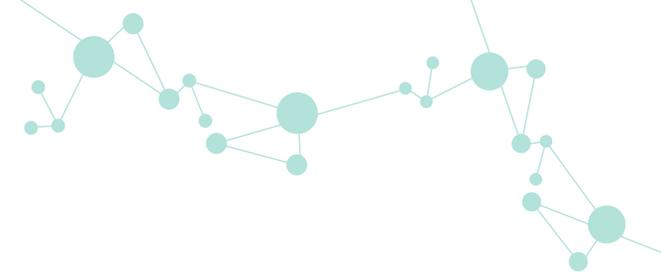
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○ Engage senior layers of the organisations you will be working with early in the process, and identify who will sign.

○ What key points need to be covered in the statement?

○ Will you sign up to an existing statement, be inspired by an existing resource and adapt it to your needs, or craft an initiative-specific statement from scratch?

○ Will the statement be public, or a document internal to the initiative?

○ Plan for a few sessions to review the contents of the first draft of the statement.

○ If public, plan for a press release once the statement has been signed.

RESOURCES:

- HCC EU CINCO_Shared Vision_CKIC (2021)
- C40 Clean Construction Declaration
- Elliott Wood Partnership Ltd's manifesto ETHICS
- RIBA's 2030 Climate Challenge
- SBTi's Science Based Targets
- Boyle, D. & Harris, M. (2009) The Challenge of Co-production, How equal partnerships between professionals and the public are crucial to improving public services, London: NESTA.
- Centro de Innovación en tecnología para el Desarrollo Humano de la Universidad Politécnica de Madrid (itdUPM) (2019), Programa Work for Progress de Obra Social La Caixa. Guia II: Co-creación.
- UNESCO/IFAP and UNU-EGOV. (2016). Knowledge societies policy handbook. Unesco, 1, 185.
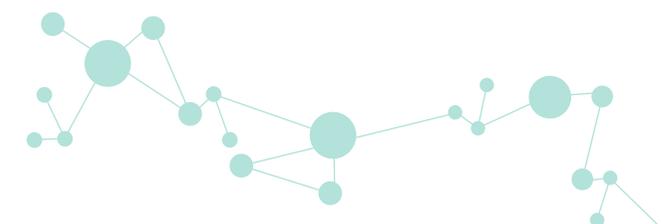
6. Skills-building, motivation, and leadership activities

WHAT IS IT FOR?

Working collaboratively across multiple levers of change requires a basic understanding of the solutions and strategies available to stakeholders from different sectors. For example, in the case of bio-based and circular buildings, these can include concepts such as whole Life Cycle Analysis, Outcome-Linked Loans, alternative end-of-life scenarios, design for remanufacturing, Product-Service-Systems, etc. Building understanding can be supported by working on two parallel, mutually supportive workstreams: One workstream involves incorporating multi-stakeholder reflection and collective learning into the regular activities of the initiative. Another workstream involves co-creating content, participating in events and webinars, networking with local and international stakeholder groups and building new partnerships.

WHEN DO WE CALL IT A SUCCESS?

This activity runs in parallel with all other activities and therefore has no defined 'end'. However, it is useful to structure the work using checklists and targets, such as a predefined number of events/meetings/workshops, and/or a joint report on lessons learned as a final deliverable.

CASE STUDY

In the Healthy, Clean Cities EU CINCO, project partner organizations have regularly engaged in skills building workshops, collective learning sessions, and communications and outreach activities. For example, Madrid Nuevo Norte developer Distrito Castellana Norte presented the project at CONAMA 2021, the annual Spanish National Environmental Conference, while itdUPM showcased it during a side event at COP 26 in Glasgow.
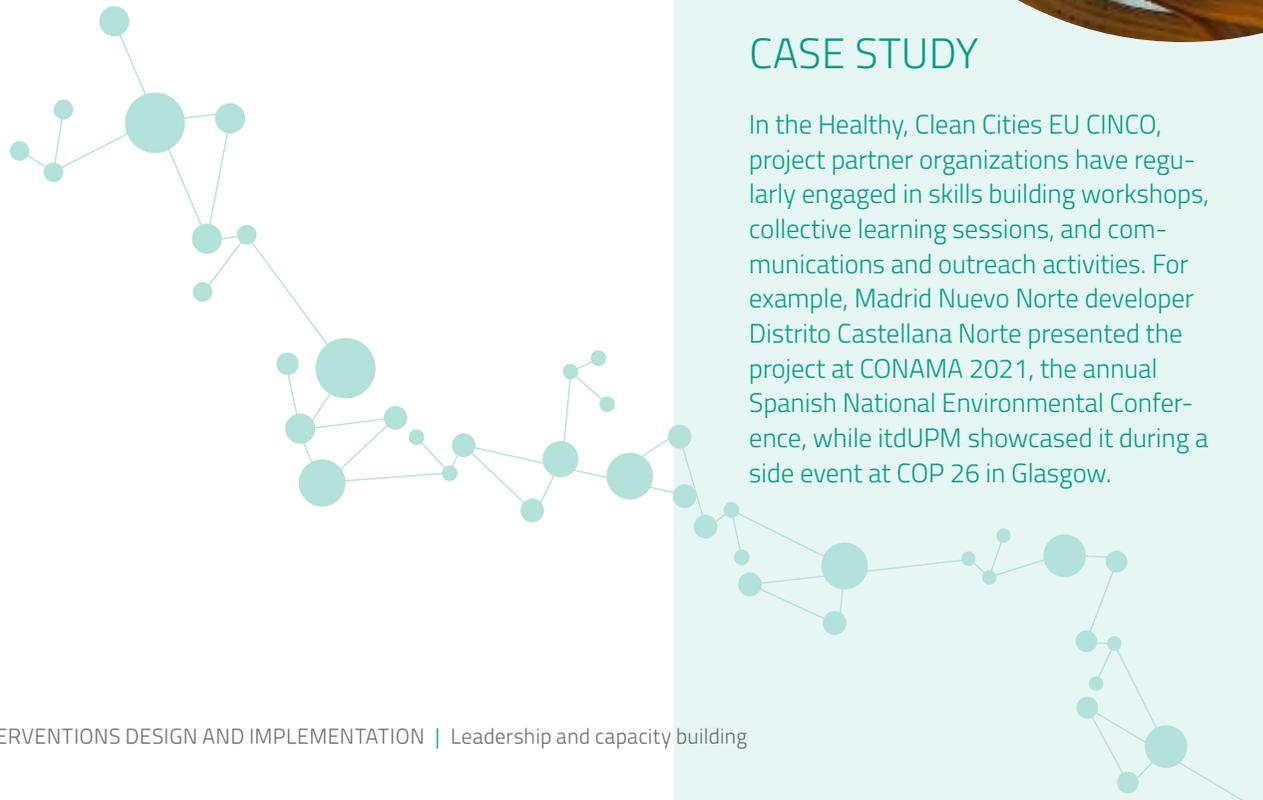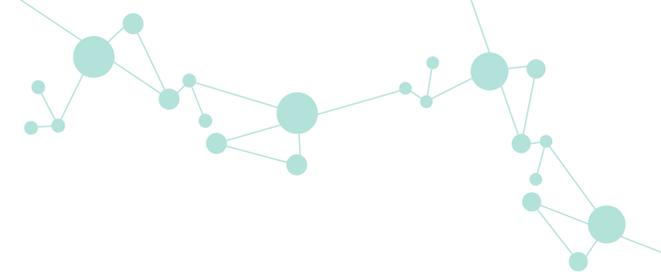
6. Skills-building, motivation, and leadership activities

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○ Send out a questionnaire to gauge how familiar your implementation partners are with the key topics and concepts that are central to the initiative's ambition.

