



CHALMERS
UNIVERSITY OF TECHNOLOGY

A Roadmap for a Sustainable Transformation of the Built Environment

Research Report-May 2023



Professor Holger Wallbaum
Professor Colin Fudge



The Swedish Foundation for
Strategic Environmental Research

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1 Project Description

“The project will provide a roadmap for the built and urban environment to achieve the UNSDGs by 2030 from a clear understanding of the reality of where we are in different regions of the world in 2022. The project will observe and respond to the barriers and successes of strategic change in this policy arena. It will provide clear examples of successful and unsuccessful practice as well as indicate research insights for action. The investment will allow Mistra and Sweden to be part of a dynamic international change process that is complex, multi layered and draws on trends that will influence the period 2022-2030.”

There were three main deliverables within the broader decision from Mistra. These included:

- (1) A Pilot Workshop- a pilot workshop for Northwest Europe on the Transformation of the built and urban environment to meet the UNSDGs by 2030 as the focus for an understanding of science and innovation including the working through of examples of practice, and the science – business - policy interfaces;**
- (2) Connectivity- connectivity, where possible with current Mistra programmes through project meetings and discussions and the arranging of future collaborative engagement;**
- (3) Recommendations- recommendations to Mistra on how to plan for, develop and define future research investments in the area of built and urban environment in relation to, for example, the planning, design, development, and construction process; climate change; biodiversity and liveable environments.**

This report of the research carried out addresses each of these points separately before concluding with a wider set of points and the need for urgency in tackling the broader research that is needed to facilitate change and transformation within this large sector.

2 Introduction

The built environment has a significant environmental footprint. It accounts for 40 per cent of global greenhouse gas emissions. There are roughly 255 billion sq. m of buildings in the world – a number that grows by around 5.5 billion sq. m every year (Built for the environment report, RIBA 2021) which is an equivalent of building New York city again every month. The need for action on the existing stock and any new stock grows ever more urgent. The built environment is a system and the transition to a fair and sustainable built environment can be brought about through collaborative and strategic system-wide analysis and action. This is the essence of our original paper to the World Conference on Sustainable Built Environments 2020 (Wallbaum and Fudge, 2020). This project funded by Mistra will provide the background research and actions for a roadmap for the built and urban environment to achieve the UNSDGs by 2030 from a clear understanding of the reality of where we are in different regions of the world in 2022. The project has been supported in 2022/23 by Mistra with preparatory funding for research programme ideas to be developed during 2023.

3 A Pilot Workshop

a pilot workshop for Northwest Europe on the Transformation of the built and urban environment to meet the UNSDGs by 2030 as the focus for an understanding of science and innovation including the working through of examples of practice, and the science – business - policy interfaces

As part of this larger project, we partnered with UN Habitat and Mistra to lead a high-level expert pilot workshop for Northwest Europe to explore the development of transformative roadmaps to lead us from our current practice to the required built and urban environment 2030 scenario with the UN SDGs achieved. This workshop took place at Chalmersska huset in Gothenburg on January 16-18, 2023. A Report of the workshop is attached in Appendix 1.

In relation to this part of the research we recommend the reading of the Workshop report in Appendix 1, however, for ease of understanding we present a summary of the findings below.

3.1 Pilot Workshop Summary

The workshop reported on in this document is one part of the wider programme of activity being led by Chalmers University to support the transformation of the built and urban environment to meet the UNSDGs by 2030. As the recent IPCC report (2023) demonstrates the urgent transformation of the built environment is a crucial and major component of the global changes that are required to change and improve the trajectory in relation to climate change, loss of biodiversity, reduction of waste, reduction of air pollution and creation of liveable and healthy environments.

There was very wide coverage of many topics or themes from the workshop participants however there were a number of key priorities that were agreed on by a large percentage of the participants. These included:

- Renovation and adaptive reuse
- Process and methods
- Social sustainability
- Nature and biodiversity
- Infrastructure
- Sustainable livelihoods

There were also many other themes of significance that other groups may have prioritised more strongly, these along with the other considerable learnings from this pilot workshop process will be taken into the design of the remaining workshops.

What do we make of all of this at this stage and what do we need to consider for our ongoing work? Integrating the findings from the pilot workshop and our other activities in this broad area, we are in a position to propose an agenda for policy, action and research that would include the following:

- (1) Rethinking our approaches to processes and methods in relation to buildings and urban development.
- (2) Rethinking our approach to adaptive reuse, renovation, and recycling as a priority over new build.
- (3) Proposing that in policy terms all new build is zero carbon as built and in use.
- (4) Rethinking our approach to development to ensure that social sustainability has equal status to environmental and economic.
- (5) Rethinking our approach to urban planning, urban design and the design of buildings or adaptive reuse of buildings address the two interrelated issues of climate change and biodiversity.
- (6) Ensuring that future energy production for adaptive reuse and new build is from renewable sources and that storage is considered within this approach.
- (7) Rethinking the professional education of key actors at undergraduate, postgraduate and craft/technical levels as well as the retraining of existing practitioners.
- (8) Rethinking the roles and responsibilities of the 'client' in all aspects of development.

3.2 Further Workshops

We are in discussion with UN Habitat and other partners about further workshops in different regions of the world. A summary of the current position is presented below:

Northwest Europe: Chalmers/UN Habitat/Mistra, completed and report of workshop circulated.

Southern Europe: Barcelona City Council Mayor' Office has agreed in principle providing the mayor is elected again in the forthcoming elections. If this was the case, they would look favourably on a Workshop taking place later in 2023 or early in 2024.

Australia: Discussions have restarted following the Northwest Europe workshop with Professors at RMIT University for Melbourne to be the location for an Australian/New Zealand workshop in late 2023 or first quarter 2024. Funding is being applied for.

Southern Africa: Chalmers and UN Habitat are in discussion over a Workshop for Southern Africa in partnership with University of Pretoria and the African Centre for Cities. It is hoped that this might take place later in 2023.

Eastern Africa: Chalmers and UN Habitat are in discussion over a Workshop in Eastern Africa that could take place in Kigali, Rwanda, or Nairobi. The discussions are at an early stage but architecture practices in the UK and Sweden working in this region may be interested in assisting with this workshop, and Chalmers University has a special relationship with the region.

Canada: Discussions with colleagues in Canada working on the World Conference on Sustainable Built Environments 2024, Montreal are progressing and there is interest once the world conference has been completed in May next year.

Workshops are one of a number of actions that Wallbaum and Fudge are working on, and they need to be considered alongside other components. As well as regional expert workshops we are also working on the following:

- Background literature reviews
- Current and programmed policy, campaign, and practice reviews
- Deep dives exploring detailed practice case studies
- Practice roundtables
- Delphi studies
- Research projects
- Collaborations with other key actors within research, practice, industry, and government.
- International conferences and journals: research and publications

Our hope is that in the near future we might see all of these components becoming integrated within a wider programme of research and action.

4 Connectivity

connectivity with current Mistra programmes and future collaborative engagement

MISTRA has 17 programs ongoing (according to the website and the available yearly program reports) and several of them offer objective links to a possible wider programme of research and action related to the built and urban environment, these are:

Mistra InfraMaint, Fairtrans, Mistra Electrification, Mistra SafeChem, Mistra Sport & Outdoors, Mistra Food Futures, Mistra Environmental Communication, Mistra Digital Forest, Mistra Sustainable Consumption, Mistra TerraClean, Mistra Carbon Exit, Mistra Geopolitics, Mistra STEPS, Mistra SAMS, Misum, Mistra REES, Mistra Environmental Nanosafety.

In the last months, we had the opportunity to study all 17 programs based on the available material on the respective program websites. Furthermore, a few personal exchanges with program participants added to the overall understanding of the program's synergies with our project of a roadmap for a sustainable transformation of the Built Environment (see Table 1), the especially related programs are:

Mistra InfraMaint is a research programme where researchers and municipalities together develop tools for decision support, better processes and smarter municipal organization. Infrastructure investment and maintenance processes as well as digitalisation are core aspects of this MISTRA program.

FAIRTRANS' purpose is precisely to build knowledge and create preparedness for a fair transition to a fossil-free society. Through collaboration between researchers and civil society, FAIRTRANS creates scientifically based strategies and political frameworks for a rapid transformation to ensure both social security and climate goals.

The vision of the **Mistra Electrification** programme is to accelerate the transition to a sustainable and efficient energy system, through the creation of actionable knowledge for a feasible and fair transition.

Reframing communication for sustainability is the research program of **Mistra Environmental Communication**. Communication about sustainability plays a decisive role in the transition to a more sustainable world. The program's goal is to improve the state of knowledge about and practice around such communication.

The **Mistra Carbon Exit** programme addresses and identifies the technical, economic, and political challenges that Sweden will encounter when it attempts to reach the net zero greenhouse gas emissions target by 2045.

The **Mistra Geopolitics** research programme works with foresight to help decision-makers at all levels find the right knowledge on how to handle a crisis, providing examples and exploring possibilities to help them understand what might happen in the future. The experts and researchers on climate issues, security policies, crisis management, food and raw materials combine knowledge and experience to produce research results and recommendations on policies.

Mistra SAMS studies digitally supported services for accessibility and mobility, to understand their potential to transform society and contribute to sustainability.

Mistra Center for Sustainable Markets (Misum) is an interdisciplinary and multi-stakeholder research center at the Stockholm School of Economics focused on sustainability with competences in economics, finance, sustainable development, business leadership and innovation. MISUM's aim is to develop rigorous knowledge around how markets may best be advanced to support the transition to sustainable development.

The **Mistra REES** research program is a collaboration between leading academic environments, industrial companies and societal actors to create knowledge about more resource-efficient and effective solutions (REES) based on a circular economy.

Table 1: Ongoing MISTRA programs and potential synergies with the workshop results for a sustainable transformation of the BuiltEnvironment.

	Mistra InfraMaint	FAIRTRANS	Mistra Electrification	Mistra Environmental Communication	Mistra Carbon Exit	Mistra Geopolitics	Mistra SAMS	MISUM	Mistra REES
(1) Rethinking our approaches to processes and methods in relation to buildings and urban development	X			X	X		X	X	X
(2) Rethinking our approach to adaptive reuse, renovation, and recycling as a priority over new build	X				X				X
(3) Proposing that in policy terms all new build is zero carbon as built and in use		X		X		X			
(4) Rethinking our approach to development to ensure that social sustainability has equal status to environmental and economic		X				X		X	
(5) Rethinking our approach to urban planning, urban design and the design of buildings or adaptive reuse of buildings address the two interrelated issues of climate change and biodiversity	X	X	X	X	X	X	X	X	X
(6) Ensuring that future energy production for adaptive reuse and new build is from renewable sources and that storage is considered within this approach			X		X				X
(7) Rethinking the professional education of key actors at undergraduate, postgraduate and craft/technical levels as well as the retraining of existing practitioners				X					
(8) Rethinking the roles and responsibilities of the 'client' in all aspects of development		X						X	

Overall, only based on desk research and a few random personal exchanges with persons engaged in different MISTRA programs it became clear that synergies with ongoing MISTRA programs are obvious but that additional research and implementation gaps do still exist as well (see the following section *Recommendations-recommendations to Mistra in relation to research investment for the built and urban environment so that it can meet the UNSDGs by 2030.*)

In the next step, we would suggest a more systemically exploration of the fields of synergies with ongoing MISTRA programs through interviews with program leads and key stakeholders (maybe 20 in total) active in the most related programs. This could be done in collaboration with MISTRAs kansliet which would lead to additional relevant material to support the possible development of an additional MISTRA activity with a focus on the built environment.

5 Recommendations

recommendations to Mistra in relation to research investment for the built and urban environment so that it can meet the UNSDGs by 2030.

