BUILT FOR LIFE
AN ECTP COMMITTEE

ECTP Built for Life Committee

Horizon Europe 2022-2027 POSITION PAPER

ECTP
INNOVATIVE BUILT ENVIRONMENT

This document was developed by ECTP's (The European Construction, built environment and energy efficient building Technology Platform) Built for Life Committee with the support of Dowel Innovation.

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Glossary

Place-making: Placemaking is the process of creating quality places where people want to live, work, play, and learn in.

Nature-Based Solutions: Nature-based solutions are solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience[1].

Salutogenesis: Salutogenesis is the origins of health and focuses on factors that support human health and wellbeing, rather than on factors that cause disease.

Smart growth: Smart growth is an urban planning and transportation theory concentrating on growth in compact walkable urban centres to avoid sprawl.

Universal Design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by severyone regardless of their age, size, ability or disability.

List of acronyms

ADL Activities of Daily Living

ECTP European Construction, built environment and energy efficient building Technology Platform

HHSR Housing Health and Safety Rating

HVAC Heating Ventilation and Air Conditioning

IWBI International Well Being Institute

NBS Nature-Based Solutions

OECD Organisation for Economic Co-operation and Development

UN United Nations

WHO World Health Organisation

[1] We provide here the definition given by the European Commission (https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en), however some concerns are currently discussed in literature regarding the cost effectiveness and reliability of NBS (see e.g. https://royalsocietypublishing.org/doi/10.1098/rstb.2019.0120)

I. Introduction

1.1. Context

The ultimate goal of our buildings and communities should be to create an ongoing positive human experience.

The Covid-19 pandemic has put a spotlight on our built environments. In 2020, we were faced with the personal, social, and physical limitations of our spaces. The experience has made us aware of our frailty and has forced us to evolve: we have embraced digital transformation as never before. Homes have been converted into schools, offices and playgrounds, and workplaces pushed into the virtual realm. We have adapted to new uses of public transport and people have reconquered urban spaces in many cities. These processes have only heightened the need to examine the link between buildings and community health and wellbeing. Indeed, the pandemic is a call to action to drive regenerative sustainability in the built environment for human health and wellbeing.

This call to action needs a human-centred approach to the built environment incorporating users into the processes of designing space (co-design), and applying user experiences, to better inform and manage the built environment operation (design for users).

The built environment sector has been mostly focused on interventions, innovation and technology that minimises environmental impact by reducing carbon emissions, waste, and energy consumption. As we usually rate buildings for resource efficiency, optimum performance, or aesthetic quality it is easy to forget about the social impact, and how systems, structures and design can actively support healthy, liveable and enjoyable communities for current and future generations.

There is an urgent need to consider how buildings, cities and infrastructures can be - not only sustainable and resilient - but also regenerative, creating net benefits. **What if the built environment could improve and maintain health, and contribute to users' wellbeing and public health? What if it could foster healthy, inclusive, and liveable communities?** There is then an opportunity to rethink how we design, construct, maintain and renovate our buildings.

The goal of the ECTP's Built for Life Committee is to propose a Research and Innovation Agenda that focuses on topics connecting the built environment with health and wellbeing for all.

The Built for Life Committee is an evolution of the previous Active Ageing and Design Committee. As we work towards Horizon Europe, we understand the need to consider the impact of design and technology on health and wellbeing, not only in relation to housing for the growing proportion of older people, but everyone. The Committee also considers that the need for inclusive design extends beyond housing into multiple spaces and scales, including infrastructure and cities.

1.2. Scope and Approach

The strain on public health of ageing populations, chronic conditions, lifestyle diseases and changing lifestyles is comparable to the great XIX century pandemics. So far, the response, in terms of transforming the physical living environment, has not been equal to the challenges.

The Covid-19 pandemic has abruptly renewed interest in the key role that the built environment plays in health. The construction sector has an opportunity to design, build and operate buildings and cities over the next decade to maximise health benefits and integrate technology as never before. This refers to residential and non-residential buildings as well as special-purpose buildings and any infrastructure intimately connected to its surroundings, such open public space. With the twin green and digital transitions dominating the Horizon Europe vision, the time is ripe for updating urban planning policies integrating technologies and digital transformation into all buildings.

A working group was set up to develop this position paper based on upcoming priorities for Horizon Europe and to gather input from different departments of the European Commission.

This position paper looks to:

- Identify research needs to drive the social impact of the built environment to the forefront of European research and innovation agendas.
- Focus on future innovations and technologies for the built environment.
- Raise awareness and communicate priorities to strategic stakeholders.
- Promote translation of research results, ensuring the smooth implementation of up-to-date, evidence-informed policies and practices.
- Support research-funding proposals and partnerships.
- Advocate and share knowledge within and beyond the ECTP.

1.3. Needs and ambition

If we are to achieve the targets of the Paris Agreement and UN Sustainable Development Goals, quantifying the environmental impact and energy performance of buildings is fundamental. Yet to make the built environment truly sustainable, we also need to address gaps in understanding the relationship between the built environment, human health, and climate change adaptation practices.

Unfortunately, infrastructure built to exacting energy performance standards can be demonstrably negative for occupants. For example, in Hong Kong more than half the 40,000 buildings classified as energy efficient are also labelled as ‘sick buildings’. The classification of ‘sick buildings’ links indoor environmental quality with negative health and comfort impacts for occupants. For example, poorly ventilated spaces have been linked to increased absences, higher operational costs, and decreased productivity, with one study attributing 35% of total absenteeism in the U.S. to the insufficient provision of fresh air in buildings.[2] Studies at schools show air quality impacts cognitive performance and access to daylight in care facilities has been associated with depression. There is evidence that

[2] IWBI Global Research Agenda, January 2021

transmission of SARSCoV-2, as well as other pathogens, commonly occurs in closed indoor spaces and that ventilation, HVAC systems and natural air circulation, have an important role in the diffusion of virus particles[3].

While furthering our understanding of sick buildings is of vital importance, to date most studies and models linking the buildings and occupants' health and wellbeing tend to focus on negative health impacts. More research needs to be focused on how building design can influence human performance for health, productivity as well as environmental outcomes, with a stronger positive focus on social impact. At the city and community scale, wider factors have been linked to health and wellbeing including inclusion and equity, access to nature, sustainability, green infrastructure, lighting and social participation. These complex factors require a systemic approach to address the social/physical variables that impact our health4 and wellbeing.

The ambition of the Committee is to make a real advance in the adaptation of buildings, open space and infrastructure, and the development of new systemic solutions and services to enhance the quality of life and wellbeing of citizens of all ages by 2030.

