NEB Impact Model (initial version)

Deliverable 1.1

30.11.2022

Creating
Actionable
Futures

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30.08.2022	v.01	Han Vandevyvere, Annemie Wyckmans (NTNU)	Initial version.
24.09.2022	v.02	Han Vandevyvere, Annemie Wyckmans (NTNU)	Integration of feedback.
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30.11.2022	v.04	Han Vandevyvere, Annemie Wyckmans (NTNU)	Inclusion of learnings from the CrAFt Cities' kick-off and addressing of co-benefits.

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Executive Summary

In CrAFt, 3 Sandbox Cities, 60 Reference Cities and City Clusters[1], 6 NEB Lighthouse projects[2] and other Cities Mission and NEB community initiatives, will contribute to fine-tuning and implementing a NEB-inspired Impact Model (see illustration below), with a related body of research and guidance.

NEB basic impact category		Related modal aspects[3]
(Space)		Spatial
Technical-environmental performance		
1	Climate neutrality (EC goal) - Energy	Physical, biological
2	Circularity (EC goal) - Materials	Physical, biological
3	Healthy, secured water cycles	Physical, biological
4	Sustainable land use	Physical, biological
5	Sustainable mobility	Physical, biological
Healthy environment – (physical) quality of life		
6	Indoor environmental quality	Sensitive-psychical
7	Outdoor environmental quality	Sensitive-psychical
Quality of life – social performance		
8	Effectiveness of services	Social, linguistic-communicative
9	Affordability and inclusivity	Social
10	Sociability	Social
11	Cultural sustainability	Historical-cultural, aesthetic
Economic performance		
12	Total societal cost of ownership	Economic, social
13	Sustainable local embeddedness (including capacity)	Economic, analytical-logical
14	Legal certainty and future economic value	Economic, jural
Governance		
15	Process quality	Jural, social, ethical
16	Participation and co-creation	Social, ethical
17	Integrity	Ethical

[1] https://craft-cities.eu/sixty-cities-join-craft-to-jointly-shape-the-transition-towards-climate-neutrality-and-inclusive-cities-by-2030/

[2] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2780

[3] For a detailed description of what the modal aspects are, see the section on *Multimodal System Analysis (MMSA) as an operational framework for realising the NEB's goals*

The Impact Model will help identify essential leverage points for systemic change towards climate neutrality, by including all aspectual layers of sustainability (ecological, infrastructural, social, cultural, economic, aesthetical, legal, etc.) into innovative models for local collaborative governance and value creation that optimally use the co-benefits between the different sectors and minimise potential conflicts. Many smart and climate-neutral solutions have less attractive business cases, and financial aspects are usually discussed rather late in the process. Integration of financial aspects and co-benefits from the beginning, will help to exploit new value chains and business opportunities.

The Impact Model will function both as a documenting and assessing tool, and a guidance instrument to improve shared understanding and support for cross-cutting decision-making and implementation between stakeholders from different sectors and disciplines. The work of all contributing cities and communities will help develop new approaches and methods for local collaborative governance models that can enable cities' transitions to climate neutrality while being at the same time inclusive, just, beautiful and sustainable.

Among the cities and partnering initiatives, we will actively recruit and assess emblematic projects that simultaneously address inclusiveness, sustainability and quality of experience **using the Impact Model, document local collaborative practices that produced them**, from the visioning phase through political anchoring and financial planning to co-production with local communities, and translate them into formats that are easily accessible and adaptable in support of cities and communities across Europe. Using the Impact Model, we will **monitor the impacts of local NEB-inspired initiatives** and document the impact pathways. Based on these experiences, we will create impact stories from and with the local stakeholders, to inform CrAFt's Storytelling Campaign and Policy Briefs. The outcomes of this work will be integrated in the Climate-Neutral and Smart Cities Guidance Package: New European Bauhaus Edition, a first version of which will be issued by May 2023, and fed back into fine-tuning the Impact Model.

These experiences will furthermore **support cities in social and organisational learning** in urban innovation and demonstration projects – within the city and between cities – through cooperation with arts, cultural and creative sectors, citizens and communities. CrAFt will incorporate this long-term "how to" perspective in Mutual Learning Exercises with all of its cities to promote and facilitate exchange of knowledge and good practices, using the Impact Model in combination with the Climate-Neutral and Smart Cities Guidance Package: NEB Edition containing principles, tools and experiences from other cities as inspiration

for others. CrAFt's Student Think/Do Tank and STEAM Teams[4] will further explore the potential of the Impact Model within and across the CrAFt Cities.

As such, the Impact Model will support the Cities Mission, the NetZeroCities platform in deploying Climate City Contracts, by **helping cities to create and implement local collaborative governance models that harness the value of inclusiveness, aesthetics and sustainability**, as understood within the local contexts of their city, in their transformation towards climate neutrality.

[4] Additional information is available in D5.1: Model of governance for next generation CrAFt think/do tank of students - https://craft-cities.eu/wp-content/uploads/2022/08/CrAFt-Governance-for-Next-Generation-ThinkDo-Tank.pdf and D5.2: STEAM Teams Management Plan - https://craft-cities.eu/wp-content/uploads/2022/09/D5.2-STEAM-Teams-Management-Plan.pdf

1. Introduction

CrAFt's Impact Model supports cities in making their transitions to climate neutrality more inclusive, beautiful and sustainable. The Impact Model offers a set of primary KPIs that are already largely known and used by most cities, composed in a way that helps cities to address the leverage points between different sectors and create win-win solutions. By working across multiple modes, rather than per sector, the transition becomes much more robust and balanced, and engages more stakeholders in a positive manner.

The Impact Model will allow cities to identify essential leverage points for systemic change towards climate neutrality, by including all aspectual layers of sustainability (ecological, infrastructural, social, cultural, economic, aesthetical, legal, etc.). It does not replace the indicator sets cities already use - rather, it complements them as a guidance instrument to improve shared understanding and support cross-cutting decision-making between stakeholders from different sectors and disciplines.

Figure 1 shows an example of how citizen engagement can be analysed through a multi-aspectual approach.

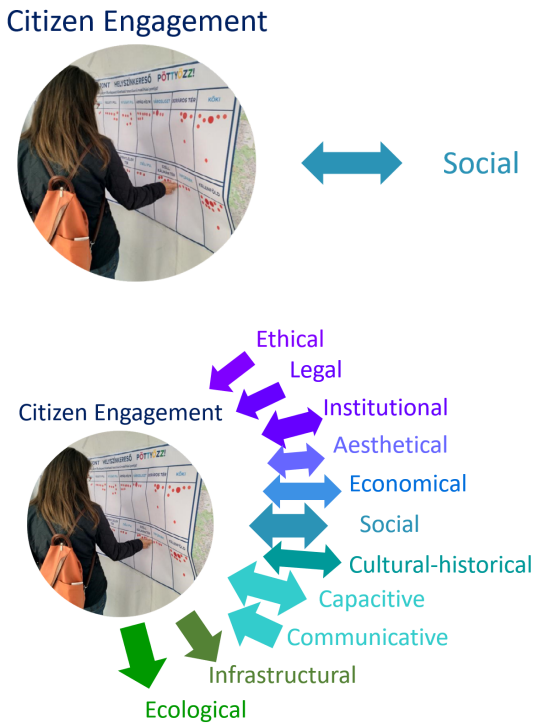

Figure 1: multi-aspectual (below) vs sectoral (above) interpretation of citizen engagement.

By functionally linking environmental aspects (materials, energy, water, waste, health and pollution, biodiversity, …) to the cultural, social, economic, legal and governance aspects in one modal chain perspective, the Impact Model will help cities to integrate cross-sectoral co-benefits from the early phases onwards, to exploit new value chains and business opportunities, and to reduce the risk of suboptimal, unilateral and siloed approaches.

This Deliverable includes the first version of the Impact Model. The first version will be tested, tried and improved throughout different tasks and with the input of all actors in CrAFt – from citizens to cities. A final version will be made available in Month 36 of the project, i.e. by April 2025.

The Deliverable is composed of two major parts: (1) the first version of CrAFt's NEB-inspired Impact Model and instructions on how to use it, targeting policy and other decision makers in/for cities and their stakeholders, and (2) a more extensive description of how the Impact Model was developed, the methods and theories that support it, and how it may be combined with existing KPI sets, targeting topical experts from city administrations, research, private sector and interest organisations.

CrAFt will use the Impact Model to document local collaborative practices, from the visioning phase through political anchoring and financial planning to co-production with local communities, and to translate them into methods for impact and value creation that are easily accessible and adaptable in support of cities and communities across Europe. These workflows will be included in CrAFt's Climate-Neutral and Smart Cities Guidance Package: NEB Edition.

Through cooperation with arts, cultural and creative sectors, and local and regional stakeholders, the Impact Model will be implemented in CrAFt's three Sandbox Cities (Amsterdam, Bologna and Prague), 60 Reference Cities, and broader Cities Mission and NEB communities, to test how it can be adapted to local context, to document how it can be used to create impact pathways in practice, and to create impact stories from and with the local stakeholders. The results will be fed back into the Impact Model and the Guidance Package, and will inform learning and sharing of hands-on practices among CrAFt's cities and their stakeholders, Student Think/Do Tanks, and the Storytelling Campaign and policy initiatives.

As such, the Impact Model will support the European Mission on Climate-Neutral and Smart Cities (aka Cities Mission) and the NetZeroCities platform in co-designing and co-deploying Climate City Contracts in the 112 Mission Cities.

2. CrAFt's NEB-inspired Impact Model

NEB basic impact category		Related modal aspects[5]
(Space)		Spatial
Technical-environmental performance		
1	Climate neutrality (EC goal) - Energy	Physical, biological
2	Circularity (EC goal) - Materials	Physical, biological
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14	Legal certainty and future economic value	Economic, jural
Governance		
15	Process quality	Jural, social, ethical
16	Participation and co-creation	Social, ethical
17	Integrity	Ethical

Table 1: CrAFt's NEB-inspired Impact Model basic categories

The Impact Model is hierarchical, modular and flexible/context-sensitive. This allows us to assess projects according to a fixed set of common values that all NEB endeavours should pursue on the one hand, while evaluating variable impacts related to particular contexts on the other hand. In this manner, we will be able to address the many varying contexts that characterise NEB-related projects and activities through a common viewing lens, while at the same time

[5] For a detailed description of what the modal aspects are, see the section on *Multimodal System Analysis (MMSA) as an operational framework for realising the NEB's goals*

avoiding that the Impact Model overly institutionalises or standardises NEB's creative outputs. These characteristics are further explained in the next Section. The main Impact Categories are explained in Section 2.3.

2.1 Hierarchical, Modular and Flexible Impact Categories

2.1.1 Impact Categories

The Impact Model assesses integrated sustainable functioning at the urban neighbourhood scale[6]. Given the wide range of scales that design addresses 'from the door knob to the urban masterplan'[7] (beauty), and taking into account the crucial role of both individual and community uptake herein (inclusiveness), the neighbourhood scale is a good intermediate level to start from (in realising sustainability). Neighbourhoods provide for an operational level that transcends individual position-taking, while at the same time presenting a level of intervention that can help to divide the enormous challenge of making society climate-neutral into more practicable endeavours: community projects, green districts, shared services, the 15 minutes city and similar.

The Impact Model contains a **common set of basic Impact Categories that cover the entire sustainability range, and that must be assessed for any NEB project or activity** to define the baseline (see Section 2.3). The number of Impact Categories in this basic set is limited so that it is accessible, understandable and manageable for all concerned stakeholders. Evaluating NEB solutions through the basic Impact Categories assures that all modal aspects of the solution are addressed, i.e. that the **complete modal chain of effects**[8] is covered through the assessment. No aspect can be neglected, but certain aspects may be in focus.