In the introductory paper of the Special Issue of Cities & Health Journal (Vol 4 number 2 2020 - Prof Colin Fudge Editor) we introduced the importance and complexity of achieving transformational change (Fudge, Grant, and Wallbaum, 2020). Given our focus on transformational change in the built and urban environment we introduced a few questions that might guide us in relation to the research and practice agendas. These included:

- **How transitions can be accelerated, and which policy tools might influence the process positively?**
- **How to encourage the decline of existing non-sustainable systems?**
- **How best to use the agency of actors involved in transition processes?**
- **How to move beyond ‘islands of innovation’ and achieve scale?**
- **How to manage uneven dimensions of transition through geography, culture, economy, and stages of development?**

The project has observed and responded to the barriers and successes of strategic change in this policy arena some of which may well translate into other areas. It has provided an updated and extended literature review, and clear examples of successful and unsuccessful practice and how this was achieved. This will include ‘research insights for action’ for example, into the relative significance of regulation, carrot and stick measures, investment in innovation and research, the role of government (at different levels), policy and its implementation, changes to the overall thinking in relation to the design and building processes, decarbonisation of building materials and construction, reductions in energy use required in existing and new buildings, shifting towards new interdisciplinary education, retraining and upskilling, rethinking business models and supply chains, and, prioritising environment such as refurbishment and adaptive reuse over demolition, bio-based over extractive materials, and renewable over fossil fuel energy.

To be able to develop our study of this complex area we are drawing on social science, design theory, engineering, and science in a transdisciplinary research method. We are exploring a mixed scanning approach that covers both whole systems understanding with detailed practice investigations, a literature study of both academic and practice research, detailed investigations of completed projects teasing out the barriers to progress and the ways round these obstacles, the wider societal understanding of sustainable development, the political economy of development and change, and work on urban futures.

From our current work through Mistra funded research, other funded research, expert workshops, participation in task forces, forums, and larger environmental organisations we have developed an agenda of issues that need to be explored in more depth, to be able to draw up a larger and wider research programme/research centre and advise Mistra on how this large and complex issue could be approached in the future.

We suggest there are perhaps three broad strategic areas for research that need to be advanced but also integrated within a holistic understanding of the research and how it might influence transformation and change in the built and urban environment.

Broad strategic areas for research

1. Conceptual frameworks and thinking
2. Understanding the detail and flow of practice
3. Middle order planning, intelligence, and imagination – holding future scanning and the everyday together.

5.1 Conceptual Frameworks and Thinking

Social transition and change: An exploration of the dimensions of change and transition through discussions with key research nodes within Mistra funding but also externally through colleagues working on social transition and change in the Netherlands, Australia, UK, and Swedish research organisations.

Conceptual transformation towards a new normal: There is a developing conceptual background that is needed to be able to change and transform thinking and ‘doing’ in practice. There are a range of components that are interrelated within this new thinking and this research examines the ‘espoused theory’ and the ‘theory in practice’. It will explore the transition that is required to shift the theory in practice towards the espoused theory through different strategies including education, training, and retraining.

Speed, scale, and mainstream: These demands have been voiced in many reports and campaigns but relatively little has advanced the ideas beyond rhetoric. This exploration starts to unpack these imperatives to find out how they could be achieved and what are the barriers to their implementation.

5.2 Understanding the Detail and Flow of Practice

Actors and agency: An exploration of the role of key actors in the development, management, and maintenance of the built environment. To include architects, engineers, cost analysts/Quantity Surveyors, development financiers, construction managers, construction companies, materials suppliers, energy companies, town planners, AI specialists, etc.

Adaptive reuse, renovation, and recycling: An exploration of this more recent significant change in emphasis which also figured as a main priority in the Northwest Europe workshop. This is to be studied to explore the need for new knowledge, skills, practice change, structural and materials assessment and new thinking in relation to planning policy, building regulation and cost valuation systems and processes.

Net zero new build: Even with adaptive reuse taking priority where possible there remains an issue with the new requirements in relation to new build in terms of climate, carbon and biodiversity.

The role of the client: A largescale study in 2021 of all the architects in the RIBA (Royal Institute of British Architects) demonstrated that the two most significant areas where projects didn't meet their climate or biodiversity goals were around the attitude of the client and the value engineering in relation to cost. These were often linked. This exploration starts to investigate the role, thinking and world view of the client and how this might be challenged and transformed. There will be a separate examination of value engineering in relation to carbon and biodiversity.

Exploring national and local government policy, regulations, incentives and their implementation: We suggest that there is a major study of the nature of planning policy, regulations and incentives for practice to transform to meet the UN SDGs, climate change and bio diversity.

Project understanding from inception to completion to in use: A deep dive into recently completed projects in the UK and Sweden tracking each project from inception to completion and in use after 1 year. Proposals are in discussion with practices in both countries.

5.3 Middle Order Planning, Intelligence, and Imagination – holding future scanning and the everyday together

Short, medium, and long-term energy futures: There has been a continuing commentary for a considerable time that we need to examine the energy provision in buildings from a short, medium and longer term perspective. This exploration seeks to provide clarity where possible to the choices and sequences needed for transforming existing and new stock.

Rethinking materials, construction, and design: Exploration and research of the choice, specification and use of materials within construction and the understanding from practice

of an innovative approach to materials including reuse, recycled and the transformation of waste to new materials and products.

Understanding asset risk for asset owners in relation to flooding, extreme heat, change in precipitation, subsidence to ensure our buildings, cities and communities are resilient to climate change:

Exploring the interrelationship of buildings and biodiversity in a regenerative approach to the future including the rethinking of urban design in cities and the public realm: This is a much needed exploration of the relationship between building and nature. Although there have been a number of significant studies and considerable support for this topic this has been under-researched in relation to its importance for the regenerative approach and in relation to the two interrelated emergencies of climate and biodiversity.

New thinking in relation to business models, and economic futures for the built environment: We would encourage that a number of organisations with Mistra funded research in this broad field also focus on the future of the built environment sector in terms of transformed business models, supply chains and building processes.

Rethinking education, training and retraining for the built and urban environment and the role of the professions: This is currently an important topic for research and transformation and change. Both meta organisations, professional bodies and education providers are reviewing and experimenting with new and changed content and pedagogy for the future of the built and urban environment. Research is needed to gather together these initial findings and trials so that there can be widescale sharing and implementation of a changed education fit for future purpose.

6 Concluding Thoughts and Suggestions for Next Steps

Through this research we have contributed to the leading and running of a high level expert workshop for Northwest Europe on the transformation of the built and urban environment to meet the UN SDGs. This was a successful pilot for a further set of workshops to take place in different regions of the world. We have encouraging responses from Africa, Australia, Canada and Southern Europe. We also have an ongoing partner in UN Habitat who we are working closely with on research, policy discussion and the workshops in Eastern and Southern Africa.

We have also been able to investigate programmes of research funded by Mistra where we think there could be beneficial, efficient and effective collaborations on the built and urban environment. We feel that we and others could easily position ourselves to discuss and identify collaborative and co-working engagement on the built environment.

We have, in principle, agreement in Sweden and the UK to explore actors and agency, the role of the client, adaptive reuse and renovation, and new build through deep dives into practice examples of recently completed projects. This exploration, if funded, could be

completed in the remainder of 2023/ early 2024 and would provide further evidence and understanding for a larger research programme or research centre.

Finally, in our discussions with UN Habitat, and International collaborators we are pleased to report that they are interested to work in parallel in their countries and organisations with their own funding in a shared and comparative approach to researching the transformation of the built and urban environment to meet the twin issues of climate change and loss of biodiversity.

7 Appendix

Northwest Europe Expert workshop Report



TRANSFORMING THE BUILT ENVIRONMENT

Implementing change and transformation in the Built and Urban Environment to meet the UN SDGs (United Nations Sustainable Development Goals)

A summary report of a high-level expert workshop held at Chalmers University, Gothenburg, Sweden, January 16-18, 2023.



Holger Wallbaum, Colin Fudge, Shea Hagy, Lina Zachrisson

April 2023

Workshop Partners:



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1 Acknowledgements

We would like to thank UN Habitat and Mistra for their agreement to be our partners in this pilot workshop. More specifically we would like to thank Klas Groth (UN Habitat) and Anna Jöborn (Mistra) for their positive engagement within the workshop itself.

2 Introduction and background

The built environment has a significant environmental footprint. It accounts for 40 per cent of global greenhouse gas emissions. There are roughly 255 billion sq. m of buildings in the world – a number that grows by around 5.5 billion sq. m every year (Built for the environment report, RIBA 2021) which is an equivalent of building New York city again every month. The need for action on the existing stock and any new stock grows ever more urgent. The built environment is a system and the transition to a fair and sustainable built environment can be brought about through collaborative and strategic system-wide analysis and action. This is the essence of our original paper to the World Conference on Sustainable Built Environments 2020 (Wallbaum and Fudge, 2020). This project will provide the background research and actions for a roadmap for the built and urban environment to achieve the UNSDGs by 2030 from a clear understanding of the reality of where we are in different regions of the world in 2022. The project has been supported in 2022/23 by Mistra with preparatory funding for research programme ideas to be developed during 2023.

Given our focus on transformational change in the built and urban environment (Fudge, Grant, and Wallbaum, 2020) we introduced a few questions that might guide us in relation to the research and practice agendas. These include: How transitions can be accelerated, and which policy tools might influence the process positively? How to encourage the decline of existing non sustainable systems? How best to use the agency of actors involved in transition processes? How to move beyond ‘islands of innovation’ and achieve scale? How to manage uneven dimensions of transition through geography, culture, economy, and stages of development? (Lorch 2017). These deep and complex issues are behind and will inform our work in this project.

The project will observe and respond to the barriers and successes of strategic change in this policy arena some of which may well translate into other areas. It will provide an updated and extended literature review, and clear examples of successful and unsuccessful practice and how this was achieved. This will include ‘research insights for action’ for example, into the relative significance of regulation, carrot and stick measures, investment in innovation and research, the role of government (at different levels), policy and its implementation, changes to the overall thinking in relation to the design and building processes, decarbonisation of building materials and construction, reductions in energy use required in existing and new buildings, shifting towards new interdisciplinary education, retraining and upskilling, rethinking business models and supply chains, and, prioritising environments such as refurbishment and adaptive reuse over demolition, bio-based over extractive materials, and renewable over fossil fuel energy.

To be able to develop our study of this complex area we are drawing on social science, design theory, engineering, and science in a transdisciplinary research method. We are exploring a mixed scanning approach that covers both whole systems understanding with detailed practice investigations, a literature study of both academic and practice research, detailed investigations of completed projects teasing out the barriers to progress and the ways round these obstacles, the wider societal understanding of sustainable development, the nature of societal change and transformation, the political economy of development and change, and work on urban futures.

As part of this larger project, we have partnered with UN Habitat and Mistra to lead a high-level expert workshop to explore the development of transformative roadmaps to lead us from our current practice to the required built and urban environment 2030 scenario with the UN SDGs achieved. This workshop took place at Chalmersska huset in Gothenburg in January 2023.

The findings of the workshop will be included in a report that will go to the Executive Director of UN Habitat, to Mistra, to Urban Futures and Gothenburg City Council and our collaborators in other

regions of the world, as well as being publicly available. It will also inform the development of a larger research application to research funding bodies to be submitted later in 2023, the papers delivered by Professors Wallbaum and Fudge to the World Sustainable Built Environments Conference to be held in Montreal in May-June 2024, and the editing of a special issue of Sustainability Journal on the 'Implementation of the transformation of the built and urban environment to meet the UN SDGs' in 2024.