This ambition requires a new concept of the built environment. It should be human-centric, meaning that it is fundamental that the user's perspective is included, and the community is fully participative. New technologies and approaches are required to increase accessibility and inclusiveness of the built environment, and take maximum advantage of cultural heritage, contribute to regenerating depopulated areas, develop tourism and healthy social connection. It is necessary to act to encourage cultural and behavioural change and to stimulate bottom-up actions. Finally, it requires new business models and financing mechanisms (including but not limited to reducing energy consumption) to be developed so that tomorrow's improved built environment is not only conceptual, but a practical reality within the reach of all European citizens.

1.4. Trends

To formalise high-level objectives to meet the above-mentioned needs and ambitions, reference should be made to some major ongoing trends in the sector. The following trends can be outlined:

- The development of the user-centred approach and universal design, including stakeholders' involvement processes as well as the integration of adaptive and assistive technologies
- A shift from care to preventive care and wellbeing in the built environment
- The integration of occupant-centred communication, automation and control systems and solutions in buildings paving the way to new functions and services, in particular, smart homes functionalities and "ageing in place" services
- The digitalization of the world
- Human capital challenges related to loss of workers in the built environment

[3] European Center for Disease prevention and control

[4] IWBI Global Research Agenda, January 2021

- The increasing consideration of health-related building factors and associated risks, and the development of related rating schemes
- The services delivered by the buildings to the communities and their connection to the public spaces around them
- The pandemic has transformed our homes into workspaces, office occupancies have changed, how patterns around the city have transformed and the connection between urban and rural has been impacted with people not travelling to city centres daily
- Social and mental health have now come to the fore strongly and are influenced by the physical space. We know how green spaces can have a positive impact on those suffering from isolation

Smart buildings

The home environment, embedded in a neighbourhood or community, is germane to the quality of life of the entire occupant population, including people with more specific needs (older people, children, people with social, mental, or physical disabilities).

More and more smart solutions, as well as some standards, certifications and public regulations are developed to improve the comfort and health of occupants, but also to ensure the inclusiveness and accessibility of the building to all. For instance, the FITWELL standard provides tailored scorecards for existing and new buildings and sites, including workplaces. It counts seven health impact categories: impact on surrounding community health; reduction of morbidity and absenteeism; support to social equity for vulnerable populations; feelings of wellbeing; access to healthy foods; occupant safety; increases physical activity.

Burgeoning academic literature shows how the home is a contested space in which material structures, typologies, technologies, older people and their friends, family and caregivers negotiate what it means to be, and to grow old (Peace et al., 2005[5]; Milligan[6], 2009; Wahl et al., 2012[7]; Mohammadi[8] et al., 2019; Peine and Neven[9], 2020). Expressly, this literature demonstrates that the home is a social, material, and affective space that is enacted through specific place-making practices. It is through these subjective experiences that built environments, together with emerging technologies, can improve the quality of life of older people.[10]

[5] Peace, Sheila & Holland, Caroline & Kellaher, Leonie. (2005). The Influence of neighborhood and community on wellbeing and identity in later life: an English perspective. Home and Identity in Late Life: International Perspectives.

[6] Milligan, C. (2017). Geographies of care: space, place and the voluntary sector. Routledge.

[7] Wahl, Hans-Werner & Iwarsson, Susanne & Oswald, Frank. (2012). Aging Well and the Environment: Toward an Integrative Model and Research Agenda for the Future. The Gerontologist. 52. 306-16. 10.1093/geront/gnr154.

[8] Masi Mohammadi, Maurice Dominicus, Leonie van Buuren, Kim Hamers, Coosje Hammink & Hüsnü Yegenoglu (2019) The Evolution of Housing Typologies for Older Adults in The Netherlands from 1945 to 2016: An Analysis in the Context of Policy, Societal, and Technological Developments, Journal of Housing For the Elderly, 33:3, 205-226, DOI: 10.1080/02763893.2018.1561590

[9] Peine, Alexander & Neven, Louis. (2020). The co-constitution of ageing and technology – a model and agenda. Ageing and Society. 41. 1-22. 10.1017/S0144686X20000641.

[10] Najafi, P., Mohammadi, M., Le Blanc, P. M., & van Wesemael, P. J. V. (2021). Experimenting a Healthy Ageing Community in Immersive Virtual Reality Environment: The Case of World's Longest-lived Populations. In The 17th International Conference on Intelligent Environments (IE2021) [9486595] Institute of Electrical and Electronics Engineers. https://doi.org/10.1109/IE51775.2021.9486595, https://doi.org/10.1109/IE51775.2021.9486595

While advanced technologies and their appropriation by older Europeans can fundamentally transform living environments, thus far, most solutions are applied in specific contexts such as luxury villas, apartments, or nursing homes. So even though smart technologies are estimated to reach a significant number of the total population by 2023, there cannot be said to be the same percentage of smart homes. Technologies such as cameras, sensor lights and virtual assistants are increasingly found in houses and part of daily life, but they often lack true smartness and are not integrated with the building and **a real opportunity to improve people's lives, transitioning from homes as physical artefacts to a living service is being missed.**

The EU Green Paper on Ageing[11], launched a policy debate on ageing to discuss options on how to anticipate and respond to the challenges and opportunities it brings, notably considering the UN 2030 Agenda for Sustainable Development and UN Decade for Healthy Ageing. To meet the health and long-term care needs of an ageing population and limit dependencies, supporting policies, such as urban renewal, revitalised rural areas and accessibility in buildings and transport, can support healthy and active ageing and help make life easier for people with limited mobility. According to the report, greater provision of community care infrastructure not only provides better health and social care, it can also allow older people to take part in social and wellbeing activities.

When ageing, older people look for a feeling of safety & security together with health and self-esteem. Furthermore, they wish to age-in-place. Not in all residential building this is possible whereas at the same time ageing people seek for a safe and comfortable environment. Smart technologies that are easy to install and to understand can provide sensing and monitoring system that support older people to age-in-place[12].

Link and measure health/wellbeing with built environment factors

Creating the link between health, risks and the built environment is needed. The OECD developed a Framework for Measuring Well-Being and Progress[13,] leading to various research related to urban health indicator tools at the city level[14] and to physical factors influencing the indoor environment quality (IEQ)[15].

Several references have investigated the risk-based approach. On the one hand, the UK has introduced the Housing Health and Safety Rating (HHSR) System that evaluates 29 risks present in the home (damp and mould, asbestos, falls on floors, etc.). On the other hand, the WHO Housing and Health Guidelines (2018), also identifies risks in the home environment. The WHO document is focused on

[11] European Commission. (2021). Green Paper on Ageing: Fostering solidarity and responsibility between generations.

[12] Kort, H. S. M. (2017). Healthy building environments for ageing adults. *Gerontechnology*, *16*(4), 207-210. https://doi.org/10.4017/gt.2017.16.4.001.00

[13] https://www.oecd.org/wise/measuring-well-being-and-progress.htm).