The set of basic impact categories described in this Section, is based on an extensive review of relevant indicator systems in the academic, government,

[6] Based on: Vandevyvere, H. (2010), Strategieën voor een verhoogde implementatie van duurzaam bouwen in Vlaanderen. Toepassing op het schaalniveau van het stadsfragment (Strategies Towards Increased Sustainable Building in Flanders. Application on the Scale of the Urban Fragment), PhD Dissertation, K.U.Leuven, https://lirias.kuleuven.be/bitstream/123456789/269336/1/ManuscriptLirias.pdf; with a summarising overview in: Vandevyvere, H. (2013), Evaluating the Sustainable Performance of an Urban District: Measured Score or Reflexive Governance?, in: International Journal of Sustainable Development & Planning, Vol. 8, No. 1, p. 36–58, https://doi.org/10.2495/SDP-V8-N1-36-58

[7] Referring to the initial Bauhaus, see e.g. Droste, M., Bauhaus-Archiv (1990), Bauhaus 1919-1930, Taschen-Librero

[8] For a detailed description of what the modal aspects are, see the section on *Multimodal System Analysis (MMSA) as an operational framework for realising the NEB's goals*

project and commercial spheres. Reference methods, theories and KPI sets are further detailed in Chapter 4.

2.1.2 Hierarchical

For each Impact Category, more elaborate indicator groups can be set to work in order to refine the impact assessment. For these **sets of sub-indicators**, there is no fixed format. The sub-indicator groups must be created in a methodologically sound way and prove to be **coherent with, and complementary to, the basic set**. It is the task of the project or activity stakeholders of the NEB-endeavour (and/or their advisors) to make sure that the sub-indicator sets are sound. Hereby the basic indicator set provides for an **integrity assessment** which requires that concerned share- or stakeholders perform integrity checks, for example through reflexive governance, in order to assure that the project's or activity's goals are being correctly realised and monitored. This will thus reflect back on the specific sub-indicator sets that the project actors put to work.

2.1.3 Flexible

To allow for **flexibility**, a given impact category can be studied into more detail based on the needs of the project or the action. For example, if a NEB project is about an intervention in the public space, indicator groups that address public space aspects can become the main focus of the assessment, however without neglecting the evaluation of all basic impacts as represented in the common set. This would imply, for the public space intervention, that aspects like sustainable energy and water use are being considered even if the main goal of the intervention is, for example, realising more social cohesion in an urban district. This approach guarantees the integrated character of the NEB solution at hand: no aspect can be neglected, but certain aspects may be in focus. It also connects to NEB's transdisciplinary mission statement.

2.1.4 Modular

Sub-indicator sets can be plugged into the basic indicator structure to efficiently assess all aspects that are relevant for a given NEB project or action, while at the same time avoiding having to revert to very detailed sub-indicator sets for all of the basic impact categories. In this way some basic impacts will be sufficiently covered with a concise evaluation, while others allow for an extensive assessment

based on the specifics of the project/action, relying on more elaborate sub-indicators.

2.1.5 Context Sensitivity

The way in which a given impact is best evaluated may vary according to the specific place, conditions or culture where the impact is being considered. For example, if a cooking/culinary activity would be considered in a setting where the use of fire has a specific cultural value, then the impact assessment could account for this factor while still assuring that the fire option is being materialised in a sustainable way. Metrics to calculate an indicator may vary from context to context and evolve over time, depending on the specific situation and data availability. The (dynamic) context becomes a defining factor for the correct (or, at least, feasible) interpretation of impact[9]. Given NEB's essentially creative nature, one may even state that the meaning of NEB solutions is intersubjectively constructed, and thus subject to constant change. Over-institutionalising the Impact Model as a means of understanding and structuring reality, therefore risks becoming counterproductive.

2.1.6 Complementarity with the NetZeroCities indicator system

CrAft has set out to align its Impact Model with the NetZeroCities (NZC) **'Impacts (including co-benefits) and impact categories'** indicator system. This effort is destined at easing the impact assessment work for cities while the latter may collaborate in, or adhere to, several projects and initiatives.

At present the alignment between the CrAFt and NetZeroCities models is ongoing work.

As a starting point, NZC's indicator system as it is brought forward in a guidance document for cities, the NetZeroCities Pilot Cities Programme Guidebook[10], has been compared with the NEB impact model's basic categories and selected sub-indicators. The comparison reveals that both models have similar set-ups and indicator categories. At the same time, the comparison allows to identify remaining gaps in both models. Future work will thus focus on further alignment

[9] Gehl Institute (2018), Inclusive Healthy Places - A Guide to Inclusion & Health in Public Space: Learning Globally to Transform Locally, p. 43

[10] NZC Consortium coordinated by EIT Climate-KIC (2022), NetZeroCities Pilot Cities Programme Guidebook, Version N°0.1, available at: https://netzerocities.eu/wp-content/uploads/2022/06/Pilot-Cities-Guidebook.pdf. The NZC indicator system is discussed pp. 35-39.

along a basic structure that will be in itself optimised for maximum compatibility and exchangeability, and the elaboration of relevant sets of (sub)indicators.

2.2 Indicators or impacts? Addressing co-benefits

2.2.1 A single indicator set addressing sequential aspects

A specific, recent strand of city-related indicator research takes a sequential approach for discerning indicator types, borrowing from more widely adopted practices[11]. Hereby 4 or 5 types of indicators are being considered: input, process/output, outcome and impact indicators.

In this context it could be questioned if the NEB Impact Model should only use the fifth type of indicator, or by contrast, cover the entire sequence of possible assessments. Because whole systems understanding is another priority of the impact model, concentrating solely on realized impact would mean a reductionist approach.

Arguments pro and contra a fully sequential indicator division could be formulated. However, in a context of whole system analysis, the complexity of the indicator system would explode if indicators were being assigned for all of these sequential stages. Therefore, the chosen approach is to work with a single, rather simple indicator set that serves two main purposes: providing for a 360° insight in all aspectual layers and functions of an intervention or a project; and thereby understanding and, where possible, quantifying impacts for a similar aspectual range (the latter being a main goal of the NEB Impact Model). In this way, the NEB Impact Model becomes (1) a 'tool to talk' and generate common understanding and (2) a tool to bring in evidence about generated impact for decision makers like politicians or investors.

The NEB Impact Model seeks to support and assess the realization of positive impacts, i.e. benefits in the widest sense of the term. These benefits may cover a wide range of direct and indirect impacts. The later category may also be coined as 'co-benefits'. For NEB endeavours these co-benefits appear to be crucial. Therefore, they are examined into more detail.

[11] For a good overview, see Aapo Huovila, Peter Bosch, Miimu Airaksinen, Comparative analysis of standardized indicators for Smart sustainable cities: What indicators and standards to use and when?, Cities, Volume 89, 2019, Pages 141-153, ISSN 0264-2751, https://doi.org/10.1016/j.cities.2019.01.029

2.2.2 The importance of co-benefits[12]

For projects or interventions that go beyond the commonly accepted business case, identifying and quantifying both direct and indirect benefits of the envisaged action is instrumental.

Regarding the direct benefits, de-risking the business case is essential in order to convince potential investors. For innovative projects, this may already be a daunting task.

However, addressing the more intangible co-benefits (also called secondary benefits or benefits for society) may be even more challenging.

2.2.2.1 Mapping and quantifying co-benefits

Certain co-benefits that return to the investor can be reasonably estimated, like increased real estate value through energy-retrofit of existing buildings. However, co-benefits like decreased social and health care costs through more healthy living environments may be very difficult to quantify. In addition, the beneficiary of those co-benefits is often not (only) the project initiator or the investor. In this way, a correctly balanced business case then only comes forward by adopting a 'total cost of ownership for society' perspective. In order to fulfil the case's feasibility requirements, multiple actors covering the entire return spectrum must participate or a redistribution mechanism must be put in place – one could think of e.g. a tax rebate for helping to realise a more healthy environment, based on tangible indicators.

Here, the NEB Impact Model should help to identify, and where possible, quantify positive impacts. For example,

- where innovative interventions are being planned, 'mature organisations' like local authorities or banks may need to be convinced of the value of the project. Relevant indicators need to chart direct and indirect benefits in order to support the proposed case. In transition terms, this is a situation where 'niche players' come into a landscape ruled by 'regime players', and need to acquire their proper operating space next to (or supported by) the already established regime players. We may call this 'innovation proving' or 'change convincing'.

[12] This paragraph is largely based on feedback from a round table discussion at the CrAFt Cities kick-off event, Prague, 9 November 2022

- in a next step, successful niche projects will then allow upscaling – again with proven impacts.
- under certain circumstances like poor evidence, regular decision making may be based on shallow arguments. For example, decision makers may state 'I have heard/read that this solution was a failure in city X; we are certainly not going to repeat that mistake in our city', or emotions like 'we must never prohibit people to enter the city centre by car' may play a decisive role in decisions. Solid impact estimations and context-sensitive comparison to relevant cases based on both numbers and qualitative assessments should better underpin such decisions. Good examples matter and can bring supporting evidence, however while always taking into account the specific project context.
- certain impacts may be virtually impossible to numerically assess. For example, what is the impact (on modal split, traffic safety, public health) of one new bike lane? In this case it must be recognized that only aggregated effects, e.g. at the district or city level, can possibly be monitored. This does, of course, not undermine the case for the single bike lane - more such lanes finally lead to a measurable impact. This should be an argument in itself. Some real effects of the intervention can be measured after realisation, e.g. by counting the number of daily users of the bike lane.
- impact assessments help to make informed choices between different possible development scenarios. Here again, one should be able to compare both direct and indirect impacts, be it in a quantitative or qualitative way. Long term versus short term effects matter. Long term effects may be subject to large probability ranges. Being transparent on assumptions is therefore important.
- co-benefits may by some be considered to be mostly subjective, and therefore only addressable with soft/qualitative indicators. This will indeed be the case for certain types of co-benefits, like a beautiful living environment. However, the entire spectrum of possible co-benefits ranges from hard/quantitative parameters (e.g. number of traffic accidents, noise levels, air pollution,...) to the former soft values like artistic or landscape quality. Nevertheless, even these qualitative aspects can receive an underpinning by solidly chosen arguments. A well-thought qualitative discourse is then needed as convincing power.
- reporting impacts may be difficult for actors that are not professionally involved in the domain. One cannot expect that citizens spend their weekend calculating indicators or filling reports. Here, artists can potentially fill a gap by assessing and reporting in an alternative way:

qualitative reporting, storytelling,… supported by the creative sector and/or a facilitator.

