

Dissertation

The role of spatial planning to support circular economy development:

Exploring examples on regional, city and district scale

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English Abstract

This dissertation contributes to the recent scientific debate on the circular economy (CE), the circular city, and circular development. The debate highlights that circular and sustainable development of cities and regions will only be achieved if spatial aspects are adequately considered and integrated into strategic spatial planning and development policies. Spatial planning is an integrative discipline that works on and across different scales. The dissertation specifically aims to deepen the understanding of spatial planning's potential to support circular development processes through its different planning instruments.

Therefore, the dissertation asks how spatial planning can support circular development on different spatial scales and with different planning instruments.

Three independent but interlinked case studies on three different spatial scales were conducted to respond to this question and resulted in three published articles. On the urban-regional scale, an analysis of governance settings (actors, policies, concepts) in six European urban regions identifies and examines current challenges in steering governance processes towards circular development. On the urban scale, a socio-spatial analysis in Hamburg-Altona guided the development of a typology of neighbourhoods, which structures a further analysis of the development process of circular waste management solutions in different urban neighbourhoods. This followed the activities of a participatory process (Living Lab) and reveals how the involvement of local stakeholders contributed to the development and implementation of circularity solutions that meet local requirements. On the local/neighbourhood scale, an ex-post analysis of the experimental project, WiedergeBORN in Osdorfer Born in Hamburg, aims to collect lessons learned from the experiment and identify potentials and challenges for its replication and scaling in Hamburg.

Drawing on the three case study examples of circular developments at urban-regional, urban and local/neighbourhood scales, the framework paper of the dissertation investigates the intersections of circular development and spatial planning instruments at and between different spatial scales. The transition management framework (Wittmayer and Loorbach 2016) is used to structure the discussion of the interactions at different scales via the first three levels of the framework and corresponding to the key findings of each published article: 1) arenas/strategic for the urban-regional scale, 2) agendas/tactical for the urban scale, and 3) experiments/operational for the local/neighbourhood scale. In a further step that is equivalent to

the fourth level of the transition management framework, 'monitoring and evaluation', learnings from the implementation in the experimental project on the local scale (article 3) are derived and connected to the research outcomes on the strategic (urban-regional scale, in article 1) and tactical (urban scale, in article 2) levels to draw conclusions to answer the research question of the dissertation.

Conclusions are subsequently presented along four types of spatial planning instruments, namely 1) strategic spatial planning instruments, 2) informal planning instruments, 3) integrative (socio-spatial) planning instruments, and 4) regulatory (land-use and physical infrastructure) planning instruments. These types were derived for the framework paper, drawing on the work of Williams (2023) and Nadin et al. (2018). The dissertation demonstrates that the role of spatial planning is critical to foster circular development because it provides certain framework conditions and processes by which multi-level, cross-sectoral and multi-actor stakeholders can be engaged and enabled to implement circularity.

Deutsche Zusammenfassung

Diese Dissertation leistet einen Beitrag zur aktuellen wissenschaftlichen Debatte über Kreislaufwirtschaft, Circular City und Circular Development. Die Debatte macht deutlich, dass eine zirkuläre und nachhaltige Entwicklung von Städten und Regionen nur erreicht werden kann, wenn räumliche Aspekte angemessen berücksichtigt und in Strategien räumlicher Planung und Entwicklung integriert werden. Die räumliche Planung ist eine integrative Disziplin, die auf und über verschiedene räumliche Ebenen hinweg arbeitet. Die Dissertation will insbesondere dazu beitragen, besser zu verstehen, welche Potenziale die räumliche Planung hat, um zirkuläre Entwicklungsprozesse durch ihre verschiedenen Planungsinstrumente zu unterstützen.

Die Dissertation geht daher der Frage nach, wie die räumliche Planung die Kreislaufentwicklung auf verschiedenen räumlichen Ebenen und mit verschiedenen Planungsinstrumenten unterstützen kann.

Zur Beantwortung dieser Frage wurden drei unabhängige, aber miteinander verknüpfte Fallstudien auf drei verschiedenen räumlichen Ebenen durchgeführt, die in drei Fachartikeln veröffentlicht wurden. Auf der stadtreionalen Ebene wurden in einer Analyse der Governance-Settings (Akteure, Politiken, Konzepte) in sechs europäischen Stadtregionen die aktuellen Herausforderungen bei der Steuerung von Governance-Prozessen zur Unterstützung einer Kreislaufwirtschaft identifiziert und untersucht. Auf der städtischen Ebene führte eine sozialräumliche Analyse in Hamburg-Altona zur Entwicklung einer Typologie städtischer Gebiete, die eine weiterführende Analyse des Entwicklungsprozesses von kreislaforientierten Lösungen in verschiedenen Stadtvierteln strukturierte. Es folgte die begleitende Untersuchung eines partizipativen Prozesses (Living Lab), die aufzeigte, wie die Einbeziehung lokaler Interessengruppen zur Entwicklung und Umsetzung von kreislaforientierten Lösungen beitrug, die den jeweiligen lokalen Anforderungen entsprechen. Auf der lokalen/nachbarschaftlichen Ebene zielte eine Ex-post-Analyse des experimentellen Projekts WiedergeBORN im Osdorfer Born in Hamburg darauf ab, Lehren aus dem Experiment zu ziehen und Potenziale und Herausforderungen für seine Replikation und Skalierung in Hamburg zu identifizieren.

Ausgehend von den drei Fallstudienbeispielen zu zirkulären Entwicklungen auf stadtreionaler, städtischer und lokaler/nachbarschaftlicher Ebene diskutiert das Rahmenpapier der Dissertation mögliche Verknüpfungen von zirkulärer Entwicklung und Instrumenten der

räumlichen Planung und Entwicklung und zwischen verschiedenen räumlichen Ebenen. Um die Diskussion der Wechselwirkungen auf den verschiedenen räumlichen Ebenen zu strukturieren, wird das von Wittmayer und Loorbach (2016) entwickelte vierstufige ‚Transition Management Framework‘ verwendet. Dabei können die Schlüsselergebnisse der einzelnen veröffentlichten Artikel den ersten drei Stufen des Frameworks entsprechend zugeordnet werden: 1) Arenen/Strategien für die städtisch-regionale Ebene, 2) Agenden/Taktiken für die städtische Ebene und 3) Experimente/Operationen für die lokale/nachbarschaftliche Ebene. In einem weiteren Schritt, der der vierten Stufe ‚Überwachung und Bewertung‘, des ‚Transition Management Frameworks‘ entspricht, werden die Erkenntnisse aus der Umsetzung des experimentellen Projekts auf lokaler Ebene (Artikel 3) abgeleitet und mit den Forschungsergebnissen auf der strategischen Stufe (stadt -regionaler Ebene, in Artikel 1) und taktischer Stufe (städtischer Ebene, in Artikel 2) verknüpft, um Schlussfolgerungen zur Beantwortung der Forschungsfrage der Dissertation zu ziehen.

Die Schlussfolgerungen werden anschließend entlang von vier Typen von räumlichen Planungsinstrumenten präsentiert: 1) strategische Planungsinstrumente, 2) informelle Planungsinstrumente, 3) integrative (sozialräumliche) Planungsinstrumente und 4) regulative (Flächennutzungs- und physische Infrastruktur-) Planungsinstrumente. Diese Typen wurden für das Rahmenpapier in Anlehnung an die Arbeiten von Williams (2023) und Nadin et al. (2018) abgeleitet. Die Dissertation zeigt, dass die Rolle der räumlichen Planung für die Förderung einer kreislauforientierten Entwicklung von entscheidender Bedeutung ist, da sie bestimmte Rahmenbedingungen und Prozesse bereitstellt, durch die Akteure auf mehreren Ebenen, sektorübergreifend und aus unterschiedlichen gesellschaftlichen Bereichen eingebunden und in die Lage versetzt werden können, eine kreislauforientierte Entwicklung umzusetzen.

1. Introduction: Scientific interest, research questions

The cumulative dissertation project aims to examine the need for a spatial understanding of circularity and the circular economy (CE) and, more specifically, to investigate the role of spatial planning in supporting circular economy development.

The dissertation project offered the opportunity to combine the author's experience as a human geographer with a background in socio-economic geography and as a researcher on urban and regional governance. The research interest lies in examining the connection between circular economy and spatial development and, more concretely, understanding the possibilities and limitations of urban and regional planning to support the development towards circularity and a sustainable use of resources. The author's work in the Horizon2020 research project *REPAiR – REsource Management in Peri-urban Areas: Going Beyond Urban Metabolism* inspired the dissertation. The author's involvement in REPAiR started with co-writing the proposal, and during the project, he coordinated the work package 'Governance and decision-making' and the Hamburg case study. The dissertation project partially builds on a circular development process that was initiated in the REPAiR project and some of its outcomes (REPAiR, 2017a-e), but reaches beyond the project, as explained in the methodology part of the first and second articles below (Section 2). The dissertation is clearly differentiated from the REPAiR research project.

Like the REPAiR project as a whole, the circular development process chosen as the subject of this dissertation focused on improved waste management and avoidance. In addition, the dissertation draws on previous research and empirical studies on circular cities and circular development, which encompass various flows and cycles besides waste. This research states the need to better understand the potential of integrating spatial development aspects as well as spatial planning aspects into circular economy concepts (Williams 2019, 2020, 2023). The dissertation contributes to the recent scientific debate on circular economy (CE), circular city and circular development, as described in section 2, which highlights that both circular and sustainable development of cities and regions will only be achieved if spatial aspects are adequately considered and integrated into strategic spatial planning and development policies and concepts. Specifically, the dissertation aims to deepen the understanding of the potential of spatial planning – as an integrative discipline that works on and across different spatial scales by using different planning instruments – in the support of circular development processes.

Therefore, the research of the thesis is structured around the following research question:

How can spatial planning support circular development on different spatial scales and with different planning instruments?

This question was investigated in three independent, but interlinked case studies on the three different spatial scales. The case studies and the respective sub-questions have been fully elaborated in three published articles:

Article 1 - On the urban-regional scale, an analysis of governance settings (actors, policies, concepts) in six European urban regions (Amsterdam [The Netherlands], Naples [Italy], Ghent [Belgium], Pécs [Hungary], Łódź [Poland] and Hamburg [Germany]) revealed and examined current challenges in steering governance processes towards circular development (Obersteg et al, 2019). The research question of the article, 'What are the governance settings that hinder respectively support a shift to circularity in the examined six urban regions?', is subdivided and discussed in three dimensions of governance challenges: 1) Multi-level, 2) Cross-sectoral, and 3) Multi-actor or quadruple helix (Schmitt and van Well, 2016; van Well and Schmitt, 2016).

Article 2 - On the urban scale, based on a socio-spatial analysis in Hamburg-Altona, a typology of neighbourhoods was developed. This typology was then used for a structured analysis and discussion of the development process of circular waste management solutions in different urban neighbourhoods (Obersteg et al., 2020). The article analysed how information on specific socio-spatial qualities of areas was used within a participatory process (Living Lab) and how the involvement of local stakeholders contributed to the development and implementation of circularity solutions that meet local requirements. This article investigated two research questions: How can the identification and understanding of challenges and opportunities in different spatial settings (urban areas) support the development and implementation of place-based solutions to reach circular development ambitions? How can the co-creative involvement of different stakeholders support the development and implementation of place-based solutions to circular development ambitions?

Article 3 - On the local/neighbourhood scale in Osdorfer Born, Hamburg, an experimental pilot project that had implemented circularity solutions for improved waste management and avoidance was analysed ex-post (Obersteg, 2024). The implemented solutions, the experimental process and the involvement of stakeholders were analysed using methods of

participatory observation and semi-structured interviews. The results of the analysis present and elaborate on the supporting and hindering factors of the experiment and the potentials and challenges for replication and scaling processes. The article responds to the three research questions: What are the lessons learned, and what are the success and failure factors of the project? How are the lessons learned perceived by the key stakeholders with regard to potential continuation and transfer of the results of the project? And, on a conceptual and methodological level, what are the potentials of the categorisation and assessment of the results through the accountability framework to enable a transfer from the experimental level into strategic planning?

Drawing on the three case study examples of circular developments at urban-regional, urban, and local/neighbourhood scales, the framework paper of the dissertation investigates the intersections of circular development and spatial planning instruments at and between different spatial scales. Wittmayer and Loorbach's (2016) transition management framework is used to shape the discussion of the interactions at different scales via the first three levels of the framework and corresponding to the key findings of each published article: 1) arenas/strategic for the urban-regional scale, 2) agendas/tactical for the urban scale, and 3) experiments/operational for the local/neighbourhood scale. In a further step that is equivalent to the fourth level of the transition management framework, 'monitoring and evaluation' (Wittmayer and Loorbach, 2016), learnings from the implementation in the experimental project on the local scale (article 3) are derived and connected to the research outcomes on the strategic (urban-regional scale, article 1) and tactical (urban scale, article 2) levels to draw conclusions to answer the research question of the dissertation. Section 5 presents these learnings structured according to their relevance for different types of planning instruments and provides the overarching conclusions from the dissertation as a whole and the outlook for further research in the field.

2. State of research: From circular economy to circular city and circular development

This section lays out the development of the scientific debate from circular economy to circular city and then circular development, as well as the connection of the latter to spatial planning. The concepts are defined and presented chronologically, starting with the concept of circular economy (CE), followed by Williams' critique of CE expressed in her circular city approach (2019). Taking into account the growing number of implemented CE approaches in cities, Williams consequently adapted her circular city approach into a circular development concept, making suggestions for spatial planning.

Circular Economy (CE) is a relatively new and increasingly popular paradigm which is rooted in the broader concept of sustainability (EC, 2011; Leipold et al., 2023) and has been interpreted and defined in various ways. It has been described as an 'umbrella concept' (Blomsma and Brennan, 2017; Christensen, 2021) and as a heuristic approach that enables the development of policies and strategies to preserve resources and to prioritise regenerative design and production (Kirchherr et al., 2017; Bauwens et al., 2020). Two related facets are at the centre of the CE concept: firstly, the physical organisation of material flows, and secondly, the economic organisation of these flows (Christensen, 2021). Despite the evident spatial dimension of both central facets of CE, it has been stated that CE approaches are mostly inadequately applied to cities and regions (Williams, 2021a, 2021b), as will be outlined further.

In addition to its economic background, CE draws upon the concept of Urban Metabolism (UM), advanced by Wolman (1965), which describes cities as systems exchanging influx (e.g. energy, materials, water) and efflux (e.g. waste, pollutants) with their environment (Kennedy et al., 2011). While UM mainly remained a descriptive concept, CE offers a conceptual framework for better managing flows (Ghisellini et al., 2016).

The initial theoretical concept of CE and its conceptual framework for transforming the economy from a linear to a circular system have been translated into policy recommendations by the Ellen MacArthur Foundation (EMF, 2013), among others. EMF has become one of the most important non-governmental stakeholders in the CE debate in Europe (Williams, 2019). Consequently, CE has been widely adopted by the European Union in the EU action plans for the CE 2015 (EC, 2015) and was further adopted in the new 'Circular Economy Action Plan 2020' (EC, 2020).

Despite its roots in urban metabolism, the CE concept and related policies initially largely ignored the accounting of the effects of CE on (urban) space and vice versa (Williams, 2019). Thus, spatial planning scholars have argued that the spatial dimension of CE needs to be stressed when handling flows in urban areas since every undertaken action inevitably implies changes on the land use (Girardet, 2015; Prendeville et al., 2018). Girardet's (2015) 'regenerative city concept' aimed at connecting aspects of the CE concept with urban development approaches. Prendeville et al. (2018) outline that circular approaches in cities are often limited to the support of businesses and do not consider the various flows (e.g. materials, waste, water, energy). Similarly, Wandl et al. (2019) state that circular economy approaches mostly regard territories like cities only as a spatial background to allocate functions and products.

In a bibliometric analysis Bahers et al. (2022) show that, in the field of urban metabolism, the spatial dimension is gaining importance. Yet, governance and urban planning are only some of several spatial approaches to urban metabolism Bahers et al. (2022) identify, the others being territorial economic, socio-political, socio-ecological, and modelling. In a literature review based on a search for the keywords 'circular economy, land, territory', Furlan et al. (2022) investigate the territorialisation of the circular economy. Their review finds that the majority of articles are related to technological fields, while papers from the spatial planning field remain, in most cases, either on a theoretical level or examine single case studies. One group of articles they found refers to the circular economy approach by the Ellen MacArthur Foundation (EMF) mentioned above, more precisely, their ReSOLVE concept (Furlan et al., 2022). The most prominent contribution in this field of research comes from Williams (2019).

In her conceptual work on circular cities, Williams (2019) underlines the deficits of CE-related approaches that do not adequately incorporate spatial and social questions. She critically discusses the circular economy and, more specifically, approaches that aim to apply its concepts to cities and territories. Williams builds her discussion on an analysis of the ReSOLVE framework (Regenerate – Share – Optimise – Loop – Virtualise – Exchange), which was developed by the McKinsey Center for Business and Environment and the Ellen McArthur Foundation and published by the Ellen MacArthur Foundation (EMF 2015). This was, at the time, the CE framework applied most frequently for businesses (Williams, 2019). Williams (2019) identifies six limitations of the ReSOLVE framework when applied to cities. Compared to businesses, cities are more complex ecosystems comprising various flows and a large number of actors across different sectors and scales. ReSOLVE focuses mainly on production; cities, however, are also

centres of consumption. Therefore, the framework neglects the role of citizens as consumers and beyond. She further criticises that the framework neither considers land nor infrastructure, both important resources in cities. Regarding infrastructure, she underscores the importance of its adaptation to facilitate a circular economy, which is also missing from the framework. Lastly, she highlights the ReSOLVE framework's lack of consideration of the importance of scale and localisation in achieving circularity in cities (Williams, 2019).

This analysis was the basis for Williams's proposal to evolve CE into a Circular City approach, which should include a strong spatial perspective for urban planning strategies and, thus, enable sustainable development towards circularity (Williams 2019, 2021a).

The circular city approach contains three main objectives: reducing waste and resource consumption, preserving ecosystem services and the natural capital and designing out negative externalities (Williams, 2019). To achieve these three goals, and to concurrently adapt CE approaches to the complex ecosystem of cities, Williams proposes two groups of actions. First are the three circular actions: a) looping to minimise resource wastage, b) regeneration to restore urban ecosystems and preserve natural capital and c) adaptation of the planning of cities to renew their infrastructure with minimized resource wastage. Secondly, four supporting actions enhance circular processes: a) optimisation uses smart technologies and processes, b) sharing promotes co-housing, co-working spaces, and shared transport systems, c) substitution replaces finite resources with renewable alternatives or physical with virtual activities and d) localisation reduces transport energy use and emissions, while reducing resource consumption and waste (Williams, 2019, 2021a).

The scientific and policy discourses on the Circular City and the consequent necessity of a stronger consideration of spatial aspects in CE policies and actions have inspired cities to develop their own strategies and policies that combine CE and spatial development (e.g. Amsterdam). With a growing number of cities in Europe developing CE strategies (Williams, 2023), spatial aspects have also been integrated into EU policies on CE, foremost being the new 'Circular Economy Action Plan 2020', and have led to the creation of the European Circular Cities & Regions Initiative (CCRI) (EC, 2020). The latter stimulated further numerous local and regional activities to develop and test CE (e.g. in the form of Living Labs) and initiated further EU-funded research. Additionally, alongside the general discussion on the necessity to include spatial aspects in the CE concept, a further scientific debate considers the adequate spatial

scale to address circular topics. Several authors argue that urban planning as a discipline should incorporate CE perspectives into the discourse on spatial development at the city level (Petit-Boix and Leipold, 2018; Williams, 2021, 2023), while others claim that urban regions are the most suitable scale to act for the concretisation and spatialization of CE (Milligan and O’Keeffe, 2019).

With regard to these recent activities, Williams underlines the need for more research on the spatial implications of CE and the role of spatial planning in steering governance processes to support circular development. Building on her circular cities approach, she stresses the role of spatial planning to support a circular development of cities (Williams, 2021a, 2023), and, more recently, she has advanced this proposal into a Circular Development approach that is more application-oriented to spatial planning (Williams, 2023).

Williams uses the terms urban planning and spatial planning in interchangeable ways (Williams, 2020, 2023). In this dissertation, the term spatial planning is used as a collective term for planning on different spatial scales and is understood in a broader sense to include, also, spatial development. This broader definition of spatial planning has been proposed by Nadin et al. (2020), understanding it as land management and support of desired spatial development with the help of strategies that combine the spatial aspects from different sectoral policies. The notion of spatial planning therefore reaches beyond the classic definition of land-use planning and includes various aspects of planning like the integration of policies, participation of communities and involvement of stakeholders (Nadin et al., 2020; Nadin et al., 2018; Tewdwr-Jones, 2004).

Williams argues that spatial planning as a discipline, and as a part of public administrations that claim to be integrative, could and should have an important role in circular city and circular development processes. She further argues that, if spatial planning is not the main responsible department, then other parts of the public administration who might take over the steering role should at least involve spatial planning in circular city and development processes as an important partner (Williams, 2020, 2023).

Williams mainly uses the examples of land-use planning and infrastructural planning (e.g. water and wastewater) to further discuss the potential role for spatial planning in circular cities and circular development. Consequently, she proposes a categorisation of planning tools used to deliver circular development: visionary, strategic, framework setting and capacity building,

and regulatory tools (Williams 2023). Williams' (2023) development of these categories leans on frameworks for planning tools provided by Nadin et al. (2018) and Tiesdell and Allmendinger (2005). Nadin et al. (2018) initially differentiated four types of spatial planning instruments (visionary, strategic, framework setting and regulative). These categorisations of planning tools by Williams (2023) and instruments by Nadin et al. (2018), respectively, were adapted in this dissertation into four types of spatial planning instruments/tools to structure the conclusions of this thesis. As Williams (2023) and Nadin et al. (2018) state, planning instruments are not restricted to planning documents, and need to be understood in connection to spatial planning and development processes and actors. Against the background of these categorisations and adapted to the specific research question, the author of this dissertation differentiates four types of spatial planning instruments that will be later used to structure the conclusions (Section 5):

- 1) Strategic spatial planning instruments, derived from the visionary and strategic tools which Williams herself merges in her research (Williams, 2023). In the case of the dissertation, this type comprises strategic instruments like spatial development concepts and visions, as well as thematic concepts that contain a spatial component, like climate action plans.
- 2) Informal planning instruments, derived from the capacity building tool (Williams, 2023) and parts of visionary instruments (Nadin et al., 2018). This type comprises instruments that enable exchange between and cooperation of stakeholders and citizens. Examples of informal planning instruments can also be found in the first and third types. However, due to the fact that not all informal planning instruments are linked either to strategic planning or integrative planning, all other forms of neighbourhood development or management are bundled here.
- 3) Integrative (socio-spatial) planning instruments, combining William's elements of framework setting and capacity building. The reason for using this separate type of instrument is that integrative socio-spatial development plays an important role in the context of German spatial planning (BBSR, 2017). The experimental project that was examined in the dissertation is situated in an integrative socio-spatial development area. This additional type of instrument enables a separate consideration of the lessons learnt on circular development in a local experiment and how the experience could be transferred to integrative socio-spatial development planning.

4) Regulatory (land-use and physical infrastructure) planning instruments, corresponding to Williams' regulatory tools that include land-use planning as well as temporary planning permissions (Williams, 2023). As will be described in the conclusion, the analysis linked to this type of instrument was limited to the waste infrastructure and the existing built environment in the examined areas. Nevertheless, it has been kept as a separate type to support specific conclusions in this area to be drawn.