[14] See Pineo, H., Glonti, K., Rutter, H. *et al.* Urban Health Indicator Tools of the Physical Environment: a Systematic Review. *J Urban Health* **95,** 613–646 (2018). https://doi.org

[15] See Sergio Altomonte, Joseph Allen, Philomena M. Bluyssen, Gail Brager, Lisa Heschong, Angela Loder, Stefano Schiavon, Jennifer A. Veitch, Lily Wang, Pawel Wargocki, Ten questions concerning well-being in the built environment, Building and Environment, Volume 180, 2020, 106949, ISSN 0360-1323, https://doi.org/10.1016/j.buildenv.2020.106949

supporting policy while the HHSR is an evaluation tool to help local authorities identify and protect against potential risks and hazards in dwellings.

Apart from the risk reduction model a more holistic, adaptive approach, focusing on impact should be mentioned. The International WELL Building Institute developed a global research agenda to address this holistic approach and highlight areas for future research. The Global Research Agenda (GRA) uses socio-ecological understanding of health-environment relationships that are aligned with current understandings of health and performance outcomes as interactive, shifting, adaptive and occurring at multiple scales (e.g., organisational, and individual).' It defines 12 Impact Topics for health and buildings, while the WHO Housing and Health Guidelines have clearly identified several other priorities, with specific attention for the challenges facing the housing sector.

The Homes4Life-project[16] was also based on the theory of salutogenesis, a generic understanding of how coping, defined as a sense of coherence and wellbeing, may be created. These approaches, focusing on impact rather than risk, have a stronger potential to influence the industry and reinforce each other. One can also mention Fitwel, BREEAM (Building Research Establishment Environmental Assessment Method) and LEED (Leadership in Energy and Environmental Design) rating system that aim to account for occupant health and wellness[17].

While the link between health and the built environment is increasingly getting clear, it is yet difficult to qualify and quantify. Research is trying to clarify this link (e.g., environmental burden of disease), yet still market adoption of measures to improve human wellbeing through built environments is lagging. Better cooperation with industry, and an interdisciplinary research approach are some possible solutions. In addition, greater consideration of the context and design processes must be weighed against generic recommendations and standards.

1.5. High-level objectives formalised by the Built for Life Committee

Based on the above-identified needs and ambitions, the Committee has formalised 3 high-level objectives that are critical to enhance the quality of life and wellbeing of European citizens by 2030, namely:

- **Objective 1: Healthy cities and communities**
- **Objective 2: Inclusive, adaptive, and regenerative buildings**
- **Objective 3: Enhanced technical, economic, and social values of buildings.**

For each of these objectives, a set of priority areas are identified for the future research and innovation activities of the sector: they each correspond to specific challenges and are complemented by a list of focused R&I topics. The next diagram provides an overview of the priority areas identified for each objective. The next sections of this Position Paper detail these objectives, R&I priority areas and topics.

[16] see Homes4Life website: http://www.homes4life.eu
[17] See respective websites: www.fitwel.org; https://bregroup.com/products/breeam/; https://www.usgbc.org/leed

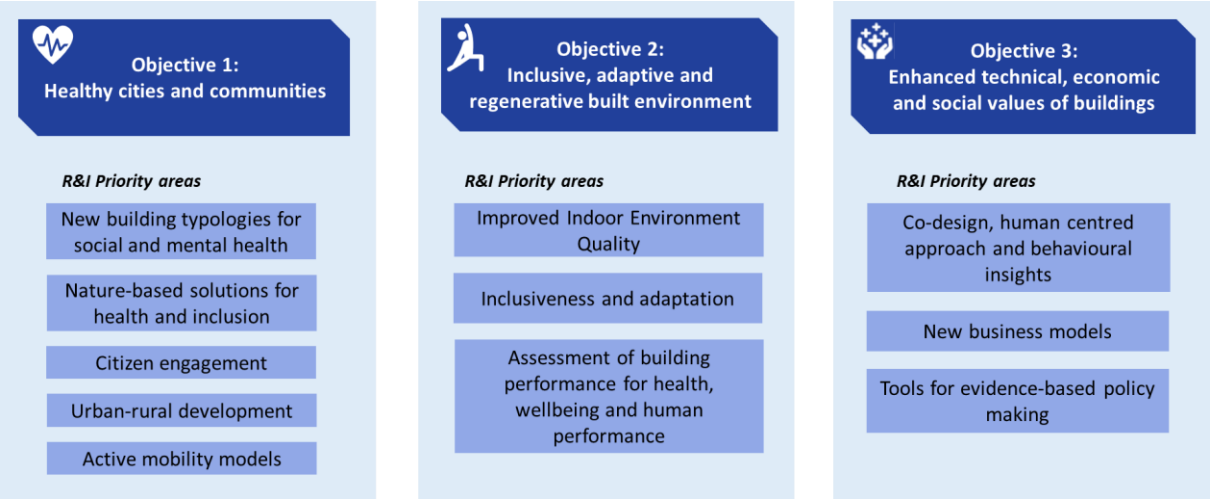

FIGURE 1: High-level objectives formalised by the Built for Life Committee, and related priority areas for Research and Innovation

II. Objective 1: Healthy Cities and Communities

The design of our built environment and the areas where people live, work, and play are directly related to the amount of time people spend outdoors[18]. The layout of our communities, transport infrastructure, and access to parks and trails generates either obstacles or opportunities for people to interact with each other and their environment. This urban landscape shapes the wellbeing of individuals and the community.

To improve the positive impact of cities and their related infrastructure on the citizens' health and wellbeing, the upcoming R&I activities should focus on the following four priority areas:

- Developing new building typologies and models of living that improve social and mental health
- Integrating more/newly co-designed **nature-based solutions** that contribute both physical and mental health, as well as climate change mitigation
- Identifying drivers and success factors to scale up the engagement and co-design process for **stakeholders' engagement**, and integrating recent concepts from social sciences (place making, salutogenesis) into these processes
- Improving and rethinking the **connection between urban and rural areas**
- Reshaping **urban mobility** infrastructures as drivers for reducing air pollution and increasing the physical activity of citizens.

These five R&I priority areas are detailed in the next sections.

[18] Sallis, J.F., et al., Role of Built Environments in Physical Activity, Obesity, and cardiovascular disease. Circulation, 2012. 125(5): p. 729-737.

2.1. New building typologies for social and mental health

Within the European housing sector, a diversity of housing typologies can be found, which are either characteristic for a specific region (for example 'hofjes' or courtyards in the Netherlands) or relatively common throughout Europe (for example apartment buildings).

