

FINDING LAND FOR THE CIRCULAR ECONOMY: TERRITORIAL DYNAMICS AND SPATIAL EXPERIMENTATION IN THE POST-INDUSTRIAL CITY

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Abstract

The emergence of European-wide circular city agendas calls attention to the integration of circular economy (CE) policies in urban development trajectories. In post-industrial contexts like the Brussels Capital Region (BE), land scarcity and industrial gentrification pose significant challenges for emerging circular activities that do not conform to traditional economic valuation criteria. This article highlights the significance of land as a central resource and contested means for circularity transitions through qualitative research on cases of urban circular economy hubs. We propose a spatial approach for investigating these spaces, examining the influence of regional territorial policies, land value dynamics and the planning system. Resulting from these interplays are diverse forms of circular spatial experimentation, manifesting in three local pathways (i.e., anchoring, transitory and transformative). Public versus private land ownership, stakeholder expectations and the dual role of public institutions are the primary drivers affecting the durability and socio-economic orientation of circular economy hubs in the city.

Keywords: circular development, urban redevelopment, regional policies, economic geography, circular economy hubs, Brussels

JEL Classifications: P25, Q01, Q15, R58

Introduction

In recent years, a growing body of research has been concerned with cities' transition towards the circular economy (CE) (Prendeville et al., 2018; Williams, 2022). Evident in the rolling out of 'circular city' agendas (ICLEI, 2020; European Commission, n.d.), the CE is being hailed as a novel model for a more just and regenerative urban development. Yet, the term 'circular city' remains as promising as it is elusive, leaving open a wide range of interpretations of the individual circularity rhetoric being adopted. Evident is that these agendas entail a transition from a linear to a circular, more resourceful economy that is coupled with a return to the local scale. Ecologically, this presupposes local material supply chains and waste recovery loops in the form of circular urban metabolisms, and socially, the creation of employment opportunities within territorial boundaries (Corvellec et al., 2022). The urban scale is therefore becoming the primary spatial unit at which sectoral reorganisations and changes in production and consumption are taking place (Tapia et al., 2021).

With the urban scale at the forefront of circularity transitions, barriers and implementations of the transition are highly context-dependent, differing in their implementation between European localities (Prendeville et al., 2018; Bourdin et al., 2022). Questions of CE territorialization have thus prompted interest from the fields of spatial planning and human geography, aimed at unravelling the embeddedness of the CE in urban and regional institutions, social networks and entrepreneurial and consumer culture (Lambert et al., 2022; Beaurain et al., 2023). Still, the majority of studies continue to prioritize European-wide CE policy comparisons (Fratini et al., 2019, Calisto Friant et al., 2023), skimming over a closer analysis of the territorial measures needed to implement CE activities (Marin et al., 2020). Questions of land provision and spatial infrastructures for the CE are rarely explicitly addressed in this debate.

Land, however, and this is the underlying argument of this paper, is a fundamental factor shaping the implementation of CE transitions. In the current capitalist model, land is a highly contested resource, remaining oriented toward the highest financial return on investment. Emerging circular initiatives in the construction or waste sector that form the basis of a closed-loop material economy, do not always conform to traditional economic valuation criteria, and therefore tend to be most affected by land value dynamics that prioritize higher returns, such as housing or high-tech industries. While public institutions can hold the power to safeguard these circular spaces through

spatial intermediation and land ownership (Bourdin & Nadou, 2020), state-driven land revalorisation can equally threaten their emergence and scaling up. Such dynamics raise the question of how circular activities and spaces, such as material reuse companies or circular enterprises (Holmes, 2018), with a potentially high socio-ecological contribution, but low 'financial' point value (Bowman et al., 2014), can be anchored in the city.

This paper therefore proposes a spatial approach to CE territorialisation, focusing on land as an essential resource and contested means of circularity transitions. To this end, a spatial approach signifies looking at how intricacies between circular ambitions, current and future circular land use, and wider development objectives take form in urban space. The research question is posed as: 'How do regional political-institutional arrangements, urban land-value dynamics and the planning system influence the locational anchoring of circular activities within a city?' To answer this question, we first theoretically situate the CE in the urban context and explore three influential dynamics: (i) political and institutional discourses surrounding the integration of the CE in urban development visions (Tapia et al., 2019), (ii) contradictions in territorialisation in terms of underlying activities and land pressure (Ferm and Jones, 2017), and (iii) the role of spatial planning regimes and institutions in facilitating spaces for the CE (Williams, 2021).

We deploy this spatial approach to cases of circular economy hubs (CE hubs) in the Brussels Capital Region (BCR), Belgium. The umbrella term CE hubs captures emerging spaces, shared by start-ups and small and medium enterprises (SMEs) working on circular innovation and experimentation. They do so through themes such as small-scale production, craftsmanship, a local 'makers' culture and social entrepreneurship. With some of these projects holding an uncertain, temporary future within the city, this paper studies how territorial CE policies, land-value dynamics and development coalitions affect the spatial anchoring and durability of these hubs in cities' wider urban redevelopment. This directly corresponds to a gap in case-study-oriented research that examines synergies and conflicts between co-existing development visions surrounding the CE (Williams, 2021).

Methodologically we explore these dynamics through a qualitative intra-urban case comparison (MacFarlane et al., 2017), drawing on 17 semi-structured expert interviews with key stakeholders from the public and private sectors involved in developing CE hubs, alongside a critical policy document and spatial plan analysis. Our findings demonstrate the diversity of spatial experimentation that is evident in the territorialisation of the CE within one city. The term spatial experimentation denotes the range of stakeholder interests and planning contexts shaping experimentation in

the forms of land provision, and the strategic role of CE hubs at the neighbourhood or city level.

For Brussels, we have identified three ideal-type pathways, namely an anchoring, a transitory and a transformative pathway. These combinations are a result of land ownership structures (public versus private) and stakeholder expectations that play an instrumental role in influencing CE hubs' primary orientation towards ecological, social or economic goals, as well as questions of durability regarding their temporary or permanent nature. We further find that public institutions perform a dual role, both sheltering the CE as well as deploying more entrepreneurial strategies through the use of spatial planning instruments. Overall, the paper seeks to open the debate on the variegated territorial emergence and embeddedness of circular hubs in post-industrial cities.

Territorially embedding circular economy spaces in urban transitions

The following sections outline how the CE concept can be integrated and coupled with visions of urban (re)development. We outline links with critical voices on the mobilisation of the CE for urban territorial competitiveness, as well as shared concerns with the effects of neoliberal urbanism. Delving into the territorialisation of the CE, we highlight how the CE draws on longstanding debates surrounding the spatial needs of productive industries and questions regarding land valorisation. An overview of the first examples of land use and planning tools for circular activities provides the theoretical underpinnings of our study.