3. Research design of the dissertation

As the introduction states, the focus of the circular development process that was investigated in this dissertation is on waste management and waste avoidance. It is obvious that waste is only one topic in the circular economy and circular city approaches, alongside water, energy, food, goods and materials, and the built environment. Nevertheless, waste is a relevant topic as large amounts of waste are landfilled or exported to developing countries where they cause ecological problems (Williams, 2021). An extended discussion on the relevance of waste for circular development and in a wider sense for sustainability is outside of the scope of this thesis, therefore a short excursus based on the outcomes of studies of the German Environment Agency will be presented here to provide thematic clarity only. While earlier studies focused on the necessity to include measures to improve waste management in climate action to achieve the objectives of climate policies (Vogt et al., 2015), more recent reports delineate the extended potential of broader circular economy approaches, while still including waste management as an important element of the contributions to climate mitigation in Germany (Vogt et al., 2023a) and the EU (Vogt et al., 2023b). The newer study for Germany (Vogt et al., 2023a) states that net emission (CO₂ equivalents) savings potentials could primarily be achieved by the following changes in the waste collection of municipal solid waste. Firstly, by raising the percentage of separately sorted dry recyclables, which is considered not easily achievable, and, secondly, by improved processing of residual waste, mainly through improved technical and environmental standards for incineration plants and higher percentages of separately collected organic waste and wood. Furthermore, for organic waste digestion processing linked to biogas production offers saving potentials compared to processing limited to composting (Vogt et al., 2023a). It should be said that all of these topics were discussed in the Living Lab process (Obersteg et al., 2020), as well as partially in the experimental project (Obersteg, 2024), both of which were analysed in the frame of this dissertation.

The research design stemmed from the overarching research question of the thesis: How can spatial planning support circular development on different spatial scales and with different planning instruments? This research question was operationalised by conducting three separate, but interlinked case study researches on three different scales and representing different phases of a circular development process. Thus, the urban-regional, urban and local/neighbourhood scales are addressed individually within the three articles published for this dissertation, while the circular development spanning all three articles is reflected here, in the

framework paper of the dissertation. As will be explained in Section 3.4 Wittmayer and Loorbach's (2016) transition management framework is used to shape the discussion of the interactions at different scales via the first three levels of the framework and corresponding to the key findings of each published article: 1) arenas/strategic for the urban-regional scale, 2) agendas/tactical for the urban scale, and 3) experiments/operational for the local/neighbourhood scale. In a next methodological step, the fourth level of the transition management framework, 'monitoring and evaluation' and the dimensions of circular development were applied to structure the discussion of the three case studies and to develop conclusions.

3.1 On the urban-regional scale, governance settings (actors, policies, concepts) in six European urban regions were analysed to examine the current challenges in steering governance processes towards circular development. The results are published in the first article of this dissertation Obersteg et al. 2019. The research question of the article, 'What are the governance settings that hinder respectively support a shift to circularity in the examined six urban regions?', is subdivided and discussed in three dimensions of governance challenges.

The regions of Amsterdam (The Netherlands), Naples (Italy), Ghent (Belgium), Pécs (Hungary), Łódź (Poland) and Hamburg (Germany), all represented in the REPAiR project, constituted a diverse set of European urban regions with different structures on which to focus this research. The urban-regional scale analysis was conducted within the frame of the REPAiR project, as part of which interviews were used to map the actors to be included in the project's Living Labs and to identify framework structures (actors, policies) of relevance to the Living Labs' co-creative process to develop solutions for circular development. The guidelines for the qualitative survey and document analysis in the six city regions were developed by the author of this thesis and carried out by six research teams (the co-authors of the article) in the respective national languages. As part of the thesis, the results of the qualitative survey and document analysis of a governance analysis were used to identify governance settings that hinder or support the shift to circularity and describe challenges according to the three dimensions: (1) Multi-level, (2) Cross-sectoral, (3) Multi-actor or quadruple helix (Schmitt and van Well, 2016; van Well and Schmitt, 2016).

Because of the novelty of the CE topic (Ghisellini et al., 2016), an exploratory research approach was chosen in order to describe the six selected case studies and to investigate the theoretical aspects derived from an extensive literature research in a real-world context (Yin,

1984/2009). To enrich the discussion of implementation challenges of CE tenets at different levels (Franco, 2017; Petit-Boix and Leipold, 2018; Prendeville et al., 2018), the article highlighted the cross-cutting – multi-level, multi-sectorial, multi-actor governance dimensions of the implementation of CE actions and their spatial relationships. The selection of the six case studies was driven by the necessity of identifying common elements in urban regions characterised by diverse social, economic and environmental settings. Despite the diversity of urban regions, a comparability logic (Kaarbo and Beasley, 1999) was achieved by exploring the phenomena in all dimensions (Bartlett and Vavrus, 2017).

The limited number of six cases allowed a “thick description” (Collier, 1993: 109) and adequate analytic depth (Kaarbo and Beasley, 1999). Thus, a story was constructed for each case, based on an analysis of archival sources such as published official documents and media reports and an overall total of 58 semi-structured, in-person interviews conducted with key stakeholders from local and regional authorities, waste management sector, housing companies, and representatives of the private sector (Nilsson, Eklund, and Tyskeng, 2009). A snowball sampling method led to the identification of further stakeholders concerned with the CE topic in the six urban regions (Reed et al., 2009). These stakeholders were invited to participate in Living Labs in each of the six case study regions (AMS, 2017; REPAiR, 2017c), in which the challenges identified in the interviews and document analysis were addressed, discussed, and summarised for each of the cases. For the Hamburg case study, the discussion of challenges with the identified stakeholders was the starting point for the Living Lab process that was analysed in the second article of this dissertation.

Comparison between the case studies was performed using the PESTEL analytical framework (Political, Economic, Social, Technological, Environmental, and Legal). PESTEL was initially conceived as a tool for evaluating alternatives within organisations (e.g., Fozzer et al., 2017; Song, Sun, and Jin, 2017) and has proved to be an adequate framework in the field of strategic planning due to its ability to provide a comprehensive overview of different factors (Osborne and Brown, 2005; Yüksel, 2012) while, in parallel, highlighting possible interdependencies between them (Codagnone and Wimmer, 2007; Mietzner and Reger, 2005). As governance challenges were the focus of the article, the authors added a seventh category, ‘organisational-related’ challenges, expanding the framework from PESTEL to PESTEL-O to enable a better comparison of the cases.

3.2 On the urban scale, a socio-spatial typology of urban neighbourhoods was developed and applied to analyse the development process of CE solutions for and in different urban neighbourhoods in Hamburg-Altona within the REPAiR Living Lab. The aim was to analyse how a participatory process could make use of information on areas' specific socio-spatial qualities and how the involvement of local stakeholders could contribute to the development and implementation of CE-solutions that fulfil local requirements. The results are published in the second article of this dissertation Obersteg et al. 2020. This article investigated two research questions: 'How can the identification and understanding of challenges and opportunities in different spatial settings (urban areas) support the development and implementation of place-based solutions to reach circular development ambitions?' and 'How can the co-creative involvement of different stakeholders support the development and implementation of place-based solutions to circular development ambitions?'

The socio-spatial analysis of the District of Hamburg-Altona was conducted by the co-authors of the second article within the process of development of a spatial data basis for the application of the Geodesign Decision Support Environment (GDSE), which was REPAiR's main output. Socio-economic, structural and ecological data were collected, spatially visualised in maps and prepared in a database for use in the GDSE. The REPAiR project's objective was only to test the geo-design process itself and, theoretically, the resulting solutions in the GDSE. However, the Hamburg-Altona Living Lab gained momentum, and the participating actors developed the ambition to create and implement realisable solutions. This momentum was the starting point for the research in this dissertation. The questions here were: How can the identification and understanding of challenges and opportunities in different spatial settings (urban areas) support the development and implementation of place-based solutions to reach circular development ambitions? How can the co-creative involvement of different stakeholders support the development and implementation of place-based solutions to circular development ambitions?

In the cooperative process of the Living Lab, the participating stakeholders expressed their interest in a more specific spatial analysis to consider different urban typologies. Consequently, as part of the thesis (article 2), a socio-spatial typology of different neighbourhood types was developed using the data collected in REPAiR. Five 'sample areas' representing the different neighbourhood types were then investigated through an extensive spatial analysis to deepen the understanding of land use, socio-economic, and physical structure, as

delineated in REPAiR (2018): 1) a large housing estate at the urban fringe (Osdorfer Born), 2) a densely built urban area (Ottensen), 3) a new urban development area (Mitte-Altona), 4) a single-housing area at the urban periphery (Rissen), and 5) a single-housing area with second homes and weekend visitors (Blankenese).

Using this typology, article 2 further discusses the necessity of developing specific solutions for the different neighbourhood types and corresponding framework planning approaches, drawing on an analysis of the Living Lab workshops and climate action plan workshops in Hamburg Altona. The Living Lab workshops were organised by the author of this thesis as part of REPAiR and served as an empirical basis for an additional participant observation and focus groups (Flick 2016; Lamnek and Krell 2016) that were conducted for this dissertation. Around the same time as the REPAiR Living Lab process, the District of Hamburg-Altona was developing its Climate Action Plan (Bezirk Altona, 2019a, 2019b). Both processes were interconnected as stakeholders from Hamburg-Altona were adopting eco-innovative solutions that had been developed in the REPAiR Living Lab into the Climate Action Plan. To understand the interaction between both processes, the events organised by the District of Hamburg-Altona to develop the Plan were also analysed by the author of the thesis using participant observation.

Inspired by the outcomes of the Living Lab process, some of the participating stakeholders decided to conduct a subsequent experimental project to further develop, adapt and test solutions to improve circular development. The experimental project called WiedergeBORN was conducted in the large housing estate Osdorfer Born, and was analysed ex-post in article 3 of this dissertation.

3.3 On the local/neighbourhood scale, an ex-post analysis of an experimental pilot project which implemented circularity solutions in the neighbourhood of Osdorfer Born in Hamburg was performed. The results are published in the third article of this dissertation Obersteg 2024. The article responds to the three research questions: ‘What are the lessons learned and what are the success and failure factors of the project?’, ‘How are the lessons learned perceived by the key stakeholders with regard to potential continuation and transfer of the results of the project?’ and, on a conceptual and methodological level, ‘What are the potentials of the categorization and assessment of the results through the accountability framework to enable a transfer from the experimental level into strategic planning?’

The case study of this article was an experimental project that was conducted by some of the stakeholders who had participated in the Living Lab process. Inspired by the outcomes of the Living Lab process, some of the participating stakeholders (Hamburg's public waste management Stadtreinigung Hamburg (SRH) and the public housing company SAGA, along with its subsidiary, Pro Quartier (PQ)) decided to conduct a subsequent experimental project to further develop, adapt and test solutions to improve circular development. Given the name WiedergeBORN, a creative wordplay reference in German to the name of the neighbourhood and circularity, the project was conducted in a large housing estate in Osdorfer Born in Hamburg.

The implemented solutions, the experimental process and the involvement of stakeholders were analysed by the author of this dissertation using methods of participatory observation and semi-structured interviews. This analysis aimed to understand the success factors of the experiment and its potential for replication and scaling. Participatory observations were conducted by the author during meetings, workshops and public events, as well as field studies carried out involving spatial analysis of the area (e.g., implemented measures and their impact on cleanliness, conducted before, during, and after the project) (Flick, 2016; Lamnek and Krell, 2016). Furthermore, a document analysis was performed using data reports, unpublished workshop minutes, plans, stakeholders' policy concepts, newspaper articles and strategies and policies defining framework conditions. After the project's conclusion, three semi-structured qualitative interviews were conducted with key stakeholders, including SRH, SAGA and PQ. These interviews focused on reflecting on the project's activities, outcomes, lessons learned and the potential for replication. The recorded interviews were transcribed and analysed using qualitative content analysis (Kuckartz and Rädiker, 2020; Mayring, 2015). The results of the analysis of the experiment during its lifetime and the ex-post analysis were then structured to answer the research questions.

3.4 Transition management framework and dimensions of circular development

As described in the introduction (1), this thesis investigates the research question: 'How can spatial planning support circular development on different spatial scales and with different planning instruments'? This thesis adapts and applies Wittmayer and Loorbach's (2016) transition management framework to frame the research outcomes on the three spatial scales (urban-regional, urban, local/neighbourhood) that', at the same time, represent three phases

of the circular development process including the governance analysis, the living lab process and the following experimental project.

In the context of circular economy research, the transition management framework has already been applied by Heurkens and Dabrowski (2020) to analyse and categorise the governance of the circular economy transition in the Amsterdam Metropolitan Area (AMA). It has further been used by Wandl et al. (2023) as a conceptual module to a Circular Economy Transitions Self-Assessment (CETSA) tool for cities and regions. In the CETSA tool, the transition management framework was included for assessing the governance dimension; however, it was adapted in a reduced form that did not include the fourth level 'transition monitoring and evaluation'. The author of this dissertation is a co-author of the article by Wandl et al. (2023) and was co-responsible for the design of the governance dimension of the Circular Economy Transitions Self-Assessment tool. While Heurkens and Dabrowski (2020) and Wandl et al. (2023) only use the first three levels of the framework, in this dissertation, all four levels are used.

The framework identifies four levels of transition and corresponding governance activities. The first level 'Transition Arenas (Strategic-level Activities)' focuses on long-term objectives that involve collective debates, visioning and policy formulation; the second level 'Transition Agendas (Tactical-level Activities)' addresses mid-term changes, activities which target existing structures, institutions, regulations and infrastructures; the third level 'Transition Experiments (Operational-level Activities)' comprises short-term activities that test and showcase alternative ideas, practices and relationships; the fourth level 'Transition Monitoring and Evaluation (Reflexive-level Activities)' focuses on learning-oriented activities that assess the current system, explore potential future states and evaluate ongoing transitions (Wittmayer and Loorbach, 2016). The first three levels correspond to the three spatial scales of the research described above (urban-regional, urban, local/neighbourhood) as well as the three phases of the circular development process that are examined in this dissertation, and serve as a structure for the discussion of the main findings from the three articles (in Section 4). The fourth level is used in the sense of Wittmayer and Loorbach (2016) to reflect on the three previous levels, and serves as input for the conclusion (in Section 5).

A second axis is provided through four dimensions of characteristics of circular development, developed by the author of this thesis: 1) 'Formal relations between stakeholders (multi-level,

multi-sectoral) dimension', 2) 'Social / behavioural dimension', 3) 'Physical (Technological/infrastructure, Environmental) dimension' and 4) 'Informal relation between stakeholders' dimension'. These four dimensions were developed based on a combination and simplification of three different schemes: firstly, the characteristics of the urban context by Wittmayer and Loorbach (2016), namely Geographic proximity, Multiscalar interaction, Multidomain interaction, Personal proximity, and Institutional proximity; secondly, the challenges to implementing circular development explored by Williams (2021a) and, thirdly, the PESTEL-O scheme (Obersteg et al., 2019) that was used in the first article of this cumulative dissertation, based on the PESTEL scheme that was further explained above (3.1). In the discussion, the four dimensions of circular development are used to frame the findings of each step of the analysis. Subsequently, the conclusion is structured according to the four types of spatial planning instruments (Section 2), as will be further described in Section 5.

4. Discussion of the main findings

As Section 3 already presented the three case studies, the applied methodologies and the context between the three cases, this section provides an overview of the contents of the three articles. All three publications thus contribute to the overarching research question: How can spatial planning support circular development on different spatial scales and with different planning instruments?

The three articles were published as stand-alone works; therefore, in some places, the articles use diverging terminologies for the same concepts or objects among each other. Part of the work performed as a part of this dissertation was to create a common and consistent logic within which to frame these different research steps. The main findings are presented in Table 1, structured according to the first three levels of the transition management framework and the four dimensions of circular development characteristics.

The first publication, titled ‘Urban Regions Shifting to Circular Economy: Understanding Challenges for New Ways of Governance’ (Obersteg et al., 2019), published in *Urban Planning* in September 2019 (volume 4, number 3), addressed the first sub-question of this dissertation: What are the governance settings that hinder respectively support a shift to circularity in the examined six urban regions?

The article examined the necessity of understanding governance challenges in order to support urban regions in shifting towards circular development. A broad spectrum of governance challenges was identified in the six case studies on urban-regional scale and categorised into three governance dimensions, namely multi-level governance, cross-sectoral governance and multi-actor governance. First, considering multi-level governance, the investigated urban regions showed ambitious CE initiatives, but they lacked connections to higher-level policies. In the Hamburg case, for instance, it was found that no CE strategy was in place at the regional level. Second, related to cross-sectoral governance, CE strategies often failed to align with other policy areas, including spatial planning. Consistent formal procedures, as well as informal dialogues, were not observed in the Hamburg case between the different responsible agencies. Even within the public sector, the lack of collaboration between municipalities limited the potential for promoting circular development on an urban-regional scale. Third, from the multi-actor governance perspective, some regions were found to have active entrepreneurial and civic-led CE initiatives that lacked public sector coordination, for example in the

Amsterdam Metropolitan area, leading to failures to achieve their goals. Others showed only limited activity from both economic sectors and citizens in CE concerns, despite some level of public sector involvement in CE promotion, for example in the cases of Pécs and Łódź, leading in the end to a similar result. Considering these challenges in all three governance dimensions, the article concludes that urban planning is uniquely suited to coordinate circular development processes, due to its cross-thematic and integrative nature. Urban planning thus has the potential to address the need for more spatially integrated circular development strategies.

The second publication, titled ‘Making cities circular: Experiences from the living lab Hamburg-Altona’ (Obersteg et al., 2020), was published in the journal *European Spatial Research and Policy* in 2020 (volume 27, number 2). It investigated the following two sub-questions of this dissertation: How can the identification and understanding of challenges and opportunities in different spatial settings (urban areas) support the development and implementation of place-based solutions to reach circular development ambitions? How can the co-creative involvement of different stakeholders support the development and implementation of place-based solutions to circular development ambitions?

The second article analysed the REPAiR Living Lab process that was conducted on the district-urban scale in Hamburg-Altona (see Obersteg et al., 2020). More precisely, the steps of the Living Lab process were examined: identification of the geographical boundaries and the governance framework setting, definition of main problems in the case study area, delineation of the problems into objectives and design of solutions. The Living Lab process used inputs from various studies and data collected in the frame of the REPAiR project. This laid the groundwork for the development of a socio-spatial typology of five different neighbourhood types. The second article concludes that the provision and usage of qualitative and quantitative socio-spatial data and its translation into a typology supported the Living Lab process by enabling the identification of neighbourhood-specific problems and place-based solutions. The combination of data from various sources and types strengthened the analytical potential and provided the involved actors in the Living Lab with detailed knowledge of real waste flows and infrastructures, for which to consider solutions. The publication further states that the co-creative involvement of different stakeholders, including practitioners and researchers from the field of spatial planning, contributed to the Living Lab’s success through a shared understanding of problems and a framework for mutual input in the development of place-based solutions for the different types of neighbourhoods. In the Hamburg case, an exchange was

initiated between spatial planners and the public waste management company, who had previously not collaborated in these contexts. Challenges were also observed during this analysis. Both the socio-spatial analyses and the Living Lab process are time-consuming and require a high level of effort. Especially the identification and involvement of a diverse group of stakeholders in a Living Lab is difficult; if not performed with adequate attention and rigour, there is a risk of obtaining biased results.

The third publication, titled ‘Successful Project—Limited Transfer: Learnings from the Local Circularity Experiment WiedergeBORN’ (Obersteg, 2024), was published in the journal *Sustainability* in December 2024 (volume 16, number 23). It addresses the following sub-questions: What are the lessons learned, and what are the success and failure factors of the project? How are the lessons learned perceived by the key stakeholders with regard to potential continuation and transfer of the results of the project? And, on a conceptual and methodological level, what are the potentials of the categorisation and assessment of the results through the accountability framework to enable a transfer from the experimental level into strategic planning?

The paper evaluated the strategic experimental project ‘WiedergeBORN’, conducted by SRH with stakeholders and citizens in the Osdorfer Born large housing estate, which aimed to improve circular development on the district/neighbourhood level. The organisers of the experiment did not conduct a scientific or operational evaluation, and no analysis of this experiment’s results, process or scalability was performed. The article examined ex-post the results of and conditions for the experimental project and delineates the genesis of the project, its main stakeholders and its objectives, measures, and outcomes. Successful and unsuccessful factors were identified and categorised, and the possible transfer of lessons learned was discussed. The experiment was found to have an expressly place-based approach, which considered local economic, social and spatial conditions, encouraged close cooperation between key stakeholders and supported the early involvement of local actors and citizens. This fostered the successful development and implementation of measures to improve waste management and cleanliness. Furthermore, it was found that the integration of environmental, social and educational aspects in the measures and the cooperation with actors from these fields led to positive outcomes. Even though the organisers considered the experiment to be a success, the transfer of the project’s results and approach remained limited due to a lack of involvement of strategic actors. For example, the absence of public administration and planning

authorities in the development of the experiment and the lack of operational evaluation and communication to other levels hindered the integration of the learnings into strategies and policies at the urban-district or urban-regional scales.

Table 1: The results from the three articles structured according to the three levels of the transition management framework (Wittmayer and Loorbach 2016) on the vertical axis and according to four dimensions of circular development characteristics. Adapted from Wittmayer and Loorbach 2016; Williams 2021a; Obersteg 2019 on the horizontal axis

Vertical axis: levels of the transition man- agement frame- work	Horizontal axis: analytical di- mensions of the circular devel- opment charac- teristics	Formal stakeholder dimension	Informal stakeholder dimension	Social / behavioural dimension	Physical dimension (technology/in- frastructure, environment)
Arenas – strategic-level activities that are long term-oriented and collectively debated. Here: Results ¹ from the analysis on challenges for circular development Research questions from article 1: What are the governance settings that hinder respectively support a shift to circularity in the examined six urban regions? (here only for the Hamburg case study)		• Lack of integration of waste management and urban planning policies; responsibility in different ministries on city-level; • No CE strategy on city-level • CE not yet a topic on regional level • The responsibility for waste management and CE is on federal state level (e.g. Hamburg, Schleswig-Holstein) which hindered cross-border cooperation	• No (or limited) dialogue between different stakeholders and sectors (waste management, spatial planning, housing) • On operational level little exchange between waste management and urban planning on district level • Conflicting interests between stakeholders responsible for waste management and spatial planning e.g. about the use of public spaces	• Waste is not present enough as a topic in the awareness of citizens, which leads to sub-optimal behavior regarding waste avoidance, separation etc. • Little interest in waste issue from either landlords or tenants • Incentives for waste separation are not clear/high enough for citizens • Waste as a topic not included sufficiently in school curricula	• Persistency of existing waste technology (collection, processing) prevents innovation • Limited openness for adapting waste collection solutions to different spatial conditions • Long distances between waste generation and treatment • Waste separation is insufficient, especially the separation of organic waste Consequently the organic-waste potential cannot be fully used for biogas and compost production • Conflicts between waste management and other uses in public spaces

¹ Here, only the challenges that were identified for the Hamburg case are outlined, as they were the baseline for the Living Lab process, and subsequently for the experimental project. In the Hamburg case study, the issue of waste management and its connection to spatial development and urban planning were highlighted by the stakeholders, who, to a large part, came from these sectors.