○ Dedicate regular and structured time for reflection and collective learning through meaningful and inclusive consultation processes.

○ Collaboratively develop content, e.g., presentations for events, webinars or other communications and marketing activities.

○ Identify local and international stakeholders and groups to engage in collective learning and / or new partnerships

RESOURCES:

- A framework of resources for Climate Solutions.
- WRI: Is a global research organization that works with governments, businesses, multilateral institutions and civil society groups to develop practical solutions that improve people's lives and ensure that nature can thrive.
- Learn about successfully deployed solutions which might be relevant to your project or initiative
- Tech4Good Marketplace of the EU 100 Intelligent Cities Challenge.
- The European Innovation Radar, a catalogue of excellent and freely available EU research and and innovation.
- DEEDS, Dialogue on European Decarbonisation Strategies.
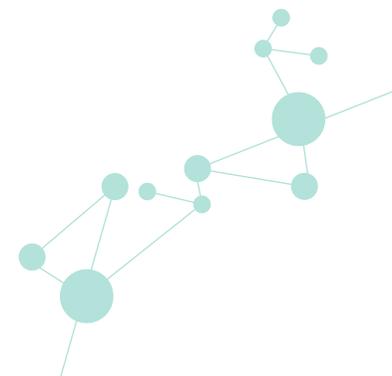
7. Impact analysis of environmental and socio-economic levers

WHAT IS IT FOR?

Local stakeholders across the value chain may not have sufficient data to assess and evaluate the environmental and socio-economic benefits of a carbon neutral built environment. As a result, decision-making processes may not support the objective of carbon reduction in construction. Stakeholders need a model to analyse these impacts and make informed decisions. The model needs to facilitate scenario analysis (e.g., comparing a business-as-usual solution to a low-carbon solution).

Life Cycle Analysis (LCA) is a type of analysis that can be applied to materials and products, but also to other "systems", such as projects, businesses, or cities. LCA can help to identify opportunities to improve the environmental performance of the selected system at various points in the life cycle, communicate the impacts (e.g., introduction of an eco-label environmental claim, or environmental product declaration), which can be used to help inform decision-makers in industry, government or non-government organisations for the purpose of strategic planning, priority setting, product or process design or redesign.

An environmental and socio-economic scenario analysis should address the aspects and potential impacts (e.g.,

resource use and environmental consequences) throughout the life cycle of a building, from raw material acquisition to production, construction use, end-of-life treatment (Modules A to C of the EN 15978 standard), and beyond, to recycling / refurbishing / remanufacturing. It should also include circularity indicators, such as recycling and reuse rates. Through such a systematic overview and perspective, potential environmental impacts from individual processes can be identified, and avoided or addressed. In addition, circularity indicators are beneficial to mitigate the risks of material price volatility and material supply.

WHEN DO WE CALL IT A SUCCESS?

When the impacts of different design decisions, including a "baseline" scenario and a low carbon scenario, have been visualised, when feedback on these scenarios has been obtained from the leadership levels of the organisations involved in the decision-making process, and, ideally, when a strategic plan for using this new data in the decision-making process (e.g., changes in tender or procurement processes aimed at moving closer to the "ideal" scenario) has been developed.

CASE STUDY

In HCC EU CINCO, astudy of impacts undertaken by Material Economics for DCN has led to the development of LCA disclosure requirements for the tendering process for Madrid Nuevo Norte.
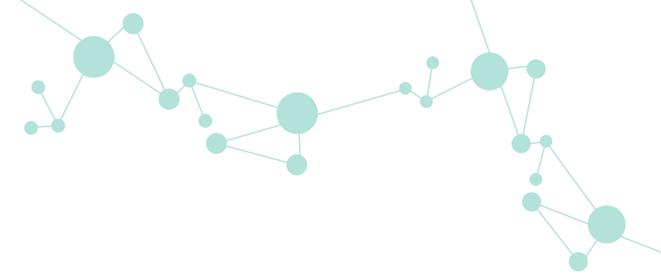
7. Impact analysis of environmental and socio-economic levers

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○ Collectively select relevant value indicators (e.g., CO_2e per capita, CO_2e per m2, EUR / tCO_2e). Identify the model(s) and database(s) to perform the analysis. If not already available, align with European and National initiatives currently working to establish official, robust, and transparent LCA databases and tools, as well as benchmarks and baselines to compare alternatives and make informed decisions.

○ Simulate scenarios, including a "baseline" scenario (to represent "business-as-usual") and an "ideal" scenario (geared toward lowest possible carbon emissions), and produce graphs, etc., to assist non-technical stakeholders (such as politicians/investors/boards, etc.) with decision-making.

○ Engage experts in feedback to assess the feasibility of scenarios and then iterate the simulations to address experts' considerations.

○ Refine simulations until baseline, target values and the parameters most sensitive to value indicators are identified.

○ Turn the baseline and target values, and the sensitive parameters, into guidelines for decision-making. For example, if the model identifies concrete and steel as major contributors to carbon emissions, set targets for low-carbon materials, re-use of and recycled materials as well as biobased materials in your project.

RESOURCES:

- One Click LCA: automated life cycle assessment software that helps users calculate and reduce the environmental impacts of building and infrastructure projects, products and portfolios.
- Level(s) European framework for sustainable buildings
- RICS' (Royal Institution of Chartered Surveyors, UK) scope and methodology for carrying out Whole Life Carbon Assessment for the Built Environment
- Royal Institute of British Architects RIBA' embodied and whole life carbon assessment guidance for architects
- Excel-based Elliott Wood and IStructE's Structural Carbon Tool
- ARUP's Net zero buildings: where do we stand? Report

List of levers influencing the environmental and socio-economic impact of building projects analysed within the scope of the HCC EU CINCO project

	Biobased levers	
1	Mass timber superstructure & lighter foundation	
2	Wooden exterior finishes	
3	Biobased insulation	
	Steel levers	
4	Lower CO_2 energy supply and process efficiency in steel manufacturing	
5	Reuse steel building components	
6	New steel making technologies	
7	Increase material efficiency of steel components	
	Concrete levers	
8	Increased material efficiency of concrete components	
9	Lower CO_2 energy supply in cement manufacturing	
10	Less cement in concrete	
11	Reuse and reconstruction of conrete structures	
12	Cement recycling	
14	New cement making technologies	
	Other levers	
14	Recycled aluminium	
15	Recycled plastic	
16	Chemically recycled plastics	

8. Analysis of the supply market for low carbon materials

WHAT IS IT FOR?