2.2.2.2 Co-benefits in the realm of climate-neutral and smart city-projects

What are the types of co-benefit that one should try to identify and estimate? In the realm of sustainable urban development and climate action planning, the following non-limitative list could be dressed up. These are co-benefits one may expect to realise when setting up interventions in an urban (re)development context, like building retrofit, sustainable newbuilt, mobility infrastructure interventions, projects dealing with green-blue infrastructure, RES production but also cultural and artistic interventions or educational and recreational projects. Possible co- or secondary benefits are thus:

- **Higher energy independence** through the provision of local RES and other sustainable energy sources like recovered waste heat;
- **Reduced energy poverty** through both increased energy efficiency and RES production – this and the previous aspect have become paramount with the current energy crisis;
- **Reduced social and health expenditure** due to higher well-being and health in sustainably conceived living and working environments or in properly retrofitted buildings[13] and infrastructures;
- **Less pollution, better and safer living environments and thus higher quality of life** through better indoor- and outdoor environmental conditions;
- **Increased physical/crime safety and traffic safety** through properly designed public spaces and mobility infrastructures;
- **Higher employee productivity, less absenteeism, better recovery in hospitals,…** through healthy, comfortable and pleasant indoor environments in buildings, providing appropriate indoor air quality and (natural) ventilation, applying low-emission building materials, providing daylight access, solar control (both allowing or blocking the sun depending on conditions), attractive outside views, green outdoor spaces at short walking distance;

[13] A rare example where project actors have assessed the (mental) health co-benefits of living in healthier and more energy-efficient, retrofitted homes is Warm Homes Oldham, https://www.theguardian.com/society-professionals/2016/nov/30/guardian-public-service-awards-2016-sustainability-winner-warm-homes-oldham

- **Less traffic congestion with related economic costs and health gains from active transport modes** while realising a modal shift towards sustainable transport modes, including reductions in health expenditure;
- **Higher real estate value** of energy-efficient (renovated) residential and non-residential buildings including 'futureproofedness' regarding future (energy) requirements. These gains may be direct (related to the building itself) or indirect (related to its environment). An example of the latter aspect is the higher price of real estate in streets with trees, compared to the same type of buildings in streets without trees[14];
- **Better, more social and beautiful public spaces**: in particular by reducing the reliance on private car or motorbike use – meaning both a reduction of travelling and parked cars or motorbikes – public space can regain a multitude of qualities, restoring it as a place for encounter, playing and relaxing. This comes in addition to related safety and health benefits stemming from reduced private car and motorbike use;
- **Reduction of the urban heat island** by green-blue infrastructures in cities, reducing ambient temperatures in the urban tissue while at the same time diminishing the active cooling loads in buildings and transport. In a similar vein, green-blue networks can improve **flood risk management,** help to **replenish groundwater tables**, increase local **biodiversity** and improve **air quality** if properly designed[15]**.** In addition these green-blue assets increase the mental well-being of citizens apart from the primary functions for which they were designed (parks, recreational areas, gardens, green façades, canals, sports fields,…);
- **More local employment in green sectors** (energy-efficient building renovation, renewable energy production, public transport, local food production based on sustainable agricultural methods,…); hence less financial flows outwards ('money leaks') and more re-injection of resources into the local economy;
- **Increased opportunities for the circular economy**, where many lower-skilled jobs can also be created in disassembly, recovery, repair and revaluation.
- **Less critical dependence on international supply chains and thus more resilience** by closing loops locally as much as possible, e.g. through urban mining and circular economy;

[14] See e.g. https://greenblue.com/gb/how-trees-increase-property-values/

[15] E.g. trees in narrow streets may rather block air pollution in those streets, so both the mobility design as well as the greenery design must account of such risks.

- **Less dependency on process water,** for example as stated in the report Energy Darwinism II: 'Renewable resources such as solar and wind need little or no water resources when compared to fossil fuel power generation which needs water for cooling purposes. This could make a huge difference to water scarce countries that rely on freshwater for cooling in power generation.' [16]

2.2.3 Co-benefits in the NEB Impact Model

The NEB Impact Model is conceived in such a way that many co-benefits directly appear as other basic categories or their immediate sub-indicators. For example,

1. Investing in renewable energy installations (indicator 1) supports the local green economy, as building, exploiting and maintaining these installations generates both future-proofed local employment and local revenue streams (indicators 12-13-14).
2. Investing in sustainable urban mobility infrastructures (indicator 5) is expected to also increase the physical quality of life, reducing air pollution and noise and increasing traffic safety (indicators 6-7). In addition, reduced private car use may well help to make public space more sociable and beautiful (indicators 10-11).

There however remains a second sphere of wider, societal co-benefits that are more difficultly linked to specific projects or interventions. These second order co-benefits comprise, for example, increased energy and materials independence, reduced energy poverty, increased public health and well-being, increased economic asset value and more local financial leveraging by eliminating outward money leaks (e.g. expenditures for acquiring fossil fuels).

How to deal with co-benefits will therefore be further considered under the detailed explanation of the impact model.

[16] Channell, J. et al. / Citigroup (2015), Energy Darwinism II: Why a Low Carbon Future Doesn't Have to Cost the Earth, p. 36, available at https://www.ourenergypolicy.org/wp-content/uploads/2015/08/ZTGI.pdf

2.3 The Impact Model in detail

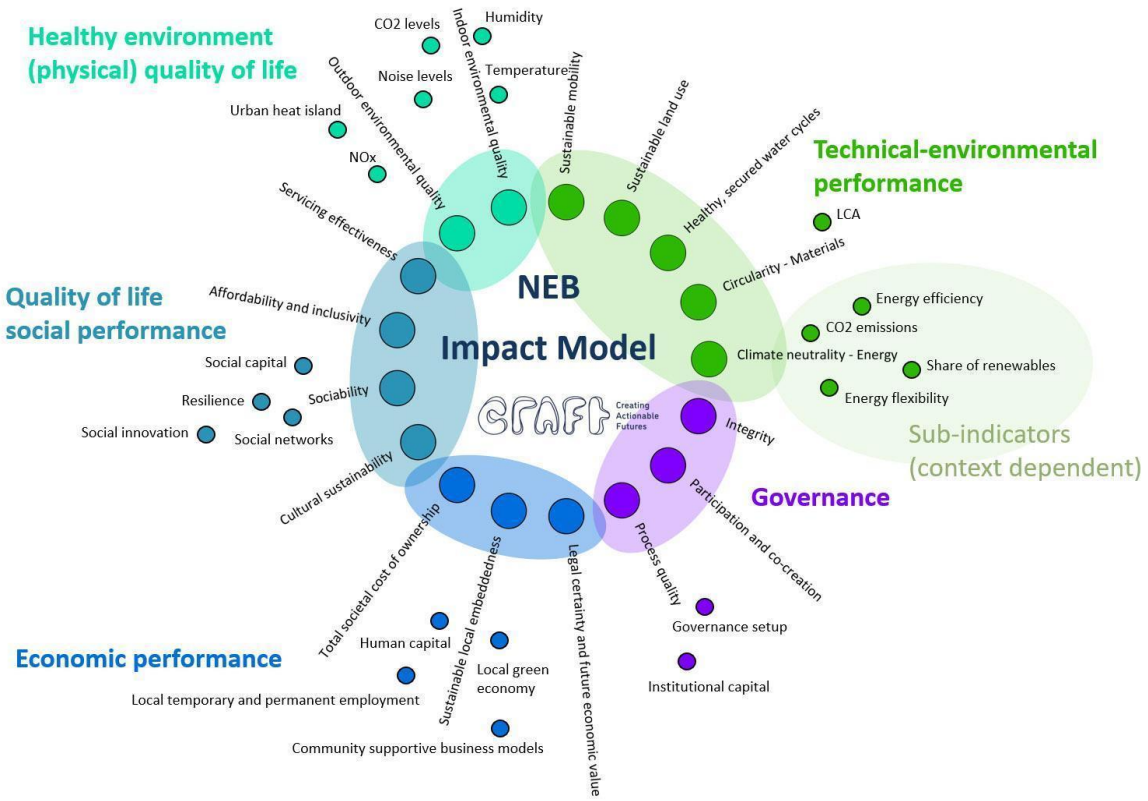

Figure 2: CrAFt's NEB-inspired Impact Model V1.0 with basic categories (fixed) and selected sets of sub-indicators (flexible). For clarity of the scheme, sets of possible sub-indicators have been indicated for a limited number of impact categories only.

2.3.1 Transversal aspect: Space

NEB basic impact category	Related modal aspects
(Space)	Spatial

Space is a fundamental layer that even precedes the biophysical world. In this sense, space is a carrier for all of the modal functions that follow, and every modal aspect will have a spatial dimension. Therefore we can speak, for example, of social space.

For this reason, space is integrated in all of the other impact categories. While spatial organisation is more explicit in the biophysical realm than in the juridical

sphere, law will interfere with spatial aspects through *retrocipations*[17]. An example of the latter are urban planning rules.

2.3.2 Impact Category 1: Technical-Environmental Performance

NEB basic impact category		Related modal aspects
Technical-environmental performance		
1	Climate neutrality (EC goal) - Energy	Physical, biological
2	Circularity (EC goal) - Materials	Physical, biological
3	Healthy, secured water cycles	Physical, biological
4	Sustainable land use	Physical, biological
5	Sustainable mobility	Physical, biological

2.3.2.1 Climate neutrality (EC goal)

Full climate neutrality is difficult to define and to assess, as it concerns all energy, material and water streams with their direct and indirect contributions to the greenhouse gas emissions of a project, development or activity. Hereby conventional system boundaries indicate where such assessment stops to include further downstream impacts of the project or activity under scope.

2.3.2.2 Energy

Additional key concepts: energy efficiency, renewable energy, flexibility, storage, positive energy districts

Energy includes (1) the amount of energy used in buildings, infrastructures and transport and (2) its environmental quality. The first parameter is optimised by reducing energy use to a level that is environmentally optimal while, as much as possible within the current economic paradigm[18], being economically feasible or profitable. This is the '**energy efficiency** first' principle. The second parameter is optimised by reverting to 100% **renewable and/or sustainable energy sources**.

[17] For a detailed description of what retrocipations are, see the section on *Multimodal System Analysis (MMSA) as an operational framework for realising the NEB's goals*

[18] In an ideal scenario, environmental and economic boundary conditions are fully aligned towards the same goals (carbon neutrality, circularity). This could imply, for example, that 'externalities' are fully accounted ('internalised') in the price of products and services; guaranteeing that no burden shifting towards the environment or towards weaker social groups occurs.

Taking into account thermodynamics and urban metabolism principles, a third principle of (3) **cascade use** can be introduced[19]. Hereby waste energy from one application can be used as input energy for another application, thus reducing overall primary energy demand and introducing another optimisation step.

And last, (4) **flexibility** is an optimisation mechanism that makes use of energy buffering/storage, exchange of energy streams, demand side management and sector coupling (heat & cold versus electricity) to further optimise the energy use in a district, city or region.

Current work on an EU-wide definition framework for *Positive Energy Districts* explicitly addresses the three principles of energy efficiency, renewable energy input and flexibility[20]. Aspects of cascade use are hereby implicitly included, e.g. through sector coupling and the exchange of energy streams; it may however be recommendable to explicitly address cascade use because thermodynamic optimisation of energy systems (assessing energy quality beyond mere carbon neutrality) is important as a complement to considering energy quantities[21].

The present approach minimises **carbon emissions related to energy use** in an indirect way, by optimising the energy use with a cocktail of strategies (efficiency, renewable production, cascading, flexibility). In this way it is, through application of the four strategies, a richer approach than considering energy use from a carbon intensity point of view alone.

2.3.2.3 Circularity (EC goal) - Materials

Additional key concepts: urban mining, urban metabolism, doughnut economics

In a similar vein as for climate neutrality, full circularity involves a complex interplay of direct and indirect aspects of materials (and energy plus water) use. Different rules apply to different streams; e.g. water effluent should not necessarily be as limited as possible, but certainly as clean as possible.

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[19] This leads to a revised *trias energetica* as described in Tillie, N.; van den Dobbelsteen, A.; Doepel, D.; de Jager, W.; Joubert, M.; Mayenburg, D. (2009), REAP Rotterdam Energy Approach and Planning: Towards CO2- Neutral Urban Development; and

[20] JPI Urban Europe, https://jpi-urbaneurope.eu/ped/

[21] Vandevyvere, H., Stremke, S. (2012), Urban planning for a renewable energy future: methodological challenges and opportunities from a design perspective, in: Sustainability, Vol. 4, No. 6, p. 1309-1328

In a more narrow sense, circularity can be reached by assuring that all material loops under scope are fully closed. The goal is to minimise the negative environmental impact of materials use, and to arrive at a maximum of circularity within the urban metabolism. This implies locally respecting the limits imposed by the global ecological (and spatial) carrying capacity. In addition to reducing, reusing and recycling materials (and designing them to optimise this), urban mining can be used to extract raw materials from used products, buildings and infrastructures.

Circularity is one possible means of minimising environmental impact, but not necessarily a goal in itself for this aspect. Assessment of material streams with regard to environmental impact is indeed best served through an LCA (life cycle analysis) and/or MFA (material flow accounting) analysis. However, circularity also targets resource scarcity, conservation, materials independency,... which are goals extending beyond the mere environmental impact as assessed through an LCA[22].

Doughnut economics[23] are a model that combines ecological carrying capacity with socially responsible servicing (a basic level of service for all, social justice, 'leaving no one behind' in Green Deal terms). The doughnut model is used by cities like Sydney, Berlin, Melbourne, Brussels and Amsterdam[24]. Similarly, **Social LCA** (S-LCA)[25] includes social impacts of production and consumption processes as a complement to evaluating the mere environmental impacts. Combined methods like doughnut economics and S-LCA provide for integrated assessments, guaranteeing a more holistic approach for assessing sustainability.