Opportunities and compromises: linking circularity discourses with urban development visions

Transitioning away from conceptualisations of the CE as a small-scale business or material innovation, scholarship from spatial planning and human geography increasingly views the CE as a model for urban development that has the potential to reshape cities towards a more socio-ecologically durable future. At the forefront of a territorialised CE understanding lies the concept of 'circular development' (CD), which is concerned with the processes through which land and infrastructure are mobilised for the CE (Williams, 2021). At the core of this argument remains the understanding that the CE is intrinsically connected with wider urban issues, and CD processes thus have to be analysed in connection with wider urban (re)development dynamics. Here, two main directions for scrutinising local CE implementations emerge. One covers the

strategic and policy dimensions, concerning “governmental dilemmas, compromises, and opportunities” (While et al., 2004, p.2) that emerge between conceptualisation and implementation. The second angle covers the spatial scale and asks about the contradictions, tensions, limitations and practices (Kębłowski et al. 2020) that emerge in territorialisation.

Regarding the first policy dimension, a proliferation of the dominant model of neoliberal urbanism (Peck et al., 2013) that supports the city as an accelerator of land and property values in the form of property-based privatised Keynesianism is evident (Engelen et al., 2017). Here, market and entrepreneurial state actors, in their retreat from public provision (Engelen et al., 2014), show a tendency to integrate ecological objectives into growth-based urban development models (Winter and Lee, 2020). Characterised as an “urban sustainability fix” (While et al., 2004, p. 551), environmental protection and ecological concerns are selectively narrowed to those that sustain continuous cycles of capitalist accumulation (Harvey, 2002). Due to the fuzzy nature of the circularity label, researchers have warned of the similar occurrence of an ‘urban circularity fix’ (Kębłowski et al. 2020). Such concerns point to the role of state actors in discursively mobilising the CE for economic gains and positioning their cities as frontrunners of European territorial competitiveness (Fratini et al., 2019; Marin & De Meulder, 2018). Secondly and crucially, urban circularity fixes correspond to a clear territorial agenda. Rather than deterring urban development, circularity discourses risk becoming deployed as drivers for redevelopment (Bassens et al., 2020; Martin et al., 2019). Transformations of the urban environment under the CE thus potentially act as a form of urban entrepreneurialism in the remaking and ‘cleaning up’ of declining urban or ex-industrial areas for capital investment (While et al., 2004).

Pushing beyond a mere critique of neoliberal urbanism, other contributions seek to reimagine how urban development can be coupled with the socio-ecological objectives of the CE. The foundational economy (FE) (Bowman et al., 2014), which proposes a transition away from a linear or singular economy (Russels et al., 2022) offers one particularly fruitful vantage point. Ambitions for circular spaces tend to reference ideals of the ‘grounded’ city, that refocus “the city as a space for collective civic provision, which meets social needs” (Engelen et al., 2017, p. 408). Circular spaces refer to urban land plots that accommodate companies working within the circular economy. In terms of the more material FE that underlies circular companies this includes activities aimed at closing material loops locally through storage, reuse and reuse, but also the local production of goods and services that renders these companies relevant employers in socio-economically disadvantaged neighbourhoods (Martynovich et al., 2023). Similarly to the FE, ‘productive city’ debates launch a critique of how neoliberal urban development has resulted in a systematic omission of

(semi)industrial functions in the city, arguing for the protection and reintegration of sufficient spaces for production and foundational activities in urban areas (Bouwmeestermaîtrearchitecte, 2018; Architecture Workroom Brussels, 2016). Retaining low-skilled jobs, urban manufacturing and reviving production through the CE would thus provide the impetus for a more grounded, diversified and socio-economically resilient city (Ferm and Jones, 2016).

Contradictions and tensions: land-value and use dynamics in grounding the circular economy

Yet, clear contradictions surround the territorialisation of CE. The very activities and businesses that appear to be desired and required for foundational circular urban transitions, struggle to find a place in the city (Hausleitner et al., 2022). While parallel to the knowledge economy renewed interest in “urban manufacturing and small-scale production or craftsmanship” (Ferm et al., 2021, p.) is occurring, manufacturing is threatened by a lack of space to accommodate these activities. This is particularly hard-hitting for circular practices and start-ups that rely on a distinct spatiality in their approach. For example, companies working with waste recycling or construction materials tend to “cluster in the few remaining pockets of industrial land in the central city” (Ferm et al., 2021, p. 351). Their urban location and agglomeration dynamics provide them access to customers, labour markets, suppliers and vicinity to production sites (Ferm & Jones, 2017). Intangible resources too, like place-specific knowledge and decade-long cemented relationships of trust between suppliers have emerged out of the city (De Boeck et al., 2020). Land, therefore, underlies both circular ambitions, and their accommodation in the city.

However, processes of industrial gentrification (Curran, 2007) or ‘managed decline’, as in the cases of London (Ferm & Jones, 2017) threaten these activities to lose their place in the city due to land valuation dynamics that orient the use of land toward the highest financial return. In the majority of cases, this entails a strategic shift from production and heavy industry to residential developments to meet governmental housing targets. Initiated through strategic zoning, this frequently entails industrial land conversions to mixed-use zones (De Boeck & Ryckewaert, 2020) under the guise of integrating more ‘human-scale’ production spaces with living quarters. Loss in production and manufacturing space can thus be attributed to governments’ deliberate place-making strategy through real estate speculation and zoning (Ferm, 2016) and threaten the emergence of circular projects, struggling to economically compete for land. Political and socially constructed convictions that production in the post-industrial city presents an inefficient and ‘dirty nuisance’ standing in the way of

achieving the highest possible land use value (While et al., 2014) further accelerate these dynamics.

By contrast, the more innovative aspects of the CE, such as novel business models and technological innovation, are often considered compatible with real estate dynamics. This alignment favours 'clean' CE activities with a strong economic or entrepreneurial focus, making them attractive for integration in mixed-use developments. However, this selective integration poses the risk of creating 'post-industrial' value creators (Stehlin, 2016), in neighbourhoods targeted for redevelopment, through activity prototyping and artisanal production (Coskun et al., 2022). The result can be "the orchestration of new spaces of sustainability" (While et al. 2004, p. 564) by public actors and development cooperations, which reinforce territorialised elite interests (Kębłowski et al., 2020) and established land (re)valorisation strategies (Marin et al., 2020).

Implementation and practices: diverse spaces for the circular economy

In the territorialisation of the CE, land is more than a mere backdrop, and instead takes centre stage in 'making circularity happen in urban space', requiring a closer scrutinization of land as an agent in the processes of territorialisation. The term 'territorialisation' depicts the "dynamics of translating visions into action through contextual planning processes, where policy visions become attached to particular places by establishing a territorial logic" (Lukkarinen et al., 2023, p. 60). This provides a two-fold impetus for research, inquiring both about the translation of transformative visions into the planning system, and their subsequent translation into space through the planning system (ibid.).

Important institutional actors that make up this socio-political framework for the implementation of the CE (Corvellec et al., 2022) are the planning system and public institutions, such as municipalities (Bourdin et al., 2022). In anglophone contexts, private interests and market-oriented approaches are the dominant mechanisms for the provision of land for the CE. In continental Europe meanwhile, governments still tend to take a rather segmented approach to urban planning for the CE (Calisto Friant et al., 2023). A positive example of the prominent role of public land ownership and land management is evident in France. There, local authorities have obligations to use their competencies for economic development and regional planning. As such, public actors engage in spatial intermediation by facilitating their land, creating organisational proximity between stakeholders for the implementation of innovative services and educating on urbanism regulations (Bourdin & Nadou, 2020). Additionally, they can take out land from the market or through circular zoning requirements

require the inclusion of socio-ecological objectives in land provision (ibid; Williams, 2022).