Studying housing typologies, means understanding how we live, both individually and as a community, and how we build and finance sustainable and healthy communities to improve our social, mental and physical health and thrive a diversity of people. It is then necessary to consider a systemic view of housing[19]:

- where community is understood and addressed as an integrated system embedded within a shared infrastructural system,
- recognising that large urban centres faced many challenges such as housing affordability, rental bias, ageing infrastructures, underutilisation of viable industrial and commercial lands, etc.,
- considering the changing and evolving values and needs of residents, including the provision of the essential amenities and social supports (access to education, culture, food, health services, transportation, childcare/eldercare etc.,).
- considering the multiple ways of using the building (i.e. impact of the pandemic on working and commuting behaviours)

As urban demographics change, we must look for new ways of re-using existing housing and building stock, conceive of new models of ownership, re-design homes to house multiple families or individuals and create new forms of community that truly reflect the current population.

Research topics in this area include:

- Explore the advantages and disadvantages of micro-living, co-living /co-working, co-housing, space-sharing and communal/intergenerational living to propose new models of living and solutions to the disadvantages
- Identify key issues that socially, economically, and culturally diverse communities are facing and propose innovative solutions to address them such as alternative intensification strategies, 'missing middle' housing, community agency and participation in design, planning and implementation
- Develop adaptive design and innovative material solutions for the adaptability, flexibility and changing use of spaces
- Define affordability strategies that create benefits to housing beyond the monetary aspect and that can mitigate the current financial burden of owning or renting
- Provide policies and regulatory recommendations to ensure and enforce inclusive housing development practices and support alternative ownership such as co-housing

[19] Bowes_ExploringInnovationinHousing_2018CFR.pdf (ocadu.ca)

2.2. Nature-based solutions for health and inclusion

Daily interaction with nature, as a setting for physical, spiritual, and recreational activity has positive effects on physical and mental health, wellbeing, social cohesion, crime reduction, environmental awareness, economic gain and belonging. At the same time, nature can strongly support climate adaptation and mitigation in urban areas, such as alleviating heat stress, air pollution and flood risk.

Areas of social and economic deprivation, which are often linked to poorer health and reduced life expectancy, can also be associated with limited access to good-quality green space. Nature-based experiences can facilitate dynamic interpersonal interaction[20]. Being exposed to nature is even hypothesized to decrease feelings of loneliness by helping to build relationships that can reduce stress.[21] Increasing and improving the quantity and quality of the urban and peri-urban green space would also enhance critical ecosystem services.

All those concerned with creating healthy places — public health professionals, urban planners, landscape architects and policy makers — need to recognise urban greening as an asset that has enormous potential to improve health and wellbeing.[22]

However, not all greenspaces are equal when it comes to delivering health and wellbeing benefits. Evidence suggests that green spaces with a higher diversity of species deliver greater wellbeing and social benefits than less diverse spaces[23] and those with water bodies are preferable to those without.[24] Furthermore, ecological imperatives for NBS must be balanced with social and aesthetic perceptions and uses, particularly for economically disadvantaged groups who can see 'wild' nature as ill-kept and a sign of disinvestment without accompanying 'cues to care'[25].

Research topics in this area include:

- Define approaches to nurture and enhance grass-roots movements for urban greening and urban blue spaces
- Better integration of ecosystem-based planning
- Co-design innovative NBS in buildings for regulating and cultural ecosystem services (with communities impacted)

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[20] Seltenrich, N., Just What the Doctor Ordered: Using Parks to Improve Children's Health. Environmental Health Perspectives, 2015. 123(10): p. A254-A259.

[21] de Vries, S., et al., Streetscape greenery and health: Stress, social cohesion, and physical activity as mediators. Social Science & Medicine, 2013. 94(0): p. 26-33.

[22] Public Health and Landscape: Creating Healthy Places, Landscape Institute Position Statement, by the Landscape Institute UK. 2013. (For Greenlink Motherwell - Forestry Commission Scotland) www.forestry.gov.uk/pdf/greenlink.pdf/$FILE/greenlink.pdf

[23] Fuller, R.A., et al., Psychological benefits of greenspace increase with biodiversity. Biology letters, 2007. 3(4): p. 390-394.

[24] Völker, S. and T. Kistemann, The impact of blue space on human health and wellbeing – Salutogenetic health effects of inland surface waters: A review. International Journal of Hygiene and Environmental Health, 2011. 214(6): p. 449-460

[25] Loder, Angela. (2020). Small-Scale Urban Greening: Creating Places of Health, Creativity, and Ecological Sustainability. 10.4324/9781315642857.

- Explore innovative use of spaces in cities for NBS including green roofs, living walls, and re-purposing post-industrial spaces
- Co-design innovative NBS for public space (including urban green spaces) to support climate adaptation, physical and mental health, and social cohesion
- Understanding the distribution of urban ecosystem services to address environmental/climate justice issues
- Designing NBS for social inclusion to support and engage culturally diverse groups, different age groups, disabilities and neurodiversities[26] (e.g., immersive sensory experience in gardens, local communities involved in planting etc.)
- Greater understanding of mental health benefits of urban greening and the intersection between
- Urban regeneration through green acupuncture (point injecting of greenery into an urban tissue, see SALUTE4CE project.)
- Revegetation and renaturing city solutions with multiple benefits: supporting biodiversity (technical solutions and new governance) and resilience (e.g., heavy rains)

2.3. Citizen engagement

The quality of life in small-scale communities is predominantly shaped by the inhabitants. Thus, to be successful, design and development strategies for urban and rural renewal must recognize this and move away from the functionalist, top-down models that have dominated planning and development since World War II.

Although user-centric design strategies have already been successfully deployed in building and spatial development research and practice, though they are far from 'business as usual'. Applied research, documenting, and analysing approaches for engagement of different groups and circumstances, as well as cost/benefit evidence, can help smooth the way for broader uptake of user-centric methods.

While placing user needs and expectations centre-stage, user-centric methodologies still often fall short of full citizen engagement. Even when users' views and preferences are elicited and incorporated into design specifications and briefs, they do not hold equal weight in the development.

For more fully realised co-creation approaches we need to look to at ´**place-making´.** It puts the shaping and reshaping of public spaces under the direction of citizens. Research in this field is also valuable in highlighting the importance of social and emotive aspects of place in addition to, and sometimes overriding, practical qualities. **While this research is relatively well-established, application of place-making principles to actual renewal is still limited, being mostly confined to projects that are considered as pilots, or special cases.** Thus, more applied research and practical experimentation outlining pathways to implementation could help upscale application.

Research and innovation particularly pertinent to the Built for Life Committee´s field of interest is the emerging **application of salutogenesis theory to shaping the physical and social environment.** Salutogenesis posits that a sense of coherence (life is understood as more or less comprehensible,

[26] https://dcp-ecp.com/projects/haptic-pathways

meaningful, and manageable)[27] is an enabling factor. It allows people to take an active and directive part in ensuring and maintaining their own health and wellbeing. The approach emphasizes resilience to adverse events over avoidance of harm. Recent research has seen a broadening of the application of salutogenesis beyond public health and healthcare to ICT, gerontechnology (the study of Technology and Aging) and – recently – the physical and social living environment at different scales.

