CircularB
Implementation of Circular Economy in the Built Environment

Analytical brief:
Beyond material efficiency: Social dimensions of the adaptive reuse and shared use in circular built environment

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Contents

Abstract

The transition to a circular built environment is predominantly framed around material efficiency and technological innovation; leaving social, cultural and political dimensions largely unaddressed. Through cases from Rotterdam, Valparaíso, Nairobi, and Athens, it examines circular commons, adaptive reuse, and shared use as frameworks for more inclusive resource governance, suggesting that circularity may deliver more equitable and lasting outcomes when grounded in collective action and local knowledge. It also argues that gender equity and norm-critical design are not peripheral concerns but fundamental conditions for socially sustainable circular building practice; and concludes with recommendations for researchers, practitioners, and policymakers to better integrate social and material approaches to circularity.

Section 1: Challenges and opportunities of the transition to CBE: the social perspective

Although the conceptual foundations of the circular economy (CE) date back to the 1970s, the concept has only recently become central to sustainability debates. CE remains under development and is contested, with competing interpretations. Substantive literature reviews of the CE field have found that economic and environmental dimensions receive more attention, while the social dimension is understudied (Henry et al., 2021; Padilla-Rivera et al., 2020). Other critics argue that dominant CE approaches rely too heavily on technocentric solutions (Friant et al. 2021). Circular models have also been criticized for neglecting the human dimension, overlooking who the actors are and how they work together to circulate resources (Egger et al. 2025). This, while the impact of CE on society is potentially important, and is affecting various stakeholder groups, e.g. workers, SMEs and local communities, which are part of the product value chain; users of products and services (Padilla-Rivera et al. 2020).

Dominant circular economy models have been criticised for reinforcing capitalist green growth agendas rather than challenging the deeper social norms, values, and power relations that genuine sustainability transformation requires; and for their predominantly Western orientation, which neglects indigenous knowledge, informal economies, and Global South perspectives, risking the reproduction of existing patterns of economic exploitation and global inequality (Egger et al., 2025).

Zooming into the circular built environment (CBE), one of its key goals is to seek to establish closed resource loops. However, similarly to CE models, CBE strategies also tend to put insufficient emphasis on social and local dimensions. One contributing factor is the highly professionalised and globalised nature of contemporary construction practices, which rely on complex international supply chains. Consequently, the built environment is seldom shaped by local labour, locally available materials, or community knowledge regarding actual needs. In many cases, individuals remain passive occupants of these spaces, with limited awareness of material origins and little influence over how environments are designed or utilised. Scholars have linked the slow transition within the construction sector to its continued reliance on entrenched institutional structures, prevailing social roles and ingrained practices (Egger et al. 2025).

At the same time, scholars and social movements have proposed alternative models of circularity, such as the "social CE", "circular humansphere", "careful circularity", and "circular society" that emphasise more inclusive, democratic and ecologically centered approaches to the circular economy (Friant et al. 2021). Rather than viewing circularity solely as a policy or strategy, these

approaches emphasise civic participation and collective societal engagement (Hobson and Lynch 2016). They also challenge dominant growth-oriented economic models by promoting sustainability, social justice, equity, community, and solidarity, drawing on insights from de-growth perspectives and non-Western approaches to sustainability (Egger et al. 2025).

Translating these principles of inclusion and social justice into built environment practice, however, necessitates critical engagement with the specific ways in which social difference; and gender in particular; mediates access to and governance of, shared spaces. Gender plays an important role in circular and adaptive building practices, as spatial use is shaped by differences in care responsibilities, safety needs and access to resources (Kern 2019). Feminist urbanism shows that participatory processes can unintentionally exclude certain groups, particularly women, due to practical and institutional barriers such as timing, childcare and safe places where to conduct participatory exercises (Ortiz Escalante & Gutiérrez Valdivia 2015). This highlights that participation is a question of social equity in how shared spaces are produced, accessed and maintained. These concerns extend beyond spatial planning to the design of the technologies and infrastructures that increasingly govern shared and domestic spaces, where norms, power relations and gendered assumptions become embedded in systems themselves.

