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Transformation of large monofunctionally used office buildings.
Photo: Carsten Schade and Johannes Staudt.

Circular Uses and Adaptive Reuse

A Concept for the Regenerative Transformation of Existing Buildings

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Keywords: Circularity; building transformation; building use; neighborhoods; early planning phases

Abstract

The adaptive reuse of existing buildings is central to urban sustainability, yet the circularity discourse has primarily focused on lower hierarchical levels, such as component reuse and material recycling. This paper introduces the concept of circular uses – continued use, change of use, intensified use, and multiple use of existing buildings and spaces – as an underexplored field in planning and design. We discussed the concept in a series of interviews with experts from urban planning, architecture, city administration, real estate, and civil society. The findings reveal potentials, challenges, and strategies for successful implementation of circular uses. They capture the relevance of the urban context, underscore the importance of early phase planning and design processes, as well as coordinated stakeholder collaboration, supported by changes in regulations and incentives. Implementing the concept of circular uses contributes to more equitable and regenerative urban environments.

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Circular uses and transformation

The pressing issues of our time such as the climate crisis, resource scarcity, and affordable housing demonstrate the challenges of balancing human needs with planetary boundaries (Raworth 2017). The built environment is a major contributor to this polycrisis (International Energy Agency 2019). In architecture and urban planning circular approaches and adaptive reuse have been proposed to address these challenges. The adaptation and activation of existing buildings can contribute to sustainability by increasing efficiency and supporting uses that advance social and environmental transformation. Although refurbishment and conversion have been important topics for years, demolition and new construction still dominate in practice. The New European Bauhaus (NEB) initiative proposes a framing that outlines clear ecological and social sustainability objectives to develop new design and planning approaches that link residents' everyday lives with the European goal of climate neutrality (European Commission 2023). Our research is part of the NEB project Creating NEBourhoods Together. The challenges of transforming large, monofunctionally used office buildings were the impetus for our subproject Circular Neuperlach. This practice-oriented research explores transformation projects as catalysts for regenerative urban development. We develop a prototypical planning approach together with actors from city administration, the real estate industry, planning, design, and civil society. The methodology is intended to address the challenges and aspirations of multiple stakeholders and make the shared benefits of the transformation of existing buildings and neighborhoods negotiable.

Drawn from this work, the present article proposes the concept of circular uses as a way to think about the transformation of existing buildings and spaces into catalysts of positive change in the urban environment. In doing so, it builds on the discourse of urban circularity, which looks at cities as complex systems of resource and energy flow that span multiple scales, from materials and components to buildings, neighborhoods, cities, and regions. Whereas much of this discourse focuses on material recycling and reuse, our contribution is to highlight the use of buildings as a powerful but underexplored means of fostering circularity in these urban systems. We identify four types of circular use: continued use, change of use, intensified use, and multiple use. Presenting our findings from a series of interviews with experienced actors, we discuss strategies for and challenges to the implementation of circular uses, as well as the role of urban context, planning and design process, and regulatory innovations.

Circularity and adaptive reuse: An overview

This overview situates our research within ongoing debates and evolving frameworks related to circular economy, circularity, and adaptive reuse. It explores how these concepts are used in both academic literature and professional practice. Particular attention is given to conceptual models of circularity to define a suitable concept for building transformation as a critical lever in sustainable urban development.

Concepts of circularity in the built environment

While often used interchangeably, circular economy and circularity differ in scope and underlying intent. In architectural and urban planning discourse, this distinction matters: circular economy has largely been framed within existing paradigms of growth and tends to prioritize material flows, recycling, efficiency, and component reuse in new construction (Ghisellini et al. 2016; Kirchherr et al. 2017; Korhonen et al. 2018; Pomponi and Moncaster 2017). In contrast, circularity focuses on how human systems, including buildings, infrastructures, and cities, can operate within planetary boundaries (Leising et al. 2018; Schröder et al. 2020; Cheshire 2024). As a concept of regeneration, circularity also foregrounds intergenerational equity, affirming values of social justice, long-term adaptability, and ecological regeneration, which are not well addressed in dominant circular economy narratives (Williams 2019). It calls for broader transformation and is related to frameworks such as postgrowth economics (Jackson 2017; Petschow et al. 2020), regenerative urbanism (Girardet 2015), and doughnut economics (Raworth 2017). Regenerative design echoes these approaches, moving from minimizing harm to actively restoring ecosystems and enhancing the socioecological fabric of urban life (Mang and Reed 2012).

Hierarchical models of circularity (e.g., Potting et al. 2017; Figure 1) distinguish between lower-level strategies like recycling and higher-level ones such as sufficiency, regeneration, and systemic change. Recent expansions of these models emphasize the regeneration of socioecological systems (Loza Adaui 2024). The concept of circularity also includes considerations of time and space, addressing both the speed and scale at which resources flow through a system (Bocken et al. 2016).