If stakeholders in the value chain are not familiar with the range of alternatives and/or cannot easily find information about the low-carbon materials available to them, they may revert to "business as usual" and miss important opportunities to reduce climate impacts. In addition, the market may not be mature, and some options may not be available. This activity focuses on conducting a specific market analysis on low-carbon alternatives to conventional materials that provides evidence, facts and figures for more informed decision-making and learning. At the same time, opportunities can be identified to work with market-shaping stakeholders such as public entities and key developers, to strengthen the availability of low-carbon alternatives.

WHEN DO WE CALL IT A SUCCESS?

A potential outcome could be the creation of a briefing document for decision makers that compares a range of construction materials and their low carbon alternatives, based on indicators such as the technical maturity of a product or process, possible uses, suppliers and co-benefits. The document could serve as the evidence base to set benchmarks, targets and/or minimum-maximum thresholds for specific indicators to be used in tender and procurement processes.

CASE STUDY

In HCC EU CINCO, the analysis of the supply market for low-carbon materials performed by ARUP Spain has led to the exploration of a potential framework collaboration between Spanish forestry managers and large buyers. This has the potential to help create a new, sustainable market for the local economy.
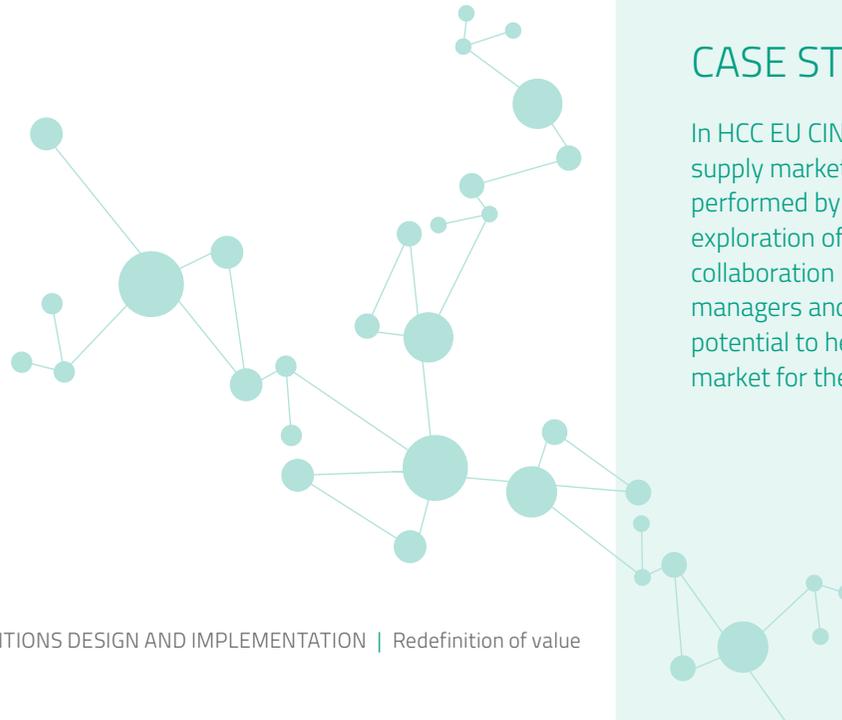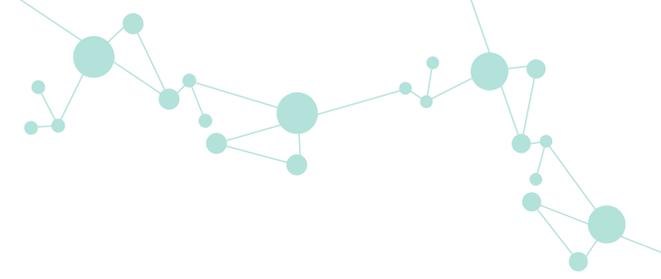
8. Analysis of the supply market for low carbon materials

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○ Co-create a list of construction materials and low-carbon alternatives (e.g., concrete/low-carbon concrete, steel/low-carbon steel, timber/sustainably sourced timber).

○ Select relevant market-supply indicators to evaluate each material (e.g., technological readiness, possible uses, companies providing the material/solution, availability, cost, projections, carbon impact, co-benefits).

○ Engage stakeholders, sector experts, etc. to provide values for the selected indicators.

○ Compare results for the different materials. Use them to develop ranking/evaluation strategies and/or decision-making guidelines.

○ Engage decision-makers in feedback and reflection sessions using the materials produced.

RESOURCES:

- HCC EU CINCO_Madrid. Readiness of the market – low-carbon materials_ARUP (2022)
- The AMS Institute's Factsheet series on timber construction

9. Analysis of the market for circular end-of-life alternatives

WHAT IS IT FOR?

Redesigning end-of-life approaches for a circular economy is critical for resource management in the near future. Construction is a resource-heavy industry, accounting for more than a one-third of all waste generated in the EU. Much of this waste could be given a second life, reducing the need for further extraction and the related negative environmental impacts. Construction projects and buildings at the end of their service life are a potential treasure trove of materials and products with associated potential for socio-economic and environmental benefits. However, the use of new materials is often perceived as cheaper, less labour-intensive, less time-consuming, and less logistically complex than circular construction (in which existing materials are harvested and repurposed). There are several reasons for this perception:

Financial reasons: The extraction and use of (new) resources and the creation of pollution is not (sufficiently) taxed. At the same time, the skilled artisanal labour required to separate and repurpose materials and components is more expensive than large scale industrial and automated production methods, which further reduces costs.

Regulatory and legal: In many countries within the EU and beyond, the regulatory framework currently favours the use of new materials as standard. The reuse of building materials often requires complex, lengthy, and costly administrative procedures.

Technical: Some of the above barriers relate to technological aspects, such as the fact that buildings are not designed and planned with end-of-life in mind. Design is therefore critical. If more projects were designed for disassembly and reuse, policymakers would feel more empowered to update regulations to favour these types of projects and use of resources. Tax and policy are certainly part of the solution, but assistance in coordinating the practical aspects in partnership with the construction industry is also key to addressing technical barriers.

WHEN DO WE CALL IT A SUCCESS?