In terms of the actual usage of these instruments, and insights into the spatial accommodation of the CE, a European-wide comparison of CE implementations at the city level, has outlined three pathways of land provision and circular urban development. These are the (i) city-regional, (ii) temporary-experimental and (iii) the eco-district pathway (Williams, 2021, p.96). For the spatial materialisation of the CE, the city-regional and temporary experimental pathways are particularly relevant. The former repurposes (industrial) sites and buildings for circular activities, allowing the city to accommodate circular initiatives in an adapting urban context. In Paris, where this pathway focused on construction and food waste, a surge in deconstruction sites and logistics centres in urban peripheries occurred. Material hubs or circular makers spaces in Leuven (Belgium) are further examples that have been facilitated through public land leases (Van den Berghe & Vos, 2019). The pressing need for land in a space-scarce city is also at the centre of the temporary experimental pathway, where temporary planning permissions are used as an instrument to test and experiment with circular activities (Williams, 2021). The next sections explain how such dynamics of spatial experimentation were analysed in the case of Brussels.

Methodology: towards a spatial approach of circularity

Brussels, from a post-industrial to a circular city?

The Brussels Capital Region (BCR), the capital of Belgium, provides a rich case study for circular development, due to its multi-sectoral CE strategies and its heritage as a post-industrial city that continues to shape the land value dynamics underpinning CE spaces. Following the European Union's first Circular Economy Action Plan (CEAP) in 2015, Brussels published its own, voluntary Regional Circular Economy Program (PREC) in 2016 (be.circular, 2016). The program outlined a holistic and territorial conceptualisation of the CE, with a focus on local employment and circular construction practices through the reintegration of productive industries. In 2022, these policies were integrated into the Regional Economic Transition Strategy (SRTE), referred to as the Shifting Economy Plan, presenting a regionalisation of the UN Sustainable Development Goals, the European Green Deal, and the Green taxonomy (shiftingeconomy. brussels, 2022a). Aiming at "the gradual transformation of economic activities in Brussels to contribute to local and global social and environmental challenges" (shiftingeconomy. brussels, 2022b, p.3), these objectives were linked with territorial measures for the region's public bodies (ibid.).

The importance of providing space, and sheltering circular activities from land market pressures, is crucial for the context of Brussels, which presents somewhat of an outlier case of archetypical urbanism, while still being subjected to many of the same pressures. Not immune to rapid processes of deindustrialisation (Orban et al., 2021), 16% of the regions' industrial spaces disappeared in the period from 2000 until 2018 alone (shiftingeconomy.brussel, 2022b, p. 9). Spatially these dynamics concentrated, and continue to do so, in the Canal Zone, an area stretching along the canal from Charleroi to Antwerp, which used to be the main industrial axis of the city.

Having been targeted as a strategic zone for redevelopment since 2015, real estate pressure for residential development there is at its peak. As such, the remaining industrial land, and the Canal Zone at large, fall within an entrepreneurial and property-led urban redevelopment approach, driven by the transversal governance of the Canal Zone and the increasing centralisation of the Brussels planning system. Regional changes in land-use policies and area-based redevelopment plans have introduced housing into previously mono-industrial zones in the form of urban enterprise zones (ZEMUs) (De Boeck et al., 2017), resulting in 35% of productive space conversions into mixed-use areas (perspective.brussels, 2018, p. 60).

Simultaneously, the role of state actors remains crucial, both in governance and spatial influence. As such, the Brussels Canal Zone is still undergoing a rather slow transformation towards waterfront residential development and continues to showcase the spatial presence of industry, a status that can be equated to the substantial presence of state-owned land. These ongoing confrontations between a communicated return of production and the simultaneous valorisation of strategic land represent a bottleneck for the long-term implementation of circular spaces, which rely on established infrastructures around the Brussels Canal.

Intra-urban case studies (IUCs) of CE hubs

Departing from these regional dynamics, our analysis of city-regional CE policies focuses on three CE hubs hosting start-ups working on circular innovation and experimentation: (i) Greenbiz ¹, an incubator for sustainable and circular entrepreneurship, (ii) Circularium ², a hub for local circular entrepreneurship and 'makers' and (iii) Stadsatelier de Ville ³, which is currently developing and will be finalised in 2025 as a production, storage and workshop hub for circular construction. We follow the methodology of intra-urban comparisons that take a comparative approach within one city to reveal territorially divergent outcomes of urban politics (McFarlane et al., 2017). The sampling criteria for these hubs focused on their shared

spatial location around the Canal Zone, yet varied forms of land ownership, which we anticipated to play a role in shaping their territorialisation.

Figure 1. Locations of circular economy hubs in Brussels.



Source: Authors's elaboration, background from © UrbIS - datastore.brussels (CC-BY).

Data collection and analysis

To gather insights into the land dynamics of these spaces, our research methodology reflected the three analytical angles of the research question. To charter the political and institutional visions driving Brussels CE territorialization, regional strategic CE programmes (PREC & SRTE) were analysed. For an understanding of the wider land dynamics and redevelopment visions framing CE hubs, we analysed strategic and regulatory spatial plans and planning tools at the regional and municipal level. This included changes in land use designations in the Regional Land Use Plan

(PRAS), the Master Development Plan (PAD), which outlines areal urban redevelopment, and the Neighbourhood Contracts for Urban Renewal (CRU) that showcase the concentration of public investment in areas of interest (perspective.brussels, n.d.a).

Additionally, we performed 17 semi-structured expert interviews. The interviews focused on key stakeholders, who were selected according to the research objectives. For example, management entities, public landowners and private developers were asked about contradictions between CE discourse and implementation around the Canal Zone. Municipal and regional authorities responsible for urban development were questioned about the role of regional development visions and planning instruments. Overall, the interview guide was structured to inquire about land value dynamics, the role of redevelopment plans, the hub's integration in the neighbourhood and connections to the CE (see Appendix). The interview process lasted from March until June 2023, in which email contact with one entity, and a total of 17 interviews were collected online via Microsoft Teams or in person. The length ranged from 33 minutes to 1 hour and 49 minutes and all interviews were recorded and transcribed. Coding occurred with the software NVivo and codes were continuously evaluated among the authors. Initially, a deductive coding round took place, with categories constructed from Lambert et al.'s (2022) territorial embeddedness framework that was structured along five dimensions of socio-spatial, economic, cultural, financial and institutional embeddedness of a localising CE. As the land dimension crystalized, a second inductive analysis brought up emergent themes, such as land ownership and the role of the planning system that were added as categories to the final coding tree (see Appendix).

Table 1. Interview sample.