3 The high-level expert workshop

3.1 Purpose

As part of this larger project, we have partnered with UN Habitat and Mistra to lead a high-level expert workshop to explore the development of transformative roadmaps to get us from our current practice to the required built and urban environment 2030 scenario with the UN SDGs achieved. This workshop took place in January 2023, focusing on Northern-Western Europe (NWE), and has acted as a pilot for similar workshops to be held in Canada, Australia, New Zealand, Southern Africa, Eastern Africa and Southern Europe (through the leadership of the Mayor of Barcelona). The workshop has included UN Habitat, and Mistra as well as experts from the countries of new, representing the different disciplines and actors engaged in the built environment.

3.2 Participants

The participants in the workshop were invited by the hosts from a range of countries and organisations in Northwest Europe and represent a range of expertise in policy, practice, and the implementation of the UN SDGs. A full list of the participants is provided in Appendix 1.

3.3 Methodology and Process

The workshop was held over 2 days and the 30 participants were arranged into 5 groups of between 4-6 people each. The group members first brainstormed individually and then were tasked in groups to, develop, map, and establish what the built and urban environment would be like in Northwest Europe in 2030. The findings were shared and discussed in the whole group drawing also on the background paper circulated to all participants before the workshop.

The programme focused on:

- Developing an understanding (a scenario) of what the built and urban environment would be like if the UN SDGs were met in 2030.
- Examining where policy and practice are today in NWE and what the journey looks like from now until the 2030 scenario.
- Building an implementation strategy and measures for change and transformation for policy and practice from a position that currently is way behind what is required by 2030.
- Making sense of the findings, developing strategies to overcome barriers to transformation and focusing on the key messages to the main actors involved in change and transformation in the built environment.

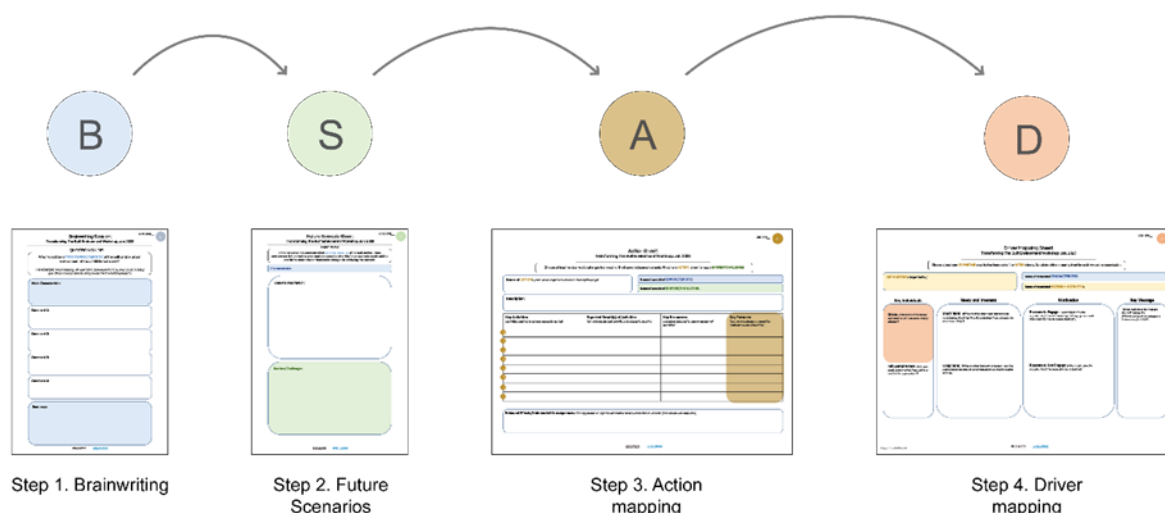


Figure 1: Workshop Process Diagram.

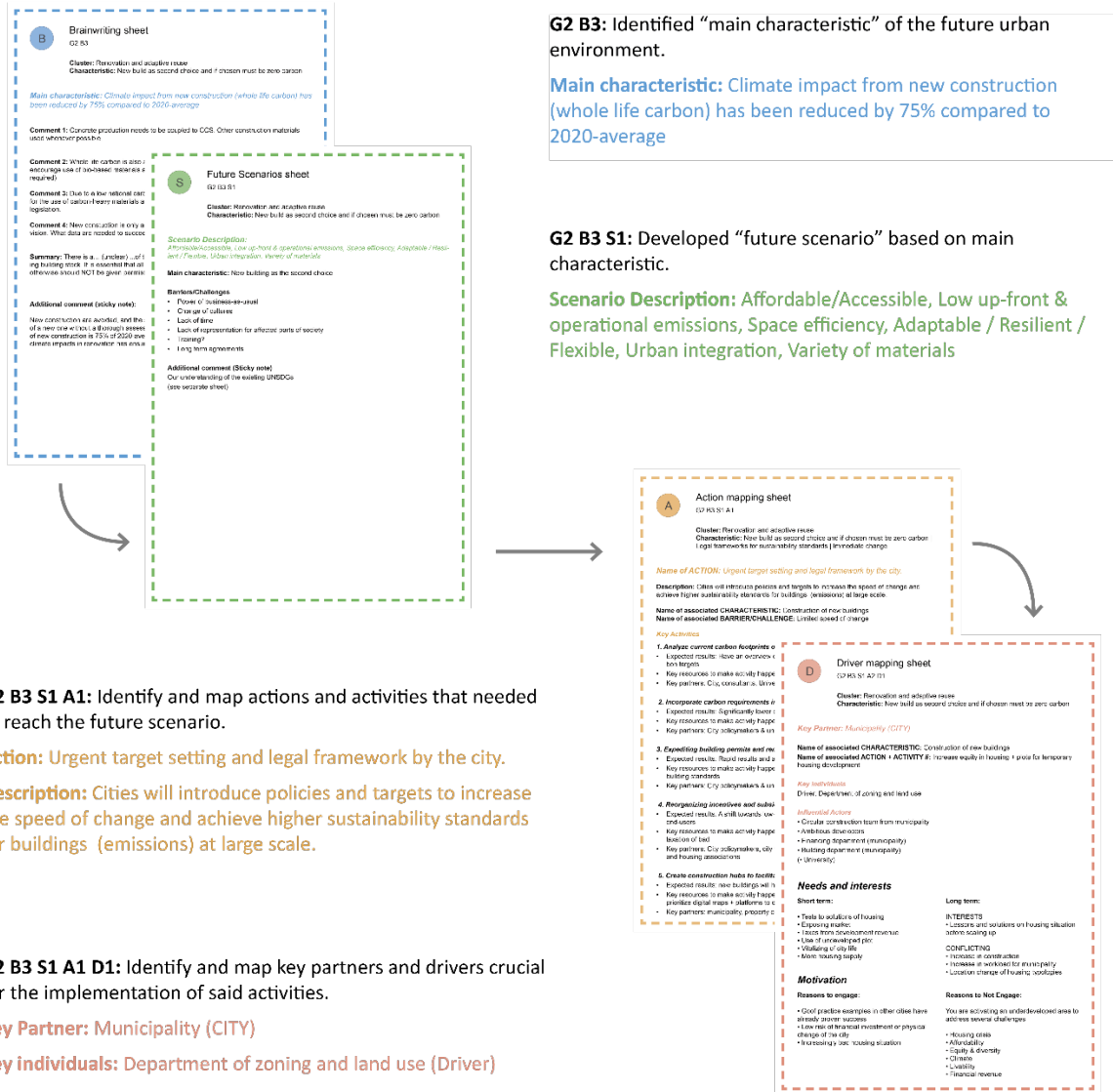
The workshop was organized around four worksheets (see Figure 1) and sessions that aimed to guide the participants through a co-creative process to share and draw on their various expertise to generate ideas and iteratively narrow down the ideas to concrete actions. Following is a brief overview of the process, as well as a sequence of sheets chosen to exemplify the process (see Figure 2). During analysis, this sequence of exemplary sheets were identified as belonging to the characteristic “New build as second choice and if chosen must be zero carbon”, which was then sorted into the cluster “Renovation and adaptive reuse”.

Definitions

Throughout this report, the workshop process and findings will be described using specific terminology. Table 1 defines these terms.

Table 1: Definition of terms for the purpose of this report.

Process steps	B - Brainwriting, S - Future Scenarios, A - Action mapping and D - Driver mapping
Sheets	The filled-in templates that were given to the workshop participants. The workshop generated 89 sheets in total, spread across the four process steps.
Characteristics	Each sheet was identified as treating or belonging to a certain characteristic of the future built environment. The characteristics are assigned to sheets across all process steps and are descriptive in nature.
Clusters of characteristics	When possible, similar characteristics were combined into “clusters”, indicating a more overarching thematic similarity between characteristics.
‘Most mentioned’ clusters	Out of all 16 clusters of characteristics, 6 could be identified as “most mentioned”, based on their total amount of sheets; they all include more than 6 total sheets each.



G2 B3 S1 A1: Identify and map actions and activities that needed to reach the future scenario.

Action: Urgent target setting and legal framework by the city.

Description: Cities will introduce policies and targets to increase the speed of change and achieve higher sustainability standards for buildings (emissions) at large scale.

G2 B3 S1 A1 D1: Identify and map key partners and drivers crucial for the implementation of said activities.

Key Partner: Municipality (CITY)

Key individuals: Department of zoning and land use (Driver)

Figure 2: Overview of process through the example of one sequence of generated sheets.

Figure 2 shows the example of one idea and how it is linked through the workshop process. A numbering system was created after the workshop to analyse the materials. In this example you can see that Group 2 (G2) has taken one of their Brainwriting sheet ideas (B3) and used it to create a future scenario (S1). From that Scenario Sheet (G2 B3 S1) 2 action sheets were created (G2 B3 S1 A1 shown above) from which one driver sheet was created (G2 B3 S1 A2 D1).

Step 1: Brainwriting

The first step in the process was a brainwriting exercise. Each group member received a sheet with the following prompt: What would be a MAIN CHARACTERISTIC of the built and/or urban environment, if the UNSDGs were met? One minute was given for each group member to simultaneously answer the aforementioned question, then each of the group members passed their paper to another and comments on the others' initial answer to compliment or deepen the characteristic. This process repeated till all group members had commented on all sheets and received their original sheet back, where it was summarized by the original author. Each group created one brainwriting sheet per group member, i.e., 5-6 sheets per group.

B Brainwriting sheet
G2 B3

Cluster: Renovation and adaptive reuse
Characteristic: New build as second choice and if chosen must be zero carbon

Main characteristic: Climate impact from new construction (whole life carbon) has been reduced by 75% compared to 2020-average

Comment 1: Concrete production needs to be coupled to CCS. Other construction materials used whenever possible.

Comment 2: Whole life carbon is also applied to renovation. Legislation will have changed to encourage use of bio-based materials and low-carbon conventional materials (where their use is required)

Comment 3: Due to a low national carbon budget, up-front carbon does in most cases not allow for the use of carbon-heavy materials and LCAs regulate the use of the word "sustainability" in legislation.

Comment 4: New construction is only a small part of the built environment. Also: carbon tunnel vision. What data are needed to succeed? Knowledge?

Summary: There is a... (unclear) ...of the future scale + volume of new build and retrofit of existing building stock. It is essential that all new build has to be exceptional in relation to performance otherwise should NOT be given permission.

Additional comment (sticky note):

New construction are avoided, and the space is optimized. No building is demolished in a favor of a new one without a thorough assessment of the possibility to preserve. The climate impact of new construction is 75% of 2020-average, and with focus on upfront emissions. Regulation of climate impacts in renovation has ensured climate-smart retrofit/renovation.