	Formal stakeholder dimension	Informal stakeholder dimension	Social / behavioural dimension	Physical dimension (technology/infrastructure, environment)
Agendas - tactical-level activities that target changes in established structures Here: Results from the analysis of the living lab process Research questions from article 2: How could the identification and understanding of challenges and opportunities in different spatial settings (urban areas) support the development and implementation of place-based solutions to reach circular development ambitions? How could the co-creative involvement of different stakeholders support the development and implementation of place-based solutions to circular development ambitions?	• The co-creative process that involved different stakeholders (waste management, urban planning, NGOs) enabled a basic understanding of each other's formal responsibilities. • The necessity of distinctive strategies for different urban neighbourhoods was formulated. • A formal connection of the Living Lab process and its outcomes to the development process of the climate action plan (CAP) Altona was established. • This led to a contribution of concrete measures on waste management and sustainable consumption into the CAP.	• The co-creative process of stakeholders (cross-sectoral) and involvement of NGOs in the living lab enabled a common understanding of problems and development of solutions. • During the process the institutionalised stakeholders from spatial planning and waste management established a continuous exchange that did not exist before. • The co-creative process led to a common understanding about the necessity for locally tailored solutions and measures. • The co-creative process enabled an open discussion of conflicts of waste management and other uses in public spaces, and of conflicts due to littering and inappropriate waste disposal	• The socio-spatial analysis that was conducted in cooperation with the stakeholders combined social and spatial aspects. The analysis was the basis for the development of the typology of urban neighbourhoods. • The typology of urban neighbourhoods that was developed, was used as a basis to target different types of local stakeholders (e.g.) landlords and citizens. • Based on the typology, the development of solutions to reach and involve local stakeholders and citizens in different urban neighbourhoods was conducted. This included: - The development of ideas to expand the involvement of schools and childcare centres to different areas. -The development of ideas for incentives in different areas, incl. the necessity to improve transparency of cost for waste disposal for house owners and cost for tenants. -The development of ideas for solutions for large housing estates information campaign and introduction of waste separation competition with benefits for inhabitants.	• For different urban neighbourhood types an analysis of the status quo of the waste separation, collection, processing situation was conducted and discussed with the stakeholders from spatial planning and waste management. The analysis contained: The waste disposal infrastructure (tons, containers, sacks); The supply of public containers, recycling stations; The supply and offers of repair cafés, initiatives for sharing, second hand shops etc. • Based on these analyses, solutions for 5 different types of neighbourhoods were developed to improve the waste disposal infrastructure and processing. • Special emphasis was set on the topic of organic waste in the Living Lab: Analysis of separation, collection, processing situation in different types of neighbourhoods. Development of solutions for different types of neighbourhoods based on the analyses.

	Formal stakeholder dimension	Informal stakeholder dimension	Social / behavioural dimension	Physical dimension (technology/infrastructure, environment)
Experiments - Operational-level activities. Short-term experiments to practise alternative ideas Here: Results of the analysis of the experimental project Wiedergeboren Research questions from article 3: What are the lessons learned and what are the success and failure factors of the experimental project?	• An agreement of the key stakeholders on a formalized cooperation was made at the start of the project. • The formal frame of the experimental project clarified the financing of the staff of the involved stakeholders and of measures • This formalized cooperation of spatial development (neighbourhood management, public housing company) and waste management stakeholders set the frame of the experimental project including common objectives and division of work. • While the project partners established a formalized cooperation, the public administration and planning authorities at urban-district scale were not further involved in the development of the experiment. • Furthermore, the lack of operational evaluation and communication to other levels hindered an integration of the learnings into strategies and policies at the urban-district or urban-regional scales.	• The co-operative work process led to trust building between the key stakeholders, and in the next stage enabled the involvement of many further local stakeholders. • The experience of the neighbourhood management and its existing relations to local stakeholders enabled their involvement in the project.	• The cooperation of key stakeholders with local stakeholders enabled a successful involvement of citizens and implementation of measures to improve sensitivity for waste topics and influence the behaviour. • The local experts (neighbourhood development) that were involved in the experimental project enabled access to information about the living conditions of the citizens. • The local experts (neighbourhood development) enabled an involvement of citizens (through interviews, workshops, activities) which provided information input to develop adequate measures. • The experimental project put citizens at the centre of its objectives and measures, and developed and implemented solutions with them. Furthermore, it directly impacted their wellbeing, improving cleanliness and the living environment through circularity objectives. • Examples for successfully implemented measures addressing or involving inhabitants are: childcare and school compost projects, adult education offers, information events in the public library. • Further Examples for successfully implemented measures addressing inhabitants are:	• An analysis of the infrastructure and the conditions of the built environment was conducted, this was enabled by combining the knowledge of the of key stakeholders from spatial planning (neighbourhood management, public housing company) and waste management. • Based on this analysis a successful development and implementation of measures for improvement of the physical infrastructure was enabled. • Examples for successfully implemented measures include: -Improved waste storage locations: barrier-free access, easier labelling -Organisation of an improved bulky waste transport, last-mile problematic solution • Outcomes of the measures were an improved organic waste collection (measurable increase) and improved cleanliness and living environment

			-Alternative offers for bulky waste disposal with reduction of fees. -Showcasing of offers of second-hand products and repair cafés as cost-saving alternatives to ordinary consumption	
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5. Conclusion and outlook for future research

How can spatial planning support circular development on different spatial scales and with different planning instruments? To answer the research question of this dissertation, three case studies on different spatial levels (urban-regional, urban, local/neighbourhood) were conducted. The cases were examined as part of different phases of a circular development process. Their key findings were briefly presented in the discussion (Section 4) and structured according to (a) the transition management framework and its levels arena, agenda and experiment and (b) the four dimensions of circular development.

As described in the methodology (Section 3), conclusions have been derived corresponding to the transition management framework's fourth level 'monitoring and evaluation' that reflects on the results of the analysis of the other three framework levels arena, agenda and experiment. While the discussion was organised (on the horizontal axis) according to the four dimensions 1) 'Formal stakeholder dimension (multi-level, multi-sectoral)', 2) 'Informal stakeholder dimension', 3) 'Social / behavioural dimension' and 4) 'Physical (Technological/infrastructure, Environmental) dimension', the conclusions are structured along four types of spatial planning instruments that were presented in Section 2.

The four types of planning instruments are related to the dimensions, but not in a one-to-one manner, as there are certain overlaps and connections between them. Nevertheless, the categorisation of the conclusions along these four types enables a link to the circular city debate and enables the derivation of possible recommendations for further circular planning discourses. Conducting a comparative case study analysis to delineate trends among the different cases and to be able to provide recommendations is regarded as a fundamental necessity in the field of CE and Circular City (Furlan et al. 2022). As outlined in Section 2, the four types of spatial planning instruments were developed by the author of this dissertation, adapting the spatial planning tools provided by Williams (2023), which themselves draw on the characterisation of spatial planning instruments by Nadin et al. (2018). Like Williams (2023) and Nadin et al. (2018) state, the planning instruments are not restricted to planning documents and need to be understood in connection to spatial planning and development processes and actors.

The four types of spatial planning instruments are: 1) strategic spatial planning instruments, 2) informal planning instruments, 3) integrative (socio-spatial) planning instruments, and 4) regulatory (land-use and physical infrastructure) planning instruments.

As a preliminary remark, it should be mentioned that, due to their diversity, not all of the four types of spatial planning tools contain outcomes related to all of the three spatial scales (urban-regional, district-urban, and local-neighbourhood), while some of the conclusions span several spatial scales. It further should be noted that the conclusions related to the urban-regional scale will be presented mainly limited to the scale of the city (in this case, Hamburg). The reason for this, as was explained above, is that the work connected to the first article was the starting point of the research and also of the process of the Living Lab and the following experimental project. The urban-regional level was involved only in a very reduced way in the further steps of both the research and the circular development process. Nevertheless, the urban-regional level will be presented in some of the following conclusions, as well as in the outlook on avenues for further research. Accordingly, the main focus of the following conclusions is on the district-urban and the local-neighbourhood level.

The conclusions for each of the four types of spatial planning tools are presented first with the main findings from the discussion, followed by general conclusions and, where fitting, by exemplary conclusions for Hamburg. They are followed by overarching conclusions crossing the four types and by an outlook on possible demands for future research.

1) Strategic spatial planning instruments

As a summary of the findings and as outlined in the discussion, on the urban-regional and urban scale, a lack of cooperation between spatial planning and waste management could be seen before and at the beginning of the circular development process. The Living Lab and the experimental project WiedergeBORN enabled a frame for cooperation between different stakeholders (Obersteg et al, 2019; Obersteg et al, 2020; Obersteg, 2024). While this worked well on the horizontal level, the cooperation across different levels for both groups of stakeholders from waste management and spatial planning was limited. The integration of some of the measures developed in the context of the Living Lab into the Climate Action Plan (Integriertes Klimaschutzkonzept Altona) of the District of Hamburg-Altona (Bezirk Altona, 2019a, 2019b) can be regarded as a positive example of stabilisation and formalisation of results of a circular development process. Yet, as of the time of completion of this dissertation,

the measures have not been implemented. Due to the experimental character of both the Living Lab and the WiedergeBORN project, the involved stakeholders did not conduct a formal evaluation of the results. This was a major handicap for the continuation, transfer and up-scaling of their results and lessons learnt (Obersteg, 2024).

Generally, it can be said that in order to keep the continuity of circular development processes, and to transfer and scale their results, it is necessary to embed the objectives and consequent measures of circular development into strategic spatial development tools like spatial strategies or visions that could offer a respective framework. In the case of Hamburg, the integration into the Climate Action Plan of Hamburg-Altona is a good example. The Climate Action Plans of the City of Hamburg (urban-regional scale) and the Climate Action Plans of the other six Districts (district-urban scale) in Hamburg do not explicitly cover the topic of circular development. However, the Climate Action Plans should be considered as a plausible instrument to promote circular development on city and district scales, at least until other strategies and concepts are in place.

A Circular Economy Strategy for the City of Hamburg is currently being developed by Hamburg's Environment, Climate, Energy and Agriculture Authority (BUKEA Behörde für Umwelt, Klima, Energie und Agrarwirtschaft) with a participatory approach and building on an earlier study on Hamburg's potentials for a circular economy (Wilts et al., 2024). However, it should be investigated in future research if and how this strategy will incorporate spatial aspects or if it is limited to circular economy activities, as Williams critically stated (2021a).

Concerning spatial development concepts or strategies in Hamburg, a new Spatial Development Strategy for the city-scale is currently being developed, while on the district-level, only the District of Hamburg-Eimsbüttel has a Spatial Development Concept. Leaning on of Nadin et al.'s (2018) work on the interrelation between spatial planning and other thematic instruments that have impacts on spatial development, these strategic processes should be accompanied by further research that investigates to what extent the new Spatial Development Strategy of the City of Hamburg will include circular development topics and whether and how it will be connected with the Circular Economy Strategy that is under development.

When it comes to the lack of cooperation across different spatial scales (Obersteg et al, 2019), the established interplay between the different scales of the mentioned spatial planning instruments (Nadin et al., 2018) - e.g. spatial development concepts or climate action plans on

different spatial scales - could be used to include circular development across and between different spatial scales, and this could support learning processes in the sense of the transition management framework between arena, agenda and experimental levels (Wittmayer and Loorbach, 2016).

As mentioned, the research was mainly focused on the urban and local/neighbourhood scales, and except for the first article, the urban-regional scale was not further investigated in this dissertation. As was outlined in the first article the topic of circular development at the urban-regional scale is addressed only in strategic planning instruments of some of the regions (Obersteg et al, 2019). Further research could focus on the role of the regional level for circular development, as material flows are not limited to administrative (e.g. municipal, federal state) boundaries and considering the fact that keeping and organising material loops within a region should be a major objective of circular development (see Milligan and O’Keeffe, 2019). On a city-regional scale, further research could investigate how the experience of spatial planning could be used to improve inter-municipal and cross-border cooperation, respectively, in the field of circular development, and how this could support the development of regional strategies. However, in the case of Hamburg, it can be said that the topic is not yet on the agenda of the Hamburg Metropolitan Region. On the European level, an analysis could be conducted to explore the representation of the regional level in circular development, for example, as mirrored in the activities of the Circular Cities and Regions Initiative (CCRI).

2) Informal planning instruments

As a summary of the findings, it can be stated that the co-creative process in the Living Lab and the experimental project WiedergeBORN led to trust-building and intensive exchange between the key stakeholders from spatial planning and waste management, which enabled the development of solutions adapted to different types of urban areas (Obersteg et al., 2020) and to the successful implementation of some measures in the frame of the experiment (Obersteg, 2024). One important success factor was the active role of the established neighbourhood management, which was one of the key stakeholders in the experimental project. With their experience concerning participatory processes, they enabled the exchange between other stakeholders and the involvement of further local stakeholders and citizens. An additional factor was the use of different tools to reach stakeholders and citizens, which enabled the identification and definition of the current problems in the area and supported the

implementation of targeted solutions. Particularly strong contributions to the involvement of stakeholders and citizens were achieved by the naming of a local project manager of the waste management company for the experimental project, the involvement of citizens through an activating survey and different workshop formats and the festival in the neighbourhood (Obersteg, 2024). Beyond the experiment in the large housing estate, the socio-spatial typology of different neighbourhoods developed in the Living Lab illuminated the differences in the structures of stakeholders in the identified types of urban areas. This enabled an understanding of the necessity to involve stakeholders and reach citizens in different urban areas in locally adapted ways and with the respective instruments (Obersteg et al., 2020).

The results of Obersteg et al. (2020) show that it can be concluded that Living Labs, as well as experiments, are adequate informal instruments to support circular development. These instruments could be further tested to develop and implement circular solutions, e.g. in the frame of local development processes for planning new urban development areas (this could be connected to formalised planning instruments, see the conclusions 4). They could also be connected to integrated (socio-spatial) development planning processes (connection to conclusions 3) to support a transformation of existing neighbourhoods towards improved circularity. Furthermore, future Living Labs and experiments could be derived from strategic planning instruments (in connection with conclusion 1) to break down objectives and measures that were defined on a strategic level to the neighbourhood scale, where they can be adapted and specified to the local requirements. Vice versa, further future Living Labs on a tactical (agenda) level (e.g. on urban-district scale) and experiments on an operational level (on local-neighbourhood scale) could be used to generate knowledge about challenges as well as ideas for solutions that could be transferred to the strategic level (arena) and then integrated into the strategic planning instruments. The connection between Living Labs and experiments and strategic planning instruments could enable the scalability of results and a transfer of knowledge between different levels, as von Wirth et al. (2019) and Bulkeley et al. (2018) have also found. This could enable the continuity and legacy of an experiment, and, thus, avoid the lack of meaningful transfer that was observed in the case of the WiedergeBORN project (Obersteg, 2024).

Beside Living Labs and experimental projects, there are other examples of existing informal instruments that could support circular development. Existing instruments to reach local stakeholders and citizens like neighbourhood management programs or local development

councils could be used to reach citizens and address circular development on local scale. Financial support could come in the form of, for example, incentives for projects of local stakeholders and citizen activities, e.g. provided via a circular development fund that could be financed as part of a strategic development instrument (see conclusions 1). The allocation of such funding could be connected with preceding idea competitions or tender processes.

3) Integrative (socio-spatial) planning instruments

The involvement of spatial planning experts (practitioners from administration, neighbourhood development, housing companies and academics) in the Living Lab process and the experimental project and the use of data stemming from the socio-spatial analysis and the interviews with citizens, as well as information provided by local stakeholders, enabled a deeper and highly detailed insight into different socio-spatial settings (Obersteg et al. 2020; Obersteg, 2024). The involvement of citizens and of social, educational and cultural stakeholders working on the neighbourhood scale allowed for the successful development and implementation of measures. The role of the established neighbourhood management in supporting both the analysis and the involvement of citizens and further local stakeholders was regarded as important for the successful development and implementation of measures (Obersteg, 2024). While the approach to put the citizens at the centre of the activities to improve their wellbeing and living environment was evaluated positively, it was also stated that the involvement of citizens requires capacity and demands continuity over a longer period to reach different groups (Obersteg, 2024).

It can be concluded that the implementation of circular development processes and the subsequent involvement of citizens, specifically in socio-economically disadvantaged neighbourhoods, needs to be embedded in a broader frame of local development and community-building: this could be provided by Integrative (socio-spatial) development planning tools. The inclusion of circularity objectives into existing (or future) integrative (socio-spatial) development planning programs could enable the necessary continuity for circular development processes and, especially, the involvement of citizens over a longer period. Furthermore, these programs offer a frame within which to formulate objectives for circularity that could subsequently be embedded into the general development of disadvantaged neighbourhoods (as in the case of WiedergeBORN, see Obersteg, 2024). Another advantage is that these programs not only comprise objectives on a strategic level but also address concrete measures, define local

stakeholders to be involved and provide some funding for implementation and, in most cases, also for a neighbourhood management agency. The latter manages the implementation of measures and is responsible for the involvement of citizens and local stakeholders. Furthermore, these programs and their respective measures are developed following a standardised analysis of the neighbourhood, which includes socio-economic and certain built-environment factors. These established analyses, conducted in the frame of integrative planning concepts, could be supplemented with the aspects that were addressed in the socio-spatial analysis conducted by Obersteg et al (2020). Finally, the integrative (socio-spatial) development planning programs are regularly evaluated; this assessment would address the issue of the lack of reflection of the outcomes of the experimental project, as described in the discussion.

In the case of Hamburg, an integration of circularity aspects in existing programs (Hamburg's Framework Programme for Integrated Urban District Development - Rahmenprogramm Integrierte Stadtteilentwicklung RISE (BSW, 2023)) could support circular development in disadvantaged areas. While the RISE program initially focused on socio-economic and building renovation issues, it has been expanded to include environmental and climate topics in the recent program phases (Obersteg, 2024). This offers an opportunity to bring in circularity aspects, especially if they address the well-being and living environment of inhabitants. As the RISE program covers only some of Hamburg's disadvantaged areas, it should be mentioned that institutionalised neighbourhood management schemes also exist outside of the RISE and the areas that are supported by this program. These neighbourhood management agencies are mostly funded by public and private housing companies, often in areas that were previously covered by the RISE program, but that have graduated out of the program funding due to a positive development evaluation in the area. Nevertheless, these neighbourhood management agencies also follow comparable objectives and implement similar activities, and, therefore, they are similarly receptive to environmental and climate topics and could, in the future, include circularity aspects.

4) Regulatory (land-use and physical infrastructure) planning instruments

It is important to reiterate that the themes of land-use and physical infrastructure explored in the presented research were limited to the spatial analysis on a smaller scale for the different neighbourhoods (Obersteg et al., 2020) and to the analysis of the waste storage locations and the littering and cleanliness in open spaces included in the experimental project interventions.

Despite this limited consideration of land-use and physical infrastructure, both analyses were important contributions to the circular development process as they enabled the development of targeted solutions (Obersteg et al., 2020) and the resulting measures that were implemented in the experimental project WiedergeBORN. The latter provided physical and environmental improvements (littering, bulky waste disposal) at a small scale. Even if the total outcomes of the experimental project only saw a limited transfer, some results of the small-scale spatial and physical analysis and some lessons learned from the measures in the experimental project have since already been used by the public housing company SAGA and the public waste management company SRH in other areas (large housing estates). Furthermore, SAGA and SRH published a guideline for improving the design of waste storage and separation locations, developed based on the experiences from the experimental project (Obersteg, 2024). This brief guideline could be expanded and adapted to other areas.

In the frame of the Living Lab, solutions to adapt the waste infrastructure to local requirements for the other four types of neighbourhoods were also developed. They were not implemented due to the fact that the key stakeholders in the Living Lab process decided to focus on the experimental project in the large housing estate neighbourhood type, in this case Osdorfer Born. Solutions for the newly built areas address the need for an earlier involvement of public waste management actors in planning processes to enable an integration of the requirements of waste management and avoid planning mistakes, like those seen in previous urban developments. For the densely built-up urban areas, solutions include waste storage locations on public property and decentralised composting sites; both require an adaptation of existing planning requirements (Obersteg et al, 2020; REPAiR, 2020).

As a general conclusion, it can be stated that the Living lab and the experimental project both focused on improving waste management and therefore, the analysis was conducted on a small-scale physical structure. Consequently, the analysis and the solutions were limited to waste infrastructure and environmental impacts of waste on the living environment in local neighbourhoods. Still, some of the learnings could be used further to target circular development in future land-use planning and connect waste management with other topics of circularity. In Hamburg, legally binding land-use plans (Bebauungsplan) and master plans for new development areas, for example, could address the topic of waste management and circular development more completely and earlier in their drafting processes. As this dissertation did not further investigate formal planning, further research could contribute to deeper learning

on the integration of improved waste management infrastructure and waste avoidance offers (sharing) in the planning of new neighbourhoods and the integration of decentralised waste management solutions in new and existing neighbourhoods, e.g. local composting and processing of organic waste, smaller-scale recycling and sharing hubs. Also, the connection of decentralised organic waste processing to produce biogas and compost with other circular solutions (biogas for local energy production, compost for local soil improvement and for local food production) should receive further research.

Overarching conclusions and avenues for further research

Going beyond the results drawn for the four types of instruments, the key conclusions of the dissertation are summarised here. A brief outlook on options for future research is also provided.

1) As outlined above, a general correlation of spatial planning and circular development can be clearly found. Planning offers the possibility to provide framework conditions like conceptual bases on different spatial scales (urban-region, urban-district, local-neighbourhood) or the involvement of stakeholders and citizens in the development of strategies that are needed for implementing circularity. Two options can be considered for the integration of circularity into spatial planning approaches.

First is the integration of circularity in existing planning instruments or, second, the creation of separate plans or strategies for circular development. A city or region may opt for the development of new instruments for circular development in order to highlight the independent positioning of the topic of circularity, with the goal of achieving more political commitment and visibility. As a consequence of the choice to develop separate instruments for circularity, the new instrument(s) must be formally connected to the different sectoral departments that are needed for execution. The willingness of the addressees to prioritise circularity within their sectoral responsibility depends on where circularity is housed within the administration: in a traditionally strong or weak department (e.g. economy versus environment) or with the mayor's office or chancellery, which provides strong authority (Williams, 2023).

Second is the option of integrating circularity as an additional aspect into urban and regional planning. This offers binding instruments and formalised processes for implementing circularity. A risk of this solution is reduced or lost visibility for the issues, which could result in a lack of public interest or political commitment (Williams, 2023).

For decision-making on these strategic options, it is necessary to consider the specific local constellations, including the political agenda of the governing parties, the mayor and the department heads, the position of spatial planning in the internal ranking of the departments, or sectoral potentials regarding circularity (Nadin et al., 2018).

Regarding future research, analyses of cities and regions that already have developed a circular economy or circular development strategy (e.g. Amsterdam, Paris, London, Stockholm) hold great potential to expand knowledge in the field. Such research should also explore how the strategies are implemented, with a focus on how the different policy fields are connected, to what extent there is a strategic division of labour with other departments and how the content is coordinated with existing thematic instruments.

2) Circular development processes are time and effort-consuming and require data availability and accessibility. Despite their limitations, participatory and co-creative approaches and integrative analytical methods have proven successful (Obersteg et al, 2020; Obersteg, 2024). Further research should examine how these approaches and methods could be optimised concerning the specific requirements of issues of circularity. One option is to integrate or connect circular development processes into or with other planning instruments and processes. An avenue for future research could be to investigate the possible integration or connection of analytical processes for circular development into or with other existing analytical processes like social monitoring, climate monitoring or the collection of data for the built environment.

3) As presented above, it can be stated that the co-creative processes, using different methods, enabled the building of bridges between different disciplines, which supported the circular development process (Bulkeley et al., 2018). It became evident that spatial planning could offer the capacity and knowledge to steer and support such integrative, analytical, and co-creative processes (Obersteg et al., 2020; Obersteg 2024). Besides its capacity to support circular development, as spatial planning is committed to sustainable development, it should furthermore have an intrinsic interest in supporting circular development as an important contribution to sustainable development.

The findings of this dissertation contribute to an improved understanding of how spatial planning could support circular development on three different spatial scales. It was demonstrated that spatial planning offers a set of instruments that can assist different steps of circular development processes, from analysing the status quo to developing and implementing

solutions. While the conclusions of this dissertation are sorted according to types of instruments, it needs to be stated that these instruments should be seen in connection to processes that are driven by stakeholders. It was also shown that an active role of spatial planners, including practitioners and academics, can improve the integration of aspects of space and place into circular development processes. This could enable a shift from the conventional understanding of cities and regions as a container for circular economy activities to a truly holistic conceptualisation of circular development, which encompasses cities and regions and their socio-spatial specificities.