	Sector	Profile
Interview 1	Private company: management temporary occupation	Project manager
Interview 2	Private company: management temporary occupation	Project manager
Interview 3	Real estate subsidiary of private company	Head of asset
Interview 4	Private developer	Project manager
Interview 5	Private company second-hand car trade	CEO
Interview 6	Civil society: citizen representative	Employee
Interview 7	Private company	Project manager
Interview 8	Urban centre of expertise & regional planning agency	Employee: Team territorial knowledge
Interview 9	Urban centre of expertise & regional planning agency	Employee: team temporary occupation
Interview 10	Non-profit organisation	Project manager
Interview 11	Fablab	Employee
Interview 12	Circular hub	CEO
Interview 13	Public entity	Director- Head of service
Interview 14	Circular start-up/Founder circular hub	Co-founder
Interview 15	Circular start-up	CEO

Interview 16	Public company for urban development	Head of economic expansion
Interview 17	Public environmental and energy agency	Coordinator for economic transition

Source: Author's elaboration.

Anchoring circularity in the city: processes of territorialisation

The following sections present the empirical findings linking policy and conceptual circularity ambitions with actual case study implementations. These findings are structured along three analytical angles, which constitute the spatial approach towards understanding involved actors and diverse processes of CE territorialisation in an urban setting.

Political-institutional policy visions for localising the circular economy

Brussels current political outlook on the Circular Economy (CE) stems from ongoing debates regarding the region's economic development, spatial planning, and urban land use. Studies commissioned by regional bodies, such as "Productive City Brussels" (Bouwmeestermaîtrearchitecte, 2018) and the "Observatory of Productive Industries" (perspective.brussels, 2018), which have consistently highlighted the rapid and actively instigated disappearance of productive spaces, particularly along the Western Canal bank (perspective.brussels, 2018). The BCR government and public institutions are thus keenly aware of the specific challenges concerning the availability of spatial infrastructures in transitioning to a circular economy. The emergence of CE spaces in Brussels can thus be seen as a response to bridging the gap between remaining production, and emerging CE processes. Each of the three case studies represents local efforts to integrate the region's industrial heritage with various CE motivations and local priorities, such as optimizing material flows, reintegrating production and fostering local employment.

Table 2. Overview of the three cases.

Case studies	<i>Stadsatelier de Ville</i>	<i>Greenbizz</i>	<i>Circularium</i>
CE-Focus	Building and construction materials Future wood cluster	Sustainable and innovative entrepreneurship Cross-sectoral (production, food, consulting, etc.)	Local production, craftsmanship Cross-sectoral (building materials, food, etc.)
Organisational structure	TM Stadsat: SPV between BC Materials & Democo	Greenbizz entity, shareholders: BCR government, Citydev, Buildwise	D'Ieteren Immo Managed by Makett

Funding	No public funding for CE-hub BC Materials as co-founder (regional funding): BBBC 2023, BeCircular 2019, Lauréat SE'NSE-fund 2019, Hub.brussels Award Start 2019, Vlaanderen Circulair 2019	European FEDER grant Cityfab (annexed) public subsidy by the Maron & Trachte Cabinet: Minister of the Climate Transition and Secretary of State for Economic Transition (Shifting Economy) and Scientific Research since 2020 Start-ups in Greenbizz: be.circular funding	No public funding for CE-hub Start-ups in Circularium: Hub.brussels & be.circular, R&D Innoviris
Start date	Start concession: March 2023 Completed building: 2025	2016	2020
Lease	Concession: 30 + years Possibility for 3 × 10-year extensions	Concession: 30 + years Possibility for 3 × 10-year extensions Production workshops: 9 years Offices: 3-5 years	Temporary occupation until 2025 Possible extension until 2030 +
Plot size and rate	5.500 m2 Rate of 10,78 euros/ m2/ year + index + provisions (fixed at 2,5 euros/ m2/year)	Production workshops 5.000 m2 Offices: 2.500 m2 Starting at 840€/month for a 120m2 workshop	20.000m2 Rate of 30 -70 euros/ m2 Profit to D'leteren Immo
Landowner	Public: Port of Brussels	Private for-profit with a public mission: Citydev	Private for-profit: D'leteren Immo
Location & Zoning	Port Business Park (previously TACT), Western Canal Bank Industrial zone for port and industrial activities	Tivoli Green City, Western Canal Bank Zone of high mixity (min. 50% residential)	Heyvaert Neighbourhood, Eastern Canal Bank Zone of high mixity (min. 50% residential)
Activity orientation	Combine production, distribution, material innovation, and workshops	Profitable start-ups in the launching and development phase Support companies in transition	Support sustainable forms of entrepreneurship, local production/makers
Tenants	Main tenants: BC Materials & Democo Preliminary: Sonian Wood Coop (currently in Circularium), Natura Mater, Tournevie	38 + Cityfab (cross-sectoral)	27 (cross-sectoral)

Source: Author's elaboration.

The first case, Stadsatelier de Ville, centres on the foundational aspects of the CE, addressing themes of urban production and objectives for the relocation of industrial activity into the city. Being a project of BC Materials, a start-up focused on the reuse of excavated earth, Stadsatelier as a future circular construction hub is emblematic of the company's wider aim to transition to circular construction, thereby tackling one of six targeted sectors from the Shifting Economy Plan (SRTE 2022a, p. 33). Stadsatelier de Ville also works as a wider educational platform for knowledge production and exchange on circular construction techniques, reflecting BC Materials' ideology of being a catalyst for change, by enabling synergies between start-ups with a focus on innovation in different building materials, as "we really believe that no single material

can really change the construction sector and the bad impact that it has" (Interview 14).

To enable these synergies, spatial measures are crucial, as reflected in regional ambitions for 'territorial logistics'. This approach entails the reuse and re-localisation of building materials in the region by fostering agglomeration dynamics between construction companies, the "construction of a material consolidation centre" (SRTE 2022^a, p.92, 127) and a smart logistics hub along the Canal. Agglomeration dynamics, however, are only possible if start-ups are accommodated central to the Canal, which is central to fostering circular practices.

"There is a kind of locality in our approach. We are here in the city where we can produce with these local materials, we have a lifespan of markets but at the same time it's not infinite, it's not like an IT project that you just can sell and scale everything." (Interview 14)

As this example demonstrates, spatial proximity to demolition and construction sites from which materials are sourced, and access to networks of distributors, craftsmen and local customers is crucial. Stadsatelier thus responds to the material territorialisation of the CE through the localisation of material flows, and production spaces coupled with circular ambitions, underlining regional ambitions to "pursue the transition of the construction sector towards a circular management of resources and construction waste" (SRTE 2022a, p.126).

The second case, Greenbizz, draws explicitly on an economic vision of circularity focused on raising and supporting circular entrepreneurship in the region, with socio-ecological goals taking a secondary role. The project's initial idea for a wood cluster, for instance, had been abandoned in favour of a more profitable incubator structure (Interview 16). Its relevance as a strategic and exemplary project pertains to this economic focus that is underlined in the regional programs. Within the PREC, Greenbizz was outlined as a regionally supported "host infrastructure specifically dedicated to environmental and CE professions" (be. circular, 2016, p.21). Within the current Shifting Economy plan, the incubator is named exemplary of "developing an ecosystem conducive to entrepreneurship" (shiftingeconomy.brussels, 2022b, p.4). Spatially, firms located at Greenbizz focus on extending their impact within Brussels (e.g., reusable diapers in Brussels nurseries), or limit it to scaling up in Belgium:

"These companies develop quite slowly, it's not easy for them and next to that, most of them are in a quite local business. So, they won't expand a lot, but it's quite a local impact they will have. So, the customers, they are in the neighbourhood or in around Brussels or Belgium, not further than that." (Interview 12)

Its importance will be further strengthened by the development of Greenbizz II, which is planned for 2026 as an adjacent multi-floor business park with “strong circular ambitions” (Interview 12) that will host start-ups in craft, industrial or high-technology sectors.