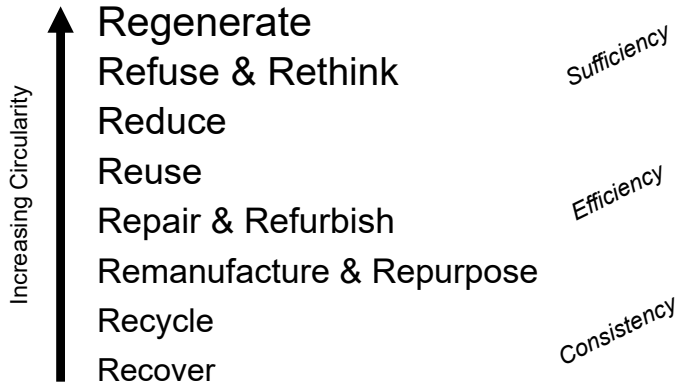

Figure 1: Circularity hierarchies. Source: Johannes Staudt, based on Potting et al. (2017) and Loza Adaui (2024).

The model of shearing layers by Stewart Brand (1995; Figure 2) and Frank Duffy describes buildings as systems of layers with different rates of change. Designing with these varying lifespans in mind enables adaptability and long-term sustainability by allowing faster-changing layers to be modified without disrupting slower ones. The model focuses on physical obsolescence. Additional criteria for obsolescence have been identified: economic, functional, technological, social, legal, and political (Conejos et al. 2013). Emotional durability (Bocken et al. 2016) addresses acceptance of existing buildings, as people care for buildings they identify with and join forces to hinder demolition.

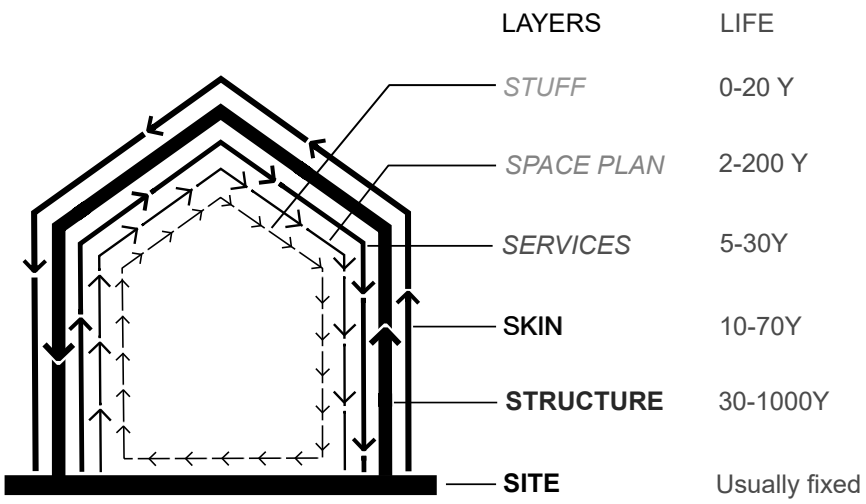

Figure 2: Model of shearing layers of a building. Source: Johannes Staudt, TU Munich, based on Brand (1995).

The lifecycle of buildings spans decades or even centuries. To understand their long-term impact on urban environments a conceptualization that goes beyond individual buildings and captures their systemic effects is needed (Anders 2016). Buildings are not mere stocks of material or financial instruments of value creation; they also shape the social, economic, and cultural activities that allow cities to thrive (Eberhardt et al. 2019, Figure 3). The concept of circular cities captures this vision of the city as a complex system of resource flows and socially valuable uses (Williams 2021).

Implementing circularity within the built environment requires a systemic conceptualization that goes beyond materials, components, and structures to include whole buildings and neighborhoods.

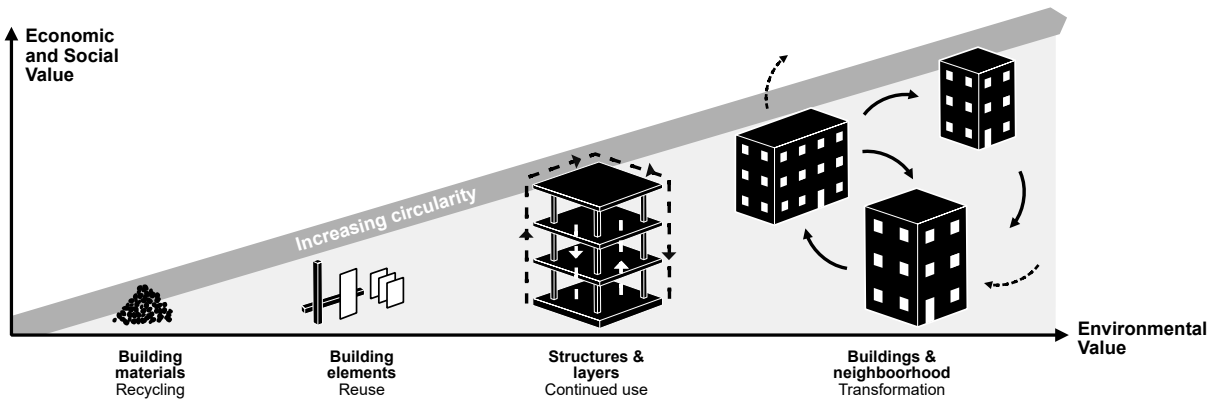

Figure 3: Circularity and scales in the built environment. Source: Johannes Staudt, based on Eberhardt et al. (2019).