Further research could investigate the potential of different spatial planning instruments to support circular development. It would be of interest to examine the interaction of a range of stakeholders in circular development when applying various instruments. Additionally, further investigations could explore the use of new spatial planning instruments to initiate or catalyse circular development processes and outcomes. While this dissertation focused on spatial planning's enabling role in the circular economy connected to waste flows and improved waste management and avoidance, further research could examine the potential role of spatial planning as an integrative discipline in linking different aspects beyond waste in the circular city, e.g. design, production and retail.

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7. Appendix: Related papers

Paper I

Obersteg, A., Arlati, A., Acke, A., Berruti, G., Czapiewski, K., Dąbrowski, M., Heurkens, E., Mezei, C., Palestino, M. F., Varjú, V., Wójcik, M., & Knieling, J. (2019). Urban regions shifting to circular economy: Understanding challenges for new ways of governance. *Urban Planning*, 4(3), 13–31. <https://doi.org/10.17645/up.v4i3.2158>

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Paper II

Obersteg, A., Arlati, A., & Knieling, J. (2020). Making cities circular: Experiences from the living lab Hamburg-Altona. *European Spatial Research and Policy*, 27(2), 59–77. <https://doi.org/10.18778/1231-1952.27.2.05>



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Paper III

Obersteg, A. (2024). Successful project – limited transfer: Learnings from the local Circularity Experiment Wiedergeborn. *Sustainability*, 16(23), Article 10643. <https://doi.org/10.3390/su162310643>

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Article

Urban Regions Shifting to Circular Economy: Understanding Challenges for New Ways of Governance

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Abstract

Urban areas account for around 50% of global solid waste generation. In the last decade, the European Union has supported numerous initiatives aiming at reducing waste generation by promoting shifts towards Circular Economy (CE) approaches. Governing this process has become imperative. This article focuses on the results of a governance analysis of six urban regions in Europe involved in the Horizon 2020 project REPAiR. By means of semi-structured interviews, document analysis and workshops with local stakeholders, for each urban area a list of governance challenges which hinder the necessary shift to circularity was drafted. In order to compare the six cases, the various challenges have been categorized using the PESTEL-O method. Results highlight a significant variation in policy contexts and the need for these to evolve by adapting stakeholders' and policy-makers' engagement and diffusing knowledge on CE. Common challenges among the six regions include a lack of an integrated guiding framework (both political and legal), limited awareness among citizens, and technological barriers. All these elements call for a multi-faceted governance approach able to embrace the complexity of the process and comprehensively address the various challenges to completing the shift towards circularity in cities.

Keywords

challenges; circular economy; governance; peri-urban areas; urban region

Issue

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1. Introduction

The need for a shift to a more sustainable way of living is key in recent strategies at European level (European

Union [EU], 2017). In order to reach this goal in a comprehensive manner, the process needs to be carefully governed. At this point, several problems and challenges have emerged, due to the relative novelty and complex-

ity of Circular Economy (CE) as a policy field; furthermore, there are still only few studies on governance of CE, particularly at the scale of urban regions (Section 2); and thus requiring a solid methodology (Section 3).

It is argued that an analysis of governance settings and related challenges is necessary to delineate new ways of governance towards circularity. The latter should allow cross-cutting (horizontal) and multi-level (vertical) involvement of various actors in finding answers to challenges posed by CE.

This article attempts to address this knowledge gap by providing guidelines for overcoming barriers and taking advantage of opportunities within governance settings to develop CE thinking on the level of urban regions. These have been developed through an explorative analysis (Section 4) of the first results on governance challenges for CE in six European peri-urban areas, as an output of the ongoing Horizon2020 Project REPAiR. The challenges derived from the six cases are compared, analyzed and discussed in Section 5. Thus, gaps in the current literature on governance of CE in urban regions are addressed. Furthermore, an account is provided on how, at regional scale, stakeholders from different governance fields and levels grapple with those issues.

We argue that the challenges linked to the different and context-specific governance and institutional settings have a significant impact on the effectiveness of resource management processes in observance of the EU goals for CE (Section 6).

2. The Need for Governance Change in Urban Regions

Urban areas are responsible for around 50% of global solid waste generation and between 60% and 80% of greenhouse gas production (Camaren & Swilling, 2012; Chávez et al., 2018). Facing ongoing urbanization, it is also predicted that consumption of goods and services and, as a consequence, the use of resources in cities, will grow in the future (McKinsey Global Institute, 2016).

Over the last decades, various concepts with regard to resource consumption and flows of materials have been developed and discussed. The urban metabolism concept as one of the most comprehensive approaches was first outlined by Wolman in 1965. It aims at understanding the flows into and out of cities and has been adapted several times, with recent approaches trying to further integrate social and economic aspects and to develop proposals on how to (re-)build cities in a more circular way (Kennedy, Pincetl, & Bunje, 2011).

While urban metabolism focused on cities, the concept of CE was conceived as primarily non-spatial as its focus is on the reorganization of enterprises, sectors and the economy. The objective is to close resource loops by recycling waste and reusing materials (Ghisellini, Cialani, & Ulgiati, 2016). The CE approach has been translated into policy recommendations by—among others—the Ellen MacArthur Foundation (2013). Also, building on the CE concept, the EU has adopted strategies—e.g., the

Circular Economy Strategy 2017—to make Europe's economy more circular (EU, 2017).

An important step when approaching CE-oriented actions is to determine their setting and the boundaries of their impact. Among the extensive recent literature on the city scale of CE is a suggested approach able to provide a holistic interpretation, allowing a systematic view of problems and objectives (Geng & Doberstein, 2008; Ghisellini et al., 2016). This is said to help in integrating the local/territorial approach, since the main flows of materials are organized in very different ways based on variations in local conditions (European Spatial Planning Observation Network, 2019).

Girardet (2015) attempted to connect the concept of CE with urban development approaches in his regenerative city concept; while Williams (2019) emphasized the deficits of the CE concept with regard to spatial and social questions. Both authors accentuate the necessity of effective governance in the process of applying CE ideas to cities. For sustaining and facilitating such changes, a territorial governance approach which integrates the multi-level and cross-sectoral features of governance must be considered (Schmitt & Van Well, 2016; Van Well & Schmitt, 2016).

Recent studies have examined circular city and CE strategies on the municipal level. Prendeville, Cherim and Bocken (2018) discuss the concept of circular cities by analyzing circular city strategies and their implementation in six cases. They argue that, even though policymakers are interested in circular city strategies to achieve CE in cities, the implementation of these strategies faces limits: policymakers often rely on big economic stakeholders to execute CE in cities, while the development and implementation of these strategies lack an involvement of a broader stakeholder setting. Based on an analysis of CE strategies on the municipal level in 83 cities, Petit-Boix and Leipold (2018) recommend taking into account urban planning in the analysis of CE in cities as it influences many strategies linked to CE. Furthermore, they suggest involving key stakeholders in cities to identify barriers to and opportunities for the implementation of CE strategies.

In this article we consider the aforementioned demand for a better understanding of how CE could be achieved in cities and how CE and circular city approaches could be supported by key stakeholders. While the approaches of the studies of Petit-Boix and Leipold (2018) and Prendeville et al. (2018) focus on cities, we argue in this research that looking at urban regions is the more suitable scale to act for the concretization and spatialization of CE actions (Milligan & O'Keeffe, 2019). Urban regions and especially their peri-urban areas are characterised by a patchwork of dispersed urbanized areas, agricultural land and open spaces. The Directorate General for Regional Policy of the European Commission underlined in *Cities of Tomorrow: Challenges, Visions, Ways Forward* (European Commission, Directorate General for Regional Policy [EC],

2011) the presence of problems such as excessive use of resources and waste production, as well as urban sprawl and extensive land consumption in peri-urban parts of urban regions. This situation is often accompanied by fragmented local governments and planning systems. Nevertheless, while urban regions and notably their peri-urban areas are considered particularly relevant as a source of problems, their spatial configurations offer at the same time a range of possibilities to establish a CE and support sustainable development (EC, 2011; Knieling, Jacuniak-Suda, & Obersteg, 2017).

Looking into the research on climate change and transition, different aspects and issues have been identified to categorize governance processes and challenges (Dewulf, Meijerink, & Runhaar, 2015; Ehnert et al., 2018). Three main dimensions to examine governance challenges can be derived from this research:

- (1) Multi-level governance considers the different scales that are involved in governance processes related to the shift of urban regions to CE (from local, regional, national to supranational) and the interactions between these levels;
- (2) Cross-sectoral governance considers the involvement of different divisions of the public sector that are connected to circularity, such as waste management, spatial planning, environmental planning and business development;
- (3) Multi-actor or quadruple helix governance focuses on the participation actors from public, private (enterprises), science (research institutions) and civil society (NGOs, initiatives) sectors.

These three dimensions were applied in our analysis with the aim to explore and enhance the understanding of the concrete governance challenges in nudging metropolitan urban regions towards a CE approach. A special focus in our research is set on identifying governance challenges where CE is linked to spatial affairs and planning. The research was conducted in six European case studies in the urban regions of Amsterdam, Naples, Ghent, Pécs, Łódź and Hamburg, using the methodology explained in Section three.

3. Methodology

Due to the novelty of the CE topic (Ghisellini et al., 2016), we opted for an exploratory approach describing six selected case studies around Europe to investigate the theoretical aspects derived from an extensive literature research in a real-world context (Yin, 1984/2009). Existing literature has drawn attention to implementation challenges of CE tenets at different levels (Franco, 2017; Petit-Boix & Leipold, 2018; Prendeville et al., 2018). We aim to enrich this discussion by highlighting the cross-cutting—multi-level, multi-sectorial, multi-actors—nature of the implementation of CE actions and their spatial relationships (REPAiR, 2017e). The case study selection was

driven by the necessity of identifying common elements in situations characterized by apparent profound social, economic and environmental diversities. Yet it was still following a comparability logic (Kaarbo & Beasley, 1999); exploring the phenomena in all dimensions (Bartlett & Vavrus, 2017). The number of cases was intentionally kept small, allowing “thick description” and adequate analytic depth (Collier, 1993, p. 109; Kaarbo & Beasley, 1999).

Therefore, we primarily constructed a story for each case based on a total of 58 semi-structured interviews and archival sources such as published official documents and media reports. The interviews were conducted in loco with key stakeholders from waste management sector, local and regional authorities, housing companies, and representatives of the private sector (Nilsson, Eklund, & Tyskeng, 2009, pp. 5–6) and using a snowball sampling method which led to the identification of additional stakeholders concerned with the CE topic in the six urban regions (snowball sampling; see Reed et al., 2009). The thus identified stakeholder constellation was considered for direct involvement in several meetings where challenges were addressed and discussed, following the Living Lab format (Advanced Metropolitan Solutions, 2017; REPAiR, 2017c). At least one organizer of these meetings per case study is author of the present article. The challenges produced in these meetings are summarized in Tables 2 to 8.

To allow and facilitate comparison between the case studies, the analytical framework PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) was used. First conceived as a tool for evaluating alternatives within organizations (e.g., Fozer et al., 2017; Song, Sun, & Jin, 2017), the framework has proved to be of significant importance in the field of strategic planning due to its ability to provide a comprehensive overview on different factors, the challenges in our case (Osborne & Brown, 2005; Yüksel, 2012), and simultaneously to highlight possible interdependencies between those (Codagnone & Wimmer, 2007; Mietzner & Reger, 2005). As governance is the focus of the present article, we considered it necessary to add organizational-related challenges as a seventh category for comparison sake.

4. Governance Settings in the Six Urban Areas

This section presents the governance background concerning spatial planning and CE topics in the case areas and provides an insight on the various challenges that a shift to CE requires. Table 1 shows key information for each case, followed by a more detailed description of each case.

4.1. Amsterdam

The Netherlands ranks among the top countries in the EU in terms of waste management (BiPRO, 2012), and has far-going ambitions to develop the country’s econ-

Table 1. Overview of the six focus areas in REPAiR project. Focus area indicates arbitrarily predetermined zones which contain peri-urban features.

Case Study Focus Area	Inhabitants in the Focus Area (number)	Waste Stream Focus
Amsterdam—The Netherlands (several municipalities in Amsterdam Metropolitan Area including Aalsmeer, Haarlemmermeer, Velsen, Zaanstad)	758 845 (2017)	• Organic waste (OW) • Construction & demolition waste (C&D) • Wastescape
Naples—Italy (Napoli Est, Casoria, Afragola, Acerra, Casalnuovo, Caivano, Cardito, Crispano, Frattaminore, Volla, Cercola)	519 425 (2017) • C&D	• OW • Wastescape
Ghent—Belgium (Ghent-Destelbergen)	277 065 (2017) <i>Ghent 259.083</i> <i>Destelbergen 17.982</i>	• OW from households and SME
Hamburg—Germany (Bezirk Altona and Kreis Pinneberg)	577 734 (2016) <i>Altona 270 263</i> <i>Pinneberg 307 471</i>	• OW from households and tree nurseries
Łódź—Poland (Łódź, Nowosolna, Główno, Stryków, Brzeziny, Dmosin, Jeźów and Rogów)	757990 (2017) <i>Łódź itself 690 422 (2017)</i>	• Municipal solid waste -especially OW fraction
Pécs—Hungary (Pécs and 41 municipalities)	144 188 (2017) <i>Pécs agglomeration 179 719 (2017)</i>	• OW • Plastic packaging waste • Residual waste • Wastescape

omy towards one based on the principles of the CE by 2050 (Ministry of Infrastructure and Environment & Ministry of Economic Affairs, 2016). In addition, the national government has formulated specific CE policies focusing on specific sectors, for instance construction (Rijkswaterstaat & Ministry of Infrastructure and Environment, 2015).

The Amsterdam Metropolitan Area (AMA) can be regarded as one of the frontrunners in moving towards a CE. The AMA spans across the boundaries of two provinces and encompasses the city of Amsterdam and 32 municipalities. For instance, the city of Amsterdam has formulated a circular city policy, which gives direction to public and private decision-making in the metropolitan area (Municipality of Amsterdam, 2016), and the municipality of Haarlemmermeer has the ambition for a transition towards a regional circular society and economy (Bosch, 2015). Moreover, various private actors, including waste management companies, as well as construction companies working on circular development initiatives, formulate their own ambitions.

Some of the key CE objectives for the AMA include: (1) redeveloping the Amsterdam docklands and wastescape while limiting the amount of construction and demolition waste; (2) reusing the airport wastescape surrounding, and reducing the food waste from Schiphol airport; and (3) reducing and reusing bio-waste from agricultural production in greenhouses and flower trading within the Greenport Aalsmeer area.

Stakeholders identified a variety of specific challenges for reaching the above objectives, including: (1) conflicting interests of stakeholders across and within organizations; (2) lack of awareness of CE solutions and business models, particularly among the business players; (3) organizational fragmentation and lack of regional leadership; and (4) regulatory, financial and behavioral obstacles to learning from and upscaling circular innovations. Both the area-specific, waste-specific, and governance-specific challenges result in ambiguous and complex governance settings in which to promote a CE strategy in the AMA.

4.2. Naples

In Italy integrated waste management started in 2006. Being recent, this measure has been absorbed differently by regional policies, and this is truly evident in southern Italy. In particular, the Campania region has experienced two environmental crises since the mid-nineties, whose effects are still ongoing: the Waste Emergency and the Land of Fires. Both crises arose from government incapacity and the poor governance model in use (REPAiR, 2017d). As a consequence of the socio-ecological decay process, the abandonment and illegal deposit of waste along peri-urban streets and infrastructure has contributed to the proliferation of wastelands. In the case-study area, which extends towards the North-East of Naples up to the town of Acerra, the assemblage of dif-

ferent kinds of wastelands has consequently given shape to wastescapes (REPAiR, 2017a).

What local authorities have to aim at is a multi-level governance through which the CE approach can be applied to both the waste management and the wasteland regeneration (Berruti & Palestino, 2019). In order to achieve this objective, there are some key challenges to face:

- (1) the stalemate in the waste management system, for which institutions do not care or even exploit at the different levels. The Regional Authority is playing its decisional power without calibrating rules to local contexts or turning them into effective policies; municipalities are interested in preserving benefits related to the previous waste system and companies selected through political nepotism. Surprisingly, Metropolitan City of Naples has been wrongly excluded from the governance of waste management by the regional law;
- (2) the increase of wastelands due to intra-institutional difficulties in overcoming sectoral policies and conflicting powers;
- (3) the lack of shared knowledge among institutions and towards citizens;
- (4) suspicion, stigmatization and distrust making it difficult to innovate policies and develop new economies.

Promoting the relationship with communities through the co-design of places would be crucial for decision-makers, in order to turn all the fragmented measures and rules into a pluralist strategic vision. It would be also crucial for institutions to sustain proposals coming from local stakeholders that otherwise risk failure.

4.3. Ghent

Flanders has a long history of Waste Management. Since 1981 a combination of instruments and tools has been used to move waste management further up in the waste hierarchy, promoting prevention and material recovery (REPAiR, 2017e). As a result, waste sensitivity is amongst the highest in Europe (REPAiR, 2017b).

The general legal framework for household waste management is determined at Flemish (regional) level, with implementation plans setting priorities, targets and general strategies. Customization at local (municipal) level remains possible, providing that waste management services are accessible to all.

The ongoing ambition to reduce the total amount of (residual) waste necessitates municipalities to look for eco-innovative solutions, in order to further improve resource management. While waste management has been integrated in the city's climate policy and urban planning, the shift to CE is yet to be made. Food waste prevention, local waste treatment and higher valorization of resources remain challenging.

In the case-study area, Vegetables, Fruit, Garden waste (VFG) still represents a considerable amount of the residual waste. Challenging collection conditions (smell, hygiene, volume) for households and waste agencies, label VFG as a difficult waste flow to treat. However, many aspects determine the direct/proactive involvement of households to the separate collection of VFG. Legal obligations and financial incentives are only part of the solution. More compact living forms, changing family units, demographic evolution and new mobility trends all impact waste behavior. They ask for other collection methods than the classic kerbside collection or the collection in recycling parks. The diverse urban fabric calls for a customized approach and cost-benefits must be taken into account to guarantee an accessible service to all. Furthermore, open public space is scarce in the inner city as well as in peri-urban areas, resulting in a strong competition between different policy objectives.

4.4. Hamburg

Germany is widely considered as a frontrunner in dealing with environmental problems (European Environmental Agency, 2009; Wilts, 2016). Since 2012, the Circular Economy Act (Kreislaufwirtschaftsgesetz) guides actions related to waste management issues. The fulfilment of its requirements is the task of the Federal States. However, the interpretation of national regulations might substantially differ between states (REPAiR, 2017e, p. 23). This situation is reflected in spatial planning issues: in Pinneberg County (Schleswig-Holstein), municipalities develop their own spatial plans according to the national strategies without any restriction from the county. Meanwhile in Hamburg, binding plans are drafted at county level (i.e., the districts), as for the District of Altona, revealing a concentration of powers at higher levels. This setting might hinder pursuing CE actions, which call for cooperation between the two different states.

Just as the systems in the two states are distinct, the challenges that are faced have two different aspects. In Hamburg's District of Altona around one third of the bio-waste generated is thrown in the bins for residual waste. This is due in some households to a lack of separate bio-waste bins available and in others to improper disposal behavior, despite the many incentives provided for correct separation (REPAiR, 2017e, p. 31). The residual waste is incinerated, leading to a loss of valuable resources. In the case of Pinneberg, the focus is on the tree nurseries business as this economic activity characterizes the county. The bio-waste that is generated in tree nurseries is often directly incinerated on site, causing emissions that annoy the neighbors. This has led to protests and, jointly with an always increasing housing market pressure, the tree nurseries are at risk of being replaced in order to build new apartments.

Barriers are also present inside each Federal State, between different stakeholders and, sometimes, even within the same institution. As a matter of fact, stakehold-

ers have mentioned the necessity of a more integrated approach between planning and waste management to overcome these challenges and to reach more circularity.

4.5. Łódź

In Poland two regulations are currently in force: one on waste from 2012 (amended in 2015) and the Act of 1996 on maintaining cleanliness and order in municipalities (amended in 2011 and 2014). The authority responsible for organizing waste management is the municipality. Moreover, municipalities' responsibilities comprise ensuring the construction, maintenance and operation of waste treatment infrastructure as well as including all households in the municipal waste management system and providing selective waste collection. Municipal authorities appoint waste collection companies by means of public tender (REPAiR, 2017e).

After various meetings and interviews with local stakeholders, three key challenges related to waste management in Łódź Agglomeration were identified:

- (1) Environmental awareness of inhabitants—concerns inadequately low level of socio-ecological awareness, manifested mainly in improper or even lack of waste separation. As a consequence, the amount of waste to be recycled is relatively low;
- (2) Legal status—the regulations in force do not ensure high quality of service concerning collection and management of municipal waste. The issue regards the restricted possibility of establishing local recycling centers and meeting requirements of complex environmental procedures in a short time. Establishment of commercial institutions intended for waste management by local authorities is also hampered;
- (3) Local government policy—local governments cooperate poorly with each other in implementing objectives of environmental policies. There is a lack of widespread actions to pass on good practices. Local authorities do not stand for lobbying innovative ecological solutions.

The coming years will be decisive to the process of stabilizing the waste collection and management system. A significant role should be played by local self-government associations, which articulate the need for changes and modernization of approaches towards waste management, including enacting legal regulations. However, the successful implementation of CE principles will depend to the greatest extent upon enhancing the environmental awareness of the local population.

4.6. Pécs

Although there have been many remarkable achievements in regard to decreasing waste generation and

improving waste management infrastructure, Hungary lacks a visible political intention related to circularity both at national and local levels. Furthermore, there are only few voluntary CE initiatives and projects in the private sector. According to the OECD report for Hungary, a whole-government approach is needed to accelerate towards CE (OECD, 2018). However, starting in 2010, a very strong centralization process within the whole governmental area can be observed, accompanied by the degradation of the independent environmental management system (in all lower decision-making levels). This centralization has resulted in the unavailability of secondary raw materials in the local market for public waste management companies, which led to a weakening in their importance in waste management activities. Because of this, local stakeholders' interest has dropped. A lack of a real iterative process in planning and decision making further complicates matters.

The EU-financed new waste management infrastructure (built in 2016) of the urban region Pécs has caused path dependency in technology in use for the next 20–25 years. As a result of this investment there is door-to-door collection for many materials. However, there are some remaining challenges: the low density of selection islands (collection points) and the lack of solutions for special waste collection and treatment (e.g., discharge the asbestos from the demolition waste).

On the other side of the waste chain, household behavior and attitudes need major improvement. In this case, the challenges in the urban region of Pécs consist of high rate of selectively collectable materials wrongly put in the residual waste (bins); garden waste burning practice of the households (instead of composting); heating with waste in poor families (REPAiR, 2017e).

The generation of wastescapes is related to the main economic development trajectory of Pécs. The three main groups of challenges are the closed mining sites and their spoil-bank, the leftover military sites and the abandoned industrial areas.

5. Comparing Cases

5.1. PESTEL-O Table

In order to understand and compare the main governance challenges to CE among the six cases, Table 2 was constructed using the PESTEL-O method. The next two paragraphs draw out the key common points of the challenges and the discussion of the main findings, respectively.

5.2. Comparison

Similarities can be identified by drawing out the key findings from the table for each category. The rule of thumb used here is that a certain challenge must be present in at least two cases and only the most significant points will be discussed.

Table 2. Governance challenges: Policy/politics.