A pertinent example is the 'Smart Killjoy' persona, developed within the Swedish research project *"The role of homes in an automated electricity grid – a norm-critical perspective"* (Innovation Leadership Group n.d.). Inspired by Sara Ahmed's feminist killjoy (Ahmed 2023), the persona functions as a speculative design tool that exposes how gender inequality becomes embedded in everyday household technologies, making visible how automation and user interfaces privilege certain ways of living while rendering others invisible. This offers a methodological model for circular building practice: one that treats spatial and technological design as inherently political and keeps asking whose needs are centred and whose labour and costs remain hidden. Such questions of equity, access and whose needs are centred are not incidental to circular governance; they lie at the heart of the circular commons framework proposed by Egger et al. (2025), discussed in the next section.

Section 2: Circular commons

Egger et al. (2025) propose "circular commons" as potential pathways for transition to social CE. Circular commons are based on the principles of closing, slowing, and narrowing loops of shared resources. Building on Elinor Ostrom's foundational work on the commons (Ostrom, 1990), circular commoning entails the governance of diverse resources through evolving social roles and participatory practices, highlighting the importance of local engagement in sustaining shared assets. It frames the commons as collectively managed systems that reconcile human well-being with ecological limits (Egger et al. 2025).

These perspectives can be directly linked to circular building strategies by highlighting that they should extend beyond material efficiency and technological innovation to also include social and community dimensions. Such perspectives can inform circular building strategies, where material flows, energy, and spatial practices are managed collectively to reduce waste, prolong lifespans and optimize resource loops. Circular commoning reframes buildings and spaces as collectively managed systems that integrate human well-being with ecological boundaries, encouraging strategies such as shared facilities, adaptive reuse and community-driven maintenance.

A circular built environment (CBE) seeks to close resource loops across scales, from individual materials and components to entire buildings, neighbourhoods and cities. Building elements differ widely in lifespan: structural components like concrete may last centuries, while items such as

furniture require frequent replacement (Egger et al., 2025). Brand's "shearing layers" -framework implies that short-lived elements, such as interior fittings, often fall under users' control (Brand 1994), offering particular opportunities to enhance circularity through everyday use.

Circular commons extend this understanding by encompassing both tangible and intangible dimensions of the built environment: while tangible resources comprise physical elements and material flows, intangible resources include the norms governing space use, social interactions, knowledge, and quotidian spatial practices that shape how buildings are actually inhabited and maintained (Egger et al., 2025). This distinction matters practically: evidence from German building life cycle assessments indicates that physical interiors contribute substantially to greenhouse gas emissions, underscoring the potential of intangible everyday spatial practices, alongside material strategies, to support more sustainable and circular approaches to the built environment (Egger et al., 2025).

Unlocking this potential, however, requires moving beyond individual practice toward coordinated collective action. In contemporary cities, circularity in the built environment cannot be achieved solely at the individual level. Collective engagement is essential to close resource loops, e.g. in higher-order practices like refusing, rethinking, and sharing depend on coordinated action across communities. Egger et al. (2025) with their concept of circular commons offer a framework for participatory governance, enabling shared stewardship of materials and knowledge, as well as a number of cases where this is applied in practice (see section "Circular commons cases" below).

Section 3: Circular commons cases

Section 3a: Adaptive reuse

Although definitions of adaptability vary, the concept fundamentally refers to a building's capacity to respond to changes throughout its lifecycle (Tsoka & Tsikaloudaki 2025). "Adaptive reuse" repurposes existing buildings, infrastructure or spaces for a new purpose or function.[1] It can help to conserve resources, reduce waste and preserve embodied energy (Bullen and Love 2011), while also supporting the protection of architectural heritage and cultural development (Langston 2010). Hence, adaptive reuse emerges as an important circular building strategy, enabling existing structures and spaces to accommodate evolving social, economic and environmental demands, while extending their functional lifespan.

However, translating adaptive reuse from principle into practice raises fundamental questions of governance: who determines how buildings are transformed, and in whose interests such decisions are made. Given the complexity of balancing diverse stakeholder interests, uncertain future uses, and environmental, socio-economic factors, participatory approaches are essential to realise the full potential of adaptive reuse for circular and sustainable urban development (van Laar et al. 2025). Calls for resident agency in housing design have a long history: Habraken (1972) and the 'open building' movement argued from the 1960s onwards that residents should have meaningful decision-making power over how their homes are built (Tarpio & Huuhka 2026, p. 2).