Figure 3: Example of transcribed Brainwriting Sheet.

Step 2: Future Scenarios

The participants were then asked to fill out one future scenario sheet for each identified characteristic that was identified in the brainwriting session. The groups worked together to create scenario sheets from each of the identified characteristics. Each scenario sheet aimed to paint the picture of a future where the respective characteristics had been realized. The groups were also asked to identify barriers/challenges that are currently keeping that scenario from being realized. Each group created between 3-5 future scenario sheets.

S Future Scenarios sheet
G2 B3 S1

Cluster: Renovation and adaptive reuse
Characteristic: New build as second choice and if chosen must be zero carbon

Scenario Description:
Affordable/Accessible, Low up-front & operational emissions, Space efficiency, Adaptable / Resilient / Flexible, Urban integration, Variety of materials

Main characteristic: New building as the second choice

Barriers/Challenges

- Power of business-as-usual
- Change of cultures
- Lack of time
- Lack of representation for affected parts of society
- Training?
- Long term agreements

Additional comment (Sticky note)
Our understanding of the existing UNSDGs
(see separate sheet)

Figure 4: Example of transcribed Future Scenario Sheet.

Step 3: Action mapping

In this step participants were asked to choose at least two barriers/challenges from each of future scenario sheets and fill out one action sheet for each barrier/challenge. The groups worked together to create actions, each with 8 associated (sub) activities, that could make that action happen. The participants also identified key partners that would need to be involved to complete the activities. This step was quite time consuming, so each group ended up creating an average of 2-3 action sheets.

A

Action mapping sheet

G2 B3 S1 A1

Cluster: Renovation and adaptive reuse
Characteristic: New build as second choice and if chosen must be zero carbon | Legal frameworks for sustainability standards | Immediate change

***Name of ACTION:** Urgent target setting and legal framework by the city.*

Description: Cities will introduce policies and targets to increase the speed of change and achieve higher sustainability standards for buildings (emissions) at large scale.

Name of associated CHARACTERISTIC: Construction of new buildings
Name of associated BARRIER/CHALLENGE: Limited speed of change

Key Activities

- 1. Analyze current carbon footprints of buildings.**
 - Expected results: Have an overview of building stock and their emissions to help you set carbon targets
 - Key resources to make activity happen: Data and measurement
 - Key partners: City, consultants, University, Developers
- 2. Incorporate carbon requirements in tenders/LCA**
 - Expected results: Significantly lower embodied + operation carbon
 - Key resources to make activity happen: Experts to develop criteria and compare data
 - Key partners: City policymakers & university, City technical staff
- 3. Expediting building permits and removing legal obstacles**
 - Expected results: Rapid results and a more active market
 - Key resources to make activity happen: Update building code to respond/accommodate new building standards
 - Key partners: City policymakers & university, City technical staff
- 4. Reorganizing incentives and subsidies to encourage net-zero**
 - Expected results: A shift towards low-carbon materials from construction developers and end-users
 - Key resources to make activity happen: Data on what to incentivize, what to trade & higher taxation of bad
 - Key partners: City policymakers, city technical staff, business community + private households and housing associations
- 5. Create construction hubs to facilitate circularity**
 - Expected results: new buildings will have increased the use of reuse/recycled materials
 - Key resources to make activity happen: Financial investment, plots understanding materials to prioritize digital maps + platforms to connect
 - Key partners: municipality, property owners, technical engineers

Figure 5: Example of transcribed Action Mapping Sheet.

Step 4: Driver mapping

The final step of the workshop was for each group to choose at least one key partner organisation from each of the action sheets and complete a driver mapping sheet for each key partner organisation. For each of the actions/activities, the groups worked together to identify key drivers, i.e. organisations, businesses or individuals that would be essential for the realisation of that specific action. Each group generated between 1-3 driver mapping sheets.

D

Driver mapping sheet

G2 B3 S1 A2 D1

Cluster: Renovation and adaptive reuse
Characteristic: New build as second choice and if chosen must be zero carbon

Key Partner: Municipality (CITY)

Name of associated CHARACTERISTIC: Construction of new buildings
Name of associated ACTION + ACTIVITY #: Increase equity in housing + plots for temporary housing development

Key individuals
 Driver: Department of zoning and land use

Influential Actors

- Circular construction team from municipality
- Ambitious developers
- Financing department (municipality)
- Building department (municipality)
- (• University)

Needs and interests

<p>Short term:</p> <ul style="list-style-type: none"> • Tests to solutions of housing • Exposing market • Taxes from development revenue • Use of undeveloped plot • Vitalizing of city life • More housing supply 	<p>Long term:</p> <p>INTERESTS</p> <ul style="list-style-type: none"> • Lessons and solutions on housing situation before scaling up <p>CONFLICTING</p> <ul style="list-style-type: none"> • Increase in construction • Increase in workload for municipality • Location change of housing typologies
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Motivation

<p>Reasons to engage:</p> <ul style="list-style-type: none"> • Goof practice examples in other cities have already proven success • Low risk of financial investment or physical change of the city • Increasingly bad housing situation 	<p>Reasons to Not Engage:</p> <p>You are activating an underdeveloped area to address several challenges</p> <ul style="list-style-type: none"> • Housing crisis • Affordability • Equity & diversity • Climate • Livability • Financial revenue
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Figure 6: Example of transcribed Driver Mapping Sheet.

4 Workshop Findings

The five working groups developed a wide array of ideas spread across a total of 89 sheets; 24 Brainwriting, 30 Future scenarios, 25 Action mappings and 7 Driver mappings. After transcribing the worksheets and materials from the workshop it was found that each group created an average of 15-20 sheets across the two days, including 4-5 Brainwritings, 5-7 Future scenarios, 4-5 Action mappings and 1-3 Driver mappings. Figure 7 illustrates this process and the generated material.

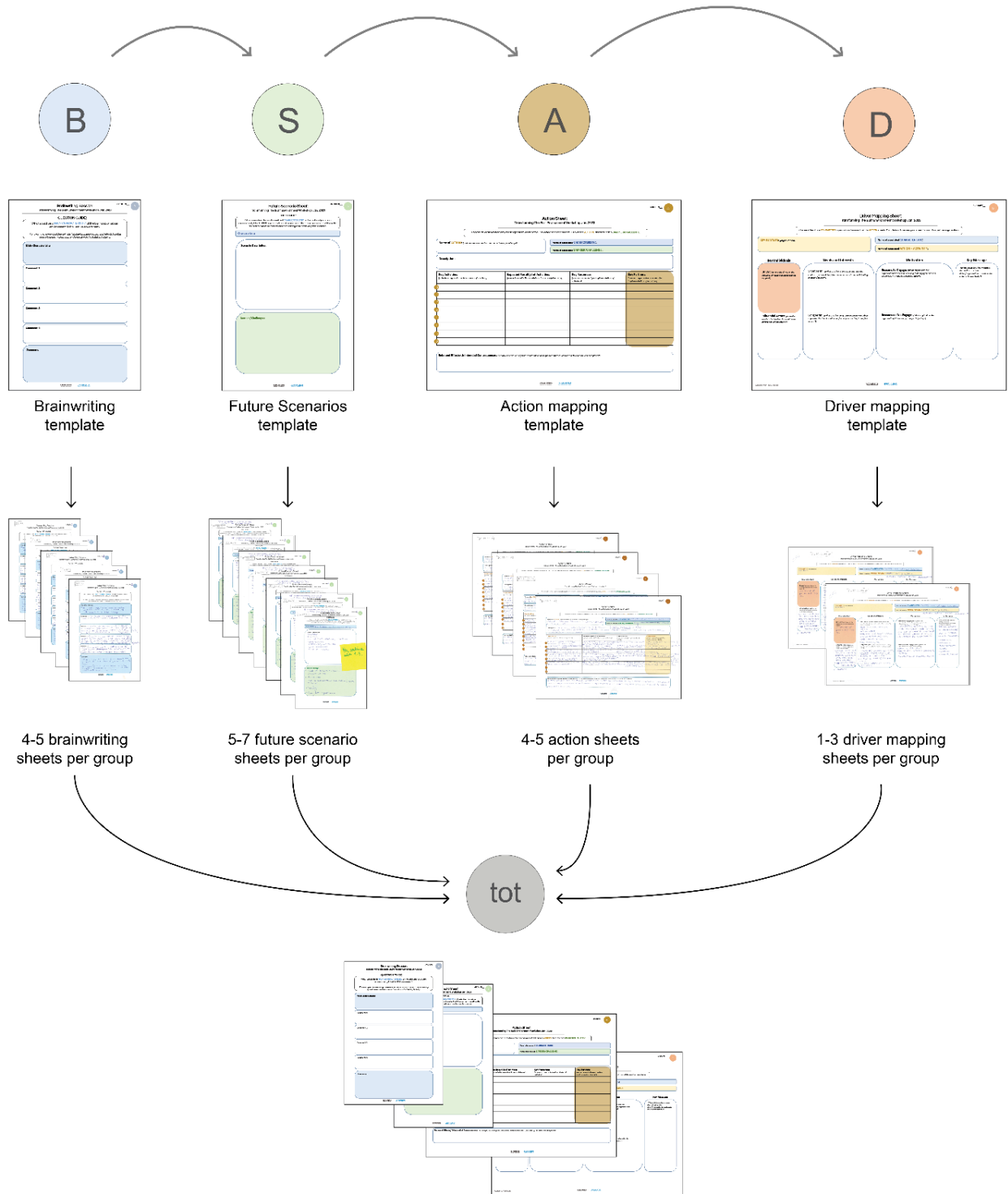


Figure 7: Workshop material flow.

The sheets from all process steps together form the total amount of 89 sheets, as shown also in Figure 8 and Table 2.

Each of the generated sheets could be identified as tackling a certain **characteristic**, or theme, of the urban environment in 2030. Upon analysis, these characteristics could be combined into a total of 16 overarching **clusters**, each containing one or more of the originally identified characteristics.

Figure 8 below shows the distribution of the 16 clusters, in terms of how many sheets were grouped into each cluster.

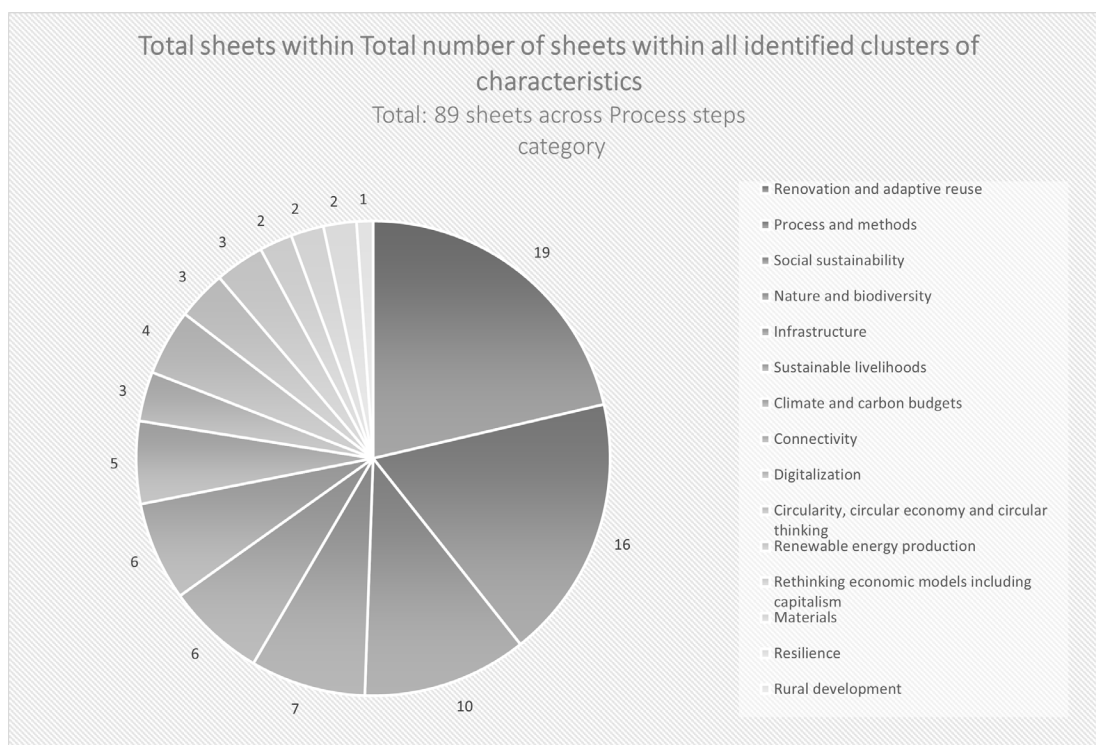


Figure 8: Total number of sheets with all clusters.