Regenerative transformation and adaptive reuse

This paper focuses on higher-level strategies of circularity by examining adaptive reuse as a key approach to promoting regenerative circularity in the urban built environment (Murray et al. 2017; Williams 2021). Unlike circularity solutions aimed at optimizing material resource flows, adaptive reuse also addresses the cultural, spatial, social, and ethical dimensions of sustainability. It challenges conventional notions of obsolescence and reveals the latent value of the existing built fabric (Wong 2023; Andreucci and Karagözler 2024). It not only reduces environmental impacts but also fosters equitable, resilient, and context-sensitive urban transformation.

Transformation in the built environment is not a new phenomenon. As Hermann Czech noted in *Der Umbau* (1996), urban life is inconceivable without continuous transformation. In recent years, the discourse on adaptive reuse has expanded from its origins in historic preservation (Arfa et al. 2022; Vafaie et al. 2023), through energy-efficient refurbishment (Richarz and Schulz 2011), to a broader recognition of existing buildings as valuable material resources. Today, adaptive reuse is increasingly seen not only as a conservation method but as a key approach to sustainable urban development and climate-responsive design. This shift reflects a growing awareness of the need to reduce grey emissions from demolition and new construction (Federal Foundation of Baukultur and Nagel 2022). A notable example of adaptive reuse as a transformation strategy is the German contribution to the 2012 Venice Architecture Biennale, Reduce / Reuse / Recycle (Petzet and Heilmeyer 2012). The work of the French architects Lacaton and Vassal (Lacaton et al. 2024) exemplifies this shift as well, with projects that prioritize minimal intervention, enhance living conditions, and create affordability, and social value. The emerging concept of *Umbaukultur*, a culture of transformation, has been explored in recent publications (Grafe and Rieniets 2020; Berke and de Monchaux 2023; Ngo et al. 2024), framing adaptive reuse as a response to broader societal megatrends (Naisbitt 1982). Another example is the project *Obsolete Stadt* (Rettich et al. 2023), which describes how buildings deemed obsolete can instead offer spatial potential for inclusive, community-oriented, climate-friendly, and coproductive development in growing cities. Such approaches emphasize "the potential of existing buildings to experiment with uses, programs, life models and economies that new buildings can no longer offer under today's more restrictive financial, legal and construction conditions" (Ngo et al. 2024: 2). The experimental nature of transformation processes and the pioneering practices of temporary and interim use have been studied (Lange et al. 2007; Haydn and Tempel 2006; Oswalt et al. 2013) and continue to influence urban transformation initiatives. Recent research on multiple uses (Schröer 2019; Foerster and Teamwerk Architekten 2021) reflects a growing interest in multicoded spaces. This research overview and current discourse reveal a convergence of adaptive reuse and regenerative circularity. Instead of treating them as competing approaches, we seek to introduce an integrated concept to advance regenerative urban development.

Circular uses: Definition and representation

To explore a concept of circularity that incorporates building use, user needs, and the urban context, we built on existing concepts and graphical models to derive the concept of circular uses. We revisited and expanded Stewart Brand's layer model (1995) to include the use, zones of uses, and context of a building (see Figure 4). Visualizing the physical layers and spatial qualities of a building helps planners and designers understand the potentials of existing structures and develop transformation strategies during early planning phases.

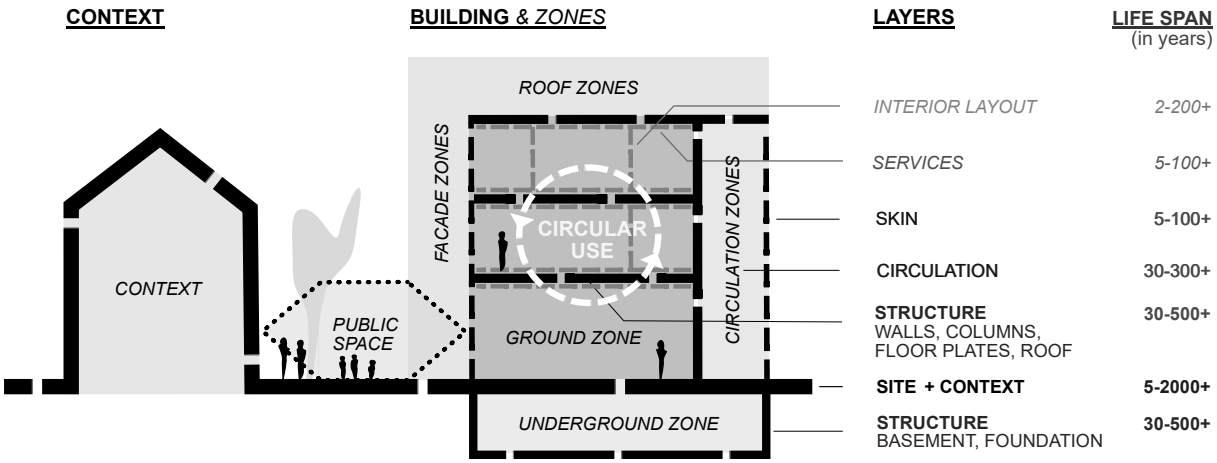

Figure 4: Conceptual model with layers and zones, focusing on circular use and context. Source: Johannes Staudt.

In addition to the updated graphic model, this article proposes the concept of circular uses, which allows planners and designers to consider circularity in the built environment in a broader sense. The aim is to create a heightened awareness of the importance of use and to incorporate the concept in planning, design, and development processes at an early stage. We define the following types of circular building use: continued use, change of use, intensified use, and multiple use (see Figure 5).