The third case, Circularium, represents a mix of the prior two cases in terms of activity while contributing a social component. Its broader approach to the CE includes circular innovation across sectors (i.e., food, materials and fashion) through socio-ecological entrepreneurship. As part of these newer ‘human-scale’ production spaces it seeks to contribute to the reintegration of production and the positioning of Brussels as a ‘makers city’. The more social dimensions of the hub are evident in its annexed Free Shop (Magasin Gratis) which provides free furniture and clothes to residents, and through some of its companies working on employing disadvantaged people in the labour force. One of the construction companies, Konligo, collaborates with Mariasteen and Salto, both organisations aiming to reintegrate neighbourhood residents in precarious situations into the labour market (Interview 15). Further, as part of the regional Renolution cluster, Circularium also hosts social training and employment workshops. Its socio-ecological ambitions thus align with regional objectives to protect citizens by providing quality jobs in the transition to a social and inclusive economy, aiming at the inclusion of workers and the training of job seekers through precisely such social enterprises (SRTE 2022a).

Territorial approaches and landownership dynamics around the Canal Zone

All three CE hubs correspond to different political motivations and exhibit a diversity of circular foci that span the material (ecological), economic and social dimensions. A shared denominator is their propensity toward locating along the Canal Zone, augmenting the need for accessible and affordable land in that area. As evident from policy documents, the government understands that a lack of spatial infrastructure (e.g., material storage sites) and land scarcity in the Canal Zone represent the main bottlenecks in enabling a local CE transition (STRE 2022a). For the remaining brownfield and industrial land in the Canal Zone, the PREC thus stipulated the implementation of circular ambitions in land use to “enhance this regional tool for urban distribution, in particular by developing pooling services and integrating the principles of the CE” (be.circular, 2016, p. 49). The availability of land for circular projects is also included in the Shifting Economy plan. Here, the programme suggests a form of spatial intermediation “through the provision of land, the leasing of buildings or accommodation through regional public landlords” (shiftingeconomy.brussels, 2022b, p. 7).

For large landowners working within a public vision, such as the Port Authority, an entity with the City of Brussels municipality and the Brussels Capital Region as shareholders, and Citydev, the private regional urban development body, circular criteria are outlined in the 2021-2025 New Management Contracts. These stipulate “the priority of supporting companies that are part of, or committed to, an economic transition process, in particular de-carbonised and circular” (ibid., p. 7-8). Additionally, for land concessions, the government provided circular tendering criteria through a point-scoring system that rates the sustainability and circularity of future companies. In the case of Citydev, higher point scores lead to a rent reduction for socially or ecologically exemplary companies (Citydev, 2023). Further objectives, such as the pooling of services, are evident in the 2040 Port Master Development Plan, which entails the development of clusters and synergies between similar companies, for example through the creation of a construction logistics hub (next to Greenbizz and Stadsatelier) at the Vergote dock (port.brussels, 2019). These plans introduce a new perspective on public tendering by demonstrating the potential role of strategic regional programs that include regulatory territorial measures to support circular activities. As a consequence, in the Canal Zone where an average of 20,000 square metres of land becomes available yearly, the Port Authority subscribes to keeping a forward-looking approach in its land use. While market demand remains important, they also take an active role in anticipating ‘trends’:

“And so we are quite a small port, we only have 80 hectares within Brussels, so now whenever there is space available we work with it (...) we work with concessions, and we do a public tendering, with criteria where you have quite a big emphasis given on the circularity and also the importance of new activities that can complete the offer that we give to Brussels.” (Interview 13)

This support of providing land is most evident in the case of Stadsatelier de Ville, which exhibits a direct form of public land ownership. The spatial trajectory of the future hub started in 2019 when BC Materials was given a temporary lease for a vacant brownfield site just outside the Port Business Park (previously TACT). With their lease being limited to a year at a time and the land set for redevelopment, BC Materials was left with little security over how they could continue accommodating their expanding spatial needs for production. After conveying their need for the long-term availability of a larger land plot to the Port Authority, they applied for the public tendering of a vacant 5,500 square-metre plot at the Port Business Park. This new plot proved to be a long-term solution, as land in the industrial business park is rented through emphyteutic leases, also called concession agreements. A standard practice for public land in Francophone contexts, and equally in Brussels, this lease provides para-

ownership rights for a long-term period of a minimum of 30 years, and the possibility of three further 10-year extensions. In this specific case, the rate amounted to €10.78 per square metre, which given the size of the land plot, was still financially unviable for BC Materials to develop on their own. As a result, and after a lengthy search they found a financing partner in Democo, one of Brussels largest private contractors, and applied for the concession through the established special purpose vehicle (SPV) TM Stadsat. Although land value, in this case, remained fairly regulated and on the more affordable end, this case nevertheless highlights the lack of available spatial infrastructure for circular companies and the continuously rising real estate pressures exerted upon productive and circular projects. Staying in the city, for small-scale CE enterprises thus means engaging in (spatial) synergies by pooling in other start-ups or private partners.

“So, if you don't mind working together with a number of partners it's going to be very difficult for circular start-ups, who were usually born in the city because it's the help of creativity, because there are a lot of innovation in the city. They are driven out towards the borders of the city because the space is cheaper.” (Interview 14)

Nevertheless, at the base of the success of a material-focused circular company remaining in the city, is public landownership. The Port Authority thus remains an important facilitator of public land for innovative yet low-yielding companies, sheltering them from industrial, or residential, displacement.

A similar long-term land concession agreement is also found in the case of Greenbizz, which is located in the mixed-use Tivoli Green City neighbourhood, next to the Canal. There, the land is provided by Citydev. Citydev is a profit-oriented public service company created in 1994 by the order of the BCR government and originally tasked with attracting economic enterprises to Brussels. Continuing this mission, in 2016 the real estate portfolio of Citydev amounted to 200 hectares of land and park for businesses, and 122,300 square metres of premises for economic activities (be. circular, 2016, p. 51). Aside from its economic focus, the company has become best known for its social housing and mixed-use projects, often being the ‘first institutional gentrifier’ in low-income neighbourhoods. Being the most influential (re)development company in Brussels and having been granted autonomy from the region in its decision-making process, the company takes a private sector approach to urban development. Despite the profit orientation of Citydev, the land of Tivoli is nevertheless leased to Greenbizz in the form of a long-term concession agreement of 30 years, renewable up to 90 years (Interviews 12 and 16).