Research in this area should help enable residents and local users of public spaces to improve the functioning of a neighbourhood. Locally developed ideas generate a sense of ownership of public space and are focussed on creating a more locally oriented public realm.

Research topics in this area include:

- Applied research analysing approaches for engaging different groups in different circumstances, as well as cost-benefit evidence to support broader take-up of user-centric methods.
- Application of place-making principles to actual urban and rural renewal considering the economic/socio-economic effects of place-making methodologies. Outlining pathways to implement at scale.
- Application of salutogenesis to the physical and social living environment at different scales.
- Citizen science initiatives for data collection/community engagement research.
- Strategies and proposals to encourage the active and emotional participation of citizens in urban life: Interactive operation and management of city assets.

Digital tools for urban planning considering the needs of all citizens:

- Understand barriers to upscale and enable demonstration of the use of digital systems and social sciences findings to involve stakeholders and citizens in urban planning & design (e.g., public presentation of new investment designs, before assignment, to receive citizens' feedback).
- Ensure that tools fostering awareness and education of citizens as members of the city community are both inclusive and sustainable to scale up their use (including the accessibility to Cultural Heritage via virtual reality, etc.).

2.4. Urban-rural development

The dichotomy between urban and rural areas was further exacerbated by the COVID-19 pandemic. Regional liveability was already a growing area of need and recent COVID migration patterns have highlighted the need to include regional areas in our focus, not just large cities.

This includes the evergreen challenges of rural services and infrastructure (facilitating internet access, teleworking, health services, education facilities, re-use of buildings etc.) and careful planning to avoid unwanted issues associated with gentrification, but also entirely rethinking rural-urban interaction, dynamics and relations, working on mobility and intermodal infrastructure, short supply chain

[27] https://www.ncbi.nlm.nih.gov/books/NBK435854/ The Meaning of Salutogenesis, Mittelmark, Maurice et al (2007)

connection (i.e., food supply), share of services, proximity tourism, and new governance and participatory models that fully include urban and rural communities.

In short, improving and rethinking the connection between urban and rural areas will be crucial to ensuring a high quality of life for all European citizens, no matter where they live.

Research topics in this area include:

- Inclusive co-creation of urban regeneration projects
- Solutions for the sustainable regeneration of urban and rural areas
- New approaches to provide a better connectivity and a new dynamism to rural and peri-urban areas ("smart villages")
- Novel strategies to increase wellbeing and economic prosperity of citizens living in rural areas and cities.

2.5. Active mobility models

Mobility is critical to quality of life. For the last hundred years, urban planning and growth has been dominated by the car. Car-centric lifestyles have had a significant impact on levels of physical activity and the rise of obesity, along with significant increases in air and noise pollution. A citizen-centric approach to the built environment needs to consider active mobility.

As physical inactivity is a primary cause of most chronic diseases, walking is at the top of the list of all medical recommendations. Walking is now being prescribed by doctors as a medication: take a daily walk for longevity.[28]

Healthy and liveable cities boast walking paths and cycling trails that connect homes to local community services such as shops, employment, and education. Safe paths with the right facilities (e.g., spaces to sit, good lighting and drinking fountains) can encourage active and healthier lifestyles across all ages.

Europe, with much of its urban infrastructure pre-dating the car, has a distinct advantage in enacting active mobility solutions and an opportunity to not only to lead in the research agenda, but in delivering benefits to citizens.

Research topics in this area include:

- Development and implementation of tools allowing a wide variety of professionals (from transport and urban planners to health economist and special interest groups) to monitor how active mobility interventions improve population health by supporting more walking and cycling, and measure exposure to air pollution and change in road injuries.
- Demonstrate the impact of transport planning on health

[28] Just 15 Minutes of Exercise a Day May Add Years to Your Life, by Meredith Melnick. 2011. TIME. Available from: http://healthland.time.com/2011/08/16/just-15-minutes-of-exercise-a-day-may-add-years-to-your-life/

- Creating liveable environments relying on the 'smart growth' models[29]: develop a set of actions to improve quality of life in urban areas, develop strategies to support the development of compact walkable/mixed-use urban centres, re-designing public space for pedestrians' priorities
- City infrastructure interventions that provide an improved street network
- Novel technological approaches and big data application to measure and understand physical activity behaviour to encourage active lifestyles (i.e., enabling more effective settings and environments to produce successful movement outcomes, better promotion, etc.)
- Develop standards, codes and best practices at the building and community scales to encourage active lifestyles
- Review urban design models and regulation for sharing space between pedestrians, cyclists, and drivers in a safe and secure way
- Trial models for reallocation of lanes from highways for new and different functions such as vegetation, cycling or walking
- Playful interactive environments using digital technology, public facilities, street furniture, places of interests. Sound, light and augmented reality using mobile phones can be used to invite pedestrians to engage with their surroundings and have fun along their route, promoting activity in the public realm. These applications can also provide access to information services and communication layers.
- Solutions enabling a better integration and an interactive operation and management of city assets by the citizens (e.g., use of digital tools to support services like transport, health, car parks, waste management)

III. Objective 2: Inclusive, adaptive, and regenerative built environment

The Real Estate sector´s shift in focus from energy to occupants, initiated by the Paris climate agreements, has been accelerated by the impact of the pandemic on working and living conditions. The ongoing transition demands a change in the assessment of buildings from material terms (components, construction as well as design), creating sustainable buildings and renovating existing stock to optimising health, wellbeing, comfort, and human performance.

To allow this successful transition, the upcoming R&I activities should focus on the following three priority areas:

- Designing and implementing solutions for wellbeing and improved Indoor Quality Environment

[29] Smart growth is an urban planning and transportation theory that concentrates growth in compact walkable urban centres to avoid sprawl. It also advocates compact, transit-oriented, walkable, bicycle-friendly land use, including neighbourhood schools, complete streets, and mixed-use development with a range of housing choices.

- Providing solutions for inclusiveness and adaptation of the built environment to all population profiles
- Proposing metrics and measurement methodologies to assess building performance for health, wellbeing, comfort, and human performance and link the built environment and wellbeing parameters.

These three R&I priority areas are detailed in the next sections.

3.1. Improved Indoor Environment Quality

This topic focuses on all solutions that can improve the indoor environment quality, thus contributing to better health, wellbeing and performance of the building occupants. Attention is paid to air quality, thermal comfort, acoustics and security, considered as the most impacting building parameters on occupants.