Amsterdam	Naples	Ghent	Pécs	Łódź	Hamburg
• Lack of consistency in municipal sustainability policies • Lack of regional CE policy formulation and coordination • Silo-mentality within governments and business regarding CE	• Competition among municipalities for leadership on waste management • Lack of policies able to face problems beyond administrative boundaries • Regional policies not calibrated to local contexts	• Long-term and solid cooperation are difficult to built • Integrate CE in urban planning policies • Balancing general regulations with tailor- made solutions	• Lack of real participation of stakeholders • Lack of decentralization of decision-making	• Not enough horizontal municipal cooperation • Difficult cooperation between local authorities and private sector	• Lack of integration of waste management and urban planning policies

Table 3. Governance challenges: Economic/financial.

Amsterdam	Naples	Ghent	Pécs	Łódź	Hamburg
• Banks reluctant in financing CE ventures • Limited awareness of successful CE business models in resource management and planning projects	• European waste management sanctions to be paid • Tendering not respondent to CE processes • Highest waste tax of Italy in the Campania Region	• Financing and up-scaling CE initiatives in a linear economy • Developing circular business model equally sharing burdens and benefits • Dual waste system (households/industrial) hinders waste management optimization	• Local service fees not purposed for refinancing new sectoral investments • Recently centralized secondary raw material market inaccessible to local service providers • Many non-re-cultivated wasted areas needing major investments	• Slow market development for eco-innovative solutions • Lack of business models to improve waste management processes • Difficult process of applying for additional funding for developing innovative solutions	• Incentives for waste separation not clear/high enough

Table 4. Governance challenges: Social/behavioral.

Amsterdam	Naples	Ghent	Pécs	Łódź	Hamburg
• Consumer readiness to pay premiums for circular products • Reliance on business leaders to make the CE transition	• Citizens' distrust of institutions • Suspicion of the quality of organic and C&D waste products • NIMBY Syndrome in local communities	• Engaging households in fighting food waste • Participation (quantity and quality) in separate collection VFG-waste • Citizen's knowledge and support for CE	• Excessive (mainly landfilled, food, plastic packaging) waste • Residual and garden waste burning practice of households	• Limited (ecological) awareness regarding waste burning for heating and waste separation advantages	• Waste topic not included sufficiently in school curricula • Little interest in waste from either landlords or tenants

Table 5. Governance challenges: Technological/infrastructure.

Amsterdam	Naples	Ghent	Pécs	Łódź	Hamburg
• Limited awareness of CE product development among producers	• High percentage of organic waste displacement in Northern Italy's waste treatment plants • Disposal of Eco bales • Lack of recycle points in the peri-urban area	• Improve valorisation of food surpluses from distribution chain • Nuisance related to storage and collection of VFG-waste	• Path dependency of waste management system and planning practice • Low density of waste collection points • Insufficient solutions for special waste collection and treatment (i.e., asbestos)	• Small number of companies with innovative potential • Insufficient waste separation infrastructure (incompatible container size) • Limited capacity for bulky waste storage and waste containers in public space	• Persistency of existing waste technology prevents innovation • Long distances between waste generation and treatment

Table 6. Governance challenges: Environmental.

Amsterdam	Naples	Ghent	Pécs	Łódź	Hamburg
• Presence of polluted or noise-restricted peri-urban wastescapes in port and airport areas	• Abandonment and illegal deposit of waste along peri-urban streets • Deposit of Eco bales in peri-urban areas by Campania Region • Peri-urban assemblages of wastelands	• Environmental impact of waste transport	• Points for separated waste collection frequently becoming wasted areas (illegally dumped litter near the separate collection bins) • No solutions for PLA (polylactic acid) collection, treatment and low level of distribution	• Enhancing the efficiency of waste collection system aiming at reduction of mixed waste • Locating new waste treatment plants • Suburbanization significantly increases waste management costs	• Bio-waste potential not fully used for biogas production

In relation to policy/politics, key challenges in the various case studies refer to a lack of leadership regarding waste management, the difficulty in formulating integrated waste management and planning policies, and a lack of stakeholder participation and cooperation. The main economic-financial challenges are the lack of tested CE business models and the difficult financing of CE initiatives. Observed social-behavioral challenges include a limited awareness about and engagement of citizens in waste collection, separation and management. The shared technological-infrastructure challenges are insufficient physical space for the collection, storage, separation and recycling points for waste. From an environmental point of view the cases illustrate the existence of wastelands, illegal waste dumping, and unwanted waste burning practices. Legislative challenges are very much

case- and context-specific and thus difficult to generalize arbitrarily. Finally, widespread organizational challenges found are knowledge asymmetry and lack of dialogue within (intra-institutional) and between (inter-institutional) organizations.

5.3. Discussion

After pointing out the similarities using the PESTEL-O, now the specificities of governance challenges for each case are highlighted. Though the AMA is one of the frontrunners in moving towards circularity, it lacks common regional strategies and actions in the public sector and coherent actions between the private sector and public institutions. In the metropolitan area of Naples, by contrast, CE works as a rhetorical argument that is rarely ap-

Table 7. Governance challenges: Legal.

Amsterdam	Naples	Ghent	Pécs	Łódź	Hamburg
• Construction tender procedures not adequately adapting CE principles • Unclear legislation on waste ownership • No tax disincentives for companies and households producing waste	• Legal control by EU on regional waste management • Poor measures for implementing CE processes • Redundancy of authorizations for implementing waste plants		• Lack of room to maneuver for local (government) stakeholders	• Privatized collection • Disrespecting environmental protection and waste management legislation • Lack of a well-functioning effective flow monitoring system	• Conflicts between waste management and other uses in public spaces

Table 8. Governance challenges: Organizational.

Amsterdam	Naples	Ghent	Pécs	Łódź	Hamburg
• Lack of regional CE platforms and networks • Risk-avoiding attitude towards CE initiatives in municipalities • Knowledge fragmentation within and asymmetry between organisations (intra- and inter-institutional)	• Slow transition in regional waste management • Organised crime interests in maintaining waste management status quo • Lack of inter-institutional and intra-institutional integration in environmental policies	• Knowledge asymmetry between stakeholders	• Insufficient level/mode of knowledge and information transfer	• Focus on waste recycling, less on design, prevention and reuse • Lack of reliable simulations regarding actual needs for providing waste management infrastructure	• No (or limited) dialogue between different stakeholders and sectors

plied in policies, due to inefficacy of sectoral planning and difficulties in fostering urban metabolism. In Ghent the transition to CE is well advanced, now the focus of local debates is how to upscale and mainstream CE initiatives. As CE is still a relatively new phenomenon in Łódź, there is a lack of cooperation between public authorities especially municipalities as well as between the public sector and enterprises. Furthermore, the citizens' environmental awareness with regard to CE and waste management is not yet very advanced. The Pécs case shows a lack of political interest in circularity and like in Łódź there are only few CE initiatives coming from the civic society. This indifference is worsened by a centralized environmental management system that hinders local actors' involvement. In the Hamburg case, in Pinneberg County the challenge is how to involve the private sector (tree nurseries) in CE activities, while in Hamburg-

Altona it is to bridge the gap between urban planning and waste management. The six cases show that, despite being in different stages of shifting towards CE, all of them are facing challenges in the implementation of CE strategies in overcoming sectoral policies and fragmented decision levels.

6. Conclusion

The study examined the necessity of understanding governance challenges in order to support urban regions in successfully shifting towards CE. The broad spectrum of governance challenges has been illustrated based on the case study specific analysis and their categorization according to the PESTEL-O method. According to the three dimensions that were introduced in Section two the following major governance challenges could be high-

lighted. First, with regard to multi-level governance the examined cases show that while ambitious initiatives for CE do exist in urban regions, the connections between these local and regional initiatives to policies on higher political and administrative levels are lacking. Second, concerning cross-sectoral governance within the public sector the examples from the six urban regions demonstrate a lack of connection of CE strategies with other policy fields especially spatial planning. Another major challenge is the often-missing horizontal cooperation between municipalities. Strategies and activities often remain local, not using the opportunity of promoting CE in larger regional scale. Third, regarding multi-actor or quadruple helix governance: while in some of the examined urban regions many entrepreneurial and civic society initiatives exist that lack coordination and support by the public sector; in other regions still only few activities from the economic sector and citizens can be observed and the public sector is mostly absent in promoting CE.

From a methodological point of view it should be stated that the use of the PESTEL-O method has its limitations. While it is useful for categorization purposes, there is a risk of neglecting the complexity of some of the challenges that cross more than one division.

Although the results of this study are limited due to the fact that the research only comprises qualitative studies in six cases, the need for further and deeper examination of CE implementation challenges in urban regions can be derived from the described findings. Urban planning has the potential to steer CE processes and has a cross-thematic and integrative character which suits the complexity of CE implementation. Further, as we have shown, CE strategies and activities must be further spatialized. The nature of this future role of spatial planning in the realization of CE demands further investigation.

As mentioned before, the presented outcomes derive from an ongoing project, and in future research each of the cases will be examined in-depth. This will allow for the development of more specific implications for policies.

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Conflict of Interests

The authors declare no conflict of interests.

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MAKING CITIES CIRCULAR: EXPERIENCES FROM THE LIVING LAB HAMBURG-ALTONA

Abstract. The article argues that to reach circular economy goals urban regions need to identify and understand the challenges and opportunities originating from the differences in spatial settings, and to develop place-based solutions by adequately involving (local) stakeholders. Based on the case study that was conducted in Hamburg within the Horizon2020 project REPAiR, spatial specificities in five different urban areas shall be analysed and strategies that were developed in a co-creative process shall be explored. The results show that the spatial organisation of CE strategies depends on urban structures and stakeholders' interest and needs to be embedded in the (local) governance setting and a spatial planning system.

Key words: circular economy, urban regions, Multi-level governance, living labs, urban metabolism.

1. INTRODUCTION

This paper is mainly based on the results from the Horizon2020-funded REPAiR project. It aimed at supporting the transition of urban regions from a linear to a circular economy by specifically addressing questions related to the spatial organisation of possible circular economy concepts. This refers to recent studies in the field, such as the 'circular city' (Williams, 2019), that have drawn attention to the spatial implications brought by actions focussed on reaching circularity at the urban scale.

The paper aims to analyse and indicate the differentiated requirements of the implementation of circular economy schemes and solutions in different types of urban neighbourhoods. The analysis was conducted in the REPAiR case study in the district of Altona in Hamburg. The thematic focus lies in the organisation of

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activities to achieve circular economy solutions that are linked to waste management (i.e. production, transport, consumption, and treatment).

The article investigates the main requirements that need to be addressed to develop, and preferably implement, CE schemes and solutions. These are namely changes in the governance structure and stakeholder constellation, and the subsequent modification of the urban tissue at the strategic level. After contextualising the working conceptual terms (Section 2), we shall present the case of Hamburg (Section 4) based on the methodological framework that is described in Section 3. This framework shall allow us to analyse and highlight the differences in the characteristics of the urban pattern of five areas representing different urban typologies in the district of Hamburg-Altona (Section 5). Here, the relationships between spatial configurations of the five neighbourhoods, the stakeholders' activities and the application of CE principles are explored. The conclusions on these relations shall be discussed in the final Section 6.

2. LINKING CIRCULAR ECONOMY AND URBAN METABOLISM WITH URBAN GOVERNANCE: SPACE MATTERS

At the base of the REPAiR project there is the exploration of innovative solutions for a shift towards a more circular economy (CE) in six European urban regions: Amsterdam, Naples, Ghent, Pécs, Łódź, and Hamburg (REPAiR, 2017a).

CE is a rather new paradigm that has been accepted and embraced at the level of the European Union, which currently demands for an inclusive and just transition towards circularity (EC, 2019). This concept is rooted in the broader concept of sustainability (EC, 2011) and, specifically, it draws upon the concept of Urban Metabolism (UM), which aims at describing cities as open systems which exchange flows with the environment (Kennedy, Pincetl and Bunje, 2011). While UM is mainly a descriptive paradigm, CE offers a conceptual framework for managing flows (Ghisellini, Cialani, and Ulgiati, 2016). This framework was translated into policy recommendations among others by the Ellen MacArthur Foundation (EMF) and largely adopted by the European Union in the EU action plan for the Circular Economy 2015 (EC, 2015; Obersteg *et al.*, 2019).

CE has mostly ignored one element, i.e. the accounting of the effects on the (urban) space of projects aimed at pursuing a shift towards circularity (Williams, 2019; Obersteg *et al.*, 2019). Further, scholars have argued that the spatial dimension cannot be underestimated when handling flows in cities, since every undertaken action implies inevitably a change on the land(use) (Girardet, 2015; Predeville, Cherim and Bocken, 2018; Williams, 2019). In the current debate, it has been argued that urban planning as a discipline that studies the development of cities should incorporate CE perspectives (Petit-Boix and Leipold, 2018; Predeville *et al.*, 2018; Obersteg *et al.*, 2019) and that

urban regions are “the most suitable scale to act for the concretization and spatialization of CE actions (Milligan and O’Keeffe, 2019)” (Obersteg *et al.*, 2019).

REPAiR positions itself inside this debate. Its ambition is to investigate the conditions which enable a shift towards circularity in urban regions. This approach includes the involvement of all relevant stakeholders in the activities concerning a specific material flow, the analysis of the urban pattern of five different neighbourhoods in Altona District, and the understanding of the implications of possible CE actions in such areas given a determined governance setting.

We assume that this shift can be pursued throughout a process (the analytical framework proposed in Section 3) that needs to be governed (Obersteg *et al.*, 2019). As governance is a rather blurry concept (Bressers and Kuks, 2003; Björk and Johansson, 2001; Rhodes, 1996), we shall define it here as multi-level, cross-sectoral and multi-actor or quadruple helix governance (Obersteg *et al.*, 2019). This approach has enabled us to “encompass a diversity of governing modes (e.g. Bulkeley and Kern, 2006; Nilsson, Eklund and Tyskeng, 2009) and multi-level interdependence (e.g. Hooghe and Marks, 2001; Newig and Fritsch, 2009)” to understand the transition (REPAiR, 2017b, p. 9).

Against this background, this article investigates the following theses: (1) to reach CE goals in urban regions it is necessary to identify and understand the challenges and opportunities in different spatial settings, (2) based on this understanding it is necessary to develop place-based solutions, and (3) the analysis process and the development of solutions need to be conducted adequately involving (local) stakeholders.

3. METHODOLOGICAL MIX: LIVING LAB APPROACH AND MATERIAL FLOW ANALYSIS

The REPAiR project approach to address CE-related issues in urban regions is built on a mix of methods that are grounded in natural science, social science, and economics: the analysis of material and energy flows provides background information as support for a series of five Living Lab (LL) workshops held in 2018 and 2019 and several smaller meetings, which enabled the real inclusion of local stakeholders’ knowledge in the project results (Evans *et al.*, n.d; REPAiR, 2017a) organised in the following four main steps: (a) identification of the geographical boundaries and the governance framework setting, (b) definition of main problems in the case study area, (c) declination of the problems and objectives, and (d) design of solutions (not further elaborated in this paper). This framework was then adapted to face the specificity of the Hamburg context. Interviews were conducted with key stakeholders from the fields of urban planning and waste management which helped identify additional actors to be involved in further steps of the process (Reed *et al.*, 2009).

As a result, the local public authority and the public waste management company shared the interest to consider five different urban typologies: (1) a large housing estate at the urban fringe (Osdorfer Born), (2) a densely built-up urban area (Ottensen), (3) a new urban development area (Mitte-Altona), (4) a single-housing area at the urban periphery (Rissen), and (5) a single-housing area with second homes and weekend visitors (Blankenese). These five “sample areas”¹ were investigated through an extensive spatial analysis to deepen the understanding of land use, socio-economic, and physical structures, as delineated in REPAiR (2018a). A Material Flow Analysis (MFA) conducted by the public waste management company provided the basic information on the waste behaviours in the five areas (U.E.C., 2017). Further, the governance analysis investigated the constellation of stakeholders in place and their responsibilities, tools and decision-making processes in use. The collected information provided a clear picture of the examined area and formed the base for discussion with the local stakeholders through the aforementioned four steps in the LL. Within this process, a university project was conducted to further analyse the areas and to collect first ideas for solutions, the latter were further discussed in the workshops with the local stakeholders.



Fig. 1. The five sample areas in the district of Hamburg-Altona (REPAiR, 2020)

Source: own work.

¹ NB: The “sample areas” have artificial boundaries developed within the REPAiR project, they borrow the name of the quarters that encompass them. As an example, the name Ottensen refers to the sample area located within the Ottensen quarter.

4. SPATIAL PLANNING, ENVIRONMENTAL AND WASTE MANAGEMENT IN THE CITY OF HAMBURG AND THE DISTRICT OF ALTONA

The circular city concept is closely linked to the policy fields of spatial planning and environmental management. The Free and Hanseatic City of Hamburg as a city-state² itself is responsible for legislating on planning and environmental issues including waste management. The Ministry of Urban Development and Housing (Behörde für Stadtentwicklung und Wohnen – BSW) manages planning policies and processes. The preparatory land-use plan (Flächennutzungsplan) is the most important and superordinate planning document; it covers spatial planning for the whole city (REPAiR, 2017b, p. 27). This document describes the current land-use and the planned new development areas to fulfil the foreseeable needs of the city (Pahl-Weber and Henckel, 2008). The plan is updated to record new city developments (BSW, 2020a). On a more concrete planning level, legally binding land-use plans (Bebauungspläne) are drafted for specific sections of the municipal territory: this “sets out the legally binding stipulations for urban structure [...] concerning property” (Pahl-Weber and Henckel, 2008, p. 47). In Hamburg, these plans are developed mostly by the planning departments of the districts, e.g. Altona. Additionally, for larger new development areas often spatial concepts, like master plans, are established: these are not legally binding but rather they coordinate the various sectoral plans, providing common goals and inputs for further developments (Pahl-Weber and Henckel, 2008; REPAiR, 2017a). This was the case in the Mitte Altona development project (see Section 5).

Hamburg’s Ministry of Environment and Energy (Behörde für Umwelt und Energie – BUE) is responsible for administrative and legislative duties regarding environmental issues, including waste management. It develops the waste management plan (Abfallwirtschaftsplan) and controls Hamburg’s public waste management company Stadtreinigung (BUE, 2017). As stipulated in a law (Stadtreinigungsgesetz SRG, 1994), Stadtreinigung (SRH) manages the collection of household waste, street cleaning, winter services, and public toilets; at the same time, it manages twelve recycling stations throughout the city. The household waste fractions that are collected by SRH are residual waste and bio waste. The first fraction is incinerated to generate heat and electricity for the city, the latter is brought to a composting facility for obtaining biogas and compost (SRH, 2019). Packaging and paper fractions belong to the so-called dual system and are managed by the subsidiary company WERT GmbH (BUE, 2017). A major aim of the waste management plan is to connect as many private households as possible to the four-tons system (residual, bio,

² Hamburg is one of 16 federal states in Germany and more specifically one of three so-called city-states (besides Berlin and Bremen). As a city-state Hamburg is a federal state and at the same time it incorporates competences and duties of a municipality. Parts of the municipal competences and duties are transferred to its seven districts. Each district has its elected council (Bezirksversammlung) and administration (Bezirksamt).

packaging, paper) to enhance recyclables rates. However, not every unit has all four bins, especially in areas with a dense building structure (cf. Section 5).

On the level of the Altona district administration, the department for urban and landscape planning is responsible for drafting binding land-use plans, in accordance with the preparatory land-use plan (BSU, 2011, p. 3; BSU, 2013). This department also steered the development of the Altona climate action plan that includes objectives, strategies and measures for climate mitigation in Altona. The plan was developed in a participatory process. Two of the plan's major topics are sustainable consumption and improved waste behaviour (Bezirk Altona, 2019a; Bezirk Altona, 2019b).

5. THE SAMPLE AREAS IN HAMBURG-ALTONA: SOCIO-ECONOMIC AND SPATIAL ANALYSIS AND IDENTIFICATION OF SPECIFIC PROBLEMS, OBJECTIVES, AND SOLUTIONS

As mentioned in Section 3, during the case study area analysis, a list of general problems was established in reference to the entire district of Altona, which then was refined at the sample area level. The following Table 1 presents the list of problems for Altona with respect to CE principles.

Table 1. List of problems identified for the entire district of Altona in order of importance for the local stakeholders

Ranked General Problems
P1) 38% of biowaste is disposed of into the residual waste bin and incinerated instead of being used for biogas and composting.
P2) When planning buildings, waste management is hardly considered, as it is not required by law.
P3) Urban planning and waste management do not communicate and cooperate sufficiently.
P4) The residents do not include waste management in their routines.
P5) With the growing collection of biowaste, there is a risk that quality will be compromised by plastic pollution.
P6) The separation of bio-waste has a bad image with many citizens ("bio-waste stinks") and they prefer to throw it into the residual waste bins, although those also stink.
P7) The financial incentives given to citizens to separate their waste are not clear or not high enough.
P8) Some public containers are not placed in the optimal position for users.
P9) Social pressure on the residents of housing estates is not sufficient to force them to separate waste properly.
P10) Older people and people with disabilities do not have access to some of the public containers.
P11) At schools and kindergartens, children do not learn enough about waste problems.
P12) Garden waste from public green spaces is generally not passed on to the waste management company for compost and biogas production.

Source: own work based on REPAiR, 2018a.

Further, the sample areas of Osdorfer Born and Ottensen are presented in detail, while the characteristics of the other three areas are only mentioned as supporting the main argument. This choice reflects also the interest of the main stakeholders involved in the process, who are currently concentrating their efforts in these two areas. Therefore, after an analysis of the socio-economic and urban physical structure, there follows – based on the work with the local stakeholders – an overview of the identified problems, objectives and first ideas for solutions. Table 2 provides an overview of all five sample areas at the end of the section.

5.1. Osdorfer born: a large housing estate at the urban fringe

Located in the northern part of the Altona district bordering Schleswig-Holstein, Osdorfer Born was the first large housing estate project in the history of Hamburg, which nowadays offers 4,750 housing units for a total of 10,263 inhabitants (Statistik Nord, 2017). Built in the late-1960s, Osdorfer Born was the result of the housing boom program after the Second World War. It was meant to be a modern and liveable place, with access to a big park area. The planned connection to the metro system was not fulfilled as a consequence of the economic crisis in the 1970s, a fact that contributed to the poor accessibility of the neighbourhood that lingers until today (Schubert, 2005). As a result, a rather disadvantaged share of Hamburg's population lives in this area: according to the social monitoring of Hamburg, Osdorfer Born is considered a neighbourhood affected by multiple types of ailments (i.e. low income, high unemployment rate – see Table 2), as well as a considerably high share of foreign population (26.4% compared to 17.3% in the Altona district). Due to its characteristics, Osdorfer Born is considered to have a “very low status” (BSW, 2019b, p. 16) and, therefore, is defined as a possible funding area receiving support for urban regeneration³. In this context, the city has been funding neighbourhood management and projects with its framework integrated urban development program ‘Rahmenprogramm Integrierte Stadtteilentwicklung’ (BSW, 2019a). Additionally, the public and cooperative housing companies in the area have set up a neighbourhood management to enhance social inclusion and requalify the built and natural environment (Osdorfer Born, 2020).

Based on the analysis and the statements of stakeholders during the living lab process, 1) socio-economic related issues, and 2) spatial-related issues were identified. Among all socio-economic issues, the language barriers are the most often indicated problem in the area, one which causes difficulties in explaining correct waste behaviour and involving citizens in CE activities within the neighbour-

³ Since 1999, the federal government of Germany has been supporting the stabilisation and upgrading of urban, economic and socially disadvantaged and structurally weak urban districts and neighborhoods with the Social City “Soziale Stadt” urban development program (BMI, 2019).

hood. Lower levels of education and income also contribute to an often-limited awareness on environmental related issues (and waste behaviour consequently).