A set of locally relevant technical guidelines for circular end-of-life approaches could be provided to local stakeholders. As a further step, local planning authorities could require, as a condition for a building permit, the submission of a report showing how these guidelines will be implemented. Since technical guidelines may not be implemented even when available, they could be complemented with further construction requirements and developed in collaboration with other activities (e.g., ambitious reuse targets and maximum waste generation caps for construction and demolition, fiscal and regulatory measures to incentivise building reuse versus demolition and new construction, establishing regional material reuse depots, amended regulations to facilitate reuse of components and materials, enfercement etc.).

CASE STUDY

In HCC EU CINCO, the analysis of the market for circular end-of-life alternatives undertaken by ARUP Spain could lead to the creation and adoption of specific guidelines for public and / or private development projects in the region.

9. Analysis of the market for circular end-of-life alternatives

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○ Identify with local stakeholders (contractors, regulators, designers, manufacturers) solutions that are viable today and ways to unlock additional options for optimal end-of-life building waste management in the near future (e.g. incremental increase in ambition, market readiness, regulation).

○ Consider a building materials passport (see Digital Tools activity).

○ Consider a Residual Value Calculator for components/materials, consumer products, etc. (as part of the project's business model/value chain).

○ Consider updating project scenarios using insight from the Analysis of socioeconomic impacts activity with circular end-of-life alternatives, if not already included.

RESOURCES:

- HCC EU CINCO_Circularity in Demolition and Construction, A hierarchy for circular practices in deconstruction and some best practice examples_DML (2022)
- Madaster is the register for materials and products. In this online platform buildings are registered including the materials and products that are used.
- New Horizon: working on the transition to the circular economy in construction
- Proposal for a Regulation laying down harmonised conditions for the marketing of construction products, amending Regulation (EU) 2019/1020 and repealing Regulation (EU) 305/2011
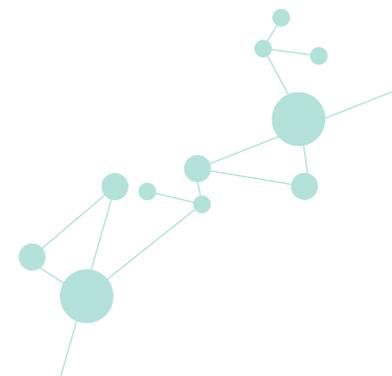
10. Guidelines and design specifications

WHAT IS IT FOR?

Design specifications are non-binding rules used by different teams of professionals involved in the design and construction of buildings. They can be issued by both public and private organisations and apply to different actors depending on their roles. Developing and sharing (locally relevant) guidelines can help create markets that favour carbon-neutral construction. Design specifications and guidelines can become contractual requirements when incorporated into tender and procurement processes. The guidelines can also be used by financial stakeholders as a basis for developing performance-based financing.

There is no need to reinvent the wheel: existing tools can be modified and combined with other resources to generate updated guidelines and specifications. For example, the European common framework Level(s), based on a review of the scientific literature by the Joint Research Centre, highlights the following design concepts for targeting environmental impact hotspots:

- Efficient design: Optimise the design to improve material efficiency and minimise energy consumption.
- Optimised material utilisation and circular value: Explore the possibility of reusing existing elements, design with minimal material use, and minimise waste generation in product manufacturing and construction.
- Extended service life: Consider options to extend the lifespan of significant components and minimise the number of replacement and renovation cycles.
- Design for adaptability: Consider the potential of the design to adapt and be flexible to changing needs.
- Design for deconstruction: Consider how the design and information records about the project's materials bank can facilitate future deconstruction at end-of-life to recover materials for reuse and recycling.

WHEN DO WE CALL IT A SUCCESS?

Practical frameworks to guide impactful design decisions toward embodied carbon-neutral buildings are provided with each assignment. There are mechanisms in place to strengthen adoption, such as financial or regulatory incentives/provisions and enfercement.

CASE STUDY

HCC EU CINCO's partner Dark Matter Labs and Democratic Society are working with Madrid City Council to incorporate carbon and broader sustainability criteria in municipal instruments, selected based on potential impact and replicability, specifically:

- Municipal Schedule of Rates
- General Design Tender documents
- District Maintenance and conservation Tender documents
- Design specifications drafted by Procurement Directorate General and used by diverse municipal teams

10. Guidelines and design specifications

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○ Identify existing policies and design guidelines that are used or applicable in your local area.

○ Compare current guidelines with best practice for biobased and circular, carbon-neutral buildings.

○ Integrate design specifications where needed to support transformative change.

○ Engage! Undertake feedback and review with key policy and industry actors in your area, involve NGOs and community groups to ensure citizens are empowered. Include universities and colleges: engage architecture, design, engineering, and construction students (the professionals of tomorrow) in developing the new guidelines.

RESOURCES:

- Engineering consultancy Elliott Wood has produced a detailed guide on the deconstruction of buildings for circular re-use.
- Decarbonizing construction: Guidance for investors and developers to reduce embodied carbon.
- The EU's Urban Agenda Partnership on Circular Economy has published the Sustainable Circular Reuse of Spaces and Buildings Handbook to guide the transformation and reuse of existing buildings and spaces.
- FutureBuilt Criteria for Circular Buildings (in Norwegian): FutureBuilt is an alliance of Norwegian partners for future-proof construction, led by the City of Oslo.
- Circular Buildings Toolkit

11. Competitions, tenders, and awarding processes

WHAT IS IT FOR?

Public and private entities can use contract documents such as tender document clauses and award criteria to guide material selection and construction practices toward low-carbon, bio-based and circular alternatives.

Changing standard procurement practices can not only impact specific construction projects, but also support supply chain R&D by increasing demand for biobased and circular materials. Tender processes (public or private) can include requirements, such as Whole Life Carbon (WLC) analysis, that can be incorporated into the multi-criteria evaluation so that direct economic costs are considered. In this way, projects can be evaluated against key environmental and social sustainability indicators.

Where sufficient data are available, tender processes can also set targets, such as goals for component reuse, minimum recycled content, or maximum global warming potential per unit of certain key materials. Where data are not yet available (i.e., more information is needed to assess market readiness or to establish local baseline for embodied carbon of standard building types), requiring data through tender clauses can enable the creation of databases to set targets and caps that are both ambitious and feasible in the local context. This activity can be linked to the development of decision-making and analytical tools.

WHEN DO WE CALL IT A SUCCESS?

WLC measurements are required and openly published throughout the lifecycle of a building for both public and private construction, with policies in place to minimize GHG emissions. This information has become a central criterion in decision-making, with biobased materials and circularity preferred over more carbon-intensive alternatives. Policymakers use lifecycle carbon thresholds (alongside other environmental and social sustainability indicators) as criteria for granting permits and other relevant decisions.