Table 2: All identified clusters of characteristics and their total number of sheets.

Clusters of characteristics	Brainwriting	Future Scenarios	Actions	Drivers	Total
Renovation and adaptive reuse	4	4	7	4	19
Process and methods	1	5	5	1	15
Social sustainability	4	5	1	0	10
Nature and biodiversity	3	3	1	0	7
Infrastructure	1	1	3	1	6
Sustainable livelihoods	1	5	0	0	6
Climate and carbon budgets	1	2	2	0	5
Connectivity	1	0	2	1	4
Digitalization	2	1	1	0	4
Circularity, circular economy, and circular thinking	2	0	1	0	3
Renewable energy production	2	1	0	0	3
Rethinking economic models including capitalism	0	1	1	0	2
Materials	1	0	1	0	2
Resilience	1	1	0	0	2
Rural development	0	1	0	0	1

After further analysis of the 16 clusters, 6 ‘most mentioned’ clusters of characteristics were identified (see Table 3), which would be apparent if the UN SDGs were met by 2030:

- Renovation and adaptive reuse (19 sheets in total)
- Process and methods (15 sheets in total)
- Social sustainability (10 sheets in total)
- Nature and biodiversity (7 sheets in total)
- Infrastructure (6 sheets in total)
- Sustainable livelihoods (6 sheets in total)

Table 3: Detailed description of 6 ‘most mentioned’ clusters of characteristics.

Most mentioned clusters of characteristics	Characteristics addressed
Renovation and adaptive reuse	retrofitting as a priority over new build, renovation and retrofitting of all types of existing building stock, new build as second choice and if chosen must be zero carbon
Process and methods	co-design, immediate change, system thinking, cross party collaboration and trans disciplinary, post humanistic design
Social sustainability	achieve social sustainability across towns and cities, leave no-one behind, social inclusion built into neighbourhoods and towns and cities as a whole, self- management, trust, habits, equity as a guiding principle for policy, transparent, inclusive and accountable governance systems, rethink ownership
Nature and biodiversity	rewilding towns, cities and countryside, think inclusively in relation to all of life and beyond just humans, integrated green infrastructure, designing green infrastructure-buildings, public space whole of public realm
Infrastructure	transportation infrastructure including electric charging networks, sewerage systems including renewal and rethinking (separation and reuse)
Sustainable livelihoods	sharing, hiring, and repairing economy, education, training and retraining at all levels, expansion of new forms of economic futures

In addition to these ‘most mentioned’ characteristics the participants also made contributions relating to a wider range of characteristics, which were clustered as shown in Table 4 below.

Table 4: Detailed description of the remaining 10 clusters of characteristics.

Cluster of characteristics	Characteristics addressed
Renewable energy production	affordable and equitable energy provision from renewable sources, development of solar settlements, neighbourhoods and cities, development of energy feedback systems
Circularity	circular economy, circular thinking
Materials	renewable materials, understanding of origins and use of existing and new materials, expansion and upscaling of use of re-used materials
Digitalisation	use of digital technology advances and innovations, development of sophisticated smart buildings, neighbourhoods, towns and cities
Air pollution	introduction of low emission zones in cities (see impact in London and Bristol re WHO levels), low emission zones and delivery of UN SDGs
Rethinking economic models including capitalism	new economic models, rethinking taxation, introducing economic incentives for change and transformation, introducing new business models
Rural development	rethink urban rural continuum, rethink food production and consider local food production innovations
Climate and carbon budgets	climate, carbon budgets
Resilience	resilient buildings
Connectivity	compact and connected urban systems and functions

When comparing the 6 ‘most mentioned’ clusters, they each contain a varying number of sheets from the 4 steps (see 9); some contain more action sheets (such as the cluster ‘Renovation and reuse’) while others contain more future scenarios (such as ‘Social sustainability’).

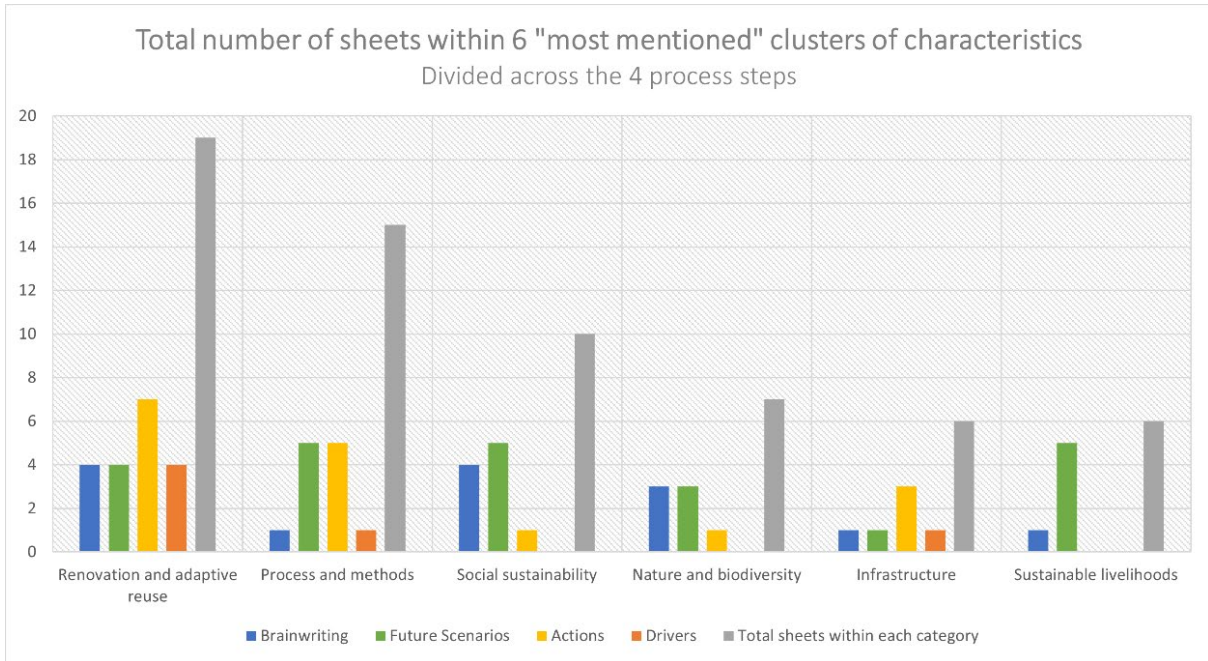


Figure 9: Distribution of sheets across process steps within most mentioned clusters.

Figure 10 to Figure 13 illustrate this difference, indicating the various 'most-mentioned' clusters of characteristics that were created in each of the 4 process steps.

Brainwriting

The most common clusters that came out of this step in the process were:

- Social sustainability (4 sheets)
- Renovation and adaptive reuse (4 sheets)
- Nature and biodiversity (3 sheets)
- Digitalization (2 sheets)
- Renewable energy production (2 sheets)
- Circularity, circular economy and circular thinking (2 sheets)

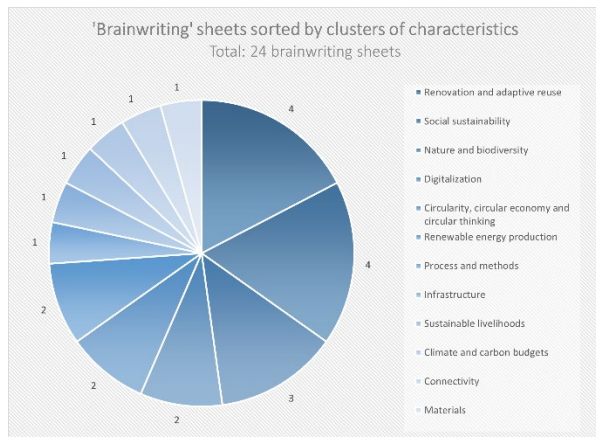


Figure 10: Most mentioned characteristics within brainwriting sheets.

Future Scenarios

The most common clusters that came out of this step in the process were:

- Social sustainability (5 sheets)
- Process and methods (5 sheets)
- Sustainable livelihoods (5 sheets)
- Renovation and adaptive reuse (4 sheets)

Nature and biodiversity (3 sheets)

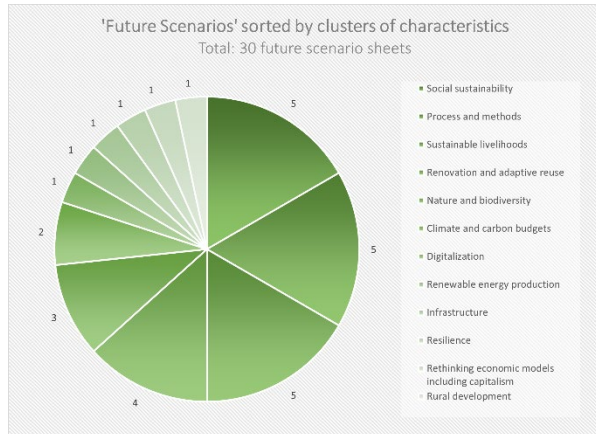


Figure 11: Most mentioned characteristics within future scenarios sheets.

Action mapping

The most common clusters that came out of this step in the process were:

- Renovation and adaptive reuse (7 actions)
- Process and methods (5 actions)
- Infrastructure (3 actions)
- Climate and carbon budgets (2 actions)

Connectivity (2 actions)

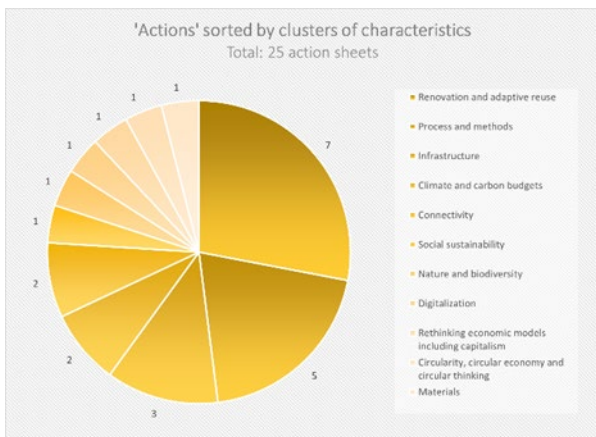


Figure 12: Most mentioned characteristics within action mapping sheets.