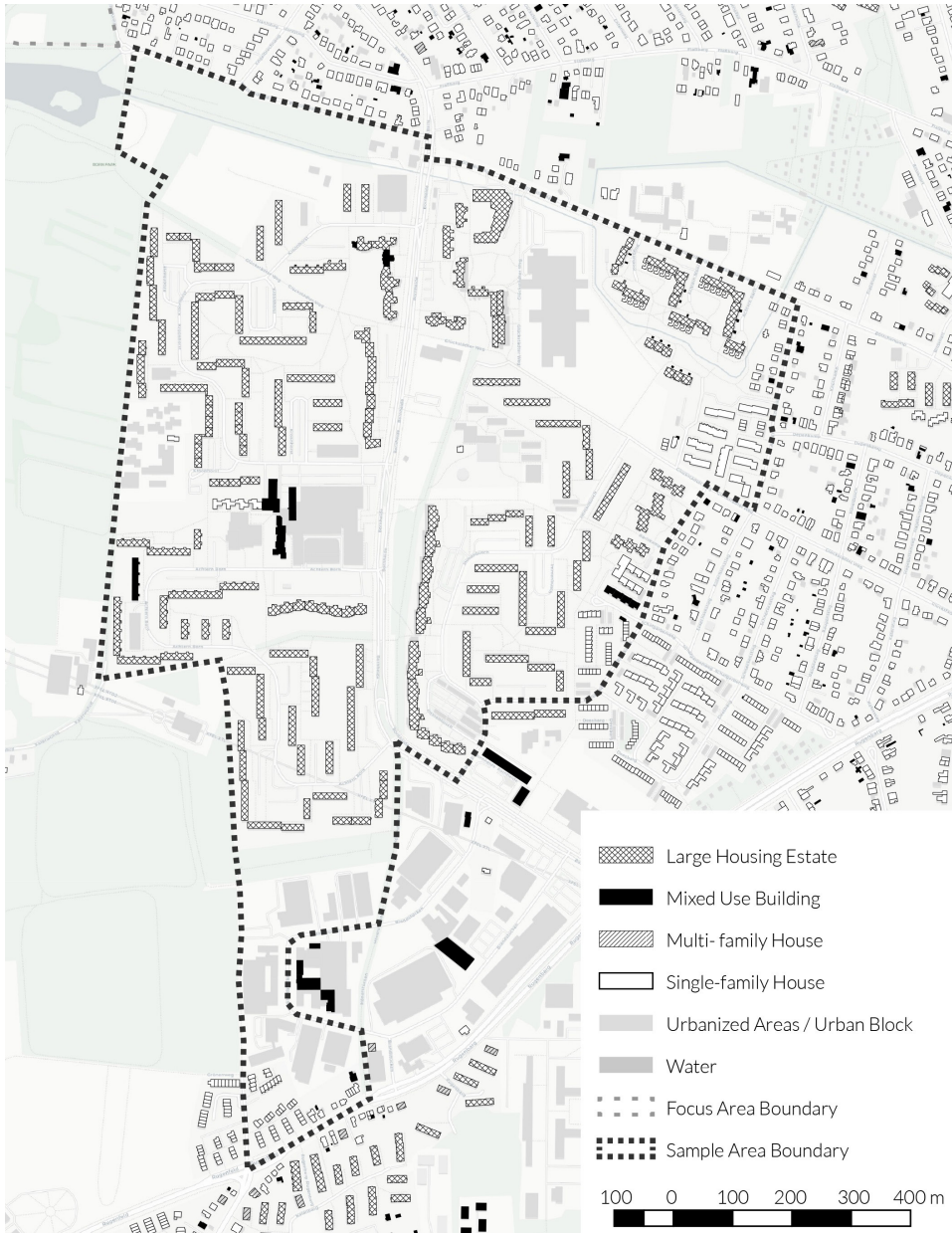


Fig. 2. Residential building types in the sample area Osdorfer Born

Source: own work based on RERaiR, 2020.

Concerning the spatial-related issues, the stakeholders stated that the anonymity of high rise buildings and the longer distances from the flats to the waste collection points on the street level lead to worse waste separation and generate littering in public spaces, especially concerning bulky waste. Moreover, the apartments' usually small kitchens do not allow residents to have all four bins for waste separation (Bauverein der Elbgemeinden, 2020). Finally, some waste collection points are not adequately accessible, especially for the elderly and disabled persons.

Therefore, the objectives defined by the local stakeholders for this area were related to enhancing social inclusion, improving environmental awareness, and at the same time providing knowledge on waste and life cycle. As space for waste separation inside the flats is scarce, alternative solutions, which enable a different way of separation, were explored (e.g. community composting, innovative forms of waste collection, like cargo bikes). To achieve these objectives the stakeholders concluded that a strategy that involves different groups of citizens is necessary to co-create solutions. Furthermore, possible tangible benefits for the citizens, like lower costs for waste management and improved cleanliness and quality of spaces, were regarded as necessary elements to be communicated. The stakeholders decided to develop this strategy using the existing network of local institutions (like housing companies, sport and neighbourhood associations) in the area. The neighbourhood management together with SRH would organise the process of strategy development and project implementation involving the local institutions.

5.2. Ottensen: a densely built-up urban area

The Ottensen neighbourhood is part of the historic centre of the district of Altona, which historically was an independent city and today functions as a centre for retail and services for the whole district. Its built environment is characterised by a rather dense structure mainly with 19th century buildings and narrow streets. Due to this high density, there is a high competition for space, especially for public land. As a consequence, it is difficult to dedicate spaces, either private or public, to waste collection, e.g. for the placement of tons or containers inside and outside of the buildings. In some parts of Ottensen, due to this insufficiency, residual and packaging waste is still collected by means of waste collection bags that are placed by households on the sidewalk (Sackabfuhr).

This bag collection causes problems of littering, bad smell, and negatively influences the aesthetic image of the area. Furthermore, a separated collection of organic waste cannot be conducted using the bag system, as it might cause hygiene-related problems. Although SRH conducted pilot projects to build underfloor containers for separated waste collection on public ground, there are still many streets where bag collection persists.

The population of Ottensen has an income close to Altona's average and is comparably well educated and young. Environmental sensitivity is rather high which is mirrored by the presence of many socio-cultural centres, initiatives and shops with an pro-environmental focus (e.g. zero packaging). Furthermore, several community gardening projects are active in the neighbourhood.

Despite these favourable conditions, the waste analysis performed by SRH has shown that the separation behaviour in this area is not better than in other parts of Hamburg even in households that potentially have the four bin system and could, therefore, separate fractions.

Further, the lack of (public) space to implement an improved waste infrastructure (especially an underfloor system) also generates conflicts of land with other possible uses of (public) space, e.g. parking spaces for cars or bicycles, and charging stations for electric vehicles.



Fig. 3. Residential building types in the sample areas Ottensen and Mitte-Altona

Source: own work based on RERaiR, 2020.

The two main objectives for this area are described as follows. First, to reduce the bag collection and to improve the situation in the waste areas by implementing underfloor containers; to achieve this, creative solutions need to be developed. Second, to improve the waste separation and collection of bio waste in households that already have the four-bin system.

5.3. Mitte-Altona: a new urban development area

Mitte-Altona is the second largest urban development project in Hamburg after HafenCity. It is situated close to the historic centre of Altona Nord and Ottensen. The project is being developed on a disused railway freight station. Its master plan is composed of two areas: the first part will largely have been finished in 2020, while the second is planned to be completed in 2023 (Hamburgische Bürgerschaft, 2012a; Hamburgische Bürgerschaft, 2012b). Mainly apartment buildings are built in the area in order to face the need for new housing in Hamburg. The planning process started in 2007 comprising different steps, like a masterplan, a legally binding land-use plan, an urban design and architectural competitions, and participatory elements as foreseen by the German planning law. A part of the first development section was completed in 2018. The area can be considered as a future-oriented residential model with a mobility concept aiming to reduce car use and offer a planned mixture of social and free market housing. The residential buildings, which are predominant in the area, are characterised by a particularly high proportion of perimeter blocks with a common courtyard. The heights of the buildings follow the ones of the surrounding structure, while the density of the area is relatively high. The development of the second part of Mitte Altona area will start in 2026 (BSW, 2020b).

Despite the innovative planning with regard to the social mixture and mobility, the stakeholders indicated during interviews and workshops that the topic of waste management was not treated in an innovative way. Actually, the topic was rather neglected. Unlike in other newly planned areas, here no underfloor containers were implemented and even too little space was provided for waste bins to be well handled during collection days. This leads to conflicts with other uses of spaces, e.g. with car parking and the use of sidewalks and streets.

5.4. Rissen: a single-housing area at the urban periphery

This neighbourhood borders Schleswig Holstein, and is located around forty minutes by local train from the city centre of Altona. This area features a low density settlement with a high share of green areas, including big parks and vegetation on streets and backyards. Single-family houses are the main housing typology besides some four to five floor buildings in the centre of the neighbourhood close to the train station, where also local supplies are located. The low density of the built area offers sufficient space both inside and outside the properties for placing bins and containers for the waste separation. However, the waste separation analysis of SRH (U.E.C., 2017) has shown that the bio waste bins are mainly filled with garden waste, while kitchen waste is mostly disposed of in the residual waste bins and with it consequently incinerated. Therefore, a considerable amount of kitchen waste is lost for further treatment in the bio waste plant, where it would be anaero-

bically digested and then fermented to produce biogas and compost. The objective in Rissen is to improve the separation behaviour. As the infrastructure (four bin system) is already in place, solutions will have to focus on education, information and incentives (REPAiR, 2018a).

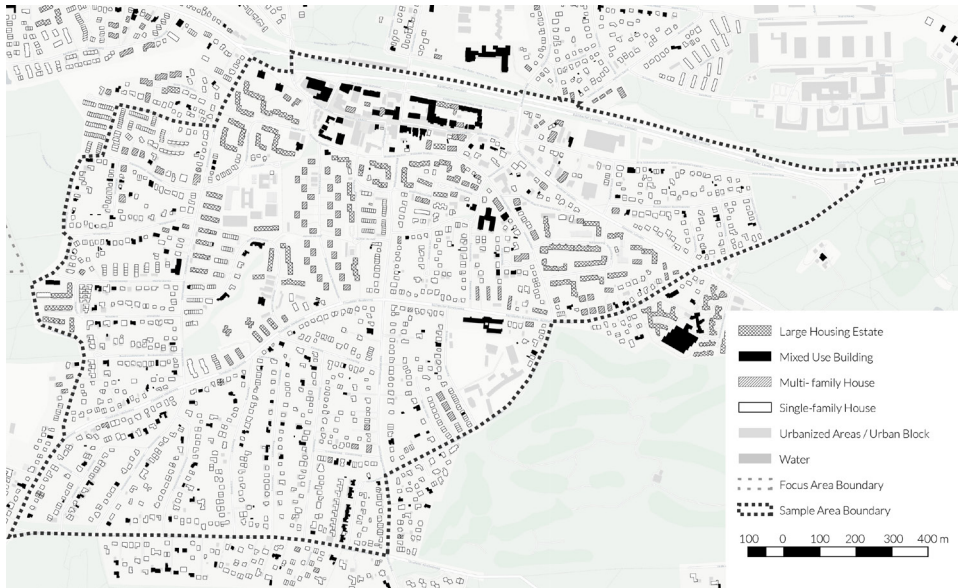


Fig. 4. Residential building types in the sample area Rissen

Source: own work based on RERaiR, 2020.

5.5. Blankenese: a single-housing area with second homes and weekend visitors

This neighbourhood features a hilly topography (around 70 metres of altitude) leading to the river Elbe (REPAiR, 2020). This area is famous for its nice paths on stairs (circa 5,000 steps) and small streets with single-family houses, many for weekend vacation. This means that the population here is not stable, and it varies considerably during the week.

Due to the topography, bins cannot be easily carried. Therefore, to a large extent, bags are used for residual, packaging and paper waste collection. In interviews and workshops this has been indicated as problematic, as it causes hygienic problems and makes the area less attractive for visitors. As in areas with bag collection, kitchen waste cannot be separately collected and has to be disposed of with residual waste. Like in Rissen, households with a bio waste bin mainly use it for garden waste. The main objective in Blankenese is to reduce bag collection. Solutions will have to tackle the lack of space and the topography.



Fig. 5. Residential building types in the sample area Blankenese
Source: own work based on RERaiR, 2020.

Table 2. Summary of the main spatial and socio-economic information for each sample area

INDICATORS	Osdorfer Born ^a	Ottensen	Altona-Nord	Blankenese	Rissen	Altona District
Population [n]	10,263	35,370	22,137	13,407	15,192	273,263*
Population density [inh/sq. km]	11,591	12,654	9,981	1,733	909	3,469*
Population over 65 years old [%]	18.0* (22.6)	13.4*	10.1*	27.2*	30.6*	18.0*

Table 2 (cont.)

INDICATORS	Osdorfer Born ^a	Ottensen	Altona-Nord	Blankenese	Rissen	Altona District
Foreign population [%]	26.4* (17.3)	13.1*	18.8*	8.3*	7.3*	16.1*
Population with migration background [%]	63.8* (39.2)	26.0*	36.0*	17.1*	16.9*	32.0*
Annual average income per taxpayer [€]	17,480 * (43,177)	40,830*	29,901*	117,139*	65,855*	48,620*
Unemployment rate (between 15 and 65 years old) [%]	11.8* (6.6)	4.4*	7.2*	1.9*	3.5*	5.9*

* These details were found in Statistik Nord (2017) related to the quarter level in the year 2016.

^aFor Osdorfer Born, the details at the neighbourhood level were found and are shown here compared to the quarter level (in parenthesis): according to the Hamburg Social Monitoring, Osdorfer Born functions as a “very low status” neighbourhood. Other details have been derived from the HCU Transparent geoportal and related to the year 2016. The comparison with the district of Altona is shown in the last column. These numbers have been calculated from the Datasets in the Transparent Geoportal Hamburg, GIS.

Source: own work, 2020.

6. DISCUSSION AND CONCLUSION

In the attempt to address the topic of circularity, the European Union is demanding a more inclusive and just transition by addressing all levels of governance. Our research concentrated on the local level and investigated the effects of CE activities on the socio-economic aspects and the consequences that affect the spatial organisation of the urban structure (as stated in Williams, 2019). Hence, the understanding of specific spatial conditions has proven important for the development of solutions that respond to local problems and meet stakeholders needs. As highlighted in Section 5, the mosaic of urban structures composing the five different areas raises unique problems specific for the local situation.

The analyses of the two most contrasting examples, i.e. Osdorfer Born and Ottensen, have shown that socio-economic and spatial aspects generate similar (but not equal) problems which require the development of a sound local strategy by involving stakeholders in place.

In Osdorfer Born, the current situation demands addressing societal challenges to overcome cultural and language barriers to reach a better waste separation at source. However, Osdorfer Born also faces problems in the built environment related to a lack or bad quality of space dedicated to waste-related activities. Additionally, spaces dedicated to waste collection and separation are not always well configured, ranging from a lack of understandable information to a suboptimal location.

In Ottensen, adequate physical waste infrastructures are present only in some parts of the area, with the Sackabfuhr (i.e. poor source separation) system currently being the most relevant practice. Additionally, even though the inhabitants of the neighbourhood have generally proven to be aware of environmental issues⁴, this is not reflected in their waste separation behaviours (U.E.C. 2017).

The differences in the two areas demand distinctive strategies to achieve circularity at the local level. In Osdorfer Born, the involvement of institutionalised stakeholders (e.g. the neighbourhood management), who are already present in the area, could foster and guide the sensitisation campaign of the citizens through systematic engagement and rewarding or fining mechanisms. In Ottensen, a possible strategy should aim to create a network to connect those stakeholders who are already active in the neighbourhood (e.g. environmental and social associations) to foster local initiatives and projects.

In summary, it is argued that the strategic component to support locally tailored actions towards CE should consider the collection of a sufficient amount of data (qualitative and quantitative) to support the decisions by the stakeholders involved in the process. These should embrace a spectrum of both local (bottom-up) and institutionalised (top-down) stakeholders, as for the cases of Ottensen and Osdorfer Born. Furthermore, not only the vertical dimension, i.e. the levels of governance but also the integration between different sectors on a horizontal level plays a relevant role. Actually in Altona-Hamburg the Climate Action Plan (see Section 4) saw the participation of local (e.g. zero-packaging shops) and super-local stakeholders, such as the local waste management company and the municipality. In fact, the results have shown that in Hamburg there is a demand for a more decisive intervention of the public authorities to guide such a process, implying a narrower collaboration between the urban planning division and the waste management sector.

Reflecting on the methodology, the mix of data-based (Material Flow Analysis) and qualitative (stakeholder involvement in living labs) methods has proven to be useful for the research on circular economy and cities. Spatial, material-flow, governance and stakeholder analyses created the base for an informed discussion to address circularity in such local contexts.

⁴ As can be interpreted by the high voting results of the Green party in the latest Hamburg regional elections in February 2020 (Statistik Nord, 2020).

The involvement of local stakeholders has helped identify problems, understand peculiarities, and discover the challenges that prevent the achievement of circularity at the local level. Moreover, although the involvement process has been time and resource consuming, it could assure an innovative way of defining suitable solutions for specific problems and raising the chances for actual implementation.

The mixture of different stakeholders enabled various views as well as new insights for the participants themselves. The observation from different angles led to a richer and more balanced analysis of the problems and the exchange of a variety of arguments set the ground for the development of new strategies and solutions.

Nevertheless, the identification, the involvement and the mixture of stakeholders in a living lab is challenging and contains risks that could strongly affect the process and outcome. Therefore, the usage of the living lab method related to circular economy and city approaches should be further examined in research, although currently being highly recommended.

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Article

Successful Project—Limited Transfer: Learnings from the Local Circularity Experiment WiedergeBORN

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Article

Successful Project—Limited Transfer: Learnings from the Local Circularity Experiment WiedergeBORN

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Abstract: The paper presents an evaluation of the strategic experimental project “WiedergeBORN”, conducted by Stadtreinigung SRH, Hamburg’s public waste management company, with stakeholders and citizens in the Osdorfer Born large housing estate. Based on an analysis of the case study, which included document analysis, observation and interviews, the article delineates the genesis of the project, its main stakeholders, and its objectives, measures, and outcomes. Success and failure factors of the project and the possible transfer of lessons learned are then categorized and discussed using the four pillars of accountability as an analytical framework. The place-based approach, which considered local conditions, the close cooperation between key stakeholders, and the early involvement of local actors and citizens, supported the successful development and implementation of measures to improve waste management and cleanliness. Furthermore, the integration of environmental, social, and educational aspects in the measures and the cooperation with actors from these fields were demonstrated to lead to positive outcomes. The transfer of the project’s results and approach remained limited due to a lack of involvement of strategic actors in the project; this hindered an integration of the participating stakeholders into strategies and into policies at the district or city levels.

Keywords: circular economy; experiment; strategic planning; accountability; participation



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1. Introduction

In the discussion of how to address the challenge of climate change, the importance of circular economy (CE) and improved waste management as contributions to climate mitigation has been emphasized. Earlier studies focused on the necessity to include measures to improve waste management in climate action [1]. More recent reports delineate the extended potential of circular economy approaches to contribute to climate mitigation in Germany [2] and the EU [3]. Others argued that CE contributions are key to reaching sustainability goals [4].

While the necessity to include CE in climate action on national and international levels is widely recognized in the scholarly discourse, research has demonstrated a lack of accountable action at the city level and a failure to integrate CE into strategic urban planning [5] (see Section 2).

At the same time, various studies have examined the role of urban experiments as a strategic approach to governing climate change in cities [6–8]. For example, Wirth et al. [9] and Bulkeley et al. [10] analyzed examples of urban living laboratories and how lessons learned from these experiments can be transferred into strategic urban planning. Some of the studies on the role of experiments for strategic planning included experiments in the fields of CE and waste management, but their number is limited. Furthermore, the specific connection of CE and waste management to strategic urban planning has only become the subject of the scientific discussion more recently.

To contribute to this discussion, this article examines a case study at the local level, the strategic experimental project WiedergeBORN, which was conducted by Stadtreinigung SRH, Hamburg’s public waste management company, in Osdorfer Born in Hamburg, a

large housing estate, and involved various stakeholders and citizens (see Section 4). The goal of this experimental project was to foster CE by improving waste management locally. The WiedergeBORN project is elaborated and examined in this paper to outline what can be learned from this case about the integration of CE into strategic urban planning. The case study is analyzed using a methodological mix of document analysis, participatory observation, and interviews (Section 3). The aim of the presented research is to analyze and understand the success and failure factors of the strategic project, and to learn from the project for potential transfer and replication. The accountability framework [11] is used to categorize the results of the analysis, to discuss possibilities of replication and scalability beyond the experimental project, and to indicate their potential for integration on the strategic planning level (Section 6).

To answer the research question, the article is subdivided in the following sub-questions:

- What are the lessons learned and what are the success and failure factors of the project (Section 5)?
- How are the lessons learned perceived by the key stakeholders with regard to potential continuation and transfer of the results of the project (Section 6)?
- On a conceptional and methodological level: What are the potentials of the categorization and assessment of the results through the accountability framework (see Section 2) to enable the transfer from the experimental level into strategic planning (Section 7)?

2. Accountability of the Circular Economy in Cities

CE is a relatively new paradigm that is rooted in the broader concept of sustainability [12,13]. More specifically, CE draws upon the concept of Urban Metabolism (UM) [14], which describes cities as open systems exchanging resource flows with their environment [15]. While UM is mainly a descriptive paradigm, CE offers a conceptual framework for managing flows [16]. The Ellen MacArthur Foundation [17], among others, translated CE into policy recommendations and has been widely adopted by the European Union in the EU action plans for the CE 2015 and 2020 [12,18].

Despite its roots in UM, CE-related policies initially mostly ignored the accounting of effects of CE on the (urban) space and vice versa [19]. Noting this gap, scholars have argued that the spatial dimension of CE needs to be stressed when handling flows in urban areas since every action undertaken inevitably implies changes to the land(use) [20,21]. Girardet [20] connects the concept of CE with urban development approaches in his regenerative city concept. Additionally, Williams's [19] circular cities concept highlights the deficits of CE in the incorporation of spatial and social questions. On this basis, Williams later suggests evolving CE into a circular development approach that should expressly include a spatial perspective for urban planning strategies and, thus, enable a sustainable development towards circularity. Further authors propose that urban planning as a discipline should incorporate CE perspectives into the discourse on spatial development at the city level [5,22,23], while others claim that urban regions are the most suitable scale to act for the concretization and spatialization of CE [24].

The scientific and policy discourses on the necessity of a stronger consideration of spatial aspects in CE policies and actions have inspired cities to develop their own strategies and policies that combine CE and spatial development (e.g., Amsterdam). Consequently, spatial aspects have also been integrated into EU policies on CE, the foremost of which is the 'New CE action plan 2020', and this has led to the creation of the European 'Circular cities and regions initiative CCRI' [18]. The latter has stimulated numerous local and regional activities to develop and test CE (e.g., in the form of living labs), and initiated further EU-funded research. With regard to these recent activities, Williams underlines the need for more research on spatial implications of CE and the role of spatial planning in steering governance processes to support circular development [5,23].

Recent work in the field discusses the process of implementation of CE strategically in cities and links it to the question of how to assess these processes [21,25]. The accountability

framework is one method that has been used to assess strategic planning related to climate action. It centers the relationship between the principal (the citizens) and agents (state, public institutions) in its analysis of strategic planning and actions. Furthermore, it enables a polycentric governance perspective on strategic planning processes, meaning that, in the relation between citizens and state, several institutions can represent the public side and, also, interactions among them can be considered [26].