Take, for example, hospitals. It is widely acknowledged that hospital buildings don´t always live up to their role of supporting the health and wellbeing of patients and health workers. Despite many innovations and improvements over centuries of effort, there is scope for solutions in these and other non-residential buildings. For example, solutions that measure and identify room acoustics conditions and sound sources respectively would be valuable to support task performance, and the health and comfort of occupants by measuring both interactions (sound-tasks) as well as personal factors (social and non-social). Some acoustic solutions, such as air-tight building envelopes, not only prevent noise transfer from the outdoors in, but prevent draft (for better thermal comfort) and help isolate the building from pollutants.

Key research and innovation topics include:

- Interpretative and predictive models to understand the impact of the built environment in quality of life.
- Develop an integrated analysis approach, re-thinking comfort, as there is no “one-size-fits-all” solution: Identify patterns of stressors (of psychological, physiological, personal, social and environmental nature), individual profiles (in terms of needs and preferences and positive and negative effects) and interactions at the environmental and occupant levels, and their ranges of variation, for different scenarios and situations.
- Processes to design, predict and include NBS and vegetation-like solutions for improving comfort and wellbeing, in a co-design process with possible participation of residents.
- Predicting and avoiding overheating: anticipating problems particularly in respect to future higher summer temperatures; solutions for the urban heat island effect; including revegetation, and related certification systems, as well as innovative heating and cooling networks which can cope with heat rejection into outdoor air.
- Solutions for improving acoustic, thermal and hygrometric comfort, natural and artificial light, minimizing vibrations and electro-magnetic fields, monitoring, and filtration of air pollutants (such as smoke from biomass heating)
- Intelligent surfaces with self-cleaning (easier to clean), self-healing (reparability capability), anti-slip (safe surface finishing and predictable properties during the flooring lifetime) and anti-fouling (including natural antimicrobial properties) emission-free and non-toxic materials.

- Solutions to optimize lighting conditions and to measure personal lighting conditions: indoor and outdoor such as giving personalized feedback (via an app) to occupants, for example about where to work (location of their desks) and or how long to be outside to have benefits of the near infrared (NIF)-effects of light.
- Building envelope solutions – improving air tightness to minimise indoor pollution infiltrating from outdoor, to prevent noise transfer from outdoor and from other parts of the building via façade elements, preventing draft (better thermal comfort), balanced with infectious disease considerations which recommend increased outdoor air flow and natural ventilation.
- Solutions for energy communities, such as easy temperature controls, with energy efficient systems
- Nature-based solutions and vegetation-like solutions for improving hydro-thermal and visual comfort and wellbeing.
- Physical safety solutions such as mechanical resistance and stability, fire safety and protection) so that people in the built environment feel psychologically protected are physically safe (ensuring intimacy and protection from intrusion by animals in outdoor space with fences, non-slip and even floor surfaces)
- Provide recommendations to policy makers for incorporating indoor environmental quality criteria into commissioning process to make sure that this is correctly addressed by contractors:
    - Music and acoustics for mental health and wellbeing and panels protection to avoid noise transfer.
    - Air quality (air conditioning with hydroscopic control, and advanced filters)
    - Light / Daylight (e.g., electrochromic windows to avoid sun over exposition and artificial light control)
- Actionable intelligence dashboards that allow users to make informed decisions/choices based on different home environments (energy consumption, quality of indoor air, timing of use of appliances, ambience, etc.
- Proactive maintenance of homes and spaces (continuous home health monitoring, and maintenance)

3.2. Inclusiveness and adaptation

This topic focuses on the access and adaptation of the built environment to all population profiles along their whole life, and to the evolving buildings' usages and life cycle phases over time.

This includes engineering models for all buildings, residential and non-residential, and offers a wealth of scope for impactful research that improves our quality of life and facilitates activities of daily living (ADL). Including flexibility in the design phase of a building becomes critical, given the massive resource investment in building and that the infrastructure usually outlives the designer/original inhabitants by many generations.

Another area of particular interest are energy communities: considering buildings, not as stand-alone entities, but as nodes of systems. Energy communities share energy and local resources and develop communities committed to energy transition and tackling energy poverty.

Finally, residential buildings are great social science laboratories: home to non-predicable, non-homogeneous groups, encompassing multiple forms of vulnerability. Any design application addressing barriers such as access and income inequality are much more likely to deliver on broad goals such as a climate neutral and green Europe.

Key research and innovation topics include:

- Repurposing and redeveloping buildings to drive flexible models (residential and commercial);
- Generative design implementation (making it necessary in the design phase to map different possible scenarios that respond to defined needs, as well as the different combinations of scenarios for users)
- Development of universal design and inclusive design to remove barriers to community access. The senior citizens, people with a disability and those with mobility issues often confront physical barriers in cities. Services such as public elevators or wayfinding aids, can help overcome barriers for people with different needs. Digital technology has the potential to make cities more inclusive and accessible, especially through access to accurate, real-time data and planning.
- Mobile construction systems that allow the agile and dynamic modification of configurations without the need to "work" on the building, (offering adequate acoustic and thermal conditions at the same time)
- Dynamic building tool: a solution allowing the planning and adaptation of the available space to the changing requirements of each moment so that precious space is used in the most highly effective and efficient ways.
- Investigate how energy communities can service vulnerable groups to end energy poverty
- Biomimetic materials that have the capability to change their surface or colour depending on the external conditions (e.g., In presence of water to increase security).
- Facilitating/creating platforms that easily allow access and beneficial use of shared space (such as rooftops for green space/energy production)
- Develop guidelines on best practices for accessibility of public infrastructure (level zero smart lifts);
- New designs of buildings, infrastructures, multimodal hubs and public spaces for accessibility and inclusiveness
- Create a tool for assessing the smart readiness of buildings and inhabitants.
- Design ready-to-use solutions for minimising the disruption while retrofitting buildings (e.g., avoiding long processes on site causing people to move for periods of time), considering the specificities of people staying in the building both in case of residential and non-residential uses (e.g., children, older people, etc).
- Adaptive homes and spaces configurable based on user needs
- Artificial Intelligence, IoT, sensing methods, smart materials, and adaptable spaces to create smart homes

3.3. Assessment of building performance for health, wellbeing, comfort, and human performance

Ideally, we would consider indoor comfort as a necessary feature of a building, yet our approach to measuring internal comfort is far from ideal. For example, to measure comfort in its widest sense, we would incorporate hygro-thermal performance, air temperature, mean radiant temperature, air speed and relative humidity among other factors. Indoor comfort also includes acoustic performance and daylight performance: does a building design provide effective internal daylighting?

Indoor comfort and health are also directly related to air quality, which should not be affected by carbon monoxide, radon, volatile organic compounds, particulate matter, or bio-pollutants such as moulds and bacteria. Yet we live with these pollutants and a lack of knowledge about their levels daily.

Thus, indoor comfort must be better measured by monitoring the wellness conditions of inhabitants, using non-contact technologies, and providing information on the user's behaviour (e.g., physical activity level, cognitive decline in fragile subjects or elders). It is especially vital for inhabitants who may not be able to get outside as much as they would like, such as older citizens.