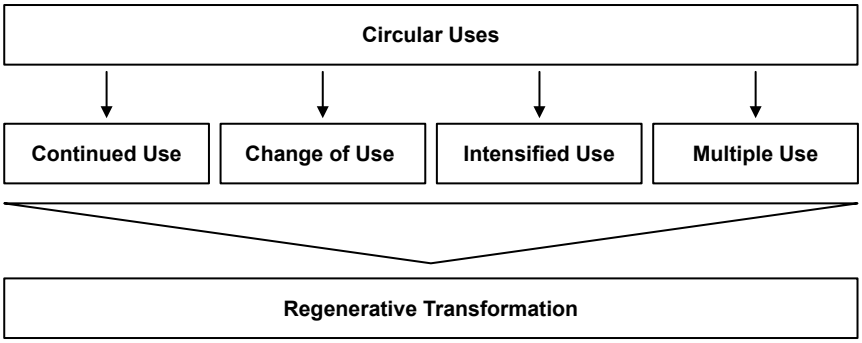

Figure 5: Circular uses as continued use, change of use, intensified use, and multiple use that contribute to a regenerativel transformation. Source: Johannes Staudt.

In the case of continued use, buildings continue to be used without any change of use. Interventions in the fabric of the building may nevertheless be necessary for functional, energy-related, or aesthetic reasons. Change of use, in most cases, necessitates a more substantial conversion, as new functional and regulatory conditions apply. Intensified use describes a sufficiency approach with more use or users in the same space or the same use in less space. It also includes redensification as an intensified use of already built-up urban land. With multiple use, several uses overlap in terms of time and/or space; rooms are thus used differently depending on the time of day or changing requirements.

Exploration and validation of concept: Methodology

To explore and validate the concept of circular uses, we conducted a series of expert interviews. We carried out twenty-one semi-standardized interviews (Table 1). The selection of experts was based on the quadruple helix model, which includes academia, industry, government, and civil society (Carayannis and Campbell 2022). We have extended the model to include architects and urban planners, as they have an intersectional position and thus a special role in cocreation, process design, and project coordination. We interviewed experts and stakeholders in leading positions as they have a good overview of the processes, options for action, and hurdles. The interviews lasted between 30 and 90 minutes and covered the following topics: a) circularity and terms, b) buildings and their properties, c) developments, trends, and context, and d) processes and stakeholders (Table 2).

Field of expertise	Role	Interview date	Code
Academia	Lawyer and urban planner	05.12.2023	A1
Civil society	Social entrepreneur	10.11.2023	C1
	Social entrepreneur	26.09.2023	C2
Governance	City administrator, dept. urban planning	11.12.2023	G1
	District committee member	25.10.2023	G2
	City administrator, dept. urban planning	25.10.2023	G3
	City administrator, dept. urban planning	07.03.2024	G4
	Local building department commissioner	05.12.2023	G5
	Local building department commissioner	14.05.2024	G6
Planners	Architect and competition manager	13.03.2024	P1
	Architect and consultant	11.10.2023	P2
	Architecture chamber representative	14.05.2024	P3
	Architect and urban planner	16.10.2023	P4
	Architect	11.10.2023	P5
	Architect	28.11.2023	P6
	Architect	25.07.2024	P7
	Architect and urban planner	11.12.2023	P8
Real estate industry	Developer	11.10.2023	R1
	Facility manager	29.11.2023	R2
	Developer	01.11.2023	R3
	Real estate strategist	12.08.2024	R4

Table 1: Experts interviewed, indicating field of expertise and role. Source: Catherine Steiner, Johannes Staudt and Carsten Schade.

All interviews were recorded, transcribed, and thematically analyzed. We coded the transcriptions to identify similarities and opposing positions. Artificial intelligence tools were used to iteratively adjust the coding (Coral AI) and to support meaningful translations of the interview texts (Claude 3.5 Sonnet, ChatGPT-4, DeepL).

Category	Main Question	Subquestion
Circular uses	What has been your experience in implementing circular uses?	What went well? Moments of success? What were challenges/ obstacles/ hurdles?
Examples	Describe examples from your practice of circular uses of existing buildings.	What uses were in the building/ space before and after? What adaptations were made to the building fabric?
Stakeholders	Who were the stakeholders and what was your own role?	Who was important for the implementation? What skills/ competencies/ knowledge were essential? Which ones were missing? Who could add them? Who should have been involved earlier?
Process	What did the process look like and how was it managed?	What were key moments/ decision? Did you follow a prescribed process? How did it differ from usual planning processes? How could the process be improved/ adapted?
Urban context and urban development	What connections do you see between circular uses and urban development? Which trends will detemine the use of buildings in the future?	
Findings	What generalizable insights have you gained from your experience? Which buildings are particularly suitable for circular uses? Which are not? What role do changes in uses play over the course of time?	Where are the greatest potentials for circular uses? Are the findings transferable? What characteristics/ qualities do these buildings have? How do uses change over time? What adaptations of the spaces are required? What causes these changes to fail? When is new construction inevitable/ are the limits reached?
References	What references have served as models?	

Table 2: Interview questions of the semi-standardized interview guideline. Source: Johannes Staudt and Carsten Schade.