Driver mapping

The most common clusters that came out of this step in the process were:

- Renovation and adaptive reuse (4 drivers)
- Process and methods (1 driver)
- Infrastructure (1 driver)

Connectivity (1 driver)

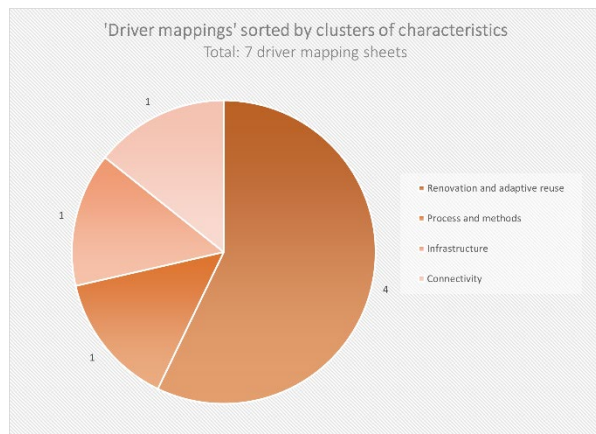


Figure 13: Most mentioned characteristics within driver mapping sheets.

4.1 Examples of actions

The meta task at the workshop followed a collective understanding of where we need to get to by 2030 compared with where we are now in 2023. In this way, we could start to prioritise the key elements where change and transformation would need to take place if the 2030 characteristics were to be achieved and actions that could be taken to achieve this.

Through individual and small group work the workshop developed a number of activities and actions in the areas where change and transformation would be needed and described steps for them to be achieved.

Here follows an account of seven detailed actions, each belonging to a different cluster of characteristics:



Action mapping sheet

G2 B3 S1 A1

Cluster: Renovation and adaptive reuse

Characteristic: New build as second choice and if chosen must be zero carbon |
Legal frameworks for sustainability standards | Immediate change

Name of ACTION: *Urgent target setting and legal framework by the city.*

Description: Cities will introduce policies and targets to increase the speed of change and achieve higher sustainability standards for buildings (emissions) at large scale.

Name of associated CHARACTERISTIC: Construction of new buildings

Name of associated BARRIER/CHALLENGE: Limited speed of change

Key Activities

1. Analyze current carbon footprints of buildings.

- Expected results: Have an overview of building stock and their emissions to help you set carbon targets
- Key resources to make activity happen: Data and measurement
- Key partners: City, consultants, University, Developers

2. Incorporate carbon requirements in tenders/LCA

- Expected results: Significantly lower embodied + operation carbon
- Key resources to make activity happen: Experts to develop criteria and compare data
- Key partners: City policymakers & university, City technical staff

3. Expediting building permits and removing legal obstacles

- Expected results: Rapid results and a more active market
- Key resources to make activity happen: Update building code to respond/accommodate new building standards
- Key partners: City policymakers & university, City technical staff

4. Reorganizing incentives and subsidies to encourage net-zero

- Expected results: A shift towards low-carbon materials from construction developers and end-users
- Key resources to make activity happen: Data on what to incentivize, what to trade & higher taxation of bad
- Key partners: City policymakers, city technical staff, business community + private households and housing associations

5. Create construction hubs to facilitate circularity

- Expected results: new buildings will have increased the use of reuse/recycled materials
- Key resources to make activity happen: Financial investment, plots understanding materials to prioritize digital maps + platforms to connect
- Key partners: municipality, property owners, technical engineers

Figure 14: Example of action 1.

A **Action mapping sheet**
G3 B1/B2 S1 A1

Cluster: Renovation and adaptive reuse
Characteristic: Renovation and retrofitting of all types of existing building stock

Name of ACTION: *Promote re-use and renovation of existing buildings*

Description: Overview of different activities to promote large scale renovation of low-performing existing buildings.

Name of associated CHARACTERISTIC: N/A
Name of associated BARRIER/CHALLENGE: N/A

Key Activities

- 1. Potential studies documenting the impact on energy bills, energy savings, CO2, security, jobs, indoor environment**
 - Expected results: New policies
 - Key partners: Research institutes and industry in different countries/regions
- 2. New codes/regulations for renovation**
 - Expected results: Regulations in area planning, Code for single buildings (Klimatraster I PBL)
 - Key partners: Industry + Research, Government
- 3. Financing schemes**
 - Expected results: Green loans, take down risks. Government financing incentives
 - Key partners: Developers, Property owners, banks, insurance, etc. Government
- 4. Business models for “easy renovation”**
 - Expected results: One-stop-shop. Energy as a service. Industrialization - remote, fast
 - Key partners: Clustering along the value chain, from research through architects, façade companies, HVAC, energy
- 5. Education and training**
 - Expected results: Knowledge, Skilled workers
 - Key partners: Universities, consultant, industry
- 6. Tools for planning, design (Digital Twins, AI, material passports etc.)**
 - Expected results: Facilitating industrialization
 - Key partners: Research + industry, architects, planners.
- 7. Tools for construction, e.e. dtones, electrical drones, click-on mechanisms etc.**
 - Key partners: Industry, contractors

Figure 15: Example of action 2, part 1.

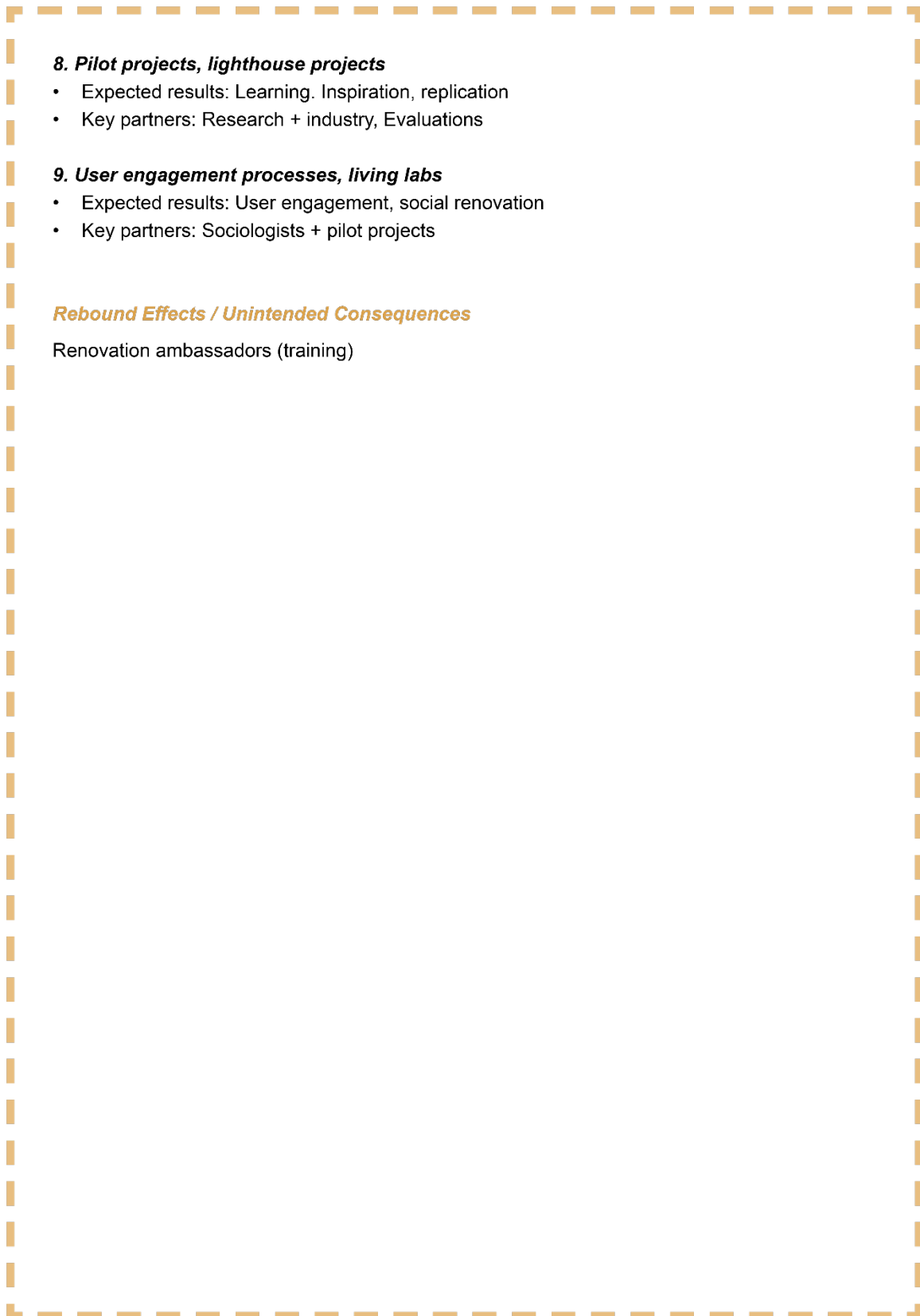


Figure 16: Example of action 2, part 2.



Action mapping sheet

G3 B3 S1 A1

Cluster: Social sustainability

Characteristic: Achieve social sustainability across towns and cities | Social inclusion built into neighbourhoods and towns and cities as a whole

Name of ACTION: *Analyze what supports interaction between people in the built environment*

Description: "Livable city". If we want people to meet, interact, feel safe etc. you need to know & learn from existing spaces (public and commercial) that function like that and why people like, visit & value these spaces (cosmopolitan spaces?)

Name of associated CHARACTERISTIC: Inclusive & equal city

Name of associated BARRIER/CHALLENGE: Responsibility, design & people's needs

Key Activities

1. Identify & look at good examples of cosmopolitan spaces in Sweden/Europe

- Expected results: Find (unclear) in the built environment that support this
- Key resources to make activity happen: Urban design, planning, sociology
- Key partners: Chalmers + GU + NGO (or group of citizens) + City + realestate owner / commercial actor

2. Analyze the process (or lack of process) in developing these inclusive spaces & development over time

- Expected results: Knowledge of the process >> was the (unclear) an inclusive place, or did it just happen >> development over time
- Key resources to make activity happen: Urban design, sociology, ethnology etc. Interdisciplinary team
- Key partners: Chalmers + GU + NGO (or group of citizens) + City + realestate owner / commercial actor

3. Small test/pilot >> to see how the (unclear) & process can be implemented (temporary prototype)

- Expected results: Learn from the test >> also where it comes to management, responsibility and people behaviour
- Key resources to make activity happen: A public & commercial actor (space owner) that are willing to temporarily test

4. Evolution of the test >>

- Expected results: Lessons learned >> possibility to scale up in the built environment
- Key resources to make activity happen: Interdisciplinary research team + space owner

Figure 17: Example of action 3.



Action mapping sheet

G4 B1 Sx A1

Cluster: Process & Methods

Characteristic: Cross party collaboration and trans disciplinary | Compact & connected urban systems & functions

Name of ACTION: *Establish a cross-party community group to deliver a holistic and integrated approach to transport. Designed for use at local level but potential to scale up to regional & national level.*

Description: This is a singular issue task force, a multi-stakeholder organisation with a long term view that rides out the short political cycles. Overseen by an independent, neutral chair, the group is drawn from across the political spectrum, business groups, NGOs and community groups. Some meetings should be held in public, affording transparency and accountability. (see below)

Name of associated CHARACTERISTIC: A compact & connected urban systems & functions

Name of associated BARRIER/CHALLENGE: Lack of integration in decision making process

Key Activities

1. **Municipal level: Identify methodology, collect data to identify baseline**

- Expected results: Establish baseline data
- Key resources to make activity happen: POLITICAL CAPITAL ON ESTABLISHMENT:
- Existing government data, car ownership, survey
- Key partners: Community, government authorities, transport companies

2. **External validation of data & process**

- Expected results: Broad acceptance of data
- Key resources to make activity happen: Money to fund external group
- Key partners: independent team

3. **Visibility & scenario development**

- Expected results: Identify options for consultation
- Key resources to make activity happen: Potentially - external consultants
- Key partners: local government sector, planners & workers/directors

4. **Community consultation**

- Expected results: Refine options for pilot testing
- Key resources to make activity happen: Vacation for events
- Key partners: Transport group, independent oversight group, community & stakeholders

5. **Plan & strategy development**

- Expected results: Establish plan, timeline
- Key resources to make activity happen: Reports, existing plans at different levels
- Key partners: startups, planners, transport experts

Figure 18: Example of action 4, part 1.