2.3.2.4 Healthy, secured water cycles

Additional key concepts: soil-, surface- and groundwater quality, climate adaptation, nature restauration, buffering and infiltration, flood risk control, nature-based solutions

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[22] For a discussion of the extension of the scope of LCA to resource depletion, see e.g. Klinglmair, M., Sala, S. & Brandão, M. Assessing resource depletion in LCA: a review of methods and methodological issues. Int J Life Cycle Assess 19, 580–592 (2014). https://doi.org/10.1007/s11367-013-0650-9

[23] Raworth, K. (2017), Doughnut economics : seven ways to think like a 21st-century economist.

[24] https://doughnuteconomics.org/stories/93

[25] E.g. https://www.social-lca.org/ and https://www.lifecycleinitiative.org/starting-life-cycle-thinking/life-cycle-approaches/social-lca/

Healthy, sustainable water use includes 2 main aspects: (1) use and management of drinking water, rainwater, and greywater, and (2) climate change adaptation, nature restoration and buffer capacity in order to mitigate the negative effects of both extreme rainfall and extreme drought.

Drinking water consumption expressed as use per person per day is to be minimised without jeopardising required servicing levels. **Rainwater** use is to be maximised (in applications where it replaces use of drinking water) without jeopardising supplies to nature and to underground aquifers. Disconnecting rainwater from the sewage system is always recommended; direct use or resupply to nature/the underground can thus be maximised. **Greywater** (from residential use, from industry) can be recycled or upcycled, and any residual heat can be extracted for reuse into the built environment. An optimisation will need to identify scale advantages: is it environmentally and economically preferable to purify water at a community plant or at the scale of individual buildings? This can be clarified through LCA and LCC (life cycle cost) assessment.

Climate adaptation measures regarding water include the use of **green-blue networks and absorption and buffering capacity** in order to mitigate the adverse effects of both extreme rainfall and drought. Taking measures to **improve the quality of surface water** and to **feed groundwater tables** are equally recommended.

2.3.2.5 Sustainable land use

Additional key concepts: nature-based solutions, biodiversity, nature restoration and regeneration, ecosystem services, soil sealing, blue-green infrastructures, flood control, water quality

Land use in this context refers to the characteristics of the project site (and not to land use for e.g. extracting building materials). It includes (1) location - the right function or mix of functions at the right place; (2) space use; and (3) quality of local ecosystems.

Location refers to the inherent sustainability of the project location: appropriateness, centrality and accessibility. Is it the right programme at the right place? Is it reachable by sustainable transport modes?

Space use regards the redevelopment rate, where (brownfield) redevelopment is preferred over greenfield development, as well as urban density. Urban density should not be maximised, but optimised to a level that suits the project's functions in its wider urban context.

Quality of local ecosystems regards the conservation, restoration, creation and compensation of local ecosystems, biodiversity and the underground (hydrology and geology, with as a goal minimal disruption by the project).

2.3.2.6 Sustainable mobility

Additional key concepts: physical activity, congestion, air quality, spatial organisation

Mobility induces 'in-between buildings' impact. Because of its current negative environmental impact and the way this impact has been structurally anchored in urban spaces, infrastructures, social habits and economic functions, turning mobility into sustainable modes is a major societal challenge.

Assessing its environmental quality is proposed by evaluating the proximity and accessibility of an urban centre (in order to first reduce the mobility demand following a 'trias' approach), the servicing level by active and public transport, the adopted parking norms in urban environments, and the maturity of mobility as a service (MaaS) and e-mobility infrastructure roll-out (for all e-modes including e.g. shared cars, shuttles, cargo bikes, steps,...).

Proximity and accessibility of an urban centre, which regards the distance to a (local) centre providing (basic) services. This aspect may be instrumentalized through a model like the '15 minute city'.
Servicing level by public transport where a distinction can be made between primary, highly efficient public transport connections versus secondary connections, in order to properly value the effectiveness of the public transport functions.
Servicing level by active transport regards the quality and effectiveness of walking and biking infrastructures; convenience, safety, health and comfort are important factors to consider.
Servicing levels of both public and active transport are instrumental in drawing

people away from individual motorised transport – mostly the car. Even in an electrification scheme, it remains important to reduce car use and facilitate a modal shift to the more sustainable transport modes. The modal split could be an indicator to steer these efforts. However, an appropriate modal split is location and context dependent and shall be carefully researched before implementation.

Parking norms for dwellings and offices are another leveraging instrument to influence the (share of) car use through urban design. Parking norms for cars shall usually define maximum values, while parking norms for sustainable transport modes like bikes shall by contrast define minimum thresholds.

MaaS (Mobility as a Service) and e-mobility level (added sub-indicator with regard to the original indicator set) assesses the provision level of shared, multi-modal mobility solutions, like last-mile services, as well as the charging infrastructure for all types of e-vehicles, including electric cars, (cargo) bikes and others.

2.3.3 Impact Category 2: Healthy Environment - (Physical) Quality of Life

NEB basic impact category		Related modal aspects
Healthy environment – (physical) quality of life		
6	Indoor environmental quality	Sensitive-psychical
7	Outdoor environmental quality	Sensitive-psychical

Sustainable living and working environments require a good indoor and outdoor environmental quality. This category could be considered as a hinge between the technical-environmental and the social aspects. It reflects how a physical environment provides the basic quality of life functions for its users and inhabitants.

It includes two subdomains: indoor and outdoor environmental quality.

2.3.3.1 Indoor Environmental Quality

Additional key concepts:

This relates to indoor air quality and hygro-thermal comfort, acceptable noise levels, and the absence of disturbing vibrations.

2.3.3.2 Outdoor Environmental Quality

Additional key concepts:

Outdoor environmental quality relates to outdoor comfort, health, air quality and safety. The latter includes traffic safety, physical safety, e.g. in terms of assuring physical integrity, risks for children and elderly people or protecting residents from flooding, and crime related safety.

Physical safety including risks related to physical integrity, crime, or risks for children and elderly people. Social control helps to increase physical safety and should be a parameter of good urban design. We may cite Jane Jacobs in her seminal work on *The death and life of great American cities*: *'The first thing to understand is that the public peace - the sidewalk and street peace - of cities is not kept primarily by the police, necessary as police are. It is kept primarily by an intricate, almost unconscious, network of voluntary controls and standards among people themselves, and enforced by the people themselves'* [26]

For **local air quality**, a proxy can be used by assessing local NO2-concentrations and comparing these to established norms or standards. **Noise levels** may for example be addressed through the WHO's L-level standards. One important distinction is between noise levels during the day, versus the night. **Traffic safety** remains a form of physical safety, but given the importance of mobility in realising sustainable and liveable environments a distinct address is recommended.

Other nuisance factors that may be considered are excessive wind, traffic congestion, vibrations (e.g. construction sites, industry, tram and bus lines), urban heat islands, visual pollution (including unwanted shadow or excessive light, landscape damage), stench, emissions to ground- and surface water, emissions to the soil and building site related nuisances.

2.3.4 Impact Category 3: Quality of Life - Social Performance

NEB basic impact category		Related modal aspects
Quality of life – social performance		
8	Effectiveness of services	Social, linguistic-communicative
9	Affordability and inclusivity	Social
10	Sociability	Social
11	Cultural sustainability	Historical-cultural, aesthetic

[26] Jacobs, J. (1961), The death and life of great American cities, Random House, p. 32.

2.3.4.1 Effectiveness of services

Additional key concepts: universal design, diversity, green space per capita

This topic addresses the effectiveness of the core social services that are provided in a given urban context. It relates to the **functional mix, diversity and accessibility of services and amenities** for a particular location, of the basic functions as the 15-minute city model promotes these - housing, working, commerce, health and childcare, education, and culture and leisure - complemented with access to green and open spaces at short distance as important factors of well-being for urban dwellers. Sustainable settings provide for a healthy mix of services and amenities with easy, low-threshold and universal access. This is opposite to monofunctional zoning. Recommended distances to all of these types of services exist and can be assessed[27].

As **digitalization** is becoming ever more important, accessibility and quality of digital services particularly needs to be taken into account, specifically taking into account the accessibility and usability for social groups that have a reduced capacity for using digital information channels and tools, in order to avoid a digital divide. As ubiquitous digital technology becomes more and more complex, see for example the case of blockchain, this problem may expand to larger groups of society and become more critical in the future.

The range of digital services may be extensive, starting from specific communication strategies towards different target groups up to the use of digital twins for the management of entire cities.

2.3.4.2 Affordability and Inclusivity

Additional key concepts: social equity, social justice

Apart from the physical accessibility of services and amenities, their level of **inclusion, affordability and social fairness** (the Green Deal pillar 'Leaving no place and no one behind') is a primary social quality.

Affordability implies, for example, that a proper share of social and/or affordable housing is available, while variety in the offer of housing types must also be seen as a factor that increases the level of integration and inclusivity. **Inclusivity**[28] assures that all social or age groups, people with reduced mobility or vulnerable

[27] See technical details in Vandevyvere 2010 (op. cit.)

[28] See the CrAFt Inclusiveness and Diversity Management Plan, available at https://craft-cities.eu/results-publications/

groups have good access to all needed services, are properly being represented as users or stakeholders in related institutions and processes, and that their contribution matters.

2.3.4.3 Sociability

Additional key concepts: social cohesion, adaptive capacity

Sociability refers to the ability of a place to support and foster healthy, lively social exchanges and social networks; in other words how the urban fabric supports a prosperous social life. Urban (regeneration) projects should therefore at least aim at minimally disrupting valuable existing social structures and, preferably, leverage on them while realizing the urban transformation. To this end project initiators can set up specific stakeholder- and co-creation processes with local actors, building on the existing social capital.

In a transition context as the one we currently experience, this becomes a highly dynamic quality that needs future-proofing. Therefore, the capacity of a place to **adapt to future conditions** in a socially sustainable way is crucial. **Resilience** is a primary aspect to include in this perspective, but also characteristics such as the intrinsic quality of housing, changing demographics, or the design of car-based facilities, may be subject to **future-proofing**[29]. **Social innovation** supports future-proofing social functions and is an important enabler in the perspective of today's societal challenges.

2.3.4.4 Cultural sustainability

Additional key concepts: environmental and cultural awareness, self-fulfilment, sense of belonging, appropriation, cultural and creative capital, cultural diversity

Cultural sustainability spans a vast domain of aspects like cultural value and diversity, identity, belonging, history, heritage and traditions, and spatial and aesthetic quality. **Spatial quality** deals with spatial, landscape and architectural quality, including aspects such as:

[29] A good example of where this can go wrong are the many post-war housing towers built during the 1960's and 1970's throughout Europe, and that provided for a 'modern' and accepted solution regarding the housing needs of that time, but became an obsolete and even problematic asset after a mere 30 years of existence. A similar reflection could be made around car-based shopping areas and malls: apart from their technical unsustainability, one must question if they provide for a valuable model of social interaction even if today they may be a (commercial) success built on a culture of consumerism. Both examples stand in contrast with numerous historic city centres throughout Europe that seem to be able to take a new, valuable life over and again, thanks to their inherent functional, social and cultural flexibility.

- **Gradations** of public and private character, transitions between these spheres, buffer areas, and corresponding changes of scale;
- **Articulation** of the different programmatic elements with respect to each other; in particular, the relation between buildings and infrastructures and the possible barrier effects of the latter;
- Meaningful **integration of green structures and green-blue networks** into the urban landscape (see also nature-based solutions);
- Visual **landscape quality and scenic beauty**;
- **Legibility and permeability** of the urban tissue;
- **Integration of different architectural concepts** in a given setting or master plan; and the articulation and integration of existing patrimony herein; and
- **Authenticity and architectural quality** of individual buildings.