On the opposite spectrum of land availability is Circularium, which highlights the variety in durability that circular spaces can take within one city as a result of different

(land) ownership structures. Founded by D'leteren, one of Belgium's largest private companies, Circularium is a relatively recent temporary project situated in the company's former Automotive Centre, which became vacant when the car trade was relocated outside the city. Opened in 2020 by D'leteren Immo, the companies' real estate subsidiary, Circularium presented an economic opportunity to repurpose the existing building (and avoid vacancy taxes), through a change in functions more in alignment with current regional ambitions for a cleaner and circular economy. In the case of this land plot, the envisioned change in discursive and spatial functions is indicative of the wider spatial dynamics framing the case. Embedded in the central urban Heyvaert neighbourhood, located between Brussels train station to the South, and the Canal to the North, the area has long been stigmatised as an arrival neighbourhood known for second-hand car trade to Africa. With decade-long plans for redevelopment in the pipeline, the CE hub was D'leteren answer to the unclear development trajectory of the neighbourhood. Uncertainty about the plot, but also the viability of circular start-ups, explains the temporary nature. Managed by the private company Makett, the building was initially made available to start-ups for a maximum duration of five years. According to the owners, the decision for a five-year occupation was taken for two reasons. Firstly, in the realm of temporary use, five years still provides a degree of security to the productive actors that they wanted to attract to the space. Secondly, financially, D'leteren that works with an invest-and-hold strategy and already owns the land for 70 years, prefers to wait for wider redevelopment of the neighbourhood, while continuously assessing the redevelopment potential of their plot.

"There is a lot of exchange with the neighbourhood and that is the most important there, to create a link between that kind of activities and the neighbourhood. But no concrete plan yet, we will wait and see, well not wait. Circularium is good and it really allows us and brings opportunities. Last week I had some talk with the city of Grenoble that is interested and the city of Montreal that wants to meet us also, so I think it is a good example. We can say that it is a success." (Interview 3)

With the project now being valued at around €1 million and being cited as a clear success story as Brussels emblematic flagship project, an informal agreement is in place that Circularium will be extended by another five years until 2030.

Spatial integration in neighbourhoods and planning systems

A closer look at the three cases hints at the apparent contradictions between communicated circular ambitions and their implemented territorial measures, and property-led redevelopment ambitions. In tracing the territorialisation of the CE, therefore a closer look at its materialisation through the political-spatial framework is warranted, concerning, in particular, the role of the planning regime and its application by public institutions.

Brussels over the years, has seen an increasing centralisation in its planning system, reinforcing the role of the regional planning agency, *perspective.brussels*. Created by the BCR government, the organisation is responsible for translating the government's political and economic visions into regional and area-based spatial plans, providing strategic visions for urban redevelopment. One of their teams for territorial strategy is tasked with drawing up the Master Development Plans (PAD), which while derogatory to the Regional Land Use Plan (PRAS), outlines regulatory redevelopment plans and spatial frameworks for priority intervention areas (*perspective.brussels*, n.d.b). Regarding the priority intervention areas, and planning visions overall, the spatial overlap between political redevelopment ambitions and territorial targets for the CE quickly becomes evident to be focused on the (post) industrial Canal Zone:

"The Brussels Planning Office and the Urban Development Company will ensure that the foundations of a circular economy are built within the 10 priority development centres and the territory of the Canal by allowing the development of integrated productive activities, diversified at the neighbourhood level (...)" (*be.circular*, 2016, p.3)

The implementation of this vision is carried by a transversal governance team consisting of the Chief Architect (*Bouwmeester*), *perspective.brussels*, *urban.brussels*, which issues building permits, the urban development cooperation (SAU) and the responsible municipalities. With various visions for the redevelopment of the entire zone existing simultaneously, different positions in the application of planning and zoning instruments for the three cases are evident.

For *Stadsatelier de Ville*, its activities are sheltered by the regional land use plan, with the Port Business Park zoned as an "industrial zone dedicated to port activities and transport" that does not allow the development of any commercial or residential activity (*perspective.brussels*, n.d). Its industrial zoning thus protects the land for logistics and production and makes space for lower-yielding activities of the CE. Aside from a smaller plot at the South Biestebroek dock, the Port Business Park remains the only largest remaining monofunctional industrial land plot in Brussels urban centre, as most of the Port's functions have been located North outwards of the city.

Greenbizz, while still protected through a long-term concession agreement, is already located in a mixed-use zone, as the Tivoli neighbourhood since has been zoned in the Regional Land Use Plan as an area of “high-mixity”, where a minimum of 50% housing is mandated. In newer applications of the PAD, where the redevelopment and rezoning of land entail the conversion from industrial to high-mixity zones, production spaces are required on the ground floor of new developments (perspective.brussels, 2021). For the Tivoli neighbourhood, however, production and commercial activities are located within a single multi-level incubator that bridges bordering industrial activity and residential developments in the area. Evident from these two cases located next to the Canal, is that land for CE hubs has been made available either through the protection of mono-industrial zones and management contracts that set out the targeted provision for circular land use, or through their integration within mixed-use developments, which works especially well with more entrepreneurial office activities, as in Greenbizz.

In the case of Circularium and Heyvaert, however, regional political pressures for residential development appear to override ambitions for circularity. The land plot on which the circular hub is located, currently characterised by industrial and economic usage, has within the PRAS and 2021 PAD Heyvaert been zoned as a plot of high-mixity (perspective.brussels, 2021). Thus, any future development taking place runs the risk of favouring residential development and is especially detrimental to single large-scale productive plots. Even for the private owner, an industrial player, the dichotomy between regional visions for production or circularity and the prioritisation of residential development for the area is evident.

“It is a bit astonishing because the authorities always speak about the productive city, but they prefer to get residential development, rather than productive industries, workshops, and production. Yes but of course, for a real estate developer, it is good, but we don’t really think that is the best way to do it and put a lot of residential at one time.” (Interview 3)

This hesitancy of the private sector to develop residential housing in Heyvaert lies in the uncertain political-economic conditions framing the redevelopment vision and timeline, and perceived low investment returns that lead to a situation where “rugged pioneersmanship is tempered by financial caution” (Smith, 2005, p. 21). The temporary nature of Circularium corresponds to yet another recent territorial agenda of the Brussels government. Since March 2023, perspective.brussels and Citydev have formed a “temporary counter” that gives an overview of vacant land plots for public tendering in the region (temporary.brussels, 2023). Frequently criteria for these concession agreements include social or ecological ambitions and are seen as experimental

grounds for circular projects (Interview 2). Circular land use in areas of redevelopment thus appears to be restricted to temporary use or threatened by the opportunistic behaviour of the private sector at large, which is slowly framing Heyvaert as a real estate frontier (*ibid.*).

Conversely, however, the redevelopment of Heyvaert is equally strongly driven by the entrepreneurial behaviour of public institutions, which aim to reconcile the districts' unwanted industrial heritage with imaginaries of the CE. This demonstrates the social discourses and power dynamics driving the development of circular spaces. For Heyvaert, which has long been stigmatised by the municipal and regional governments for its car trade and traffic contestation, various future scenarios, such as 'Productive Heyvaert' have been on the table in discussions on selecting the appropriate change in functions and social connotations of the area.