Circular uses: Expert feedback

The concept of circular uses was well received by most interviewees. Some, however, initially questioned the necessity for a reframing of already existing practices. Urban planners emphasized the inherent circularity in city development, highlighting the historical precedent for continuous urban transformation (P1). Of the four types of circular uses discussed, change of use was central to most conversations. Continued use, intensified use, and multiple use expanded the discourse toward a broader range of higher-level circular strategies. Additional concepts of circular use were introduced and will be discussed below.

Challenges to implementation

The interviews confirm that the implementation of circular uses in the built environment faces a range of interconnected challenges that span regulatory, economic, technical, and cultural domains (Table 3). Rigid building codes and outdated planning laws often prioritize new construction, creating legal and procedural barriers to adaptive reuse. The condition of existing structures, such as low ceiling heights, contamination, and missing documentation, further complicates transformation efforts. Financially, adaptive reuse is often perceived as riskier and less predictable than new builds, with supposedly higher costs associated with renovation and adaptation, limited incentives, and unfavorable tax structures. In parallel, a persistent cultural bias within the construction industry continues to favor demolition and new construction over adaptive reuse. Additionally, conventional planning processes rarely allow for the early, cross-disciplinary collaboration necessary to address the multifaceted demands of circular projects.

Challenge	Findings from interviews	Interviewee
Regulatory frameworks	Rigid building codes favor new construction and discourage adaptive reuse	R3
	Regulations apply the same standards to reuse as to new builds, complicating compliance	G1, P7
	Excessive number of technical norms (>3500) adds complexity and cost	P3, G5
	Comfort standards (e.g., sound/ thermal insulation) are overly strict and not always necessary for reuse projects	P3, P7
Structural and technical barriers	Existing buildings often have limitations like low room heights, contamination, or outdated structures	A1
	Missing documentation complicates planning and design	A1
	Outdated spatial programs, rigid layouts, and changing technological requirements limit adaptability	G4

Economic and financial factors	Market-driven decisions favor predictably profitable new builds	A1, P7, G3
	Adaptive reuse is seen as financially riskier and harder to assess	R5, G6, P1, P3
	Lack of tax or financial incentives makes adaptive reuse less attractive	P4, R3, R4, A1
	Municipalities favor commercial uses due to tax revenue potential	P5
	Need for innovative financial models to support reuse	R4
	Adaptive reuse requires risk tolerance and openness to lower standards or minor imperfections	P7
	Most projects are self-financed, which increases risk	P7
Cultural attitudes	Resistance to alternative approaches in the construction industry	P7
Planning and design processes	Conventional architectural design focuses on later phases, lacking early-phase coordination	G6
	Successful reuse requires early collaboration among experts (administration, specialist planners)	G6
	Dependencies like noise, parking space requirements, and capacity limits of existing social infrastructures must be managed early and holistically	G3, G4

Table 3: Findings from interviews regarding challenges and barriers to successful implementation of circular uses. Source: Johannes Staudt, Carsten Schade, and Catherine Steiner.

Strategies for successful implementation of circular uses

Successful strategies for implementing circular uses described by the interviewees focus on maximizing the potential of existing structures while minimizing waste and resource consumption. In addition to the circular uses that we proposed, the experts also mentioned *minimal refurbishment*, *interim uses* and *mixed use* of buildings and neighborhoods, uses that can generate both ecological and social value. These concepts can be assigned to the four proposed circular uses as they are expansions of these concepts (Table 4). Examples given by the interviewees included change of use projects such as converting offices into student housing with minimal alterations to the building's structure. While strategies based on short term housing regulations provide immediate, often low cost solutions, challenges include managing legal regulations and ensuring long-term social justice. Temporary or interim uses allow for testing and experimentation, but users must often accept less-than-ideal conditions and precarious lease conditions. The term *pioneering use* indicates the intent of longer-term continuity of tested uses after a transitional process. Additionally, strategies like intensified or multiple use approaches aim to better utilize space, including accommodating evolving needs such as multigenerational living, yet require careful planning and management to address potential conflicts and ensure long-term sustainability.

Circular use *Concepts in italics were introduced by interviewees*	**Strategies for successful implementation**	**Interviewee**
Continued use	Use existing spaces as they are without major alterations, encouraging behavioral adaptation over structural change	C3
	Work creatively within spatial, financial, and regulatory constraints	C2, C3
	Avoid triggering new regulations by keeping use the same and working with the existing building fabric	G6
	Avoid delays from permits or raw materials suppliers	C2
Minimal refurbishment	Ensure safety measures like structural fire protection without unnecessary complexities	G6
	Accept lower standards (e.g., sound and thermal insulation) to maintain affordability and feasibility	P7
Change of use	Employ adaptive reuse strategies to reprogram buildings creatively with minimal changes and minimal regulatory hurdles	P7, R4
	Maintain structure, reuse elements, and use integrated furniture to minimize cost (e.g. converting office spaces into student housing by classifying them as commercial hostels to bypass stricter residential codes)	R4
	Test spatial ideas and community needs with quick, low-cost implementation	P4, R4
Temporary/ Interim/ Pioneering use	Support experimentation before long-term investment (suitable for cultural and social functions to assess spatial and acoustic needs)	P4
	Enable fast feedback and learning	R1, R3, C1, C2
	Employ transitional pioneering uses to help manage expectations and continuity	P4, C2
	Anticipate returning spaces to original conditions	C2, R1
	Ensure project continuity for vulnerable groups	C2, R1
Multiple use	Design spaces for flexible, multi-functional use with provisions for easy adaptation (e.g., IT, water, power infrastructure)	P5
	Engage local communities early to build acceptance	P5
Mixed use	Address potential conflicts (noise, schedules) through participatory planning and smart spatial programming	P5
	Allocate resources for continuous management to enhance efficiency and maximize synergies	P5
Intensified use	Plan for using less space for the same function or accommodating more users	P5
	Flexibly design for lifecycle changes, e.g., aging populations or shared living among seniors or families	G2, P5
	Prevent underuse of large apartments by promoting co-living and multi-generational models that support community integration	R4