Identity indicates the degree to which the built environment is loaded with **identity, culture and history – or at a higher level of abstraction, meaning**. That quality helps to assure long-term appropriation of the built fabric by its inhabitants and users: it 'has a soul'. This does not only have to be the case for places with a long history. 'Young' environments can quickly and successfully charge with relevant meaning for their inhabitants or users if they have been well designed and created, and subsequently been successfully taken into use. Apart from buildings and other infrastructure, the landscape itself can be a reservoir of identity, culture, history and meaning. Therefore good projects will leverage on that already present ***genius loci***[30].

Spatial quality and identity are different in the sense that some places with much identity may display poor spatial quality and vice versa – the latter situation often occurring in 'overdesigned' environments.

Cultural sustainability strongly relates to the role **the arts** can play in enhancing all of this – not only by creating beauty in the narrowest sense of the word, but also by promoting inclusiveness and diversity, mobilise, empowering and emancipating individuals and communities, nurturing local cooperation, and holding a critical mirror to society. In fact, the arts have fulfilled this role throughout history. This holds even more for the highly dynamic transition context that characterises every aspect of life today. By levering on social innovation and

[30] Concepts as 'soul' and 'genius loci' may seem very difficult to discuss, let alone measure, yet a reflection around such aspects can be methodologically framed, see e.g. Norberg-Schulz, C. (1980), Genius Loci: Towards a Phenomenology of Architecture, Rizzoli.

increasingly relevant social and cultural capital, NEB solutions can become fully appropriated by their users: they become part of the life people are aspiring.

Specific approaches to art can contribute to increasing social and cultural sustainability such as relational art, participatory art or community art.

Moreover, cultural sustainability is not unrelated to economic and social factors. The arts, culture and creative sectors have the power to infuse life into abandoned urban areas (or buildings) and generate new social and economic dynamics. This is illustrative of the art's and culture's active position in the 'modal chain' of impacts that projects and interventions can generate.

2.3.5 Impact Category 4: Economic Performance

NEB basic impact category		Related modal aspects
Economic performance		
12	Total societal cost of ownership	Economic, social
13	Sustainable local embeddedness (including capacity)	Economic, analytical-logical
14	Legal certainty and future economic value	Economic, jural

2.3.5.1 Total societal cost of ownership (TsCO)

Additional key concepts: equitable funding

By valuing investments through a Life Cycle Cost or Total Cost of Ownership approach, sustainable alternatives may win over investment-driven projects that often come with a short-term profit goal. This holds even more if social and environmental externalities are accounted of in the investment equation, a practice that is gaining more and more momentum: (1) accounting of externalities, i.e. all the (hidden) environmental and social costs and subsequently internalising them in the price tag, and reversely (2) including all secondary benefits for society. These benefits reach far beyond the mere financial-economic sphere, but can profit from a monetized pillar to convince decision makers such as politicians and investors.

TsCO approach should therefore account for the (economic) benefits of:

- Higher energy independence, reduced energy poverty
- Higher materials independence and reduced waste volumes
- Reduced social security expenditure through increased well-being and health

- Less pollution, better and safer living environments and therefore a higher quality of life
- Higher productivity of employees, less absenteeism, better recovery in hospitals,... through healthy, comfortable and pleasant buildings
- More local and stable employment in green sectors (energy efficient building renovation, renewable energy production, public transport...)
- Less traffic congestion with related costs
- Higher real estate value of energy-efficient (renovated) residential and non-residential buildings; 'future-proofedness' with regard to future (energy) requirements

2.3.5.2 Sustainable local embeddedness (including capacity)

Additional key concepts: competences, human and intellectual capital, empowerment, risk control capacity, adaptive capacity

Sustainable local embeddedness assesses the degree to which an investment or project inscribes itself meaningfully in the local economic tissue, with as a boundary condition that it supports sustainable economic activities. **Local temporary and permanent employment** relates to the number of qualitative jobs the project generates in both forms and how well these are anchored in the local labour market. **Educational/capacity** building projects can be linked to such efforts, thus increasing the local **human capital**. This can be complemented by **support to the local green economy**, or how the activity contributes to circular and climate-neutral functioning while reinforcing the local anchoring of such activities (providing, as much as possible, locally closed material and energy loops, locally produced food, nature-based solutions and biodiversity preservation).

Community-supportive business models move from an individual, simple short-term product or service towards more collective, complex and long-term oriented set-ups like micro district heating and cooling networks, shared renewable energy generation installations managed by local energy communities, sustainable collective- or co-housing, shared or collective mobility solutions including mobility-as-a-service (MaaS). Although the underlying composite business model is often more difficult to set up, such enterprises are now much needed.

Business models based on the cooperative company model can boost community building, help to build local economies, and maintain a for-profit mentality while sharing and reinvesting these profits into the community.

2.3.5.3 Legal certainty and future economic value

Additional key concepts: flexible use of assets and multiple use of spaces, legitimacy, civic trust, political and institutional capital

This aspect deals with the **future-proofedness** of economic investments and enterprises, both from the viewpoint of **regulatory stability and foreseeability**, and from a perspective of **future economic value** – how much does the activity fit within a circular, climate-neutral society?

Many sustainable investments, for example in renewable energy generation capacity, are battered by obsolete legislation, legal uncertainties and changing regulatory frameworks. Lagging or instable political steering is often an underlying cause hereof. In order to better facilitate the energy, climate and sustainability transition, **predictable, stable and long term (change) policies** are a necessity. Changes in regulatory frameworks should hereby foresee fair transition periods and mechanisms, allowing all concerned stakeholders to duly prepare for the new situations that will come into vigour. Investors that build sustainable assets must be sufficiently assured that their long-term investment horizon and related business case do not come under threat by possible regulatory changes in the future, but will rather be supported by such changes. In this way the related **risk profiles become acceptable for investors**, at least from a legal point of view.

Innovation support can provide for a specific form of legal certainty, and help to limit the risks related to highly innovative projects and developments. This means that the innovation risk is not only taken by the innovator itself, but also by the larger group of societal stakeholders that will co-benefit from the innovation. Innovation support does not only have to come via finance. **Legal sandboxes** can be considered as a non-financial example of innovation support. Their use should be properly set up in order to facilitate real breakthroughs afterwards (i.e. replication/upscaling within newly established regulation, based on the sandbox experiences).

The functional **flexibility and adaptability** of products with a long functional lifetime, like buildings and infrastructures, is another aspect that deserves scrutiny. This not only regards the assets themselves, but also the governance models that manage them. The split incentive problem is an example of a barrier in this regard.

Future economic value assesses **functional flexibility and adaptability**, and thus concerns an economic variant of future-proofedness. Buildings and infrastructures are products with a long to very long service life, and therefore

must be designed to adapt, as smoothly as possible, to foreseeable changes in functional requirements. It helps to avoid suboptimal investments and wasted resources: the more functions an asset can dynamically assume over time, the more sustainable it becomes.

2.3.6 Impact Category 5: Governance

NEB basic impact category		Related modal aspects
Governance		
15	Process quality	Jural, social, ethical
16	Participation and co-creation	Social, ethical
17	Integrity	Ethical

2.3.6.1 Process Quality

Additional key concepts: institutional capital

Especially in a context of societal transitions, good governance processes make the difference. Good governance is needed both in the development phase of a solution, as well as in its operational phase. This is even more stringent in cases where complex (urban) projects must developed[31] or community supportive business models must be put to work. Appropriately involving all concerned stakeholders in the governance process is a basic requirement, see also the following aspect.

Process quality measures the quality of the integrated process and project management, i.e. the effectiveness with which the project objectives are managed and turned into reality. Because the process quality in the development phase has a permanent effect on the performance of the realized project, this temporary aspect should be included in the assessment of the permanent quality of the project. The process does not stop at delivery, but continues during the operational phase. Sustainable projects will often make use of alternative management concepts, for example for collective energy, water, green or waste management. These also require a well-thought-out operation. Suitable business models, communication structures and related agreements are the basic components for successful exploitation.

[31] Cf. 'A Positive Energy District is a process, not a product', Smart Cities Information System (2021), Positive Energy Districts Solution Booklet, p.51, https://smart-cities-marketplace.ec.europa.eu/insights/solutions/solution-booklet-positive-energy-districts

2.3.6.2 Participation and co-creation

Additional key concepts: stewardship, agency

Participation and co-creation examine the extent to which the various stakeholders participate in the decision-making process, in which form (e.g. up to co-creation or citizen control) and how this leads to solid support for the project or the development. The participation format must be fit for purpose and can therefore take various forms[32]. As with process quality, participation is partly a 'temporary' indicator, although the participation process will preferably also find an extension in the use phase of the development. The score will therefore be best if the participation functions optimally in both the project and the use phase.

Well-designed participation also supports social fairness, as all involved actors can have their concerns expressed and taken into account. Duly covering the stakeholder field is an important aspect, in particular with regard to onboarding 'silent majorities', marginalized groups and other potentially underrepresented stakeholder groups.

2.3.6.3 Integrity

Additional key concepts: ethics, burden shifting, greenwashing, reflexive governance

Integrity checks in how far the project or development realises true sustainability, and in how far the share- or stakeholders' agendas, investments and actions support this. Greenwashing is a typical example where integrity is particularly low – sustainability is being claimed but other (unsustainable) goals are being served primarily. Burden shifting (to the environment, to certain social groups, to other locations) is another example where project integrity can be seriously jeopardised. An integrity check is thus instrumental in unearthing hidden agendas, project setup flaws, but also unwanted side effects. This requires, amongst others, the use of well-thought indicator sets for project monitoring.

An integrity check can be (periodically) performed through a process of **reflexive governance**. All stakeholders' interests (including vulnerable groups and even 'nature' or the environment as silent stakeholders) must be considered. An integrity check is also instrumental for identifying clear conditions that must be

[32] Examples of models/methods that can support participation and co-creation are Arnstein's ladder of participation and other models built on the former such as Wilcox's level of participation theory and the framework developed by the Quality of Life Foundation (https://www.qolf.org/framework/).

met at all stages of the process, as well as building and managing sub-indicator sets for the Impact Model, to ensure that the complete modal scale has been used with sound methodologies.

2.4 Re-visiting co-benefits

As explained earlier, the NEB Impact Model is built in such a way that it immediately considers a wide range of co-benefits for any type of given intervention. Nevertheless, second-order, wider societal benefits may not be included in commonly used sub-indicator sets. These second-order benefits may also be very difficult to quantify, yet very relevant for NEB endeavours. This implies that one should consider them at least from a qualitative point of view, and aim at quantification where possible, e.g. assessing how a project or intervention helps to reduce public health expenditure while increasing general health and well-being.

In this way the NEB Impact Model overview scheme could be extended as illustrated in Figure 3.