CASE STUDY

Environmental clauses developed with DCN and Madrid City Council within the scope of the HCC EU CINCO project and have been included in private tenders, may be tested in public tendering.
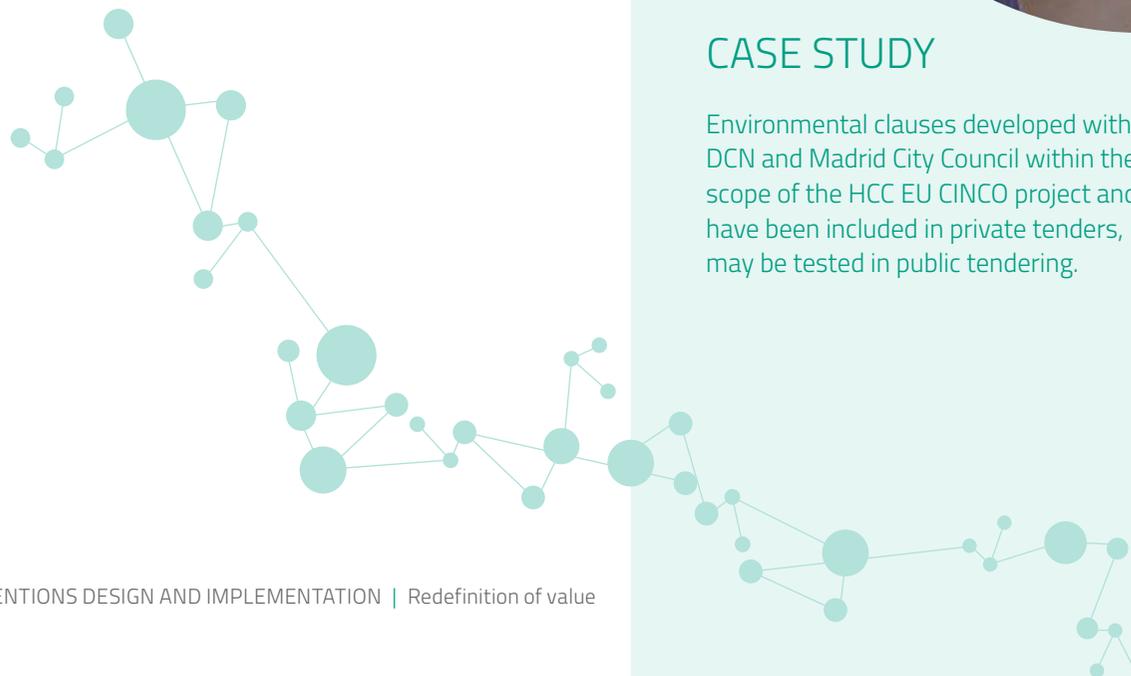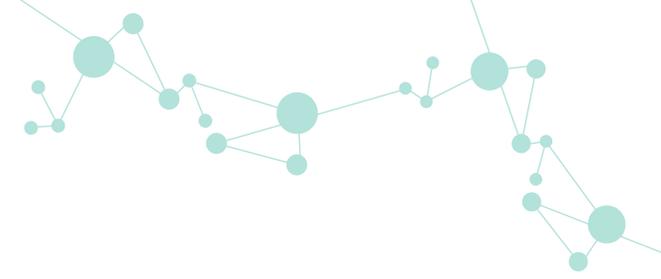
11. Competitions, tenders, and awarding processes

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○ Work with key stakeholders (architects, engineers, manufacturers, contractors, and developers) to assess the availability of data and tools related to carbon, social, environmental, and technical performance and identify opportunities for improvement. For example, can requiring the use of products with Environmental Product Declarations (EPD) in public or private construction lead to an uptake in their adoption by the local market?

○ Collaboratively develop tender requirements and award criteria that are achievable yet ambitious.

○ Review the performance of tenders (private / public): align with the development of multi-criteria tools, digital tools, and data.

○ Regularly update tender requirements and award criteria to ensure ambition grows as market maturity, technology and data capacity evolve.

RESOURCES:

- EPD Library | EPD International: Environmental Product Declarations (EPDs) signal a manufacturer's commitment to measuring and reducing the environmental impacts of its products and services and reporting those impacts in a transparent way. With an EPD, manufacturers report comparable, objective, and third-party verified data that shows the good, the bad and the ugly relating to the environmental performance of their products and services.
- Public tendering examples: The CO2 Performance Ladder, the Low Embodied Carbon Concrete Leadership Act (LECCLA) , Dubo Calc Portal
- The City of Amsterdam has published a comprehensive, step-by-step guide on how to conduct circular construction procurements, which includes sample criteria for different aspects of a building or civil works project (with criteria text, rationale, calculation, and validation) and an example tender text. The Roadmap to Circular Land Tendering
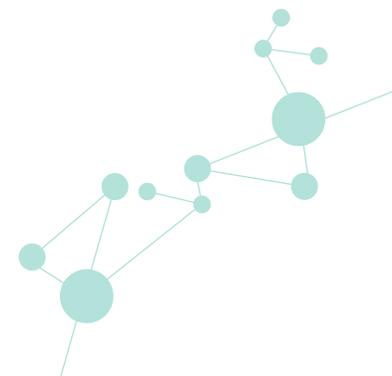
12. Evaluation with a decision support model

WHAT IS IT FOR?

Incorporating environmental indicators, such as carbon, into the evaluation of solutions for construction adds an additional dimension to the decision-making process for some actors. A "decision support model" for the evaluation of relevant levers needed to analyse embodied carbon when constructing buildings is provided in the resources listed in the next page. The purpose is to create understanding of the impact of levers when constructing buildings to set the direction to reduce embodied emissions.

Almost 20 levers are described in detail. Each lever would also presents an average emissions rate on a European level that could be used as a reference value for local, project-specific data. Such an analytical tool can help compare and contextualize the trade-offs between alternative options available. The developer can use such a tool in the bid evaluation process, for example. The tool may visualize results in the form of a scorecard, matrix, or other graphical representation (e.g., a Pareto analysis).

WHEN DO WE CALL IT A SUCCESS?

Use of the model is adopted by the project developer and/or investor as part of the standard project decision-making process. Investment decisions are made and justified based on holistic information provided by the model. This increases consideration of environmental aspects in the selection process and motivates stakeholders to find or develop trade-offs with other indicators as needed.

CASE STUDY

In Milan, in spring 2022, the HCC EU CINCO project kicked off the creation of an "abatement cost-curve" model for local bio-based and circular construction, a task led by the municipality and supported by Material Economics.

12. Evaluation with a decision support model

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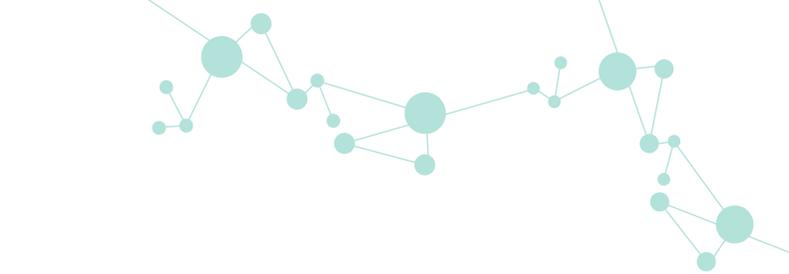
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○ Select parameters relevant to the tool. Ideally, build on previous activities. For example, baseline and ideal scenario analysis can provide benchmarks and targets, and market analysis can provide guidance on desirable thresholds.