6. Business & finance plan & implementation strategy

- Expected results: Economically viable plan / finance options
- Key resources to make activity happen: Potentially external financial expert - independent
- Key partners: Financiers, business leaders, planners & urbanists

7. Pilot study + assessment

- Key partners: Confirmation & opportunity to mend plan
- Key resources to make activity happen: Finance for pilot, assessment group for review
- Key partners: External oversight team, community leaders/groups

8. Role out for region/city following political ratification

- Expected results: Plan delivered with ongoing data collection & assessment
- Key resources to make activity happen: MONEY
- Key partners: Political decision makers.

Rebound Effects / Unintended Consequences

- Conflicts of interest, such as business influence.
- Task force not able to deliver - impacts of failure
- Potential to complicate political process around the focus

Invite negative attention / focus of lobbyists. Better engagement in political system, by groups who might not have been involved previously.

Additional annotations (sticky notes)

Connection to SDGs: 9) Industry, Innovation & Infrastructure, 11) Sustainable Cities & Communities, 12) Responsible Consumption & Production, 8) Decent work & Economic Growth, 17) Partnerships for the goals, 13) Climate action, 9) Gender equality, 10) Reduced inequality, and 3) Good Health & Wellbeing.

Figure 19: Example of action 4, part 2.



Action mapping sheet

G2 B1 S1 A3

Cluster: Infrastructure

Characteristic: Infrastructure | Sewage systems

Name of ACTION: *Separate stormwater, graywaater, fecals & urine and create a new sewage systems. A library and platform (online)*

Description: Stormwater, graywater & blackwater (fecal & urine) are currently mixed in sewage treatment plants. This gives emissions to aquatic environment of toxic compounds. Fecal & urine could be a resource for agriculture as fertilizers. Graywater can be used to produce food (fishm vegetables) in the houses. Rainwater collected for watering. Stormwater from streets to the wastewater treatment plants.

Name of associated CHARACTERISTIC: Sewage infrastructure for newbuilds

Name of associated BARRIER/CHALLENGE: Investment & implementation of sewage separation

Key Activities

1. Collect examples of separation projects

- Expected results: Data for the online platform
- Key resources to make activity happen: Competence, network, staff
- Key partners: academia, municipalities, business

2. Build an online platform

- Expected results: Examples & their costs and benefits available
- Key resources to make activity happen: Competence in IT design
- Key partners: academia, business, boverket, property owners association

3. Calculation & modelling of costs, benefits

- Expected results: Costs & benefits of examples available
- Key resources to make activity happen: Competence, network
- Key partners: academia, business

4. Storytelling outputs / communication

- Expected results: Widen the interests
- Key resources to make activity happen: Communication competence, network
- Key partners: academia, business

Figure 20: Example of action 5.



Action mapping sheet

G5 B6 S1 A1

Cluster: Connectivity

Characteristic: Compact & connected urban systems & functions

Name of ACTION: *Complete interaction of materials data across domains by 2027*

Name of associated CHARACTERISTIC: Closed-loop lifecycle management of materials and products across domains/value networks

Name of associated BARRIER/CHALLENGE: Management of materials in value networks

Key Activities

1. Develop a system for the integration of materials data across domains

- Expected results: Tracking of each material asset across value networks
- Key resources to make activity happen: Interoperability, ontology ecosystems, APIs, AP, etc.
- Key partners: ICT, materials manufacturers, industry

2. Standardize data formats for materials modelling

- Expected results: Cross-domain interoperability allows to broaden possible market applications
- Key resources to make activity happen: Working groups in standardization bodies
- Key partners: Standardization bodies

3. Establish a materials data commons across domains

- Expected results: A shared resource across domains opens possibilities for innovation
- Key resources to make activity happen: Do RTD for funding but long-term sustainability >> who will maintain this?
- Key partners: Key academic institutions to keep a materials library

4. Integrate materials data within regulation smart contracts, business enterprise integration

- Expected results: Novel business models for procurement, business risk mitigation
- Key resources to make activity happen: Harmonization of enterprise data systems with materials ecosystems
- Key partners: Business & ICT stakeholders to work together

5. Manage resource allocation and the impact of extractive practice on the environment

- Expected results: Lower environmental impact
- Key resources to make activity happen: Data availability from primary industry
- Key partners: ICT, primary industry

6. Develop modelling of re-use, re-purpose, re-manufacturing and novel use cases

- Expected results: Novel material applications

Figure 21: Example of action 6, part 1.

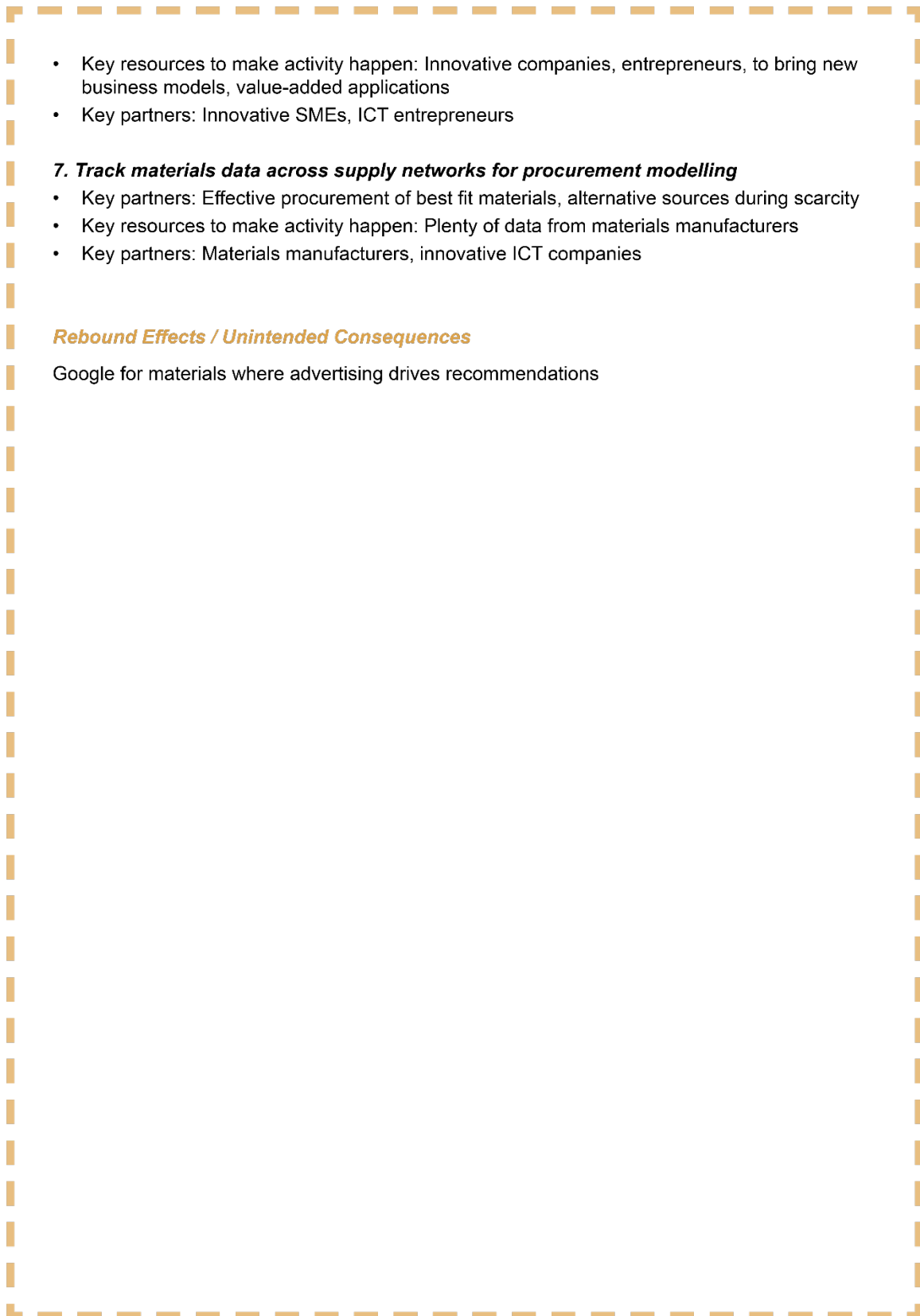


Figure 22: Example of action 6, part 2.

A

Action mapping sheet

G5 Bx Sx A1

Cluster: Materials
Characteristic: Biobased building materials | Marine-based building materials

Name of ACTION: *Public building renovation should require 50% biobased material by 2025*

Description: How can biobased building material reduce the 40% energy consumption in building, how can we capture more carbon in the built environment and can we push more ICCAI produce building material by using the ocean to produce building material.

Name of associated CHARACTERISTIC: Low carbon construction, Resilience
Name of associated BARRIER/CHALLENGE: N/A

Key Activities

- 1. 1) Prototype, 2) Assessment of building code, 3) Usability, what type of building type**
 - Expected results: We learn about behaviours (of materials) in different environments - we use data (Material data base)
 - Key resources to make activity happen: Funding, test sites, new material resources
 - Key partners: R&D, local producers, material experts, building owners
- 2. Assessment of building code**
 - Expected results: Fire testing, acoustic, indoor environment, assessment of durability'
 - Key resources to make activity happen: LAB-testing, legal advising, local policy adoption
 - Key partners: R&D, city network, Boverket, procurement experts
- 3. Education around biobased material**
 - Expected results: Skilling people, course catalogue
 - Key resources to make activity happen: Pool of expeters; construction, asset ownwers, procurement
 - Key partners: Universities, educators, end-users, housing association
- 4. Environmental impact assessment**
 - Expected results: What is the boundary, what is the ROI, what is the embodied carbon
 - Key resources to make activity happen: Research, existing data (baseline) data, policy consultation/stakeholder (unclear)
 - Key partners: MOE, marine research, SDG experts
- 5. Regional development plan (local production/local use)**
 - Expected results: Potential (unclear), with the marine spatial plan, rural and local job creation
 - Key resources to make activity happen: Local community groups, existing NGO network
 - Key partners: Political level, national law, start-ups, makers, business clusters

Figure 23: Example of action 7, part 1.

6. Transportation and manufacturing roadmap

- Expected results: Detail supply chain study, LCA calculation, digital moduling
- Key resources to make activity happen: 'Productions facilities, transport infrastructure
- Key partners: Investors, business developers

7. Adoption plan in public building

- Key partners: Workshop to evaluate implementation, risk assessment, how to test in refurbishment
- Key resources to make activity happen: Public servant, architects, test building, investment/business plan
- Key partners: Cities, housing association, supply chain, investors, product owners

8. Transformation / Scaling

- Expected results: Climate action plan / CO2 calculation, 20 business model, feasibility study
- Key resources to make activity happen: Dynamic carbon neutral city network, investors, public interests/awareness
- Key partners: Pention funds, asset managers cities, CO2 neutral cities

Rebound Effects / Unintended Consequences

Destruction of the seabed, change of farming focus, limited CO2 impact (miscalculation), introduction of mold/odour in the indoor environment, lack in durability.

Figure 24: Example of action 7, part 2.