Ultimately, having taken stock of Circularium and similar productive-entrepreneurial spaces in Heyvaert, the municipality of Molenbeek, one of the three municipalities governing Heyvaert, recognised the demand and economic prospects of these spaces. There are now vested political interests to mobilize the CE for Heyvaert's rebranding as a circular district. Most evident is the 2022 application of the municipality of Molenbeek for the 2020-2028 European Regional Development Fund (ERDF) with the project "Federation Heyvaert" as a local economic transition project. The project would link the local economy, one of the cornerstones of the Shifting Economy plan, with circularity ambitions (Molenbeek, 2022). While CE ambitions are rather hidden between the lines in redevelopment contracts such as the CRU, one could argue that the private initiative by D'leteren represented the necessary push that put the CE label on the map for policymakers and planning institutions as an opportunity for discursive and spatial change. This political 'circular' redevelopment strategy, however, risks that the CE becomes an empty signifier that encourages the production of a clean city, devoid of prior industrial traces. While Circularium is thus built on visions of local production and makers, its ambitions of circularity appear incompatible with the already existing 'productive' activity embodied in the informal car trade.

Discussion

Our findings demonstrate the importance of a spatial approach in analysing the implementation of circular objectives at the urban level, highlighting the variety of actors, motivations and scales influencing processes of CE territorialisation. Foregrounding the spatial aspect is particularly pertinent, as dominant territorialisation discourses continue to privilege European-level governance comparisons, institutional imaginaries (Fratini et al., 2019) and divergences in circular development pathways

between cities (Prendeville et al., 2018), much to the detriment of insights into local-level implementation. As we have exemplified in the case of the Brussels Capital Region, regional institutional discourses and policies for the CE transition theoretically provide coherent guidelines on territorial measures for CE transitions. Yet, as evident from the three case studies of CE flagship projects, their actual spatial accommodation and durability in the urban fabric differs greatly.

These differences in spatial anchoring and socio-ecological orientation of CE hubs that emerge out of a spatial approach converge in a framework of spatial experimentation. Spatial experimentation demonstrates the current status quo of CE implantation in cities, highlighting the intricate links between circular ambitions and urban development visions. Our resulting framework builds on three analytical angles, namely (i) political-institutional arrangements, demonstrating regional CE policies and stakeholder expectations, (ii) urban land-value dynamics, wherein public versus private land ownership is a crucial variable and (iii) the planning system in its application by public institutions regarding zoning and redevelopment plans. Crucially, however, these three angles framing spatial experimentation with the CE, inherently centre on questions of land. At the regional governance level, territorial barriers for the CE are recognised, at the local scale landowners provide varying forms of land availability and affordability, and planning and redevelopment tools have the potential to shape the durability of CE hubs at the plot level and provide larger areal visions for integrating circular projects in urban redevelopment trajectories. Our analysis thus not only foregrounds land as a crucial dimension in CE implementation, but also fills the research gap by illustrating the different roles of urban actors in the mobilisation of the CE for urban development visions (Fratini et al., 2019), through their political, economic, and socio-spatial attitudes of experimentation. The resulting outcomes of these interplays have been categorized as three ideal-type pathways in Brussels.

First, Stadsatelier de Ville illustrates a viable 'anchoring pathway'. In this case, a congruence between regional territorial strategies and long-term land availability is evident, which is implemented through corresponding planning instruments for the provision and protection of land through zoning and affordable land provision through public land ownership. Here, the public landowner, the Port Authority, facilitates land for circular enterprises by adopting land management contracts with circular tendering criteria, as stipulated by the government. By supplying long-term and relatively affordable land, circular start-ups are sheltered by the landowner from the prevailing land pressure around the Canal Zone. Spatially fixed, experimentation here rather concerns how the Port and the hosted circular start-ups had to grapple with changes in their usual ways of working. The Port Authority, while simply acting according to regional objectives in its role as a spatial facilitator of urban land (Bourdin

& Nadou, 2020), demonstrated agency in the active land provision and openness in working with new circular companies. However, even with the industrial plot zoning that provides space for more foundational and low-yielding activities, difficulties in establishing circular infrastructure that does not prioritise economic objectives still prevail. For the start-ups, therefore, the only ways of anchoring themselves in the city involved collaboration with like-minded companies in the form of a hub structure and creating an entity with a larger private player. An anchoring pathway for material-focused circular activities thus can only take place when a strong alignment between explicit political territorial strategies, industrial zoning for productive industries, public land ownership, and collaboration between multiple innovative players is present.

Second, as illustrated by Greenbizz, spatial experimentation can also engender what we call a 'transitory pathway'. Here spatial experimentation takes a more complex approach, as the CE hub is located within a mixed-use zone, where a for-profit urban development company with a public mission, experiments with high-end and entrepreneurial CE activities. Both the focus on innovative and 'human-scale' CE activities and the company's focus on economic development are evident here. While the land for the larger Greenbizz incubator is made available through the same long-term concession agreement that provides for a continuation of the project, this spatial security does not apply to the start-ups hosted inside. With rental leases from three to nine years, lucrative start-ups are only accommodated to the point of having scaled up sufficiently to afford their own space. Greenbizz thus works with the economic incubator logic as a transitory space that is not concerned with the long-term provision of productive space per se. While this form of CE incubator provides an easy leeway for economic players to take part in the transition, its innovativeness arguably lies more on the side of economic experimentation. As this typology of circular incubators is a popular option for CE experimentation in more neoliberal urban politics, doubts about the scope of supported CE activities, their spatial accommodation after departure and the hub's transformative potential remain salient.

The third scenario demonstrates a 'transformative pathway', and shares characteristics with Williams's (2021) experimental-temporary pathway. Circularium exemplifies the complex spatio-temporal position that a CE hub on privately owned land in a redevelopment area can take, illustrating governance dilemmas and spatial contradictions between top-down urban development visions and local circular materialisations. In this case, contradictions are driven by experimentation from the private landowner and the dual role of public institutions. For the private landowner, the project's "spatio-temporal impermanence" (McCann et al., 2023, p. 954) is a win-win situation. The hub's star status as a "temple for the circular economy" (Interview 2) positions the owner as a nonchalant 'fixer' of the CE (Martin et al., 2019). Additionally,

the landowner is able to test the financial viability and prototype this economic niche activity for integration into residential buildings, while media buzz and incoming visitors help reshape the neighbourhood's image ahead of future redevelopment (While et al. 2004). Currently, Circularium benefits from the owners' 'wait-and-see' approach. With the land plot however already zoned for high-mixity, there is a significant risk that existing circular start-ups, most of all productive ones, will be driven out or have to assimilate into mixed-use developments, a move that is surprisingly primarily driven by public institutions and the planning system's zoning changes, rather than by the developer's interests. Simultaneously, at the communal level, the municipality recognises the potential of a circular flagship project in a stigmatised neighbourhood and plans to integrate the CE in an area-based redevelopment approach for the creation of a 'circular valley' around the Canal Zone. This highlights one important distinction between Greenbizz and Circularium. For the former, the term 'transitory' captures the continuous movement of actors through a permanent, yet rather isolated, space. On the contrary, Circularium's transformative character lies in its wider embeddedness, illustrating the wide-reaching potential that the introduction of circular activities can have on the discursive and spatial transformation of neighbourhoods.