○ Ask bidders, designers, and suppliers to specify the parameters selected and identified (e.g., cost and potential carbon emissions) for each material. This is a critical but challenging step to ensure that the data are comparable. As a best practice, refer to international standards and guidelines to learn how to calculate and specify the selected parameters (e.g., EN 15978 for life cycle modules and ISO 14040 for LCA).

○ Design the type of visualisation of results that is most useful to you. Is it a scorecard, a canvas, a matrix, a point cloud, a curve, or a combination of these?

○ Add the data to the selected template(s) to compare solutions based on their key performance parameters.

RESOURCES:

■ Röck M, Sørensen A, Steinmann J, Le Den X, Lynge K, Horup L H, Tozan B, Birgisdottir H. Towards Embodied Carbon Benchmarks for Buildings in Europe – Facing the data challenge, 2022

13. Digital tools and data

WHAT IS IT FOR?

The use of digital tools and access to verified data sets can help those involved in construction projects make more informed decisions about emissions, costs, maintenance and building performance throughout the lifecycle of a development. Policymakers, financiers, developers, construction professionals, building managers and end users can all benefit by helping to minimise life-cycle emissions, maximise the circularity of materials, increase construction efficiency, and minimise the cost of a construction project throughout its life cycle. Project stakeholders should be aware of the tools and data sets available, and those which are most suitable for each project type and geography, as well as the skills required to embed them.

Digital tools such as Building Information Modelling (BIM) software should be adopted as early as possible in the development process. The generic national carbon databases and LCA software should also be used early on to calculate baseline and benchmark targets for whole life-cycle carbon and to identify carbon or material waste hotspots. As the design becomes more detailed, product specific EPDs and local carbon data sets can be used to provide more accurate analyses. In combination, Material Passports can be used to store instance-specific data on environmental impacts, material use, maintenance requirements and performance of buildings and their components. Buildings As Material Banks (an EU project promoting materials reuse in construction, https://www. bamb2020.eu/) describes Material Passports as "sets of data describing defined characteristics of materials in products that give them value for recovery and reuse." The Material Passport should be updated as the building is designed, built, used, renovated and deconstructed, providing a live digital replica of the physical components that contains verified data to support reuse.

Post-occupancy evaluation and in-use performance monitoring, which measures a building's internal environment (air quality, temperature, humidity, noise) and performance (energy use, ventilation, lighting, structural condition), should be used to analyse whole-life emissions and building performance. This can help identify any divergence from initial designs and provide information for future projects. In addition, this can facilitate regulatory and financing innovation, including performance-based regulation, outcomes-linked loans, parametric insurance and smart warranties, in combination with innovation in contracting.

WHEN DO WE CALL IT A SUCCESS?

An ideal outcome would be to: require the use of BIM in the project(s), including an embodied carbon and whole-lifecycle assessment; and develop a Materials/ Building Passport for each project that builds on existing efforts. Finally, a public entity integrates comparable LCA information into a public and transparent database to establish local benchmarks.

CASE STUDY

Dark Matter Labs has developed digital LCA and BIM integration requirements with DCN in Madrid and included them in the urban infrastructure tender process. There is ongoing collaboration with the City of Madrid to better understand needs and capacity (current and future), which will require long term engagement. In Milan, there is ongoing engagement with AMAT and Redo Sgr. for LCA integration to BIM (both at urban and building scale) to assist design development and ensure that all the targets set at concept stage are met. Ongoing research, development and prototyping are exploring the potential of material passports, material circularity data and building performance data to aid decision-making for possible future implementation at L'Innesto with Redo Sgr. These strategies will support L'Innesto in reaching the targets specified in its winning bid to C40's Reinventing Cities contest, which is Milan's reference methodology for embodied carbon neutral, circular urban spaces.

13. Digital tools and data

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○ Review suitable software tools and Material Passport methods for the project.

○ Identify suitable global, national, and local WLC and EPD databases.

○ Prepare and integrate digital tools and data requirements into briefs and tenders.

○ Conduct initial WLC assessment using local baseline and benchmark data.

○ Update WLC analysis with product specific data as the project progresses.

○ Implement Building and/or Material Passports for the project.

○ Specify and install building sensors for ongoing performance monitoring.

RESOURCES:

- HCC EU CINCO_Digital Tools and Data Briefing_DML (2022)
- **EPD databases:**
  ECO Platform (EU);
  ÖKOBAUDAT (DE);
  EC3 (US)
- **Material Passports:**
  BAMB (EU);
  Madaster (NE);
  Woningpass (BE);
  General guidelines
- **LCA software:**
  Ecometro (ES);
  OpenLCA;
  One Click LCA;
  SimaPro;
  GaBi
- InData

14. Conducive policy and regulation

WHAT IS IT FOR?

How can policymakers support the transition toward circularity and carbon-neutral buildings? What are the strategic policy tools that could shift the balance away from Business as Usual to circular and biobased construction?

This section aims to improve the understanding of opportunities for urban stakeholders to engage in the development of supportive policy and regulation. The starting point is to identify existing city working groups and regulatory frameworks to assess how they could be improved/updated to accelerate embodied-carbon reduction in new buildings, and, based on this work, to prepare a policy brief for city decision makers.

Through HCC EU CINCO, we identified key policy areas for consideration:

City level

- Local/city level planning policy: Have potential regulatory barriers for using low-carbon materials and circular practices been identified? If not, carry out a diagnosis with all who may be affected, including local officials from different departments, developers, designers, contractors, and civic associations. Do local policies need updating to drive circular and bio-based construction in the public and private sectors? Are city policies actively hindering sustainable approaches? Clearly describe how policymakers can tackle these issues and introduce incentives to accelerate decarbonisation. (Examples include density bonuses for developers using low-carbon materials or requiring tender submissions to be fully circular). Does the city need to engage with other levels of government to overcome some of these barriers? Strengthen, establish, or make use of existing multi-level collaboration channels to address this common challenge.
- Taxation/fiscal incentives: Can the city use tax incentives to encourage circular and bio-based approaches (e.g., a tax cut for exemplary environmental performance)? Can the city use fiscal policy to discourage the use of high-carbon or other negative impact choices (e.g., a tax on new raw materials to encourage reuse)?
- City approaches to public procurement: Can the city develop a phased approach to gradually collect data and define incremental awarding criteria?