These normative calls for participatory governance are increasingly finding empirical grounding in circular commons practice. Eggers et al. (2025) provide some good practice cases of circular commons focusing on adaptive reuse, where projects preserved the main structures of vacant buildings while creatively repurposing them for new functions. These cases are based on the

[1] This definition was based on Langston (2008) and the text of the DUT call "Cross-cutting Topic 1: Adaptive reuse of existing urban structures and spaces": https://dutpartnership.eu/cross-cutting-topic-1-adaptive-reuse-existing-urban-structures-and-spaces

commoning process with collaborative governance, community engagement and shared resources.

For example, in Rotterdam, an abandoned swimming pool was transformed into a circular production hub (BlueCity), using locally reclaimed materials (Egger et al. 2025, p. 1175). BlueCity, located in a former subtropical water park (Tropicana) on Rotterdam's riverside boulevard, was transformed from an abandoned building into a 12,000m² circular economy incubator by architects (see Figure 1). They reused materials from the swimming pool and other derelict buildings sourced through a local materials database. Now home to over 30 circular startups, the site operates as an ecosystem of industrial symbiosis; where the waste or by-product of one tenant becomes the resource of another; hosting businesses such as a mushroom farm growing on local coffee grounds, a furniture maker using beeswax, and a studio transforming surplus fruit into leather-like material. Beyond its role as a business incubator, BlueCity functions as a national platform for circular entrepreneurship and a public space for knowledge exchange, renting event space, and running workshops and programmes that connect circular innovation with broader civic engagement (EU Circular Economy Platform, n.d.).

Figure 1. Picture of the BlueCity event space (Source: https://bluecity.nl/en/eventlocatie)

In Valparaíso, Chile, the Ludoteca Merced emerged from the aftermath of a devastating fire that destroyed the homes of thousands of families in the hillside neighbourhood of Cerro Merced. Rather than rebuilding through conventional means, Fundación Minga Valpo, together with community members and volunteers, dismantled a sustainable housing prototype and collectively reassembled it on site; transforming it into a ludoteca (a community recreational and cultural centre for children). The building was adapted using natural, bio-based materials including soil, hay, and repurposed glass, following ecological construction principles. Both the transport and reconstruction were carried out through the traditional Chilean practice of *minga*; collective community labour; providing a safe space for play, artistic workshops, and community activities in a neighbourhood characterised by high vulnerability and limited access to public recreational space. The project exemplifies a grassroots form of circular commoning, where social solidarity, locally sourced materials, and participatory building practices converge to produce shared community infrastructure (Egger et al., 2025; Fundación Minga Valpo, n.d.).

Figure 2. Picture of the Ludoteca Merced (Source: https://mingavalpo.cl/ludoteca-merced/)

Material reuse is closely connected to circular strategies such as adaptive reuse, and its implementation involves not only technical considerations but also significant social and institutional challenges and opportunities (Verhagen et al. 2021). The CiaBOT project illustrates how waste materials can serve not only environmental goals but also convey cultural and social meaning, highlighting the value of community engagement and local materials used in circular design (Lusso et al. 2024). The results is a belvedere (see Figure 4) aimed at enhancing the landscape and providing a temporary stopping point in the Monferrato hills in Italy (Montacchini et al. 2024) The project involved university researchers, architecture and design students, and a local wine farm in the Monferrato region collaborating through participatory design and self-construction processes. It employed reclaimed and locally sourced agricultural by-products, demonstrating how circular building practices can integrate material reuse with local knowledge and community engagement (Lusso et al., 2024).

Figure 3. Picture of the CiaBOT belvedere (Source: https://riunet.upv.es/entities/publication/2bff1fed-68c7-43e4-acd1-da33351b32b3)

Section 3b: Shared use

Shared use, which is another CBE, refers to the collective utilisation of building spaces, facilities, or resources by multiple users, maximising resource efficiency, extending asset lifespans, and reducing material consumption in line with circular economy principles. Similarly to adaptive reuse of buildings, shared use generates both environmental benefits, such as reducing space demand, energy use and carbon emissions, and social benefits, including strengthened knowledge-sharing and collaboration (Lundgren 2023).