Table 4: Findings from interviews regarding strategies for successful implementation of circular uses. Source: Johannes Staudt, Carsten Schade, and Catherine Steiner.

Urban context and neighborhood transformation

Interviewees emphasized that a context-specific approach, grounded in local needs and community participation, is critical for revitalizing underused buildings and spaces (Table 5).

Mixed-use developments and multifunctional designs were highlighted for their ability to support social, commercial, and cultural life, while also remaining adaptable over time. Moreover, enhancing sustainable infrastructure such as green spaces, public amenities, and public transportation networks not only improves environmental quality but also strengthens the viability and equity of transformation efforts. Developing transformation projects in contexts with existing sustainable energy and public transportation infrastructure supports whole lifecycle sustainability. Ultimately, aligning building reuse with the broader urban ecosystem enables socially and ecologically resilient neighborhood development.

Aspect of urban transformation	**Findings from interviews**	**Interviewee**
Holistic neighborhood activation	Circular uses can enhance social cohesion, economic vitality, and ecological value when based on local needs and community involvement	P4
Mixed-use development and multifunctionality	Revitalization through buildings that combine residential, commercial, and communal functions supports vibrant and resilient neighborhoods	P5
	Spaces should remain adaptable to multiple uses over time, rather than serving a single fixed purpose	P6
Sustainable infrastructure: Green areas, communal and public spaces	Transforming existing buildings can improve the urban environment by enhancing public spaces and integrating green infrastructure for climate adaptation	P7
	Required green spaces and flood water management need to be included	G2
Social infrastructure	Integrating spaces for cultural and social services is essential to meet diverse urban needs and foster inclusive communities	G3
	Required social infrastructure needs to be included in urban transformation projects (e.g. schools, kindergardens, playgrounds)	G3
Mobility and accessibility	Effective mobility and public transport connections are essential for the success and the sustainability of transformation projects by enabling access to resources and services	G5
Context sensitivity	The feasibility and success of reuse projects strongly depend on the surrounding urban infrastructure and community dynamics	G5

Table 5: Findings from interviews regarding urban context and neighborhood transformation.
Source: Johannes Staudt, Carsten Schade, and Catherine Steiner.

Building properties supporting circular uses

Interviewees highlighted specific material and spatial qualities that make buildings or spaces particularly well-suited for circular uses by enhancing the durability and the ability to accommodate change and adapt to different uses over time. A detailed analysis of these criteria will be published in a subsequent paper.

Planning and design processes

The interviews show a growing consensus that circular trnsformation in the built environment requires a fundamental rethinking of conventional planning and design processes (Table 6). Rather than adhering to linear, segmented workflows, practitioners advocate for iterative, whole lifecycle-oriented models that begin with early context analysis (*phase zero*) and extend through long-term building management and monitoring (*phase ten*). A key insight is the necessity of multidisciplinary collaboration and stakeholder engagement from the outset, ensuring that social, environmental, and economic considerations inform decision-making. Participation, communication and moderation are emphasized as essential for navigating complex urban dynamics, fostering trust, and reflecting diverse interests. The interviews also underscore the importance of mindset and institutional leadership in driving innovation, particularly within municipal structures. Additionally, evaluation methods based on multiple possible use scenarios are seen by some experts as more effective for guiding sustainable choices than lifecycle metrics based on a single use scenario. Together, these insights point toward an integrated planning and design approach that is context-sensitive, collaborative, and oriented toward long-term urban resilience.

Aspect	Findings from interviews	Interviewee
Planning and design, process and management	Multidisciplinary collaboration and iterative planning and design is crucial for meeting sustainability goals	R3
	Involve diverse actors including local authorities, local businesses, community groups, and private developers to ensure broader perspectives and lead to more robust and sustainable outcomes	R4
	Consider the entire lifecycle of the building, integrating social and environmental factors from design to long-term use	P1
	Expand phases to include *phase zero* (context research and strategic planning) and *phase ten* (post-project evaluation and maintenance)	P1, G1
Early predesign (phase zero)	Early predesign is critical to adaptive reuse because knowledge of existing structures, neighborhood context, and socioeconomic trends is key to understanding future potentials	R1, R3
	Require input from diverse experts such as sociologists or sustainability and climate specialists	R1, R3
	Early participation, collaboration, and moderation help to create consensus, build trust, solve problems, and enable stakeholder engagement	P1, R3