As evident from these cases, spatial experimentation occurs equally at the level of individual land plots, as it is an integral part of wider social and cultural discourses envisioning alternative urban development scenarios. Urban planning in itself is part of this process of futuring or visioning (Vermeulen, 2013) that involves the negotiation and translation of political, economic, social - and in this case ecological - objectives into space. Particularly in industrial zones where different visions are at play, identities such as 'productive' or 'circular' compete with more economic value-driven imaginaries. Yet, even within current applications of the CE label, a focus on production and innovation in support of economic development objectives remains evident, much to the peril of the social dimensions surrounding circular consumption and redistribution. While temporary use of vacant buildings or redevelopment sites is a relevant avenue for circular experimentation and should not be underestimated in its capacity to generate alternative discourses and the willingness of governments and landowners to support circular initiatives, these spaces ultimately do not answer to wider problematics at hand. Even more so, temporary socio-spatial experimentation with the CE runs the risk of supporting landowners and stakeholders in capitalizing on current circular projects, while envisioning future returns from circular-inspired land use. Socio-cultural values and expectations therefore form an inherent part of the 'soft conditions' framing circular land provision.

In its broader significance, this research thus invites reflections on how policy and land use can be integrated in a form of circular land management. Particularly in the early stages of the CE transitions, targeted interventions in land value dynamics are crucial. In essence, this calls on governments to include regulatory territorial measures in their circular city agendas, and vice versa, to anchor circular policies in the planning system, be it through land use designations or redevelopment plans. For post-industrial contexts where industrial heritage still showcases a strong spatial presence, the second avenue of tackling redevelopment areas for future circular land use deserves closer attention. Currently however, scenarios of circular land use, both in policy and planning circles, remain frequently associated with large-scale industrial symbiosis, exemplified in the form of Eco Parks at urban borders, or through the repurposing of polluted sites for circular material streams (Amenta et al., 2022).

We argue that on a smaller scale, remaining industrial land plots in areas of redevelopment, showcase great potential for anchoring circular land use. One policy suggestion, drawing on Brussels recent practice of including productive functions on the ground floor of mixed-use buildings, could be to stipulate certain percentages of circular land use in plots that are currently industrial or logistically zoned, and will be under subjection for rezoning. As such, the transition from linear production toward circular infrastructure (coupled with residential developments) could be gradually phased out and would ensure that strategically and historically relevant locations of production circle back to CE companies. Governments will however be tasked with providing 'production-inclusive' circular land use labels, to guarantee the inclusion of more industry-intensive activities and prevent the singling out of 'circular office activities'. In terms of stakeholders too, the role of private companies and privately-owned land is expected to become even more prevalent. Here, complementary to discounted CE land use rates on public land, governments have the opportunity to support CE companies on private land by subsidising the difference between market and affordable land rates through a form of circular land funds and introducing circular licencing for private players. Coupling land provision directly with circular ambitions therefore opens the debate to wider questions of land valorisation that go beyond economic considerations and demonstrates the role of land as a key resource in the realisation of ecological and social ambitions.

Conclusion

This paper has proposed a spatial approach towards the territorialisation of the circular economy, by investigating the processes shaping local materializations of CE hubs in the Brussels Capital Region. Prior research on the territorialisation of the CE

has mainly been concerned with top-down policy discourses on the institutional or economic side of circularity. Our research therefore focused on a comparison of three case studies of CE hubs within one city. Informed by literature that offers foundational and productive critiques of the neoliberal city, we foregrounded access to land as a crucial condition for the implementation of the CE and illustrated the role of various public and private actors within the process. As such, we have provided insights into the diverse outcomes of spatial experimentation in the production of a city's circular transition.

Our analysis leading to a framework on spatial experimentation was structured along three analytical angles, respectively focusing on (i) regional political-institutional CE policy visions, (ii) land value dynamics covering conditions of land ownership, location and lease duration and (iii) the role of planning institutions and tools in a redevelopment context. We found that combinations of these angles resulted in diverse scenarios of contemporary spatial experimentation, with different capacities to 'anchor' the CE in urban space. Three pathways of experimentation were distinguished: an anchoring one, a transitory one and a transformative pathway. Emergent is that the degree of alignment between regional CE discourses and planning visions shapes the viability of circular spaces in the city. Even more importantly, however, the analysis stressed that the question of 'who owns the land' emerged as a crucial condition determining the spatial durability of CE initiatives and their orientation towards social, ecological or economic values.

Spatial experimentation, as a process of CE territorialisation, further illustrated the influence that CE objectives and imaginaries can exert on the direction of urban transformations, and vice versa. In mixed-use developments and strategic areas of redevelopment, there appears to be a tendency for CE objectives to become integrated within growth-driven urban development visions. While we observe both publicly and privately driven experiments to host the CE in mixed neighbourhoods, there is a clear and present danger that these experiments ultimately remain temporary. As such, the risk persists that CE activities are utilised as a discursive driver to reconcile objectives of growth-oriented redevelopment and social and environmental goals. This can install a 'circular fix' (Kębłowski et al., 2020 cf. While et al., 2004) in a move toward cleaner and more desirable areas that push out existing industry. Ultimately, we highlight that the very same processes leading to a loss of productive spaces in cities like London and Brussels, namely re-zoning and real estate speculation (Ferm, 2017) also affect the emergence of circular activities that build on prior industrial heritage and rely on many of the same spatial infrastructures.

At the same time, in urban core areas where industry still prevails, governments were found to implement 'circular planning strategies' through zoning and tendering

requirements for public landlords with the potential to durably anchor the CE in the city. These insights from Brussels chime in with the case of Amsterdam, where research has shown how municipal tendering criteria helped streamline circular construction (Williams, 2021) by linking the release of public land at a discounted rate to circular building requirements. There, local governments did however not demonstrate a willingness to take land off the market to facilitate space for circular activities themselves. Brussels thus presents an interesting case, also in terms of policy recommendations, where land management contracts orientate tendering requirements or rent reductions towards exemplary circular activities themselves. Public land ownership in particular has the potential to shelter the CE from processes of property-led redevelopment, in making space for a more grounded and locally rooted CE. Simultaneously, mere public land ownership in itself is not a sufficient guarantee for foundational agendas since the very public actor may instead be more concerned with entrepreneurial strategies. Therefore, the role of private landowners and companies is expected to take an even more central role in CE transitions. Here, the potential of circular licensing, whereby companies operating on previously industrial or logistically zoned land have obligations for ecological responsibility and social returns to local communities (Froud & Williams, 2019), will be a relevant avenue for future research.

In conclusion, as our research illustrated, circular transitions are rarely the sole goal of CE policies (Marjanovic et al., 2022). Such an understanding implies that we need to be less preoccupied with defining circularity in abstract terms, and instead inquire about the precise urban issues or agendas to which circularity is responding. With this paper, we hope to have made the case for a shift in circular scholarship from a policy-level comparison to a more grounded project-based comparison of circular activities. Such an approach allowed us to contribute to scholarship on circular urban development, by providing a critical view on the spatial territorialisation of the CE, through the lens of land. If conducted and compared on a European scale, this could present concrete insights into how economic, ecological and social problems and priorities are negotiated and materialised. An investigation of these emerging spaces would ultimately enhance our understanding of the inherent complexities of circular cities, which currently represent less of a coherent urban framework and more a web of loosely linked circular projects that are finding different arrangements and pathways of anchoring themselves in the contemporary city.

Supplementary information

Appendix

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