These principles find concrete expression in circular commons practice, where shared use is embedded within participatory governance frameworks. Egger et al. (2025) highlight some concrete examples of circular commons that emphasise sharing and the temporary use of space. The first example is located in Kibera, a densely populated informal settlement in Nairobi (Kenya), marked by severe overcrowding, inadequate sanitation, high unemployment and recurrent flooding (Kounkuey Design Initiative n.d.). In the Kibera Public Space Project, spatial professionals collaborated with local communities to transform dumpsites into multifunctional public spaces.

These areas integrate flood prevention measures using bio-based and reclaimed materials while supporting social encounters, urban agriculture and productive activities. The spaces are self-managed by the community, demonstrating how underused urban areas can be activated and maintained through participatory governance and circular urban strategies (Egger et al. 2025, p. 1176). The initiative is also employing community members for construction and supports income-generating activities prior to transferring governance to residents (Infrahub.africa n.d.).

Figure 4. Picture of the Kibera Public Space Project (Source: https://www.kounkuey.org/projects/kibera_public_space_project_11)

Another such example is "Eleonas Market" in Athens, Greece, where urban space is used efficiently throughout the week, with industrial activities during weekdays and a self-organised pop-up recycling market on weekends. Known as the "Pazari Rakosyllekton" (that translates from Greek as "Scavengers' Market") the market serves as a vital survival economy for citizens, where waste collectors sell salvaged and reclaimed materials. Operated by a city-wide network of waste pickers and unions, the market activates underused post-industrial spaces and practices urban scavenging and material reuse (Egger et al. 2025, p. 1176). Bauer (2022) theorises "Eleonas Market" as a form of urban commoning, analysing how marginalised groups appropriate post-industrial space through informal commercial activity and arguing that the spatial strategies developed by individual traders to sustain their livelihoods constitute emergent expressions of collective governance.

Section 4: Conclusions and recommendations

This brief has argued that the transition to a circular built environment cannot rest on material efficiency and technological innovation alone. The cases examined (from BlueCity in Rotterdam to the Ludoteca Merced in Valparaíso and the Kibera Public Space Project in Nairobi) suggest that circularity achieves more durable and equitable outcomes when it is grounded in collective governance, local knowledge and community participation. Circular commons offer a promising framework for this but only if the social dimensions of participation are taken seriously: who gets to participate, on whose term, and whose everyday practices and care responsibilities are made visible in the process. Gender equity is a key concern; it is a condition for circularity that is both just and socially sustainable. On this basis, we propose the following recommendations:

For researchers, there is a need for more interdisciplinary research that better integrates social dimensions (including user behaviour and participation and cross-actor collaboration) with material and digital approaches to circularity in the built environment (Verhagen et al. 2021). This includes prioritising studies that connect material science and digital design with social behaviour, developing validated circularity indicators, and embedding stakeholder collaboration and user engagement in early design processes (Verhagen et al., 2021). Norm-critical design methods; such as the Smart Killjoy persona described above, offer promising tools for surfacing the gendered and political assumptions embedded in circular building systems and deserve wider uptake in built environment research.

For practitioners and designers, participatory governance should be embedded from the outset of circular building projects, rather than treated as a consultation afterthought. Participatory processes must actively address practical barriers to inclusion (e.g. timing for consultations, childcare arrangements, choice of (non-technical) language and feeling of safety) to avoid reproducing the exclusions they seek to overcome (Ortiz Escalante & Gutiérrez Valdivia, 2015). Adaptive reuse and shared use projects should draw on local materials, knowledge, and labour wherever possible, resisting the pull of globalised supply chains that disconnect buildings from their communities.

For policymakers, education and governance frameworks that foster collective engagement in circular construction should have stronger institutional support (Verhagen et al., 2021). Policymakers should look beyond Western models of circularity and engage with the diversity of commoning practices already present in informal economies and communities across the Global South. The intangible dimensions of circular commons, such as social norms, everyday practices and the relationships and trust that make collective governance work in practice (Ostrom, 1990), deserve as much policy attention as material flows and technical performance indicators.

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