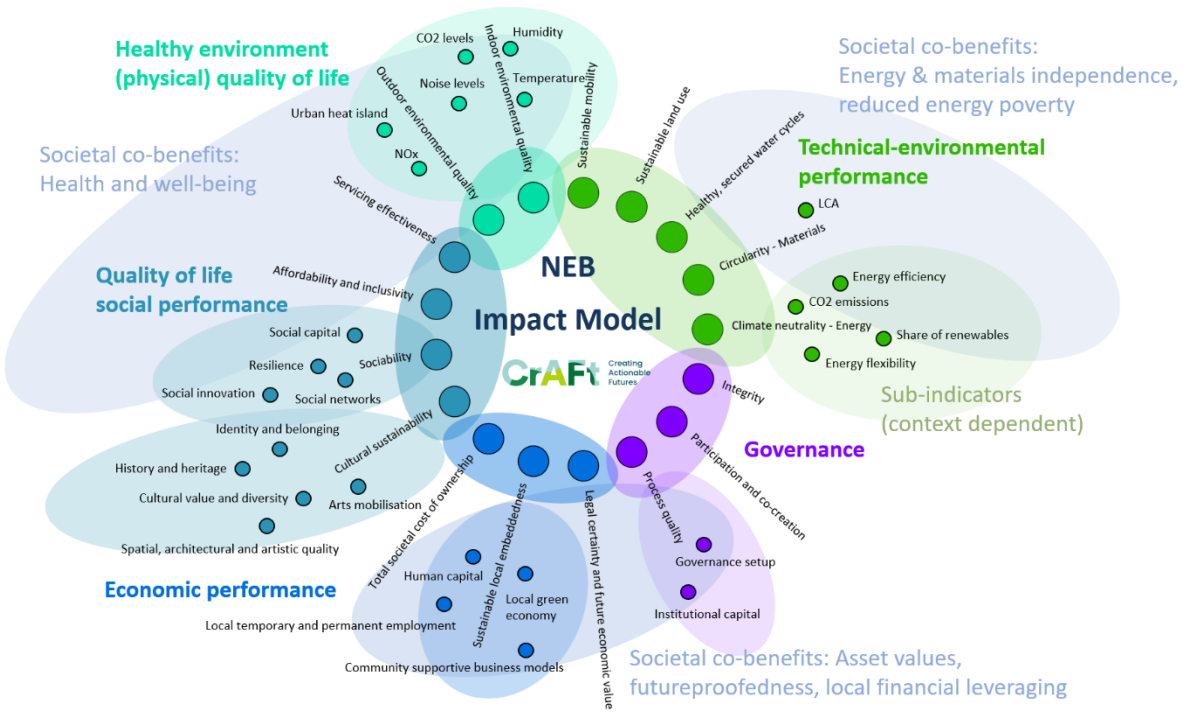

Figure 3: CrAFt's NEB Impact Model with an extended view on second-order, societal benefits. The latter are often not being accounted of in common sub-indicator sets, but are relevant for NEB endeavours. It is therefore recommended to assess them qualitatively, and where possible, quantitatively.

3. Implementation of the Impact Model

3.1 Testing and fine-tuning the Impact Model with CrAFt Cities

Which local collaborative governance models can enable cities' transitions to climate neutrality while being at the same time inclusive, just, beautiful and sustainable?

In CrAFt, 3 Sandbox Cities, 60 Reference Cities[33], 5 NEB Lighthouse projects[34] and other Cities Mission and NEB community initiatives, will contribute to fine-tuning and implementing the Impact Model, with a related body of research and guidance, to help identify essential leverage points for systemic change towards climate neutrality, by including all aspectual layers of sustainability (ecological, infrastructural, social, cultural, economic, aesthetical, legal, etc.) into innovative models for local collaborative governance and value creation that optimally use the co-benefits between the different sectors and minimise potential conflicts. Many smart and climate-neutral solutions have less attractive business cases, and financial aspects are usually discussed rather late in the process. Integration of financial aspects and co-benefits from the beginning, will help to exploit new value chains and business opportunities.

The Impact Model will function both as a documenting and assessing tool, and a guidance instrument to improve shared understanding and support for cross-cutting decision-making and implementation between stakeholders from different sectors and disciplines. The work of all contributing cities and communities will help develop new approaches and methods for local collaborative governance models that can enable cities' transitions to climate neutrality while being at the same time inclusive, just, beautiful and sustainable.

Among the cities and partnering initiatives, we will actively recruit and assess emblematic projects that simultaneously address inclusiveness, sustainability and quality of experience **using the Impact Model, document local collaborative practices that produced them**, from the visioning phase through political anchoring and financial planning to co-production with local communities, and translate them into formats that are easily accessible and adaptable in support of cities and communities across Europe. Using the Impact Model, we will **monitor**

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33 https://craft-cities.eu/sixty-cities-join-craft-to-jointly-shape-the-transition-towards-climate-neutrality-and-inclusive-cities-by-2030/

34 https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2780

the impacts of local NEB-inspired initiatives and document the impact pathways. Based on these experiences, we will create impact stories from and with the local stakeholders, to inform CrAFt's Storytelling Campaign and Policy Briefs. The outcomes of this work will be integrated in the Climate-Neutral and Smart Cities Guidance Package: New European Bauhaus Edition, a first version of which will be issued by May 2023, and fed back into fine-tuning the Impact Model.

These experiences will furthermore **support cities in social and organisational learning** in urban innovation and demonstration projects – within the city and between cities – through cooperation with arts, cultural and creative sectors, citizens and communities. CrAFt will incorporate this long-term "how to" perspective in Mutual Learning Exercises with all of its cities to promote and facilitate exchange of knowledge and good practices, using the Impact Model in combination with the Climate-Neutral and Smart Cities Guidance Package: NEB Edition containing principles, tools and experiences from other cities as inspiration for others. CrAFt's Student Think/Do Tank and STEAM Teams[35] will further explore the potential of the Impact Model within and across the CrAFt Cities.

As such, the Impact Model will support the Cities Mission, the NetZeroCities platform in deploying Climate City Contracts, by **helping cities to create and implement local collaborative governance models that harness the value of inclusiveness, aesthetics and sustainability**, as understood within the local contexts of their city, in their transformation towards climate neutrality.

Finally, CrAFt will develop a model for in-project Monitoring and Evaluation based on the Impact Model, to be used for self-reflexive evaluation and improvement among the project partners, Work Packages and Advisory Boards.

3.2 Next steps in the development of the Impact Model

The current version does not yet address how the Impact Model will handle systems dynamics and scale levels (in Bauhaus terms, from the door knob to the urban plan), beyond static indicator-based impact assessment. In principle, downscaling assessments starting from the urban level (as is proposed here) creates less risks of leaving indicator gaps, than upscaling from a smaller scale level indicator system (e.g. at the single building or single activity level).

[35] Additional information is available in D5.1: Model of governance for next generation CrAFt think/do tank of students - https://craft-cities.eu/wp-content/uploads/2022/08/CrAFt-Governance-for-Next-Generation-ThinkDo-Tank.pdf and D5.2: STEAM Teams Management Plan - https://craft-cities.eu/wp-content/uploads/2022/09/D5.2-STEAM-Teams-Management-Plan.pdf

In a next version, we will include suggestions on how to adapt the Impact Model to different project development phases, in line with CrAFt's upcoming Climate-Neutral and Smart Cities Guidance Package: NEB Edition.

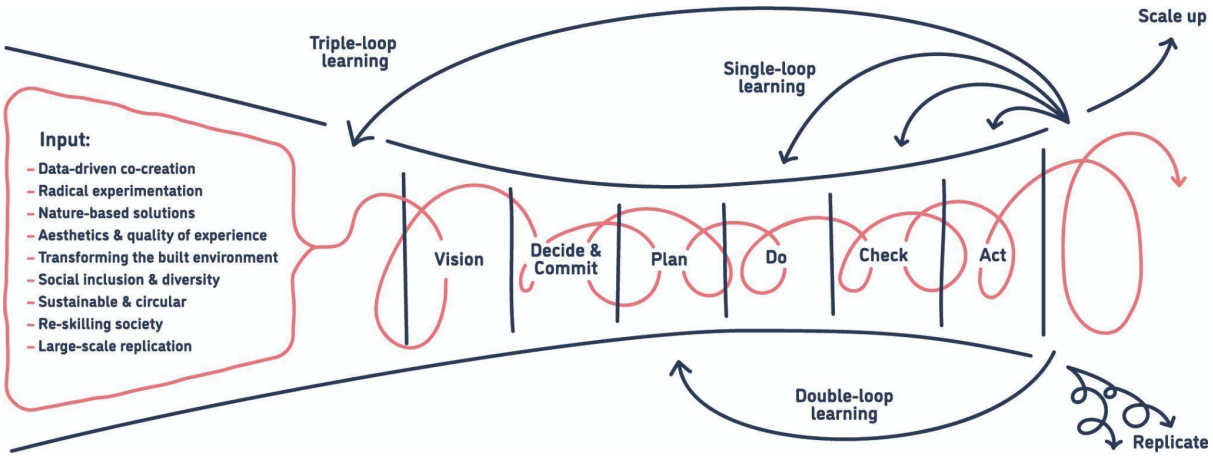

Figure 4: CrAFt's workflow with its built-in feedback/learning loops. Expanded Smart City Guidance Package: NEB Edition

Furthermore, a strategy for (quantitatively) assessing second-order societal benefits shall be explored. This effort will rely on a scientific literature review in order to identify the methods and practices that already perform this type of assessment, combined with on-the-ground experiences by the CrAFt Cities.

4. Supporting programmes and methods

4.1 Situating the New European Bauhaus in the EU policy landscape

In order to realise its energy, climate and sustainability goals the EC implements a series of policies among which are the Green Deal[36] and its Renovation Wave[37], the Fit for 55 package[38] and REPowerEU[39]. Hereby stated ambitions are not only techno-economical but include social policy goals as well. In this way the triple baseline of the Green Deal proposes (1) *'no net emissions of greenhouse gases by 2050'*; (2) *'economic growth decoupled from resource use'*; and (3) *'no person and no place left behind'*.[40]

Yet, a simple triple baseline 'environmental-economic-social' does not cover all of the aspects that come into play, and as such does not sufficiently address the **wicked problems** that come with a paradigm change of reaching climate neutrality in all sectors of society. Within such perspective, the New European Bauhaus[41] initiative can be considered as a policy instrument that addresses the need for a more **integrative approach**, helping to cover the full spectrum of aspects that contribute to this paradigm shift.

If the European Green Deal has a soul, then it is the New European Bauhaus which has led to an explosion of creativity across our Union.

(Ursula Von der Leyen, President of the European Commission)

In the background of such a transformation process, people's aspirations ultimately relate to safeguarding quality of life. Decomposing the concept of quality of life back into its constituting elements is therefore a good methodological option. This is where the New European Bauhaus (NEB) brings its specific contribution.

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[36] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[37] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

[38] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

[39] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

[40] Cited from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[41] https://europa.eu/new-european-bauhaus/index_en

Today's societal context only adds to the challenge - post-pandemic effects, war, political and economic crisis. Here NEB can be a way to safeguard climate-neutrality ambitions and help increase Societal Readiness Levels for the transition to climate neutrality, making it more likely for politicians to keep true to this ambition when they observe the people's support.

The mission of the NEB is stated as follows:

'The New European Bauhaus is a creative and interdisciplinary initiative that connects the European Green Deal to our living spaces and experiences.

The New European Bauhaus initiative calls on all of us to imagine and build together a sustainable and inclusive future that is beautiful for our eyes, minds, and souls. Beautiful are the places, practices, and experiences that are:

- *Enriching, inspired by art and culture, responding to needs beyond functionality.*
- *Sustainable, in harmony with nature, the environment, and our planet.*
- *Inclusive, encouraging a dialogue across cultures, disciplines, genders and ages.'* [42]

This means that true quality of life is at the heart of NEB's aspirations – beyond the functional goals of the Green Deal's triple bottom line.

At the same time, NEB comes with a historical connotation. In this way NEB also refers to values that have been aspired earlier, and that remain relevant for today's challenges. It is therefore recommended to consider the original Bauhaus' intentions and realisations in order to understand how such an approach can contribute to building the integrative solutions that are needed for addressing the energy, climate and sustainability challenges of today.[43]

4.2 CrAFt, NEB and the original Bauhaus

Our built environment is the place where good design is finding its expression from the door knob to the urban masterplan – coinciding with the scope the original Bauhaus was targeting. How then to integrate good design with 100% renewable energy and a 100% circular economy, the underlying goals for realising a sustainable, climate neutral society?

[42] Cited from https://europa.eu/new-european-bauhaus/index_en

[43] For an in-depth reflection on Modernism and its connections to sustainability challenges, see: Vandevyvere, H., Heynen, H. (2014), Sustainable Development, Architecture and Modernism: Aspects of an Ongoing Controversy, in: Arts, Vol. 3, No. 4, p. 350-366, https://doi.org/10.3390/arts3040350

In CrAFt, we connect the qualities of the original and New Bauhaus to the overarching goals of the EU Green Deal, through a methodology that integrates the spheres of urban and landscape design and architectural and aesthetic quality in a whole systems perspective where environmental, social, cultural, economic, regulatory, governance and ethical aspects are equally valued in a proportionate way. This multimodal system analysis supports the disruptive change so much needed to arrive at sustainable functioning within the limited timeframe that remains available. In this way it is fit for supporting a paradigm shift comparable to the one the Bauhaus was envisioning. The development of this methodology is elaborated upon in the next Sections. First, we introduce the original Bauhaus and its connection with the New European Bauhaus.