In the application of the accountability framework, Zengerling proposes four pillars to analyze accountability [11]. In the first pillar, “responsibility”, the relationship between the principal (the citizens) and agents (public institutions) is examined with regard to the strategic planning project. Clear responsibilities between the stakeholders and the citizens are important for the successful implementation of a strategic project [11,27]. As the case study WiedergeBORN was an experimental strategic project involving several public, private, and civic stakeholders, not only the relation between the principal and agents, but also the responsibility relations between different stakeholders as agents are considered. The second pillar, “transparency”, focuses on questions related to communication and information flows between principals and agents, similar to the other pillars between the different stakeholders (agents) in the strategic project. In the third pillar, “assessment”, the focus is on data in relation to the strategic project and its objectives. Lastly the fourth pillar, “participation”, examines the involvement of citizens in the strategic project and of stakeholders in the decision-making process [11,27]. An assessment of a strategic CE project using this framework allows for a nuanced depiction of the processes of the project implementation, beyond a merely technical or regulatory approach, and provides insights into the potential for transfer of project learnings and results.

3. Methods Applied and Accountable Strategic Planning as Conceptual Frameworks

The case study, the experimental strategic project WiedergeBORN, was analyzed using a methodological mix: participatory observations during meetings, workshops, and public events (see Table 1), and field studies, including spatial observation and analysis of the area (implemented built measures, impact on cleanliness, see Section 4) before, during, and after the project [28,29]. A document analysis was performed, drawing on data reports, unpublished minutes of workshops, plans, stakeholders’ policy concepts and newspaper articles. After the end of the project, three semi-structured qualitative interviews with the key stakeholders involved in the experimental project, Stadtreinigung Hamburg SRH and SAGA/Pro Quartier PQ (see Section 4.3), were conducted to reflect on the project’s activities, outcomes, lessons learned, and possible transfer and replication of results (see Supplementary Materials File S1: Guideline for interviews with key stakeholders). The interviews were recorded and transcribed. The transcribed interviews were subsequently analyzed using qualitative content analysis [30,31]. The interviews had two aims: to complete and clarify information on the measures and their immediate outcomes (see Section 5), and to evaluate the factors contributing to their success or failure. The interviews, documents, and minutes were then examined following the four pillars of the accountability framework, described in Section 2. The results of the analysis are presented in Section 6.

Table 1. Effective and potential waste disposal for different waste fractions and different neighborhoods.

Waste in kg per Year and per Capita	Osдорfer Born	Ottensen	Altona-Nord	Blankenese	Lurup
Sum of waste collected	367.9	352	243.7	306.9	277.1
Disposed effectively in recyclables bin	20	44.8	8.4	47.1	15.2
Disposed effectively in paper bin	66	68	10.5	49.8	57.6
Disposed effectively in residual waste bin	269.4	216.7	182.4	104.7	176.5

Table 1. Cont.

Waste in kg per Year and per Capita	Osdorfer Born	Ottensen	Altona-Nord	Blankenese	Lurup
Disposed effectively in organic waste bin	12.5	22.5	42.4	105.3	27.8
Ideally disposed in recyclables bin	42.3	46.1	25.3	28.5	36.8
Ideally disposed in paper bin	79.8	81.3	23	58	71.5
Ideally disposed in residual waste bin	111.4	116.4	59.6	42.2	56.2
Ideally disposed in organic waste bin	105.1	70.8	109.7	159.9	86.6
Ideally disposed in collection containers (glass, textile, WEEE)	29.3	37.5	26	26	12.8

4. The Case Study “WiedergeBORN”

4.1. The Experimental Project of WiedergeBORN

WiedergeBORN led to direct, measurable improvements in waste management and circularity in the local project focus area. These results hold special significance with regard to the discussion of the increasing importance of CE contributions to the achievement of sustainability goals and, especially, to the reduction of greenhouse gas emissions. This is of specific relevance in Hamburg, as the city has, to date, no circularity strategy, and its city-wide and district-level climate action plans largely lack measurable activities in the field of circular economy.

The results of the regular waste separation surveys of SRH had shown that the sensitivity for waste separation is relatively low in large housing areas like Osdorfer Born compared to other types of areas: dense historic area (Ottensen), dense post-war area (Altona-Nord), lower density multiple-family housing (Lurup), and single-family housing (Blankenese) [32]. Table 1 shows the amount of waste per year and per capita effectively disposed of in the bins for the different waste fractions, and the potential amount of waste per fraction that could be ideally disposed of in the correct bin. Osdorfer Born has the highest amount of waste in total, showing potential for waste avoidance. The gap between effectively and ideally disposed organic waste and recyclables is the highest compared to the other areas. Therefore, the key stakeholders decided to conduct the experimental project in the large housing estate Osdorfer Born [32].

The key stakeholders chose Osdorfer Born for the experimental project because of its characteristics as a large residential area with a population that is culturally mixed, economically rather poor, and with a comparatively low level of education.

Table 2 shows a summary of the main spatial and socio-economic information for different neighborhoods in the district Hamburg-Altona that were compiled in the frame of the REPAiR project and were the base to choose Osdorfer Born as the area for the experimental project. Data sources are statistical profiles for Hamburg’s neighborhoods and districts [33], and, for Osdorfer Born, the evaluation report for social development programs [34].

The WiedergeBORN project was conceived within the research and sustainability unit of Stadtreinigung SRH in two Horizon2020 projects: FORCE and REPAiR. SRH adopted ideas for circularity solutions and place-based concepts that were developed in REPAiR, a more research-oriented project, and applied these in the more practically-oriented project, FORCE, which had a dedicated budget for the implementation of concrete measures on the ground. Table 3 shows the timeline of the project. A major motivation for the research and sustainability unit was their recognition of SRH practitioners’ needs for tangible project actions and results. Based on an earlier waste separation analysis [32] and a socio-spatial study conducted in REPAiR, as well as the place-based solutions that had been developed in the REPAiR project for different areas, the research and sustainability unit selected the large housing estate Osdorfer Born as the implementation site. SRH chose Osdorfer Born, first, because the waste separation analysis showed a low compliance with waste separation policy in the community, and, second, because of their ambition to work in an area that is considered more challenging. Osdorfer Born is among Hamburg’s lowest income communi-

ties. Thus, this project was an attempt to demonstrate measurable improvement in an area with a clear waste problem, while also improving service and support to a community with a high level of need. At an early stage, outreach was performed with further stakeholders, such as SAGA, Hamburg’s public housing company, and Pro Quartier (PQ), a subsidiary company of SAGA offering services like neighborhood management. They also agreed to participate in the project and in the choice of the project area. The objectives of the project were to improve circularity in the area with a focus on waste management and cleanliness through the development and implementation of place-based solutions with citizens and the involved stakeholders. The project name “WiedergeBORN” refers to Osdorfer Born and is a play on the German word “wiedergeboren”, meaning “reborn”.

Table 2. Main spatial and socio-economic information for different neighborhoods in the district Hamburg-Altona.

Indicators	Osdorfer Born	Ottensen	Altona-Nord	Blankenese	Rissen	Altona District
Population [n]	10,263	35,370	22,137	13,407	15,192	273,263
Population density [inh/km ²]	11,591	12,654	9981	1733	909	3469
Population over 65 years old [%]	18.0	13.4	10.1	27.2	30.6	18.0
Foreign population [%]	26.4	13.1	18.8	8.3	7.3	16.1
Population with migration background [%]	63.8	26.0	36.0	17.1	16.9	32.0
Annual average income per taxpayer [EUR]	17,480	40,830	29,901	117,139	65,855	48,620
Unemployment rate (between 15 and 65 years old) [%]	11.8	4.4	7.2	1.9	3.5	5.9

Table 3. Timeline of the project WiedergeBORN.

Date	Activity/Event
2017–2019	Co-creative process in REPAiR living lab; first analysis of place-specific waste and circularity problematic and potential in different areas in Hamburg
19–22 June 2018	Student workshops at HCU and TU Delft as part of the REPAiR project to develop solutions to improve circularity in Osdorfer Born and other different areas in Hamburg
January–May 2019	Idea for WiedergeBORN as a project focusing on the specific area of Osdorfer Born was developed by SRH; using input from REPAiR (socio-spatial, waste analysis, eco-innovative solutions) and FORCE (input from other cities: Lisbon and Copenhagen)
5–9 August 2019	International summer school of the FORCE project with a focus on the development of WEEE (Waste of Electrical and Electronic Equipment) solutions for Osdorfer Born
June 2019	SRH establishes an internal team, local project manager starts work
28 August 2019	WiedergeBORN Kick-off Workshop (WS1) with key stakeholders; the core working group is established
September–December 2019	Survey of inhabitants conducted by SRH
September 2019–February 2020	First implementation of project measures and activities
17 February 2020	WiedergeBORN mid-term Workshop (WS2), first evaluation of activities
February 2020–February 2021	Continuation of measures and activities (limited due to COVID-19)
8–10 September 2020	WiedergeBORN Festival
8 February 2021	WiedergeBORN closing Workshop (WS3) with project internal evaluation of the results
Spring 2021	Postprocessing of the project: guideline for SAGA, SRH
Spring 2021	Attempt to achieve EU funding for follow-up project failed
From 2021	Usage of selected experiences and learnings from the project in other areas and project by the different partners (SRH, PQ)

4.2. Osdorfer Born the Case Study Area of the WiedergeBORN Project

Osdorfer Born is located in the northern part of the District of Hamburg-Altona, one of the seven districts in Hamburg that represent the municipal political and administrative level. In Hamburg, the districts take on many of the tasks that municipalities would elsewhere, as Hamburg, as a city-state, is one of the sixteen German federal states. According to the latest statistics available in the area, in 2016, Osdorfer Born had 4750 housing units for a total of 10,263 inhabitants [33]. Newer statistics are only publicly available for the larger administrative urban area Osdorf or for the larger social development area (Fördergebiet Sozialer Zusammenhalt) Osdorfer Born/Lurup [34].

Osdorfer Born was built in the late 1960s as part of the housing development program in reaction to the immense need for flats after the Second World War. It was the first large housing estate project of this kind built in Hamburg. It was meant to be a modern and livable place, offering social, educational, and cultural infrastructure and access to a big park area. A connection to the metro system, initially included in the plans, was not built due to the economic crisis in the 1970s, a fact that contributed to the poor accessibility of the neighborhood that lingers to today. Since the end of the 1970s, the share of households with higher incomes has decreased and the area has attracted more households with lower incomes due to its affordability. Osdorfer Born has become, like other comparable neighborhoods, a first place to find accommodation for many persons moving to Hamburg.

Until the 1990s, due to a lack of investment in renovation and modernization of the housing stock and public spaces, a process of physical downgrading occurred [35]. In reaction to this development, Osdorfer Born has received funding from different programs co-financed by the City of Hamburg and the German government since 1992 (“Revitalisierungsprogramm” 1992–1998; “Soziale Stadtteilentwicklung” 1999–2005; “Aktive Stadtteilentwicklung” 2005–2008; in parallel, from 2002 Bund-Länder-Programm “Soziale Stadt”) [34]. Since 2014, Osdorfer Born, together with the adjoining neighborhood Lurup, has received funding from Hamburg’s framework Programme for Integrated Urban District Development (Rahmenprogramm Integrierte Stadtteilentwicklung RISE) for neighborhood management programs and mainly social projects [34]. Additionally, SAGA has set up neighborhood management programs through its subsidiary company, Pro Quartier, to enhance social inclusion and to improve the built and natural environment [34].

According to the socio-spatial monitoring conducted by the City of Hamburg, Osdorfer Born is characterized by a significantly higher unemployment rate, a higher share of households receiving social welfare, and a higher school dropout rate than the Hamburg average [34]. Due to its characteristics, Osdorfer Born is considered to have a “low status” according to the latest social monitoring report published by Hamburg’s Ministry of Urban Development and Housing, which is an improvement compared to the previous report where the area had a “very low status”. Nevertheless, Osdorfer Born, together with Lurup, is again defined as a future funding area receiving support for urban regeneration [36].

4.3. The Stakeholders in the Project WiedergeBORN

The key stakeholders in the project WiedergeBORN were Stadtreinigung Hamburg (SRH), SAGA Unternehmensgruppe, and CHANCE and Pro Quartier (PQ), two subsidiary companies of SAGA.

Stadtreinigung Hamburg (SRH) is Hamburg’s public waste management company. As stipulated by law [37], Stadtreinigung (SRH) manages the collection of household waste, street cleaning, winter maintenance services, and public toilets. Furthermore, it operates twelve recycling centers throughout the city, one of which is located next to Osdorfer Born. According to law [37], SRH is responsible for the collection and processing of household waste fractions [38]. These fractions are residual waste, which is collected and then incinerated to generate heat and electricity, and organic waste, which is brought to facilities for anaerobic digestion and subsequent composting to produce biogas and compost [39]. SRH is also responsible for collecting large or bulky household waste on demand, in exchange for a collection fee. Bulky waste is further processed at the recycling

centers. Still usable items (i.e., furniture) can be brought to second-hand warehouses operated by Stilbruch, a subsidiary company of SRH. Other waste fractions, including packaging, glass, and paper, belong to the so-called dual system and are collected by private companies, including by the SRH subsidiary company WERT GmbH [38].

SAGA Unternehmensgruppe (SAGA) is a public housing company, fully owned by the City of Hamburg, and is Germany's largest municipal housing company. In 2022, SAGA rented out a total of 138,656 flats in Hamburg, of which 30,187 flats were publicly subsidized, and 108,500 were financed without public subsidies (of which 102,121 were without limited rents and 6348 had limited rents). Circa 270,000 persons live in a SAGA flat, representing 14% of Hamburg's population. As SAGA offers moderately priced flats, it is considered to have a balancing effect on the rental flat market, offering housing to lower- and middle-income households [40,41]. In Osdorfer Born, SAGA owns 3600 of the 5100 total flats. SAGA has conducted an energy-efficient renovation and modernization of its building stock in Osdorfer Born over the last few years [34]. In its sustainability strategy, SAGA addresses the reduction of energy and water usage linked with the refurbishment of buildings as its main ecological concerns. Regarding the topic of waste reduction, a reduction in the amount of residual waste was observed between 2011 and 2018, but the amount has increased again since then. The separated waste fraction of paper and organic waste has continuously increased. The collected amount of all fractions grew significantly in 2021 compared to 2020, which can be explained by the lockdowns during the COVID-19 pandemic. In the sustainability reports, SAGA mentions only an intelligent waste management system in cooperation with external partners since 2004 and holds contracts with SRH for waste collection, while no concrete measures on waste reduction are described [42–44].

CHANCE (CHANCE Beschäftigungsgesellschaft mbH) is a subsidiary non-profit company of SAGA that employs long-term unemployed persons to reintegrate them into the job market. The employees work as service and contact persons for the inhabitants, mainly in large housing estates of SAGA and some estates owned by other housing cooperatives. The employees are located in so-called lodges and serve as contact points for the inhabitants. They offer concierge services to the inhabitants and inform the facility management and caretakers about problems like technical issues, vandalism, littering, and security [45].

Pro Quartier (PQ) is a subsidiary company of SAGA that offers services like neighborhood management, mainly in SAGA estates, but also in other areas. In Osdorfer Born, PQ are responsible for the neighborhood management of the large housing estate owned by SAGA and other housing cooperatives.

Table 4 lists the further stakeholders that participated and their involvement in the project.

Table 4. Further stakeholders involved in the project WiedergeBORN.

Stakeholder Name and Description	Cooperation in WiedergeBORN
Nutzmüll e.V., (Nutzmüll means “useful trash” in German) is an association that has been active for several years in the area in the fields of waste prevention and sensitivity.	In cooperation with Nutzmüll, various collection activities were conducted, for example, bulky waste collection and shopping trolley collection.
Kinder Museum, Hamburg's museum for children, is located in the area	Cooperation during the festival and workshops with children
Bürgerhaus, a community centre	Cooperation in several workshops and information events
Born-Center, a shopping center	Cooperation during the festival; exhibitions on waste prevention and recycling
Citizens	Individually cooperated, for example collecting waste or informing about illegal waste dumping
Westwind, local newspaper	Several articles were published
Recycling center/yard Osdorf, one of 12 recycling centers operated by SRH in Hamburg	Cooperation on bulky waste and other hazardous or special waste fractions

Table 4. *Cont.*

Stakeholder Name and Description	Cooperation in WiedergeBORN
Churches	Cooperation with, they were supportive. Participation in swap meets (Tauschbörsen)
Daycare centers (Kita)	Cooperation on composting project
Bücherhalle (public library)	Organized and staged puppet theatre for children about waste separation
Hamburger Volkshochschule (adult education center)	Cooperation during the festival; exhibitions on waste prevention and recycling
Borner Runde (community roundtable in the neighborhood)	SRH and SAGA presented WiedergeBORN; the round table was used for feedback, broader outreach, and connection with further initiatives and associations in Osdorfer Born
Parent-Child-Centre	Practical waste separation training
Geschwister-Scholl-Stadtteilschule, a secondary school	School workshops on plastic recycling
Precious Plastic Hamburg, a non-profit company	School workshops on plastic recycling

4.4. Development of the Measures

The main measures and activities of WiedergeBORN were created based on outcomes of analyses and ideas for solutions from the projects REPAiR and FORCE. They then were further developed in a co-creative process between SRH and the other main stakeholders, PQ and CHANCE. In the next step, the concrete measures were elaborated in cooperation with further stakeholders (see Table 4), also using input from the inhabitants' survey.

4.5. Process of Cooperation

At the start of the project, a core group was established that consisted of two people from the research and sustainability unit SRH, a person from SRH who was hired as the local project manager to be present in Osdorfer Born, and three people from PQ (one from the PQ headquarters and two working in Osdorfer Born and who received additional funding from the project). PQ served as a contact to CHANCE (persons working in the lodges) and to the local SAGA office (See Table 4).

During the project, three workshops were held with the main stakeholders: one at the start to define measures and activities (see Table 3), one at mid-term to evaluate the progress, and one at the end to evaluate the project and its measures. Between these workshops, regular meetings with the core group of stakeholders were held to monitor the process of the measures. To gather broad input from citizens, a survey among inhabitants was conducted as a starting activity. In total, 354 residents were contacted, of whom 114 were interviewed at the door of their flat by employees of SRH with a semi-structured questionnaire. The survey had two aims: first, to generate citizens' interest in the subjects of waste and cleanliness and in future activities; and second, to learn from their experiences and understand which topics citizens want to be handled, to learn about their waste separation behavior, and to learn about their attitudes towards waste topics. Table 5 gives examples from the unpublished survey and how it contributed to the development of measures.

Table 5. SRH survey with inhabitants: Overview on outcomes with focus on organic waste and respective measures developed.

Question Category	Summarized Answers	Respective Measure Developed
What types of waste are generally separated at home?	Organic waste 19%, recyclables 46%, paper 87%	Measure 4: improving waste separation behavior, reaching different target groups
What would have to change to enable or facilitate the separate collection of organic waste?	Free bins and collection bags 9%, neighbors need to participate 8%, more information 9%, more space for separation bins in flat 7%, better labeling of tons 4%	Measure 1 Improving waste locations sites; Measure 3 Lodges as information points, distribution of free bins

5. The Main Measures and Activities of the Project—Description and Results

In this section, based on the empirical studies (document analysis, observation, interviews), the main measures in the WiedergeBORN project are presented, including the problem definition, the development and conduction of activities, and the evaluation of the measure.

During the co-creative process at the beginning of the project, the key stakeholders decided to conduct the following main activities. Each main activity was then further developed, divided into sub-activities, and additional stakeholders were involved (see Table 4).

Measure 1—Improving Waste Storage Locations: Site visits, workshops, and direct observations at the beginning of the project revealed that the neighborhood's waste storage areas faced significant issues. These included poor accessibility for people with disabilities, inadequate placement of bins, and an unclean environment that discouraged residents from using the sites properly. The organic waste bins were too small, difficult to reach, and placed in inconvenient areas. Additionally, labels on the bins were too small, not self-explanatory, and not accessible to all residents despite translation into multiple languages. As a result, many residents had difficulty understanding the waste separation requirements, leading to improper waste disposal.

In response, a set of physical improvements was implemented. These included constructing new, accessible structures at waste storage sites, providing larger and cleaner bins, and introducing more intuitive labeling that included larger pictograms in place of text. The new labels were designed to convey sorting instructions visually, minimizing language barriers. The project also adjusted bin sizes based on waste type, with larger bins for organic waste placed in easily accessible spots. Three main partners collaborated on these interventions: SAGA, the property owner responsible for providing appropriate waste storage locations (according to German law, waste must be stored on private property and the owner must provide a location where the bins are placed that is adequate and accessible) [38]; a service provider contracted by SAGA to maintain the cleanliness and order of bins; and SRH, which supplied bins and managed their regular emptying. Through close collaboration, SAGA undertook necessary construction, SRH provided improved bins and labels, and enhanced communication was established between SRH and the service provider to address issues like littering and vandalism more effectively.

The evaluation workshop indicated a positive reception from residents, caretakers, and visitors, who reported improved cleanliness and accessibility. Measurable improvements included an increase in organic waste volume collected and a decrease in incorrect waste sorting, both essential goals for SRH. According to stakeholders, a key success factor was the improved physical environment of the waste storage areas, which facilitated easier, more appealing, and more accessible use by residents. This change was seen as a foundation for fostering sustainable behavioral shifts among residents, as an accessible and well-maintained environment was more likely to encourage proper waste disposal practices. Furthermore, improved cooperation between service providers, SRH, and CHANCE, a local neighborhood support organization, allowed for a quicker response to issues such as vandalism and improper bin usage.

Measure 2—Cleanliness in the neighborhood: SAGA highlighted a lack of cleanliness, which could be observed, and subsequently, the causes of littering were further analyzed and discussed in the co-creative process. The littering comprised minor issues such as papers and cigarettes disposed of in public spaces and littering on a larger scale, namely the illegal dumping of bulky waste items. Several causes for the bulky waste problem were identified, including a lack of knowledge, "inhabitants do not know how and where to dispose of bulky waste", and the cost, as the collection and disposal of bulky waste must be paid individually by households and many inhabitants regard the fees as too high. As an alternative, the inhabitants can bring their bulky waste to a recycling center free of charge, but, although the closest recycling center is in only 1 km away from Osdorfer Born, according to PQ the transport is still problematic as many households in the large housing estate do not own a car. As a consequence, bulky waste was often left in front of

the house. Bulky waste that is dumped illegally in the area must be collected by SRH in so-called 'sprint collections,' for which a fee is charged to SAGA and, therefore, is paid by all inhabitants. SAGA stated that the lack of cleanliness and littering are major concerns expressed by their tenants.

To improve the cleanliness in the neighborhood, more attractive public waste bins (colorful and "monster" bins to attract interest, especially of children) were provided. A more complex cooperation was needed to reduce the bulky waste problem. Before the project started, SAGA had already designated a garage where inhabitants could bring bulky waste. This offer was expanded by installing a container for bulky waste in front of another large building. The inhabitants could use the waste storage by contacting the concierges at the CHANCE lodges, who then could open the container or garage so that the bulky waste could be put in. A small vehicle was offered to assist with the transport from the apartments. When the container or garage was full, CHANCE informed SRH to collect the bulky waste and transport it to the recycling center. There, the usable bulky waste could be sorted as usual and brought to Stilbruch second-hand shops.

During the evaluation workshop and the interviews, the new colorful public waste bins were assessed positively, and minor littering visibly decreased. However, a need for more educational work on how to use the bins was expressed. The bulky waste measure was also regarded as successful. Illegal dumping of bulky household waste items in the area was significantly reduced, which translated into a considerable reduction of costs for SAGA, as the collection from the container and garage could be better planned. Furthermore, the bulky waste could be separated into different sub-fractions (especially furniture and WEEE—waste from electrical and electronic equipment) and consequently was easier to re-use or recycle. Additionally, the amount of separately collected WEEE increased because inhabitants were informed that they should dispose of WEEE as bulky waste and not as residual waste.