Moderation and communication	Clear and ongoing communication is key for public involvement, phased stakeholder engagement, and managing expectations	P6, R4, P4
	Professional moderation with a solid foundation in the field increases acceptance by the parties involved: standard methods are insufficient for urban transformation's complexity	P8
	Defined roles within teams improve managing deliverables and addressing issues	R4
	Matching community needs with available spaces can foster identity and belonging	C1, C2
Postcompletion (phase ten)	Postproject planning is crucial for sustaining circular use and involves building maintenance, operations, and tenant selection	P1, P4, G4, R2, R3
	Developers must embed cultural and community considerations and coordinate with municipalities	R4, G2
Mindset	A mindset shift is necessary among planners and city officials to support circular practices	P4, G5, G6
	Municipal leadership must inspire staff and assume creative responsibility	G5, G6, P4, C2, P2, P7
Scenario-based evaluation	Scenario-based evaluation supports more accurate, sustainable decisions	P7
	Standard lifecycle CO2 metrics are often misleading: A *building climate calculator* enables comparison of reuse vs. demolition strategies through cumulative CO2 impacts by 2045	P7

Table 6: Findings from interviews regarding planning and design process. Source: Johannes Staudt, Carsten Schade, and Catherine Steiner.

Regulatory, economic, and administrative innovations

The interviews underscore the urgent need for regulatory, administrative, and financial innovations to support a circular transformation (Table 7). Flexible, goal-oriented legal frameworks are essential to navigate the unique challenges of existing structures, replacing rigid, one-size-fits-all standards. The experts referred to current approaches like the *Umbauordnung* (BAK 2023) and the federally endorsed *Gebäudetyp e* (BMWSB 2024) that offer pathways to enable simplified, creative approaches to building reuse. Interviewees emphasized that building authorities, while constrained by current laws, do have interpretive leeway and must engage earlier and more proactively in the planning process. Economically, adaptive reuse faces hurdles from market-driven preferences for new construction, underlining the necessity of new financial models and incentives to de-risk and promote transformation efforts. Together, these insights point to a growing recognition that legal, administrative, and market structures must evolve to make circular and adaptive practices viable at scale.

Aspect	Findings from interviews	Interviewee
Flexible regulatory frameworks and funding mechanisms	Rigid standards impede circular practices; flexible, goal-oriented regulations are needed	P3
	Flexibility should extend to funding mechanisms	P3
	Mixed-use and fluid zoning can promote adaptive reuse	A1
Conversion code / Historic preservation	Current building laws treat reuse like new construction, limiting flexibility	G1
	A dedicated *Umbauordnung* (adaptive reuse regulation) is needed, akin to historic preservation rules	R3, G1
	Historic preservation offers flexibility (for projects with major modifications to use and form, e.g. residential use requiring balconies)	P7
Building type e (Gebäudetyp e)	New building classification introduced by the Bavarian Chamber of Architects to allow simplified (einfach) and experimental construction	P1, P3, G1
	Enables more flexible, faster, cost-effective, and innovative construction by allowing planners to deviate from rigid standards while still meeting essential safety, health, and environmental protection goals	P1, P3, G1
	Recognized by federal authorities in 2024, enabling broader adoption	P1, P3, G1
Building authorities	Building departments engage too late and don't prioritize reuse	G5
	Legal flexibility exists if protective aims are met	G5
	Legal instruments are available, but application often depends on proactive efforts by individuals at local authorities	A1
	Suggested reforms include fast-tracks and expedited approvals for circular projects	P1, A1
	Experienced building department officials can take on advisory roles for novice planners or non-standard projects (*tandems*)	P1, A1
Economic framework conditions	Profitability determines project feasibility; new builds are often financially preferred (more predicatable, less perceived risk)	A1, P7, G3
	Adaptation of commercial spaces for housing is driven by urban demand	G2
	Innovative financial models, regulations, and incentives are needed to reduce risk and support adaptive reuse	R4

Table 7: Findings from interviews regarding regulatory, economic, and administrative innovations. Source: Johannes Staudt, Carsten Schade, and Catherine Steiner.

Flexibility, holistic approaches, collaboration

A recurring tension lies in diverging perspectives between key actors: while architects, developers, and planners often feel constrained by rigid regulations, legal experts and city officials argue that existing frameworks already provide room for action, pointing instead to a lack of willingness or creativity in implementation. This disconnect signals the need for clearer communication, collaborative frameworks, and a collective reevaluation of how regulations are interpreted and applied.

A key area of consensus among interviewees was the value of flexibility and adaptability, both in building design and in the regulatory environment. Circular uses benefit from building designs that can be modified over time with minimal intervention. Strategies like change of use and multiple uses benefit from flexible conditions that encourage creative solutions without triggering costly structural changes or complex regulatory processes. The interviews highlight the need for regulatory reform and innovative financial mechanisms. Regulations must evolve to enable adaptive reuse and flexible approaches, reducing bureaucratic barriers and promoting long-term sustainability. Financial mechanisms, such as subsidies and tax incentives, are essential to encourage the regenerative transformation of existing buildings.

Participants also emphasized the importance of systemic and holistic approaches that integrate environmental, social, and economic dimensions across planning and design. Successful circular transformation depends on a whole lifecycle approach starting from the earliest stages – strategic thinking, analysis, evaluation, programming, and concept development – through iterative, feedback-driven implementation and finally use phase monitoring and evaluation. Community engagement emerged as another vital aspect. Thorough needs assessments, participatory design processes, and continuous feedback loops were seen as crucial, particularly for projects involving multiple or overlapping uses. Projects that align with community aspirations not only foster a sense of ownership and acceptance but also yield more meaningful and lasting transformations.