5 Making Sense of workshop findings

The expert workshop for Northwest Europe was the first of a number of workshops that will take place in different regions of the world over the next two years. This workshop led by Chalmers University in partnership with UN Habitat and Mistra was a pilot workshop for the whole series and in that sense was experimental and the results, in terms of content and process are important in themselves for Northwest Europe, but also for our own learning and evaluation and suggestions for the 'retuning' of the remaining workshops to follow.

In addition to making sense of the findings from the workshop we are also taking the opportunity to go beyond the first order findings to discuss a wider range of issues that need to be addressed if the built and urban environment are to be transformed to meet the UNSDGs by 2030.

The learnings from the workshop were manifold and could be summarised as follows:

- The complexity of the transformation of the built and urban environment to meet the UNSDGs needs considerable discussion and unpacking even with experts and may be this suggests that there should be more information provided in advance of the workshop and/or that each participant completed a personal experience survey that could be shared with other participants.
- Participants mixed orientation and backgrounds provided a rich base for discussion however there were differences in their orientations in relation to policy thinking and strategy and more practice-based actions and implementable solutions. It may be necessary to recognise that each group needs this mix but also needs more help with facilitation and recording.
- The discussions at the end of Step 1- the characteristics of the built and urban environment that would meet the UN SDGs by 2030 – could have been extended further so that the issues being addressed in the rest of the workshop formed a wider base. This would mean that the facilitators introduced other characteristics that were either omitted or not prioritised.
- Similarly, it may have been useful for a wider discussion around where we are today in relation to the SDGs so that it was clearer for all participants of the challenge, urgency, and requirements to be able to implement a transformational change at scale, at speed and by 2030.
- Our means of recording the groups findings during the workshop were adequate and simple in relation to pre-printed worksheets and pens and stickies but meant that the translation of this material at the end of the workshop was somewhat difficult and it could be that utilising digital recording for each group would have been easier for presentations and as a long-term record of the workshop.
- One of the intentions was to end up with a clear understanding of the key messages for different stakeholders, however there was not enough time to satisfactorily address this issue, and this needs further thought and reflection.
- We need to think through the external facilitation/guidance to ensure participants remain focussed on problem solving and delivery. We will need to think through the balance of using the participants own understanding of direction and our own thoughts on what we might add to enrich the conversations.

- More space and time may be needed to bring the key issues to some form of conclusion and to discuss the broader issues that might include: How the societal transformational approach can be achieved? How to scale up? How to speed up? How to communicate successful practice? How to build a route map? How to overcome barriers?

6 Next steps for regional workshops

We are in discussion with UN Habitat and other partners about further workshops in different regions of the world. A summary of the current position is presented below.

Northwest Europe: Chalmers/UN Habitat/Mistra, completed and Report of workshop circulated.

Southern Europe: Barcelona City Council Mayor' Office has agreed in principle providing the mayor is elected again in the forthcoming elections. If this was the case, they would look favourably on a Workshop taking place later in 2023 or early in 2024.

Australia: Discussions have restarted following the Northwest Europe workshop with Professors at RMIT University for Melbourne to be the location for an Australian/New Zealand workshop in late 2023 or first quarter 2024. Funding is being applied for.

Southern Africa: Chalmers and UN Habitat are in discussion over a Workshop for Southern Africa in partnership with University of Pretoria and the African Centre for Cities. It is hoped that this might take place later in 2023.

Eastern Africa: Chalmers and UN Habitat are in discussion over a Workshop in Eastern Africa that could take place in Kigali, Rwanda, or Nairobi. The discussions are at an early stage but architecture practices in the UK and Sweden working in this region may be interested in assisting with this workshop.

Canada: Discussions with colleagues in Canada working on the World Conference on Sustainable Built Environments 2024, Montreal are progressing and there is interest once the world conference has been completed.

7 Next steps for the wider programme of work

The workshop reported on in this document is one part of the wider programme of activity being led by Chalmers University to support the transformation of the built and urban environment to meet the UNSDGs by 2030. As the recent IPCC report (2023) demonstrates the urgent transformation of the built environment is a crucial and major component of the global changes that are required to change and improve the trajectory in relation to climate change, loss of biodiversity, reduction of waste, reduction of air pollution and creation of liveable and healthy environments.

There was very wide coverage of many topics or themes from the workshop participants however there were a number of key priorities that were agreed by a large percentage of the participants. These included:

- Renovation and adaptive reuse (19 sheets in total)
- Process and methods (15 sheets in total)
- Social sustainability (10 sheets in total)
- Nature and biodiversity (7 sheets in total)
- Infrastructure (6 sheets in total)
- Sustainable livelihoods (6 sheets in total)

There were also many other themes of significance that other groups may have prioritised more strongly and considerable learning and tuning in relation to this pilot workshop process that will be taken into the design of the remaining workshops. However, the workshop is just one of the components we are working on, and they need to be considered alongside other components. As well as regional expert workshops we are also working on the following:

- Background literature reviews and current and programmed policy and practice reviews
- Deep dives exploring detailed practice case studies
- Practice roundtables
- Delphi surveys
- Research projects
- Collaborations

We see all of these components becoming integrated within a wider programme of research and action. What do we make of all of this at this stage and what do we need to consider for our ongoing work.

Integrating the findings from the pilot workshop and our other activities in this broad area we are in a position to propose an agenda for policy, action and research that would include the following:

- 1. Rethinking our approaches to processes and methods in relation to buildings and urban development**
- 2. Rethinking our approach to adaptive reuse, renovation, and recycling as a priority over new build**
- 3. Proposing that in policy terms all new build is zero carbon as built and in use**
- 4. Rethinking our approach to development to ensure that social sustainability has equal status to environmental and economic**
- 5. Rethinking our approach to urban planning, urban design and the design of buildings or adaptive reuse of buildings address the two interrelated issues of climate change and biodiversity.**

- 6. Ensuring that future energy production for adaptive reuse and new build is from renewable sources and that storage is considered within this approach.**
- 7. Rethinking the professional education of key actors at undergraduate, postgraduate and craft/technical levels as well as the retraining of existing practitioners.**
- 8. Rethinking the roles and responsibilities of the 'client' in all aspects of development**

In conclusion, our own experience over the last three or four decades has led us to develop research paradigms and regenerative thinking to include systems analysis, quantitative and qualitative research, policy, and governance analysis, understanding societal change, circularity, low and zero carbon futures, urban futures, healthy cities, design for nature and landscape, sustainable cities and buildings. Our intention following this pilot workshop is to build our capacity and experience in collaboration with others to be able to focus our action and research energies within a larger programme of education, research, and transformation.

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9 Appendix

(i) Participants

WORKSHOP PARTICIPANT CONTACT LIST

Name	Affiliation	Email
Anders Sandoff	Handelshögskolan	anders.sandoff@handels.gu.se
Andrea Hulting-Gustavsson	City of Gothenburg	andrea.hulting.gustavsson@stadsbyggnad.goteborg.se
Anna Jöborn	MISTRA	anna.joborn@mistra.org
Björn Sandén	Chalmers University	bjorn.sanden@chalmers.se
Carl Mossfeldt	City of Gothenburg	carl.mossfeldt@miljo.goteborg.se
Christine Olofsson	Byggföretagen	christine.olofsson@byggforetagen.se
Colin Fudge	Chalmers/RMIT	colin.fudge@rmit.edu.au
Cristina Fedato	CSCP	cristina.fedato@cscp.org
Fabian Lecker	Effekt Arkitekter	fl@effekt.dk
Harpa Birgisdóttir	Aalborg University	hbi@build.aau.dk
Helena Bjarnegård	Riksarkitekt	helena.bjarnegard@boverket.se
Helena Norlen-Holmes	SWECO	helena.norlen-holmes@sweco.se
Helmuth Kreiner	TU Graz	helmuth.kreiner@tugraz.at
Henriette Söderberg	Chalmers University	henriette.soderberg@chalmers.se
Holger Wallbaum	Chalmers University	holger.wallbaum@chalmers.se
Inger Andresen	NTNU	inger.andresen@ntnu.no
Irene Garcia	Carbon Neutral Cities Alliance	irenegarcia@carbonneutralcities.org
Jason Oberholster	University of Pretoria	u12034968@tuks.co.za
Kat Martindale	Savills	kamartindale@aim.com
Klas Groth	UN Habitat	klas.groth@un.org
Kristina Mjörnell	RISE, IVA	kristina.mjornell@ri.se
Liane Thuvander	Chalmers University	liane.thuvander@chalmers.se
Lina Zachrisson	Chalmers University	lina.zachrisson@chalmers.se
Lukas Memborn	City of Gothenburg	lukas.memborn@fastighet.goteborg.se
Martin Eriksson	UNSDG Chapter Sweden/GU	martin.eriksson@chalmers.se
Michela Magas	Industry commons	michela.magas@industrycommons.net
Pär Svensson	Building Futures Institute	info@buildingfuture.se
Peter Normann Vangsbo	Arup	peter.vangsbo@arup.com
Sara Petersson	SLK, Urban Futures	sara.petersson@stadshuset.goteborg.se
Shea Hagy	Chalmers University	shea.hagy@chalmers.se

(ii) Worksheets

Brainwriting Session:
Transforming The Built Environment Workshop Jan. 2023

QUESTION GUIDE:

What would be a **MAIN CHARACTERISTIC** of the built and/or urban environment, if the UNSDGs were met?

For example: *Smart building, off -site fabrication/manufacture, and robotic building operations are mainstream and prevalent in the building industry.*

Idea/Question:

Comment 1:

Comment 2:

Comment 3:

Comment 4:

Summary:

Characteristic Details Sheet:
Transforming The Built Environment Workshop Jan. 2023

SHEET GUIDE:

Fill out one sheet for each identified **CHARACTERISTIC** of the built and/or urban environment, if the UNSDGs were met.

Name/Title:

Description:

2 Most Important/Impactful Barriers/Challenges:

- 1.
- 2.

Affected/Involved Industry/Society Sectors:

Action Sheet:

Transforming The Built Environment Workshop Jan. 2023

A

Fill out one sheet for each identified **ACTION** enabling the respective characteristic to be realized.

Name/Title of ACTION: <i>(main action required to overcome barrier/challenge)</i>	Name/Title of associated CHARACTERISTIC:
	Name/Title of associated BARRIER/CHALLENGE:
Description:	

	Key Activities: <i>(top 2 activities required to achieve successful action)</i>	Expected Result(s) of Activities: <i>(concrete results that contribute to successful activity)</i>	Key Resources: <i>(resources required for implementation of activities)</i>	Key Partners: <i>(partners needed for implementation of activities)</i>
1.				
2.				

Driver Mapping Sheet:

Transforming The Built Environment Workshop Jan. 2023

D

Based on key partners and actors identified in Action sheets. Complete a driver mapping sheet for each crucial organisations needed for selected activity

Name/Title of associated ACTION/ACTIVITY:	Name/Title of associated CHARACTERISTIC:
Name of Organisation:	

Key Individuals:	Needs and Interests:	Motivation:	Influential Actors:
<p>Driver <i>(Who is the driver in the organisation who can make change happen?)</i></p> <p>Additional influential or relevant people <i>(who else needs to be involved from the organisation?)</i></p>	<p>Short term <i>(What are their short-term interests that could attract them or dissuade them from participating in action/activity?)</i></p> <p>Long term <i>(What are their long term interests – are they supported by the aims of action/activity or are they in conflict with it?)</i></p>	<p>Reasons to engage <i>(What might drive the organisation/ the driver into believing that engagement with activity Action may be a good strategy?)</i></p> <p>Reasons to not engage <i>(What might drive the organisation/the driver away from participating?)</i></p>	<p>Positive influences <i>(Which other organisations have an influence which may encourage them to participate?)</i></p> <p>Negative influences <i>(Which other organisations have an influence which may encourage them to avoid activity/action?)</i></p>