National level

- National planning policy/regional planning policy (if relevant): Cities may have limited influence on national or regional policies in the short term, but the briefing should identify these to show where opportunities and barriers lie. Cities can then advocate for change individually or with others.
- Building Regulations/Building codes: These can quickly become out of date and include obsolete requirements that hinder low-carbon construction. Some building regulation schemes do not address circularity or bio-based materials at all. Work with planning teams to create a list of specific regulations to consider.
- Design Standards

European level

- Legal framework (directive, regulation, or communication such as Green Public Procurement)
- Product-specific framework (such as the Construction Products Regulation - CPR)

WHEN DO WE CALL IT A SUCCESS?

- Decision-makers (city technical officers, politicians) engage constructively with stakeholders to reduce barriers to decarbonization in construction.
- Stakeholders are consulted about policy, regulation and opportunities in the market.
- Policies and regulations are reshaped, tested, and progressively implemented to dismantle perverse incentives and actively drive the use of design, methods, and materials which reduce embodied carbon in new buildings.

CASE STUDY

As part of a review of, and public consultation on Madrid's Urban Planning regulations, the HCC EU CINCO team (DML, DemSoc and EIT Climate-KIC) together with the UPM University was invited by the City Council's Energy and Climate Change department, to lead a participatory approach and draft proposals to increase the climate ambition of the reviewed regulation, specifically targeting circularity and low embodied carbon.

14. Conducive policy and regulation

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○ Examine policies, regulations, and incentives at the local/city level relevant to new buildings and infrastructure to identify barriers and opportunities to reduce embodied carbon.

○ Examine national (and, if applicable, regional) policies.

○ Summarise barriers and opportunities in a briefing document for policymakers (e.g., council planning committee, councillor responsible for planning/regeneration, urban planning team) and advise them how to dismantle barriers and incentivise best practices.

○ Ensure that your stakeholder group participates in relevant policy consultations and engagement events

○ Make the most of any ad hoc opportunities to address barriers and drive circularity and decarbonisation of buildings, e.g., in land use planning consultations, development plans and master plans for major sites. This will help refine and embed supporting policies and regulations in day-to-day planning practices.

RESOURCES:

- Carbon Neutral Cities Alliance (CNCA) City Policy Framework for Dramatically reducing Embodied Carbon (2020)
- Bringing embodied carbon upfront. World Green Building Council (2019)
- Embodied Carbon Review: Embodied carbon reduction in 100+ regulations and rating systems globally (One click LCA 2018)
- Understanding the Role of Embodied Carbon in Climate Smart Buildings: Report on Carbon Reduction Policy and Design Best Practices | Think Wood
- Decarbonising Buildings in Cities and Regions | en | OECD
- Sandbox Madrid: ¿Por qué no aceleramos la descarbonización? – Centro de Innovación en Tecnología para el Desarrollo Humano. (n.d.).

15. Innovative funding structures, capital planning, governance, and risk management

WHAT IS IT FOR?

For the transformative change we seek, real estate development financing needs to shift from a model that focuses only on expected revenues to one that attracts investment for outcomes defined by new, broader values, such as carbon reduction and social/environmental benefits. This shift promotes and incentivises investment in projects that address carbon-neutral buildings, and therefore incrementally encourages capital flows toward these developments.

WHEN DO WE CALL IT A SUCCESS?

One possible outcome could be a commitment by financial stakeholders from the real estate sector to engage in funding biobased, circular, and carbon-neutral building projects by a certain date, taking into account the broader positive environmental and/or social impacts.

CASE STUDY

In the workshops and meetings organised by Bankers without Boundaries, a diverse group of investors, funds, and financial institutions showed interest in engaging in the HCC EU CINCO project. During these discussions, participants expressed enthusiasm and willingness to participate in market-testing the proposed funding structures to get a sense of acceptable rates of return, and in particular to determine if these structures could lead to significant reductions in the cost of debt (i.e., through reduced interest rates for those engaging in bio-based construction projects). This funding structure would also make it possible to monetise the co-benefits connected to the projects; not only the lower CO2 footprint in building material but also potentially reduced energy costs, construction times, etc.
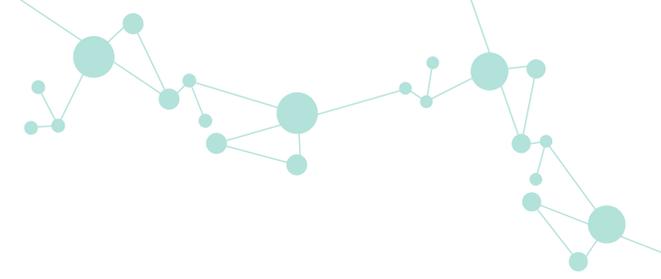
15. Innovative funding structures, capital planning, governance, and risk management

WHO IS LEADING?

WHO IS INVOLVED?

NOTES ON PROGRESS

TO DO

○ Identify relevant financial stakeholders (e.g., potential investors), set up regular meetings to explore their interest, and gather insights and feedback. Iteratively update recommendations and strategy based on input from financial stakeholders.

○ Prepare a set of non-financial indicators to integrate into the decision-making model to increase the financial attractiveness of a project, and develop an evaluation system.

○ Develop a "value" flow structure for the project that includes both financial and non-financial indicators, ensuring a balanced distribution of gains and losses among project stakeholders and the broader network of indirectly involved stakeholders.

○ Prepare the key contract terms that need to be embedded in the framework to implement the new value distribution to ensure accountability, traceability and transparency.

○ Set up a governance structure to manage the use of capital and ensure impact and project monitoring.

○ Create a risk register for the project and keep it up to date, taking into account the new set of value indicators.

RESOURCES:

- Corporate sustainability reporting | European Commission
- Sustainability-Linked Loan Principles in real estate finance
- Guidance on Sustainability Linked Loan Principles
- Climate risk and the opportunity for real estate
- Real Estate Investment Management in the light of ESG
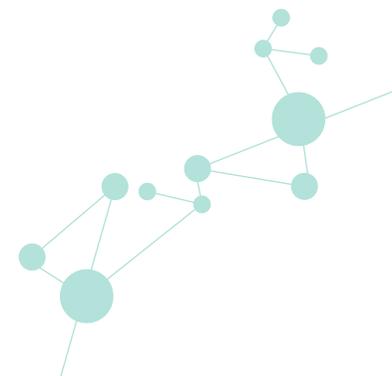
16. Risk assessment models

WHAT IS IT FOR?

The building insurance industry has been identified as one of the main barriers to bio-based and circular building, as this type of construction is generally perceived as involving more risk compared to concrete and steel structures. Therefore, working with insurance stakeholders to review their risk assessment models in relation to timber buildings and develop harmless building insurance products will be key to unlocking progress.

WHEN DO WE CALL IT A SUCCESS?