Measure 3—Lodges as information and communication points: The experience of SRH, and the analyses prior to the project, highlighted the lack of knowledge of the inhabitants about waste and recycling topics and the necessity to better inform residents to change their behaviors. To tackle this problem, at the project start, SRH and SAGA decided to use the existing lodges of the residential buildings and to involve CHANCE and its concierge employees as information and contact points for the project. The concierge employees of CHANCE were involved at an early stage and expressed high interest in the project, as many of them regarded waste and the lack of cleanliness as major problems in the area. They were trained at the beginning of the project on how to address the topics of waste prevention, recycling, and cleanliness.

The concrete measures were counselling sessions held during the lodges' opening hours. While residents' attendance at these sessions was lower than expected, they offered a good opportunity to exchange ideas with other local project partners. Craft and games afternoons were offered to inform about reuse and repair, but they met low responses due to comparable offers available in the neighborhood. Additionally, themed swap meets were held, intended to encourage resource-sharing among residents; the toy swap was well-received, while the clothes swap met with less enthusiasm, likely due to other competing events. It became clear that a longer period of time would be required to establish the idea and offers for such swap meets in the neighborhood. In the interviews, SRH and PQ stated that inhabitants expressed that used things have a negative stigma. Informational exhibits and displays on different waste-related topics, including showing previously used furniture from Stilbruch second-hand shops, were designed to increase local residents' use of various offers, but only met moderate interest. Although the impact was not directly measurable, these activities were still seen as valuable, as they increased general awareness and offered food for thought to the residents.

The distribution 300 small organic waste bins (Biomüllis) to separate organic waste and 10,000 compostable bags to the residents, free of charge, was regarded as successful by SRH. This measure was based on the findings from the analysis prior to the project and

from the survey among residents that many households did not separate organic waste due, on one hand, to the lack of knowledge, but also to practical reasons like lack of space for several bins and the fear of a bad smell from organic waste. The small waste bins and the compostable bags could offer solutions to overcome these concerns.

The training on waste topics, which was offered by SRH to the CHANCE employees, was regarded as successful and enabled the CHANCE employees to serve as direct contact people and multipliers towards the residents. However, due to the COVID-19 pandemic, the trainings had to be reduced, and, also, the direct contact with the residents was limited.

Measure 4—Improving waste separation behavior: SRH regularly conducts studies on waste separation in different sample areas in Hamburg that examine the content of the different waste fraction bins to estimate correct or incorrect sorting of waste fractions. The latest study prior to the project showed that in Osdorfer Born, the separation practice is significantly worse than in other areas with different types of housing [32]. During the workshops, SRH employees confirmed that incorrect waste separation is a problem in Osdorfer Born (see Section 4.1). The amount of organic waste that is collected in the area was significantly lower than in other neighborhoods. SRH, in the past, hesitated to campaign for more organic waste collection in large housing estates like Osdorfer Born because SRH expected an increase of mis-filling/mis-disposal of non-organic waste into the organic waste bins. This corrupts the organic waste stream; thus, such impure organic waste cannot be further processed (in the organic waste treatment plant: fermentation, biogas production, composting of the rest material). Therefore, in the past, SRH preferred to collect less but pure organic waste.

To improve the waste separation behaviors of the inhabitants and to increase correct waste separation, several measures were developed and conducted. A four-week organic waste collection campaign was conducted to achieve a collection of qualitatively and quantitatively ‘high-quality’ organic waste through information and training of residents on the waste separation process. It included the distribution of 1100 free-of-charge organic waste bins for pre-sorting bins at home (Biomüllis) and flyers at an information stand in the neighborhood, join-in campaigns, and a raffle of attractive prizes. Circa 20% of the inhabitants in the focus area could be reached, with 254 visitors at the stand. An extra analysis of organic waste was conducted before and after the four-week campaign, with the results showing that the volume of organic waste had increased by 51%. The usage of compostable paper bags to dispose of organic waste increased to 70%, while the usage of plastic bags to dispose of organic waste was reduced from 53% to 18%. The most common contaminants in the organic waste were plastic bags and packaged food.

Further outreach measures included school workshops on plastic recycling with the non-profit company Precious Plastic Hamburg. According to the interviews with SRH and PQ, these workshops received good feedback from teachers and pupils and led to a sustainable change in behavior among pupils. SRH also conducted practical waste separation training in the parent-child center. The participants were interested in the topic. For SRH, it was a positive takeaway that different target groups can be reached through specific facilities in the neighborhood.

In the evaluation workshop, the measures were regarded as successful. It was stated that separation behavior had improved, but also that the residual waste bins still fill up very quickly and that there is potential for more separation. The stakeholders agreed that behavioral change would need time and requires continuous support in the neighborhood and repetition of the campaigns. Regarding the waste separation training and the school workshops, the importance of reaching different target groups via neighborhood facilities was stressed and the attempt to consider different levels of knowledge and the motivation of adults through their children were highlighted as positive outcomes.

Measure 5—WiedergeBORN Festival: A three-day neighborhood festival was conducted to address the themes of waste and sustainability in a playful, informative, and participatory way. The festival was organized in cooperation with various facilities like VHS, public library, initiatives like Precious Plastic, and the shopping center. It offered

services like waste avoidance workshops and repair cafés, a puppet theatre on recycling, and games and challenges with prizes. In total, 500 visitors across different age groups could be reached.

The festival was evaluated positively, as it reached many inhabitants who were not very familiar with the topics of waste and sustainability. Through the offers for children, their parents and relatives could be reached, and further participants could be targeted and mobilized via local stakeholders. The festival was regarded as a means to spread knowledge on the topic and to create a certain expertise among the citizens. It was important that the festival allowed dialogue with citizens rather than only one-way information. This enabled a further understanding of the views of inhabitants on waste and sustainability problems.

It can be stated that most of the measures were successful, and some still have a positive impact in the neighborhood. In contrast, the desired knowledge transfer of the lessons learnt from the project into the participating stakeholders' organizations and to other neighborhoods could not be implemented as desired by the core team of the project. Table 6 gives an overview on the measures and their innovative aspects compared to normal measures in this or other areas

Table 6. Measures and innovations introduced compared to other urban areas.

Measure Description	Innovative Aspects of Measure	Normal Measures in This or Other Areas
1—Improving Waste Storage Locations: physical improvements, accessibility, labelling, management of sites.	Measures developed in cooperation of different stakeholders (property owner, waste management, service provider).	Property owners provide standard waste storage locations, waste management company provides standard bins and labeling, not adapted to specific needs in areas. Limited cooperation between stakeholder
2—Cleanliness in the neighborhood: improved offers for bulky waste collection, and measures to improve cleanliness	Cooperation of concierge service of the property owner with waste management company; locally adapted measures against littering	Households are individually responsible for bulky waste disposal, no support from property owner; standard paper bins not addressing individual neighborhood
3—Lodges as information and communication points	Involvement of existing concierge employees, training as contact persons for waste and circularity topics	Concierge services normally are less interactive with inhabitants and other stakeholders. They are not responsible for circularity topics
4—Improving waste separation behavior	Four-week information campaign in the area as cooperation between various stakeholders. Educational workshops with different target groups (children, pupils, adults)	Normal waste separation behavior campaigns use classic media (posters, adverts) and address the citizens in general. Stakeholders like schools and childcare centers are less involved
5—WiedergeBORN Festival	Three-day neighborhood festival on waste and sustainability, organized with various local stakeholders	The topics waste and sustainability normally are addressed in classic information campaigns, not in neighborhood festivals

6. Discussion—Accounting of the Success and Failure Factors

As was described in Section 5, the stakeholders considered the project itself and most of its measures to be successful; however, the transfer of the lessons learned from the project was regarded as limited. To understand why, in this section, a categorization and discussion of the success and failure factors of the experimental project and its potential for transfer on a strategic planning level are conducted using the four pillars of accountability [11,27] as the analytical framework (see Section 2).

6.1. Responsibility: Success and Failure Factors

The guiding questions in the pillar 'responsibility' are: Which stakeholders (agents) were responsible to the citizens (principal)? Who was responsible for which actions? What were the responsibilities of stakeholders in regard to the actions monitored and in which form? As WiedergeBORN was an experimental strategic project involving several public, private, and civic stakeholders, the responsibility relations among these actors were also considered.

The main stakeholders of the project, SAGA, together with CHANCE, PQ, and SRH, are, as public actors, in general directly responsible to the government and the parliament of the City of Hamburg, and indirectly responsible to the citizens of Hamburg. Their specific main responsibilities are linked to their defined tasks and objectives, which are defined on a political level. In the case of SAGA, these are the offer of affordable housing and to care for the needs of its tenants. For SRH, the main tasks are waste management and cleanliness services in Hamburg (see Section 4.3).

According to the interviews, during the starting phase of the project, the responsibilities of the different public actors (SRH, SAGA with CHANCE and PQ) were not always clearly defined between the actors. As an example, the shared responsibilities for the waste storage locations (see measure 1) were mentioned in the interviews. SAGA owns the locations and is responsible for their construction and maintenance, but a sub-contractor is in charge of the cleanliness of the area. CHANCE can only collect complaints from inhabitants and is not allowed to intervene. Further, SRH owns the bins and oversees their contents and emptying them. The explanation and clear definition of the responsibilities, including the mandatory tasks and the objectives of the public actors, enabled the development of common goals for the project: to improve circularity in the area with a focus on waste management and cleanliness by developing and implementing place-based solutions with citizens and various stakeholders.

In the next step, the goals could be operationalized into measures to reach the agreed objectives. This would enable the joint development of new measures as well as the combination of different (existing) actions that normally would each have been under the responsibility of different actors (see five measures). The responsibilities for the implementation were clarified for both the new and the newly combined actions, which enabled their successful realization. In the interviews, the combination of actions was stated to have enabled synergies and made the project, as a whole, more effective and efficient. As described in Sections 4 and 5, many actions involved further public, private, and civic stakeholders. Again, the responsibilities and objectives of the different stakeholders were defined and then communicated between each other and the citizens, which supported the successful implementation of these actions.

The project enabled a clearer communication with the citizens regarding the responsibilities of each of the public stakeholders and the objectives of the project to improve waste management and cleanliness. This was possible through various information campaigns, exchanges, and direct contact because of the project's presence in the area and the way citizens were approached with different methods and by different actors.

In the interviews, it was stated that to successfully implement actions, it was good to combine the thematic responsibilities of the different public and other stakeholders and to commonly address the citizens in the area. This thematic and spatial focus was regarded as a key success factor, especially compared to customary actions of the different stakeholders that often are isolated and not adapted to specific spatial conditions. This corresponds with the findings of Williams [23] and Prendeville et al. [21], which show that, in order to achieve circularity objectives, spatially adapted solutions should involve stakeholders in their development and implementation and shared responsibility with citizens.

Continuation and transfer beyond the project: A major failure factor for the continuation of the activities of the project was, as stated by the interviewees, the lack of clear responsibilities beyond the project lifetime in Osdorfer Born. The different actors (CHANCE, SRH, PQ) continued some of the actions, but, with the closure of the project, the position of the local project manager also ended, and, therefore, a central responsible person was missing. Some of the lessons learned could be integrated into the work of the stakeholders and have been taken up as tasks in the respective units inside of the organizations: SAGA continues to use the developed recommendations for restructuring its waste storage locations; CHANCE was interested in using the training guideline for its lodge employees, but has not yet implemented a follow-up; SRH is implementing the

concept of a local caretaker, but in an adapted way; and PQ is integrating the topic of circularity more in its work in other neighborhoods.

A negative aspect that was mentioned regarding the legacy of the project was the limited or missing involvement of higher tiers of the administration on the district level (integrated urban district development, climate mitigation) and the city level (Ministry for Urban Development and Housing, Ministry for the Environment, Climate, Energy, and Agriculture). As a consequence, a responsibility gap occurred at the end of the project. This is a major hinderance for the transferring of the project's lessons learned on a strategic level, due to missed potential for up-take into policy, as described by von Wirth et al. [9] and Bulkeley et al. [10].

6.2. Transparency: Success and Failure Factors

The guiding questions regarding transparency are: How transparent was the strategic project to stakeholders and citizens? Who among the stakeholders (agents) is communicating with citizens in general and with different target groups? What kind of information is offered to citizens, and in which forms and formats is information presented [11,27]?

In the interviews, the sharing of knowledge and information and making it understandable and transparent among the project partners was seen as a main positive factor. This was possible because of the close cooperation and trust-building between the partners during the project.

Information on the aims and activities of the project and on its effects on improved waste management and cleanliness were communicated to the inhabitants in a clear and transparent way by the project partners. The citizens were reached by using different channels to address diverse target groups (see measure 4 on waste separation behavior). The cooperation of the partners enabled the bundling of information towards citizens. This proved to be more efficient compared to the normally separated communication by each of the different public actors. The inhabitants could be better reached because the information was specific to the project and adapted to the citizens in the area. This was regarded as an important success factor for the project, as SRH conducts generalized information campaigns for the whole City of Hamburg and consequently does not reach specific target groups, while SAGA and PQ communicate with local inhabitants, but normally not about the topics of waste management, CE, or sustainability in general. This efficient form of communication with the inhabitants was regarded as important to involve citizens (see Section 6.4 participation) and change their behaviors over a longer term.

The idea to involve the CHANCE employees at the lodges to train them as direct contact persons to communicate with the inhabitants on the project and its topics was regarded as very successful. The CHANCE employees were considered as easily accessible for the inhabitants and were enabled to transmit information to them. However, because of COVID-19, some of the communication activities, especially in and with the CHANCE lodges, could not be fully implemented, and the training of the CHANCE employees had to be limited.

Continuation and transfer beyond the project: As a shortcoming, the interviewees highlighted that continuous communication with the citizens and a repetition of information on waste management, cleanliness, and circularity would be necessary: first, because new inhabitants need to be informed, and, second, because the information needs to be refreshed over time. With the end of the project, the communication efforts could not be continued with the same intensity.

6.3. Assessment: Success and Failure Factors

The guiding questions in the pillar assessment are how the measures and their outcomes are evaluated. Which data are collected, by whom, and with which methods, and how are the data evaluated?

The analyses of the socio-spatial situation of the project area and its inhabitants that were conducted before the start of the project were regarded as important for understanding

the specific local problems and as crucial for the successful development and implementation of the measures that were adapted to the local situation. At the start of the project, the analysis of the regular waste separation assessment of SRH, which is normally used only internally, was shared and openly discussed with the other stakeholders. This was an important starting point for understanding the local problems and defining objectives and then measures in the project.

The assessment of waste separation (see measure 4) that was specially developed for the project and conducted before and after the waste separation awareness campaign made it possible for the project team to evaluate the effects of the measures immediately. Therefore, the significant improvement in organic waste separation due to the measures could be communicated to the citizens, which, according to SRH, had an additional motivation effect towards the inhabitants.

The survey among inhabitants (see Section 4.5) was seen as an important source of information to assess the status quo situation. Compared to the standard surveys that SRH conducts, this survey was regarded as more interactive and polled for deeper information about the behavior and attitude of the inhabitants on waste and circularity and on their personal perception of problems with waste management.

Overall, the intensive participation of the citizens in the project led to diverse and useful feedback from citizens on activities and outcomes of the measures and, according to the interviews, enabled a continuous assessment and consequent adaption of the actions.

The assessment of further measures (less bulky waste, increased re-use and recycling of bulky waste, improved cleanliness in the waste storage locations, less littering in public spaces) was primarily used for feedback among the stakeholders. In the interviews, it was highlighted that the positive results of the assessment were communicated internally to the management levels of SRH and SAGA. Based on the positively assessed measures, the members of the core group of the project could develop guidelines for the replication of some of the measures: the renovation and restructuring of the waste storage locations; the involvement of CHANCE lodges; and the involvement of day-care centers and schools.

Continuation and transfer beyond the project: A long-term assessment of the outcomes of the measures was not conducted after the project ended. According to the interviews, this information is necessary to evaluate the effects of the measures and the whole project, and it was suggested that a further assessment should be conducted a few years later. Furthermore, it was stated that a general evaluation of the project after its closure was missing. This was regarded as a hindering factor for the transfer of the project's learnings and the ability to integrate them in the strategies of the participating key stakeholders as well as on district and city level. Such a general evaluation serves to formalize learnings and experiences and permits an additional reflexive exchange among stakeholders [5,22,23].

6.4. Participation: Success and Failure Factors

In the fourth pillar, "participation", the involvement of citizens in the strategic project and of stakeholders in the decision-making process is examined. Guiding questions are: How are citizens and different groups involved? How are different stakeholders involved in the project? How are decisions made between different stakeholders?

As a main positive outcome of the project regarding participation, the direct and intensive contact with inhabitants via different channels was highlighted in the interviews. Through the bundling of activities and the cooperation between different stakeholders, many citizens who, according to SRH and PQ, normally are not interested in CE and waste management could be reached and directly engaged. Additionally, the cooperation with local experts and initiatives (see Table 4), who are closer to the inhabitants and have knowledge of how to approach and reach different groups of citizens, was also regarded as supportive when seeking to reach different groups of inhabitants. The intensive involvement of different groups of citizens enabled a more specific and better understanding of the local circumstances. As a consequence, the measures could be developed and implemented according to the problems and needs of different groups of inhabitants (e.g., considering

language barriers and using children as multipliers in families). The combination of the activities of the different stakeholders to involve citizens was regarded as a success factor. This was only possible because of the project's strategic approach, as normally each of the stakeholders would approach citizens separately.

Some of the projects involving citizens were regarded as particularly successful. The waste separation contest with inhabitants in two streets enabled citizens to gain direct insight into the content of their waste bins and immediately learn about correct waste separation (see measure 4). The presence of the local project manager and of the CHANCE lodges as direct contact points were also considered as positive factors that lowered the barrier for citizens to get involved in the different activities.

Continuation and transfer beyond the project: The employees of CHANCE were trained as multipliers to involve citizens during the project, but the training had to be reduced due to the COVID-19 pandemic. This hindered the stabilization of the work of the CHANCE employees. Nevertheless, according to the interviews, the CHANCE lodges served as information points for the inhabitants beyond the project's lifetime, but without offering specific activities. The negative aspects mentioned in the interviews were that, despite the intensive involvement of citizens, it needs to be critically observed how far the situation (waste separation behavior, cleanliness) could be improved in the long term. Limiting factors were that not all citizens could be reached and that many inhabitants are facing other problems, such as financial or social issues, and therefore waste or recycling are not the main concerns.

Table 7 provides a summary of the success and failure factors in the project respectively beyond the project and assigns them to the four pillars of accountability.

Table 7. Summary of success and failure factors in the project and beyond the project.

Pillars of Accountability	Success and Failure Factors in Project	Beyond the Project
1—Responsibility	Understanding of responsibilities of stakeholders enabled development of common objectives, and consequently of integrated measures. Responsibilities of different stakeholders were made transparent towards citizens which facilitated their involvement.	Responsibility beyond the project was unclear which hindered continuation of activities and transfer.
2—Transparency	Sharing information and trust building between stakeholders supported their cooperation. This enabled integrated communication with citizens adapted to target groups.	Communication with citizens could not be continued in the same intensity.
3—Assessment	Special analysis of data and survey enabled the development of locally adapted solutions. Assessment of measures could be used to develop guidelines for future transfer.	Assessment of measures ended with the project. The experimental project itself was not evaluated.
4—Participation	Citizens and local stakeholders were involved with targeted activities. The bundling and connection of activities and the cooperation with local multipliers enabled them to reach more citizens.	The training of local multipliers had to be reduced due to COVID-19. This limited their work beyond the project.

7. Conclusions and Outlook

Regarding integrating CE into strategic urban planning, the lessons learned from the experimental project WiedergeBORN need to be regarded on the project level and beyond.

Considering the project level, based on the evaluation conducted in this study, I find that the strategic approach of the project can be rated as successful. The project was set-up

based on an analysis of the situation (socio-economic, spatial). Subsequently, a cooperation between the main public stakeholders who are active in the area could be established. This enabled a common definition of objectives—in accordance with the sustainability strategies of the different stakeholders—to be reached with the project. Based on these objectives, measures and activities were developed and implemented. Further stakeholders from the public, private, and civic sectors were involved, which supported the successful implementation of most of the planned actions. The intensive exchange between the stakeholders enabled a collaborative learning process during the project. This was possible due to the exceptional situation of the project that gave the stakeholders a mandate to cooperate and act beyond their ordinary tasks. From a spatial development perspective, the concentration in a neighborhood proved to be key for the success of the measures because it enabled the bundling of activities in a functional area. The combination of social and educational measures that envisaged a behavioral change with physical measures that improved the built environment proved to be successful. This underlines the necessity of a socio-spatial approach. Another spatial aspect was the ability to overcome administrative micro-boundaries between involved stakeholders due to the cooperative project design.

Beyond the project, both in terms of timing and organizational levels, the legacy of the project was limited. Reasons can be found in the extraordinary project situation, which enabled extra funding notably to finance a project manager in the area. With the end of the project, the funding of the managing position ended, and with it the intensive exchange between stakeholders and the bundling of activities. Furthermore, all representatives of the key stakeholders had a mandate to work on the project. This enabled opportunities and the freedom to try things out as part of the project and collaboration between the stakeholders over short distances. With the end of the project, the work of the individual actors resumed according to the customary practice. Moreover, only a limited transfer of learnings from the working level to the decision-making level with the involved organizations, SRH and SAGA, was achieved. Consequently, SRH and SAGA/CHANCE only transferred the project results to a limited level into their strategies (sustainability strategies of SAGA, SRH, local development plans) and future work. Another shortcoming was the lack of involvement of strategic levels in the district and the city. Lastly, there was a lack of a strategy to maintain the legacy of the project. Such a strategy could enable the sustainability of project outcomes and enable transfer and replication of the results of the project.

I propose several recommendations for future projects that center place-based approaches to develop and implement solutions to improve waste management and circularity in collaboration with the relevant stakeholders and with local citizens.

One success factor was the local project manager, who enabled cooperation with stakeholders in the area and with citizens. This role is not transferable one-to-one in all cases, but its tasks could be integrated into the work of existing ‘caretakers’ like neighborhood or climate action managers and other intermediaries working at the interface with citizens.

The strategic approach led to accountable results whose measurable outcomes gained the interest of stakeholders. This could support replication in other projects, as the communication of tangible results is important both to citizens and within the organizations of stakeholders and to decision-makers [9,11].

The integration of environmental, social, and educational aspects in the measures and the cooperation with actors from these fields led to positive outcomes. For future projects on circularity, the involvement of actors representing social services and education can be recommended. This could be supported through strategies and programs that interlink different policy fields (e.g., local development plans).

The project placed citizens at the center of its objectives and measures, and it developed and implemented solutions with them. Furthermore, it directly impacted their wellbeing, improving cleanliness and the living environment through circularity objectives. This could be adopted by other projects to involve citizens in the sense of just transformation.

Another recommendation for future projects is to develop a plan for the legacy of the project and to better integrate higher decision-making levels from an early stage. This could support the integration of lessons learned into strategies of the participating stakeholders.

Lastly, comparable projects will need enabling framework conditions. A simple replication of a project like WiedergeBORN might cause unnecessarily high efforts and costs. To provide projects with funding and an organizational frame, circular economy aspects could be integrated into existing programs, e.g., social development programs (like RISE in Hamburg), local climate action plans, and urban development plans. These plans should consequently be adapted and used for future projects to enable the integration of social and environmental aspects to realize circularity [46,47]. An alternative could be the development of specific strategies on circularity, which for their part need to consider existing social, environmental, and spatial development strategies [5,22,23].

From a methodological perspective, the usage of accountability as a framework enabled a structured analysis of the project, especially regarding the relationship between the principal (citizens) and the agents (public actors), and in this case also between the different public actors. The four pillars of accountability are a basis for a practicable guideline to deconstruct a project in order to understand its potential contribution to strategic planning. However, in this case study, the four categories were partly overlapping and could not be always easily separated from each other.

To better understand the potential of experimental projects that establish CE and how they are or could be linked to strategic urban planning, an in-depth investigation of further examples would be required. An analysis of several experiments could then enable a comparative approach of a larger variety of cases.

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