4.2.1 The original Bauhaus

The original Bauhaus was not just about design. Bauhaus, and more generally the Modern Movement, wanted to settle with an obsolete paradigm: a decayed society that kept up the appearances behind its neoclassical facades but that had at the same time provoked the absurd carnage of World War I.

The Modern Movement wanted to replace this approach of life with something radically new, bright, just and transparent. Bauhaus was thus as much part of a social and societal experiment as it was a design revolution, in particular under the directorship of Hannes Meyer (1928-1930). It was embedded in the 20's and 30's social and functionalist ambitions of Modernism, as reflected in CIAM's ideas on uplifting the working class from its poor living conditions through concepts like the *Existenzminimum*[44]. The Bauhaus researched new materials and industrialised production for affordability and mass production while preserving the qualities of well-designed craftsmanship.

In his educational program, Hannes Meyer used a vertical approach to integrate and create flexibility of combinations within different disciplines. The designs were integral: they included social, economic, aesthetic, and sustainability aspects. The proposed multimodal character of the CrAFt Impact Model resonates with such an approach. The goal of the Bauhaus, also according to Gropius, was to educate to a cosmic conscience: everything is connected and related. Understanding the process enabled self-expression. By reconnecting artists to industry and daily life, and everything and everybody to design, a sense of engagement and ownership

[44] See for example https://www.moma.org/collection/works/6107 referring to Leistikow, H. (1929), Die Wohnung für das Existenzminimum

was re-distributed so that a design was not only produced by materials but also by the larger immaterial, societal capital.

Neither the Bauhaus nor the Modern Movement, however, appear to have been alarmed about the lurking environment and climate crisis, as was probably the large majority of scholars at that time. There was only a limited group of people who pointed out that the outcomes of the industrial revolution could have a far-reaching, negative impact on the planet's ecosystems.

Such was for example the rare and visionary conclusion of George Perkins Marsh in Man and Nature (1864) where he stated that society is *'breaking up the floor and wainscoting and doors and window frames of our dwelling, for fuel to warm our bodies and seethe our pottage, and the world cannot afford to wait till the slow and sure progress of exact science has taught it better economy'* [45]. From his side, Svante Arrhenius had calculated the effects of anthropogenic greenhouse gas emissions, with remarkable accuracy, as early as 1896-1908[46].

Occasional details in the literature do show a glimpse of this forgotten dimension. Sometime after the Bauhaus teachers went to live in their new master's houses designed by Walter Gropius, Paul Klee started to complain about the astronomic heating bill. He and Wassily Kandinsky finally went to ask the town of Dessau for a rent subsidy in order to afford for the energy bills[47] - parallels with the situation today are striking.

The uninsulated concrete walls and large single-glazed window bays leading to catastrophic energy figures do not necessarily impair Bauhaus' brilliant output. They rather illustrate that progressing insights matter.

Today, it is the fossil fuel paradigm that has become obsolete – even if we seem unable to quit it at short notice. And so there is a need for developing something new, bright, just and transparent; and sustainable.

[45] Marsh, G.P. (1965), Man and Nature, Harvard University Press, p. 36, cited in: McCormick, J. (1995), The Global Environmental Movement, 2nd edition, Wiley, p. 12

[46] Arrhenius, S. (1896), On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground, in: Philosophical Magazine and Journal of Science, Series 5, Vol. 41, p. 237-276, www.globalwarmingart.com/images/1/18/Arrhenius.pdf; and Arrhenius, S. (1908), Worlds in the Making: The Evolution of the Universe, Harper & Row, p. 54, p. 63.

[47] Droste, M., Bauhaus-Archief (1990), Bauhaus 1919-1930, Taschen-Librero, p. 126

Figure 5: The Bauhaus teacher's houses (source: Droste & Bauhaus Archief 1990)

4.2.2 The New European Bauhaus

The European Commission states the mission of the NEB as follows[48]:

'The New European Bauhaus initiative connects the European Green Deal to our daily lives and living spaces. It calls on all Europeans to imagine and build together a sustainable and inclusive future that is beautiful for our eyes, minds, and souls.'

Co-creation across disciplines and sectors lies at the core of the New European Bauhaus:

- *'It is a bridge between the world of science and technology, art and culture*
- *It is about leveraging our green and digital challenges to transform our lives for the better.*
- *It is an invitation to address complex societal problems together through co-creation.'*

This co-creation intends to drive societal transformation across three interlocking values:

[48] cited from https://europa.eu/new-european-bauhaus/about/about-initiative_en

- ***sustainability***, *from climate goals, to circularity, zero pollution, and biodiversity*
- ***aesthetics***, *quality of experience and style, beyond functionality*
- ***inclusion***, *from valuing diversity, to securing accessibility and affordability'*

Through this co-creation, the New European Bauhaus will systematically support experiments towards positive, actionable futures in support of the Green Deal. In its explanatory note, the Commission further states[49]:

- *The New European Bauhaus wants to make the Green Deal a cultural, human centred and positive, "tangible" experience. It shows the opportunities and hopes and brings the Green Deal to the people by building a new future together.*
- *The New European Bauhaus wants to connect different realities. The COVID crisis has shown that many topics are interlinked and that new thinking comes from breaking silos, just as the Bauhaus movement did one hundred years ago. The New European Bauhaus would like to facilitate the exchange of knowledge between people across Europe and to create an interdisciplinary project.*
- *The New European Bauhaus wants form to follow planet: We want to create a design movement integrating three dimensions: sustainability (including circularity), quality of experience (including aesthetics) and inclusion (including affordability). Showing that creativity is in finding affordable, inclusive and attractive solutions for our climate challenges.*

Based on these co-creation and experimentation activities, the New European Bauhaus becomes a think-do tank that connects societal stakeholders across science, culture and art:

- *The New European Bauhaus is a think-do tank. A design lab, accelerator and network at the same time. A creative and interdisciplinary movement, convening a space of encounter to recuperate and revisit sustainable practices from, empower the most inspiring practices of today, and design future ways of living, at the crossroads between art, culture and science.*
- *The New European Bauhaus wants to build a sustainable future through creativity, innovation and imagination. To enable experimental places and spaces for us to reimagine how to live better together after the pandemic.*

[49] Cited from: https://europa.eu/new-european-bauhaus/system/files_en?file=2021-01/New-European-Bauhaus-Explained.pdf

- *The New European Bauhaus is a crossroads project. It connects innovation, creativity and design to citizen's quality of life in towns and localities. It bridges, connects and blends the green and digital transformations.*
- *The New European Bauhaus is a transformational project. It aims to lead the thinking, inspire behaviours, attract the markets and influence public procurement to make new ways of living possible. The ultimate focus is "beyond buildings" – the project should bring benefit to the whole of society. It will help to revisit Europe's cultural heritage and shape its future.*
- *The New European Bauhaus is transformational in its delivery. Co-created and delivered in innovative, fresh, inclusive and creative ways.'*

4.3 Multimodal System Analysis (MMSA) as an operational framework for realising the NEB's goals

In what follows, a multimodal methodology is presented that can both help to deepen insight in the NEB's stated ambitions, and to structure interventions that aim at realising the NEB's goals in practice. In CrAFt, we transform this methodology into a NEB-inspired Impact Model to support inclusive, beautiful and sustainable city transitions towards climate neutrality. The Impact Model was presented in Chapter 2. In the Section below, we describe how the methodology was developed.

4.3.1 Multimodal System Analysis

The basis of multimodal system analysis is to be found in the Dutch philosopher Herman Dooyeweerd's work regarding the 'Wijsbegeerte der Wetsidee' or 'Philosophy of the Law-idea'[50].

[50] This philosophy is described in 4 successive publications:
Dooyeweerd, H. (1953), A New Critique of Theoretical Thought, Vol. 1: The necessary presuppositions of philosophy, H.J. Paris / The Presbyterian and Reformed Publisher Company
Dooyeweerd, H. (1955), A New Critique of Theoretical Thought, Vol. 2: The general theory of the modal spheres, H.J. Paris / The Presbyterian and Reformed Publisher Company
Dooyeweerd, H. (1957), A New Critique of Theoretical Thought, Vol. 3: The structures of individuality of temporal reality, H.J. Paris / The Presbyterian and Reformed Publisher Company
Dooyeweerd, H., De Jongste, H. (1958), A New Critique of Theoretical Thought, Vol. 4: Index of subjects and authors, H.J. Paris / The Presbyterian and Reformed Publisher Company

Herein the modal sphere theory was initially developed by Dooyeweerd starting from the 1930s[51]. It is an epistemology or knowledge theory.

Dooyeweerd identifies, in a non-exclusive manner, 15 modal spheres (also called aspects) that can structure our understanding of reality. They logically succeed each other in a sequential order as follows: the numerical, the spatial, the kinetic, the physical, the biological, the sensitive-psychical, the analytical-logical, the historical-cultural, the linguistic-communicative, the social, the economic, the aesthetic, the jural, the ethical, and the credal law-sphere.

The power of Dooyeweerd's epistemology lies essentially in the relations he discerns between these modal spheres. All spheres meaningfully and functionally link to each other in modal "chain reactions", but have at the same time an irreducible autonomy: no sphere can be broken down in composing elements that all resort to other spheres. Each sphere has singular characteristics. Another important property of the spheres is that their functions evolve from being ruled by strictly determinative laws (e.g., the laws of physics, which are evidently not open to negotiation) towards regimes of human normative character (e.g., the laws of a given juridical system which are the result of human convention, and therefore open to negotiation). Their natural order implies specific functional consequences; as such there is no biological life possible without the basis of physical matter, or there can be no economy without social relations. A lower order sphere is, thus, always conditional for the existence of higher order spheres.

This interlinking has been expressed as the fact that spheres anticipate and, reversely, retrocipate other spheres. Retrocipation is, in Dooyeweerd's theory, the opposite of anticipation: if sphere A anticipates (makes up the lower order foundation for) sphere B in the modal sequence, then sphere B retrocipates (or falls back on) sphere A. As argued above, it is not possible to have an economic system without social relations: the economy is, thus, a social construct. Expressed in Dooyeweerd's terms social relations anticipate economic behaviour and economic behaviour necessarily retrocipates into its foundations of social interaction. In a similar way, we can conclude that human societies with their social and economic functions cannot operate without the ecosystem services provided in the physical and biological spheres, because a society necessarily retrocipates into these material spheres.

[51] The main reference for the modal sphere theory is: Dooyeweerd, H. (1955). Original texts can be consulted at https://www.dbnl.org/tekst/dooy002wijs02_01/ (Dutch) and https://www.dbnl.org/tekst/dooy002newc06_01/dooy002newc06_01.pdf (English)

4.3.2 Multimodal sustainability

In the following graph, we have applied the theory to sustainable development[52]. Taking the Brundtland definition[53] as a reference, we may indeed state that sustainable development expressed in this way, is based on an ethical principle. By contrast, no religious underpinning interferes in its accepted interpretations[54]. From the ethics level, engagements trickle down to all of the aspectual layers, deep into the physical world of, for example, carbon emissions (see also further).