One possible outcome could be a commitment by real estate insurers to revise their risk assessment models for bio-based, circular, and carbon-neutral building projects by a certain date, taking into account new research and incentives.

CASE STUDY

In workshops and meetings with insurance stakeholders, Bankers without Boundaries explained the features of the HCC EU CINCO project and tested interest in developing new risk assessment models for bio-based and circular buildings. Research on green incentives in European and Asian countries has started the development of a methodology to apply these incentives to insurance models for carbon neutral buildings.

16. Risk assessment models

WHO IS LEADING?

WHO IS INVOLVED?

NOTES ON PROGRESS

TO DO

○ Research the current risk assessment model for timber buildings.

○ Identify harmful practices, material challenges, and value chain barriers, and prepare risk assessment model requirements and best practices for timber construction.

○ Set up regular meetings with relevant insurance stakeholders to explore their interest, gather insights and feedback.

○ Deliver an external document for insurance building products based on insights and feedback for insurance stakeholders.

RESOURCES:

- Decarbonizing construction: Guidance for investors and developers to reduce embodied carbon
- Carbon Footprint Assessment of a Novel Bio-Based Composite for Building Insulation

Additional activities to promote circular and bio-based construction

In this section we have presented the portfolio of activities undertaken by the project HCC EU CINCO in the cities of Milan and Madrid. The portfolio represents a non-exhaustive list of opportunities to help effect transformative change towards bio-based and circular construction and can be expanded by engaging more actors and stakeholders. Below are a few ideas for potential additional activities.

- Set (more ambitious) reduction targets for Scopes 1–3 and report publicly on the progress.

- Work with suppliers to reduce their emissions.

- Work with suppliers to help them develop sustainable products.

- Develop a value chain/sourcing strategy for sustainability.

- Scale-up "buying groups" to amplify demand-side commitments.

- Engage (more) in sector initiatives, such as those relating to best practice, certification, traceability, policy advocacy.

- Introduce low-carbon governance to align internal incentives and empower your organisation.

Learn and iterate:

Monitoring, evaluation, learning and sensemaking for reflexive governance
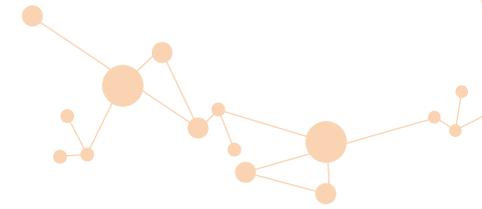
17. Sensemaking and course correction of pathway(s) based on learnings from portfolio implementation

WHAT IS IT FOR?

Monitoring, Evaluation, and Learning (MEL) are inter-linked activities that help to measure progress towards climate-neutrality, and build synergies across the port-folio of interventions based on collective learning.

- Monitoring relates to the development and application of quantitative indicators to track and analyse cities' progress towards direct impacts (such as net-zero GHG emissions) and indirect impacts (co-benefits), as well as the setup, management and maintenance of data collection tools and infrastructure.
- Evaluation denotes the analysis and assessment of monitoring information against set goals, targets, and benchmarks. The aim is to determine the degrees to which critical milestones, intermediate outcomes, and final impacts have been achieved.
- Learning implies a structured and continuous process of stock-taking and synthesis to generate real-time insights that help cities and their partners understand which solutions are working, in what contexts, for whom and why. MEL is also essential to the scalability and transferability of activities across multiple urban systems relevant to climate-neutrality and / or other cities or contexts.

MEL activities generate evidence and knowledge to enable reflexive governance and correct/refine the course of action. Cities and their partners will need to work in experimental, iterative ways, as the problems that they are dealing with are complex and without any clear boundaries. Taking the standard approach of 'analyse, plan, deliver' harbours the risk that both time and money are invested in solutions that are not viable under real-life conditions. Taking a reflexive approach to governance of 'plan, test, iterate' instead helps to build confidence in the direction of travel, as well as enabling partners to shape the work as it develops. This is why accelerating learning has emerged as such a critical driver of the transition towards bio-based and circular buildings.

Where they do not already exist, teams will need to establish processes for extracting rapid learning from small experiments and using them to inform urgent action, such as enabling policies. For this, the portfolio of multi-lever innovation initiatives is supported through dynamic management and regular 'sensemaking', with the intention of accelerating the pace of learning about obstacles and barriers to innovation, potential multipliers, more or less effective leverage points, integration effects and pathways to scaling.

WHEN DO WE CALL IT A SUCCESS?

In MEL, in addition to quantitative GHG emissions baseline/inventories and related data analysis, it is essential to describe complementary or supportive changes essential for the project's targets. These might comprise qualitative and quantitative changes, such as behavioural changes, mindsets and organisational learning, capability building, knowledge transfer and adoption, etc. Measures of success are:

- to ensure clear articulation of the MEL framework in the early project stages.
- to establish a baseline and targets of systems-wide impacts that work for most stakeholders.
- to ensure that multi-dimensional and systemic impacts from activities are continuously captured, measured, and fed into the sensemaking processes. Generating intelligence to inform the development of the portfolio is the ultimate objective of the sensemaking process. By intelligence we mean input prepared for decision makers to enable action.

CASE STUDY

In HCC EU CINCO, project coordinator EIT Climate-KIC adopts dynamic management and reflexive governance to go beyond simply meeting regular reporting requirements. The 'orchestrating' approach has proved helpful to inform the development, implementation, and improvement of HCC EU CINCO and has largely ensured that it has remained relevant, efficient, and effective over and beyond its lifespan.

17. Sensemaking and course correction of pathway(s) based on learnings from portfolio implementation

WHO IS LEADING?

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WHO IS INVOLVED?

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NOTES ON PROGRESS

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TO DO

○ Designing and operationalising efficient MEL and 'sensemaking' requires dedicated human resources and data governance practices, which will need to be planned for early on. Consider: Who should run this process? How will this process happen? What formal and/or informal structures will support it? What resources, structures, models, etc., will be required to do this successfully? Do you have any previous experience in such approaches / processes that you can build upon? Set evaluation criteria to measure progress towards envisioned impacts, determine the most relevant indicator sets, assess evidence gaps, and how these gaps could be addressed though the MEL processes. Frame strategic learning goals to help assess progress towards expected outcomes and inform evaluation/reporting in relation to the achievement of impacts.

RESOURCES:

- GHG Protocol supplies the world's most widely used greenhouse gas accounting standards.
- Laudes Foundation Measurement and Learning Approach has developed 21 rubrics that work across different levels, from processes to long-term impact. When measuring a specific initiative, a smaller set of relevant rubrics are chosen and assessed on a rating scale from 'harmful' to 'thrivable'.
- Covenant of Mayors framework: This methodological approach to the climate change mitigation and adaptation reporting (incl. local GHG accounting) is holistic in its nature. With respect to climate mitigation, this approach helps local authorities to address all the different consumers in their territory.