Addressing this challenge also represents a wider opportunity to deal with issues of inclusiveness and accessibility not limited to age. Not enough is known about how multi-domain factors in the built environment influence occupants' health, wellbeing, comfort, performance, and behaviour. This is because most research is executed in with a single domain.[30]A multi-domain approach will deliver a better understanding of which building aspects influence human performance and how human health, wellbeing and comfort interact with measures normally associated with building performance and **allow a distinction to be made between health promotion and harm prevention[31].**

Health promotion is intimately linked to social lives, and we mustn't forget that residential buildings support not only our independence and autonomy but also provide a space for socialising.[32] Buildings must allow us to maintain our community, (e.g., assuring appropriate internet connection from any point of the home). Buildings have to offer inhabitants infrastructure and solutions (constructive and technological) that allow people to be at home and maintain their social interactions, as well as the autonomy to be able also to disconnect (digitally and otherwise) when needed.

Key research and innovation topics include:

- Developing assessment strategies for optimal building performance, including both energy consumption as well as occupant performance (metabolic rate, activity)
- Improve understanding of which building aspects influence human performance and how health, wellbeing and comfort interact with measures normally associated with building performance (differentiating between health promotion and harm prevention)
- Develop non-contact tools and methods to actively measure occupants' comfort (thermal balance of occupants through heat gains and losses of their body depending on metabolic

[30] . An understanding of multi-domain building environmental effects is limited according to ASHRAE (guideline 10-2016).

[31] See Mamulova, E., Brink, H., Loomans, M. G. L. C., Loonen, R. C. G. M., & Kort, H. S. M. (2022). A Multi-Domain Approach to Explanatory and Predictive Thermal Comfort Modelling in Offices. In *CLIMA 2022 The 14th REHVA HVAC World Congress* TU Delft Open. https://doi.org/10.34641/clima.2022.181

[32] (whilst respecting our lifestyle choices and evolving needs as the years go by). (Homes4Life vision).

rate, clothing insulation, activity level etc) in multiple domains, while delivering information on inhabitant´s behaviour and habits

- Creating tools which take all possible quantifiable elements into account in measuring indoor comfort
- Normalising methodologies to measure indoor comfort and air quality based on an open-science approach to deliver better data quality and enhance learning and exchange, evidence-based decision making and policy (provide standardized data reporting requirements in EC funded projects, Creation of a shared and navigable library of methodologies and applications)
- Develop a user-centric measurement framework that communicates metrics to individual users in a meaningful way, based on behavioural insights and prospect theory, so that they can assess their personal costs and benefits as well as the overall ones.
- Advanced mapping and simulation tools of energy consumption and monitoring at district level (e.g., digital twins)
- Develop tools for measuring the social performance of buildings (do they reply to the social needs of inhabitants) and methods for improving it, considering the links between technological connection and social satisfaction of inhabitants
- Measure links between technological connection and social satisfaction of inhabitants
- Investigate the relation between environmental performance, lifecycle, and social assessment tools.
- Develop common protocols to protect ageing residents from accidents using new technologies such as sensors that detect humid floors and further community adoption of said protocols (Testing protocols and norms differs from one country to another, and common protocols are needed)
- Rating schemes and standards (topic be developed)

IV. Objective 3: Enhanced technical, economic, and social values of buildings

The construction industry has been under pressure to demonstrate its social contribution to the community. **Every meaningful change in the built environment needs to be technically, economically, and socially viable.** Meeting our obligations to become carbon neutral by 2050 and transitioning to sustainable spaces requires not only an improved built environment, but an environment that supports profound changes to individual- and community-behaviour. To reach this goal, the engagement and active participation of community stakeholders, including a diversity of citizens as well as professional, insurance, financial, and governmental agencies, are critical to ensure that innovation in this field is resilient, sustainable, inclusive and reflective of all building's occupants.

To address those challenges, the upcoming R&I activities should focus on the following three priority areas:

- Co-design, human centred approach, and behavioural insights
- New business model approach, synergies between private and public sector
- Tools for evidence-based policy making

These three R&I priority areas are detailed in the next sections.

4.1. Co-design, human centred approach, and behavioural insights

While excellent solutions require expertise and rigorous methods and processes, nothing can be developed for the users without a people-centric focus, user participation and co-creation. This implies to better understand people's wishes and preferences, and to associate them to the design and implementation processes.

However, past experiences have shown that living labs that truly engage citizen participation are scarce: they generally do not fully follow genuine co-design processes and citizens have little influence and decision-making power. We propose that the practical implementation of living labs meets their theoretical ambitions but also encompasses the business models that are associated with each solution. To that end, interdisciplinary teams (including behavioural experts and other social scientists) should work on the designs with users and stakeholders to understand all behavioural opportunities and effects and take full advantage of this 'moment of change'.

Research into new, meaningful hybrid solutions (working from home but complementing online encounters with physical ones) and smart home typologies will create a better understanding of the motivations and needs (aging in place, adapting to climate change) of diverse users towards technologies and their implementation in smart homes. To fully understand the actual needs and preferences of the users, we need participatory design principles and co-creation methods (Jarke, 2021[33]). This implies a multi-disciplinary research and development strategy, in which architecture and design, social sciences along with the philosophy of technology among others collaborate closely in the design and development of smart living environments, moving towards a holistic perspective of a person's entire living environment and a new concept of home.

The research topics in this area include:

- Co-creation in design of Living Labs, but also Co-creative Business Model Canvas, involving all the stakeholders
- Full demonstration on real building processes and sites of the benefits related to the implementation of integrated and participatory design and delivery processes, against business-as-usual baselines.
- Perform consolidated return on experience regarding co-creation processes and valorise the outcome to the end user
- Implement systems to collect human feedback on comfort perception all along the occupation phases in a non-disruptive manner
- Develop and maintain an Open EU database on cost and savings, relying on demonstrations with clear cost breakdown before/after measurements, financing etc.

[33] Jarke, Juliane & Molina León, Gabriela & Zakharova, Irina & Heuer, Hendrik & Gerhard, Ulrike & Bremen, Universität. (2021). Beyond Participation: A Review of Co-Creation in Computing.

4.1. Business model approach, synergies between private and public sector

Sustainable transition suffers from the classic economic challenges of external costs and benefits, hindering the market from arriving at a socially optimal solution. While the boundary between public and private provision need not be limiting, and over time we have learned a lot about public-private partnerships and synergistic cooperation, fruitful participation of the private sector requires the emergence of new business models. And an overall successful transformation requires new governance models. Importantly, we would like to avoid not only business models which are narrow in their scope, but also a narrow view of the application of business models. **Business models are not just for business**[1]**. Every organization, public or private, that captures and delivers value has, or should have, a business model.** Recognising this is the first step towards various organisations and stakeholders working together.