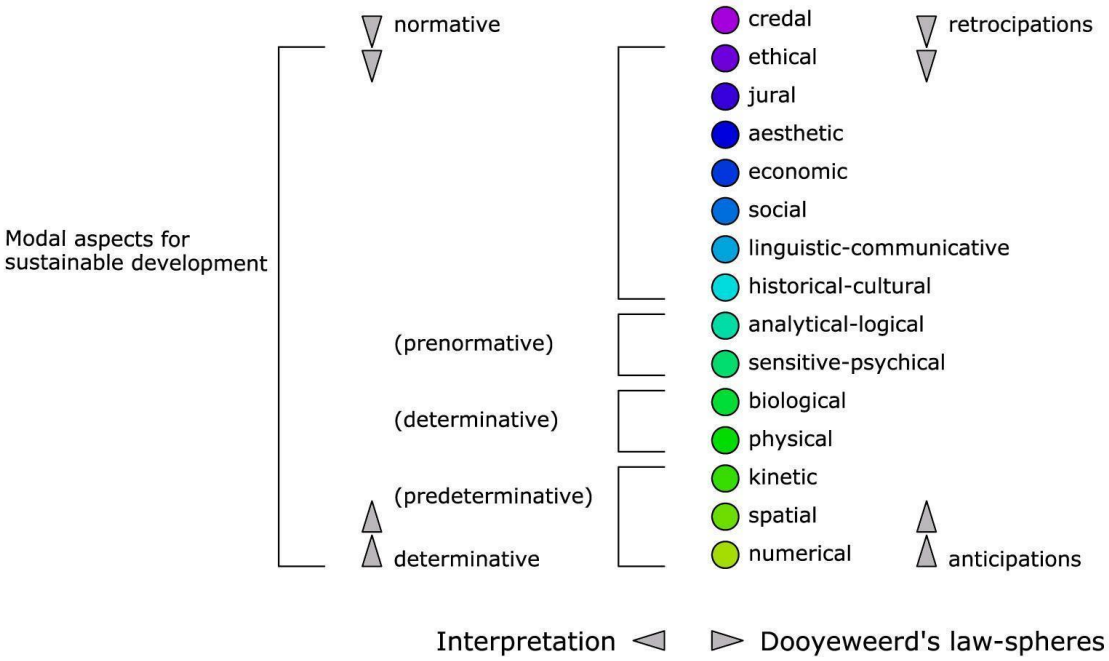

Figure 6: Graphical representation of modal aspects of sustainable development based on Herman Dooyeweerd's theory of the modal spheres, source: Vandevyvere, H. (2010), Strategieën voor een verhoogde implementatie van duurzaam bouwen in Vlaanderen. Toepassing op het schaalniveau van het stadsfragment.

[52] A detailed analysis can be found in Vandevyvere, H. (2011), How to cut across the catchall? A philosophical-cultural framework for assessing sustainability, in: International Journal of Innovation and Sustainable Development, Vol. 5, No. 4, p. 403-424

[53] United Nations World Commission on Environment and Development, Brundtland, G.H. (1987), Our Common Future: Report of the World Commission on Environment and Development, WCED, Chapter 2, Article 1: *'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (...)'*

[54] In this sense the Brundtland Report's sustainability definition is of a very similar nature as another UN charter, the Human Rights Declaration. Note that both adhering to sustainable development or respecting the human rights can nevertheless retrocipate from a religious stance by individuals.

For example, the Kyoto protocol and the Paris Agreement are jural agreements that retrocipate from an ethical stance as illustrated through the Brundtland definition (*'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'*). They in turn retrocipate back into the physical realm by imposing limits on the amount of greenhouse gases that are released into the atmosphere. The retrocipation chain includes the economic and social spheres, implying that addressing the challenge will require specific economic and social measures as well.

4.3.3 NEB revisited

Considering sustainability from a multimodal perspective leads to a number of interesting outcomes.

The sovereignty of each of the modal aspects requires an explicit, independent address of all of these aspects. No aspect can be implicitly handled through another aspect (e.g. considering culture as a social function, or aesthetics as a social convention). Hence, and mostly interesting from a NEB perspective, aesthetics do matter and need to receive a proper, independent address when discussing sustainability. This can be extended to any other aspect like cultural (how shall we change our cultural and behavioural routines to allow for a low-carbon system?) or linguistic (how shall we transmit the message or build a convincing story line to support it?). In a similar vein, the ethics and values behind sustainability claims require an explicit address. The latter principle can for example help to unveil *greenwashing*.

There can be no social or economic sustainability without environmental sustainability as a prerequisite. Lower aspects are the foundation (substrate) for higher aspects. Therefore higher aspects cannot function without relying on those lower aspects. Hence, sustainability becomes a normative concept with determinative foundations. As a consequence, a multidisciplinary framework is needed for proper treatment of all independent spheres.

For this reason, CrAFt aims to use a NEB-inspired, multimodal Impact Model to support cities in their transitions to climate neutrality. The Impact Model will be able to bring a much-needed, systemic correction on widespread established approaches that limit sustainability to e.g. 3Ps (People, Planet, Profit) while ignoring the role of beauty, culture, language and inclusivity.

This is fully aligned with NEB's mission to complete the technical character of the Green Deal by infusing aspects that give it a 'soul', i.e. human value and meaning.

4.4 Additional KPI sources to support the Impact Model

- Vandevyvere, H. (2010), Strategieën voor een verhoogde implementatie van duurzaam bouwen in Vlaanderen. Toepassing op het schaalniveau van het stadsfragment (Strategies Towards Increased Sustainable Building in Flanders. Application on the Scale of the Urban Fragment), PhD Dissertation, K.U.Leuven;
- JPI UE PED definition development activities, see https://jpi-urbaneurope.eu/ped/;
- SSPCR 2022 World Café "Sharing the experiences on Positive Energy Districts: Lessons learned from Annex 83" - session on quality of life indicators for PEDs, Bolzano, 19.07.2022;
- The Inclusive Healthy Places indicator set by the Gehl Institute, https://gehlpeople.com/wp-content/uploads/2020/02/Inclusive-Healthy-Places_Gehl-Institute.pdf;
- Tillie, N. et al. (2012), Rotterdam – people make the inner city (Densification + Greenification = Sustainable City), https://www.academia.edu/es/41492761/Rotterdam_People_make_the_inner_city_densification_greenification_sustainable_city;
- Rollins, D., Castillo, E. (2020), Using Six Conceptualizations of Capital to Help Achieve the SDGs, Stanford Social Innovation Review, https://ssir.org/articles/entry/using_six_conceptualizations_of_capital_to_help_achieve_the_sdgs;
- Khameneh, T.A. (2022), Developing an Assessment Framework for Social Sustainability within Neighborhoods, Case Study: Furuset Neighborhood in Oslo, Master Thesis in Sustainable Architecture, NTNU

5. Conclusion

Which local collaborative governance models can enable cities' transitions to climate neutrality while being at the same time inclusive, just, beautiful and sustainable?

In CrAFt, 3 Sandbox Cities, 60 Reference Cities and City Clusters, 6 NEB Lighthouse projects and other Cities Mission and NEB community initiatives, will contribute to fine-tuning and implementing the NEB-inspired Impact Model, with a related body of research and guidance.

The Impact Model, introduced in this Deliverable, offers a set of primary KPIs that are already largely known and used by most cities. It does not replace the indicator sets cities already use - rather, it complements them as a guidance instrument to improve shared understanding and support cross-cutting decision-making between stakeholders from different sectors and disciplines.

The Impact Model will help cities and their stakeholders to identify essential leverage points for systemic change towards climate neutrality, by including all aspectual layers of sustainability (ecological, infrastructural, social, cultural, economic, aesthetical, legal, etc.). By working across multiple modes, rather than per sector, the transition becomes much more robust and balanced, and engages more stakeholders in a positive manner.

This Deliverable includes the first version of the Impact Model. In the next phase, CrAFt will test how the Impact Model can be adapted to local context, to document how it can be used to create impact pathways in practice, and to create impact stories from and with the local stakeholders, through cooperation with arts, cultural and creative sectors, and local and regional stakeholders. The results will be fed back into the Impact Model and the Guidance Package, and will inform learning and sharing of hands-on practices among CrAFt's cities and their stakeholders, Student Think/Do Tanks, and the Storytelling Campaign and policy initiatives.

The work of all contributing cities and communities will help develop new approaches and methods for local collaborative governance models that can enable cities' transitions to climate neutrality while being at the same time inclusive, just, beautiful and sustainable. Integration of financial aspects and co-benefits from the beginning, will help to exploit new value chains and business opportunities. As such, the Impact Model will support the Cities Mission, the NetZeroCities platform in deploying Climate City Contracts, by helping cities to

create and implement local collaborative governance models that harness the value of inclusiveness, aesthetics and sustainability, as understood within the local contexts of their city, in their transformation towards climate neutrality.

The current version does not yet address how the Impact Model will handle systems dynamics and scale levels (in Bauhaus terms, from the door knob to the urban plan), beyond static indicator-based impact assessment. In principle, downscaling assessments starting from the urban level (as is proposed here) creates less risks of leaving indicator gaps, than upscaling from a smaller scale level indicator system (e.g. at the single building or single activity level). In a next version, we will include suggestions on how to adapt the Impact Model to different project development phases, in line with CrAFt's upcoming Climate-Neutral and Smart Cities Guidance Package: NEB Edition.

A final version will be made available in Month 36 of the project, i.e. by April 2025.

List of Acronyms

CIAM	International Congress of Modern Architecture
EC	European Commission
EU	European Union
KPI	Key Performance Indicator
LCA	Life Cycle Analysis
LCC	Life Cycle Cost
MaaS	Mobility-as-a-Service
MMSA	Multimodal System Analysis
MFA	Material Flow Accounting
NEB	New European Bauhaus
NZC	NetZeroCities
RES	Renewable Energy Sources
S-LCA	Social Life Cycle Analysis
TCO	Total Cost of Ownership
TsCO	Total Societal Cost of Ownership

Annex I: Original MMSA-based indicator set and diagram

The indicator set

The table represents the original indicator and sub-indicator set, which has been slightly updated in the above elaboration. Normative numbers are (composite) scores based on expert judgement or (a weighted sum of) further quantitative sub-indicators with their respective scoring functions.

	Categories (4) **Indicators (20)**	**Subindicators (39)**
	Ecology – environmental aspects	
M1	Materials+	LCA of buildings and infrastructures (ecopoints/$m^2_{\text{building floor}}$, year)
M2	Energy+	Building energy in use phase ($kWh_{\text{primary, fossile}}$ /m², year)
		Environmental quality building energy in use phase (ecopoints / kWh)
		Transport energy in use phase ($kWh_{\text{primary, fossile}}$ /person, year)
M3	Water+	Residential drinking water use (litre/day, person)
		Disconnection degree of rain water (%)
		Quality of the district water metabolism (normative number)
M4	Land use	Quality of the location choice (normative number)
		Space use: redevelopment rate and urban density (normative number)
		Quality of local ecosystems (normative number)
M5	Mobility	Proximity and accessibility of an urban centre (normative number)
		Servicing effectiveness of public transport (normative number)
		Servicing effectiveness of active transport (normative number)
		Parking norm (normative number)
M6	Emissions and nuisance	NO2-concentrations (µg/$m^3_{\text{yearly average}}$)
		Levels of outside noise (dB)
		Annex-indicators (normative number)
	Society – socio-cultural aspects	
S1	Safety	Fysical safety and social control (normative number)
		Traffic safety (normative number)
S2	Servicing effectiveness	Functional diversity (normative number)
		Collective servicing level (normative number)
		Proximity and accessibility (normative number)
		Quality of information and communication (normative number)
S3	Integration	Quality of integration (normative number)
		Share of social housing (%)

S4	Sociability	Social potential (normative number)
S5	Future social value	Social flexibility (normative number)
R1	Spatial quality	Spatial quality (normative number)
R2	Identity	Identity (normative number)
	Economy	
E1	Life cycle cost	Payback time (year)
		Cost effectivity (normative number)
E2	Economic embedding	Economic substantiation (normative number)
		Permanent employment (jobs/hectare)
		Temporary employment (normative number)
E3	Legal certainty	Institutional-juridical framework, innovation support (normative number)
E4	Future economic value	Functional flexibility and adaptability (normative number)
	Governance – process aspects	
I1	Process quality	Quality of process en governance structures (normative number)
I2	Participation	Quality of participation (normative number)
I3	Integrity	Normative integrity and ethics (normative number)

The radar diagram

Connected to the MMSA-based indicator set, a radar diagram representing assessment scores was developed. It is designed to visually represent the composite assessment, limiting visual bias to a minimum compared to other established visualisation methods.

The size of the blocks in the radar diagram represents the relative weight each indicator received by an expert panel.

[Location] Score: 69,5 / 100

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