Additionally, professionals in real estate, city administration, architecture, and urban planning must shift their mindset to embrace circularity as a standard practice, fostering iterative processes and interdisciplinary collaboration. The complexity of circular transformation projects demands process-specific expertise beyond generic planning and design methods. Practical knowledge, targeted facilitation and participation, as well as a grounded understanding of legal and procedural contexts significantly increase the likelihood of successful implementation. To this end, we propose the institution of an Urban Transformation Office (UTO), aiming to bridge scales (building, neighborhood, city, region) and mediate between stakeholders, enhancing knowledge transfer and ensuring effective implementation across diverse contexts.

Further research: Frameworks, methods, and mindsets

For the broader implementation of circular use strategies, we identified the following research fields. One major area of inquiry concerns the legal and regulatory frameworks and barriers that govern adaptive reuse. Evaluating how regulatory reforms, such as modifications to zoning laws and building codes, can support circular use practices and make adaptive reuse more feasible is also necessary.

In parallel, economic research is needed to evaluate how financial incentives, such as grants, tax credits, or low-interest financing, can encourage developers to prioritize long-term investment in existing buildings over demolition and short-term returns. Interdisciplinary development of new economic models that capture the long-term social and environmental benefits of circular uses will be crucial. This includes conducting whole lifecycle cost analyses to compare scenarios like adaptive reuse with demolition and new construction, incorporating environmental costs, embodied carbon, and future adaptability into the equation.

Another focus is the socioeconomic impact of transformation projects on local communities. Research should examine how circular strategies affect housing affordability, displacement, social equity, community resilience, and neighborhood identity. This entails investigating the role of key local actors, including municipal decision-makers, developers, and civil society groups, in shaping project outcomes. Additionally, investigating the relationship between community engagement and the economic success of projects could yield valuable insights into how to align community needs with broader economic objectives. Insights into how participatory planning processes affect design quality, maintenance, and long-term viability could strengthen the case for more inclusive approaches.

Developing new planning tools and methods that support circular approaches is also needed, especially for the early design phases. Approaches such as systems thinking, architectural programming, graphic analysis and representation, and scenario planning can help integrate circularity goals from the outset. Methodological frameworks that facilitate decision-making under conditions of uncertainty, while integrating environmental, social, and economic information, can enhance strategic planning. Additionally, establishing feedback mechanisms during building use and after project completion, such as post-occupancy evaluations, can inform future projects and ensure end-of-life reuse strategies.

Comparative case studies of successful adaptive reuse and neighborhood activation projects can provide insights into effective regulatory frameworks, financial models, building properties, and planning strategies that support circular transformations while ensuring safety, social equity, and material and spatial quality.

Lastly, educational and training programs for architects, planners, and community stakeholders should be expanded to include circular design principles and interdisciplinary methods. Building professional capacity and enhancing public knowledge is essential for embedding circularity into standard urban planning and architectural practice.

Toward a regenerative urban practice

The expert interviews show that circular use strategies – continued use, change of use, intensified use, and multiple use of existing buildings and spaces – represent a promising avenue for achieving more sustainable, resilient, and socially inclusive urban development. These strategies enable cities to reduce resource consumption, extend the life of the existing building stock, and adapt urban environments to changing needs without erasing their historical or cultural fabric.

Yet the successful implementation of circular use strategies depends on significant shifts – in mindset, regulation, economic frameworks, and design methodologies. It requires embracing complexity rather than avoiding it. Stakeholders must move beyond the conventional model of top-down planning and static regulation toward collaborative planning and design practices and flexible regulations.

One key insight from the interviews is that many of the tools and policies needed for this shift already exist in some form. What is lacking is not necessarily comprehensive legal reform, but institutional coordination, shared understanding, and the procedural knowledge required to activate the existing possibilities effectively. This highlights the urgent need for intermediary institutions that can translate between legal and economic frameworks, community aspirations, and architectural and planning practice.

Economic transformation is also essential. The current real estate market heavily favors new development and short-term returns. To counter this, policy-makers must introduce incentives that reward long-term thinking, environmental stewardship, and community-oriented design. Financial structures should reflect the true lifecycle costs of buildings, incorporating environmental externalities and social impacts.

Importantly, circular strategies must be embedded from the earliest planning stages. Early-phase programming, contextual research, and inclusive design processes are critical to identifying transformation potential and ensuring projects remain viable and responsive throughout their life cycle. These approaches need to be supported by adaptive policy, interdisciplinary expertise, and strong networks across public, private, and civic sectors. The development of new methodologies, educational programs, and collaborative networks is essential for fostering a culture of innovation and ensuring that circular urban transformation becomes a mainstream practice.

In sum, the transition toward regenerative urban development is not only possible, it is already underway in practice. However, scaling it requires concerted action. Cities must invest in regulatory reform, knowledge transfer, and capacity building. Architects and planners must lead with creativity, whole lifecycle and systems thinking, and community engagement. Real estate developers must take responsibility for the neighborhood context and prioritize long-term environmental and social outcomes over short-term profit. And public institutions must create the enabling environments that make circular strategies economically viable and socially equitable. If these elements come together, regenerative circularity can become a core principle of sustainable urban development, moving beyond material reuse and resource efficiency toward a resilient and equitable urban future.

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