Indeed, if research agendas, policy agendas and company interests are better coordinated with end-user expectations, better results will be obtained. Depending on the type of building, various stakeholders should be involved in the cooperative processes: investors, insurance companies, social housing companies, hospitals, etc.

The research topics in this area include:

- Develop and demonstrate new business models along the following:
  - Global contract binding all stakeholders to the targeted performance and usage values (e.g., comfort)
  - Financing and new models of ownership for high performance buildings
- Define metrics to demonstrate return on investment of inclusive design and wellbeing
- Holistic platform-based solutions that interconnect, providing users with collected, analysed, and visualized information for informed decision making and forecast analysis
- Develop new contractual and regulatory approaches to solve split incentive problems (the one who pays is not always the one who profits)
- Proposal to policy makers who translate research into practice so that policy initiatives are aligned across local, regional, and state levels
- Provide recommendations for interdisciplinary/transdisciplinary funding opportunities
- Explore options for cooperative ventures such as such as non-profit housing cooperatives, shared equity-based housing cooperatives, and community land trusts for affordable housing
- Explore governance models for cross domain data sharing in a safe and value- added way, larger scale integrations across sectors for services stacking, infrastructure sharing between different stakeholders
- Facilitating/creating platforms that easily allow access and beneficial use of shared space (such as rooftops for green space/energy production)

4.2. Tools for evidence-based policy making

What will be the comprehensive short and long-term impacts of today's transformations of the built environment? What are the most promising solutions and how should we assess these? Given ever-growing needs and limited resources, we need a holistic framework that will go well beyond private

economic cost/benefit, while being flexible and responsive to various built environments and conditions, and suitably standardized, allowing for comparability, replication, and learning.

The first challenge lies in identifying and measuring all the diverse social costs and benefits associated with new designs, solutions, or interventions**.** Improved measurement means improved understanding and decision making and is a necessary early step towards transformative business models and new ways of capturing and increasing the value of the built environment for people.

The second challenge is that many of these various costs and benefits occur in the future and are subject to significant uncertainty. Hence there is the problem of estimating the probability of their occurrence and their likely magnitude. Even if it is possible to estimate some of the risk within reasonable limits, a lot of other risks are not measurable and should be modelled or evaluated based on expert opinion. Overemphasizing one risk, that can be measured/or where data is available, could neglect other risks that are equally important with more long-term effects. Moreover, identifying a risk does not solve the problem. A staircase can be too steep, but a thorough renovation can be impossible (due to space restrictions) or too expensive, and perhaps other measures could have a greater impact for the same price. Context is vital.

The research topics in this area include:

- Cost/benefit analysis methods to measure social costs and benefits of new designs, solutions, or interventions in the built environment
- Roadmap to risk reduction and impact maximization for health and safety
- Identification of priority markets for health and safety
- Identification of the stakeholders and possible obstacles for implementation
- Identification of best practices in policy for health optimization and promotion
- Develop tools for policy makers for optimal citizens involvement in urban planning and design

V. Conclusion

5.1. Timing of the different R&I priorities

Members of the B4L Committee were asked about the most relevant scheduling for the above identified R&I activities, according to three time horizon: the next Horizon Europe's Work programme (2023-2025), the following one (2025-2027), or after the end of the current framework programme (beyond 2027).

The next table synthesises their views. The colour code is as follows:

>75% of votes	between 50 and 75% of votes	between 25 and 50% of votes	<25% of votes	No votes

Objective 1: Healthy cities and communities	2023-2025	2025-2027	Beyond 2027
New building typologies for social and mental health			
Nature-based solutions for health and inclusion			
Citizen engagement			
Urban-rural development			
Active mobility models			

Objective 2: Inclusive, adaptive and regenerative built environment	2023-2025	2025-2027	Beyond 2027
Improved Indoor Environment Quality			
Inclusiveness and adaptation			
Assessment of building performance for health, wellbeing and human performance			

Objective 3: Enhanced technical, economic, and social values of buildings	2023-2025	2025-2027	Beyond 2027
Co-design, human centred approach, and behavioural insights			
New business models			
Tools for evidence-based policy making			

5.2. Synergies between the Built for Life position papers and other ECTP committees

The next diagram synthesises the main topics that are addressed by several ECTP Committees and their respective Position Papers. For the Built for Life Committee, the synergies are:

- The questions of quality of life, energy communities and biodiversity with the Energy Efficient Buildings committee: B4L focuses on the development of new systemic solutions and services to enhance the quality of life and wellbeing of all European citizens and on how energy communities can serve vulnerable groups and tackle energy poverty.
- The topics related to inclusiveness, adaptation and accessibility with the Infrastructure & Mobility, Digital Built Environment and Materials & Sustainability committees. For B4L, the focus is on the access and adaptation of the built environment to all population profiles along their whole life, and to the evolving buildings' usages and life cycle phases over time.
- The topics of smart places with the Digital Built Environment committee. B4L put the emphasis on a true integration of smart technologies within the built environment to make cities more inclusive and accessible, to improve people's lives and provide 'ageing in place' services.
- The aspects of climate adaptation and indoor environment quality also addressed by the Materials and Sustainability committee with a specific focus on nature-based solutions that contribute to both physical and mental health, health and social cohesion as well as climate adaptation and mitigation in urban areas.
- The questions of comfort and accessibility of historical buildings, and the strategies for building reuse and local regeneration, also addressed by Heritage & Regeneration Committee.

	Energy Efficient buildings	Digital built environment	Material & sustainability	Built4Life	Heritage & Regeneration	Infrastructure & mobility
Infrastructure & mobility	Climate mitigation Energy integration & management	Inclusiveness Asset management Skills & safety Strategic planning	Resilience & climate mitigation Circularity	Inclusiveness & accessibility	Cross-impact assessment	
Heritage & Regeneration	Retrofitting solutions & skills	Inclusiveness Digital preservation Retrofit & Maintenance	Resilience & climate mitigation Circularity	Comfort & accessibility Regeneration		
Built4Life	Quality of life Energy communities Biodiversity	Quality of life Inclusiveness & adaptation Smart places	Inclusiveness & adaptation Indoor env. quality Climate adaptation			
Material & sustainability	Retrofit, RES, CCUS Circularity	Construction & renovation processes, incl. circularity				
Digital built environment	Smart buildings Skills & safety					
Energy Efficient buildings						

FIGURE 2: SYNERGIES BETWEEN ECTP COMMITTEES

5.3. Link with other initiatives

The topics proposed in this Position Papers are aligned with:

- The International Well Being Institute Global Research Agenda (2021)
- The EU Green Paper on Ageing (2020)
- The European Green Deal
- The United Nations Decade (2021-2030) for Healthy Ageing (2021)