Original Research Paper

Circular Cities: Mapping Six Cities in Transition

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ABSTRACT

Urbanisation and climate change are urging cities to chart novel paths towards sustainable futures. Many cities are turning to the alluring 'circular economy' (CE) concept to guide this redirection. The CE concept re-imagines how flows of resources moving through economies might be 'closed'. Here, we explore this new *'circular city'* agenda by asking: *How are cities adopting CE as a strategy*?. We found that political leadership, building adaptable future visions, using experimental approaches (such as living labs), developing contextual knowledge about resource use, and engaging with diverse stakeholders to be important. However, we also expose that there is a lack of consensus on what a circular city constitutes and a need to further untangle the *how* and *why* of the circular city concept. The research contributes to the field by outlining emergent cases, identifying a set of common policy strategies, conceptualising a circular city and identifying areas for future research.

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1. Introduction

Industrial development has brought enormous economic growth, yet hand-in-hand pressure on our planet's resources mounts. Globally, material consumption has grown eightfold over the past 100 years (Krausmann et al., 2009) and is expected to have tripled by 2050 (UNEP, 2011). The likely consequences of this include future scarcity of resources, fertile land, clean water and air (Ellen Macarthur Foundation (EMF), 2012) leading to global price volatility (McKinsey Global Institute, 2011). We know that this system cannot be sustained (O'Neill, 2009; UNEP, 2011).

Cities are mutable 'multi-faceted' entities formed by 'various agents, organizations and networks', perceived by some as increasingly important in the global transition to a sustainable society (Loorbach and Shiroyama, 2016). 75% of global natural resources and 80% of the global energy supply are consumed in cities (UNEP-DTIE, 2012). Urbanisation means nearly 50% of the global population now live in cities and this trend is set to continue leading to 70% by 2050 (UN DESA, 2013). The contributions to and threats of climate change for cities are significant (floods, droughts, storms) and future protection for cities is paramount (Parry, 2007; Rosenzweig et al., 2011). This means that city managers (including policy-makers, urban planners, mayors) can be leveraged and enabled to lead on urban sustainability issues and to tackle climate change at the city-level. Local governments have extensive knowledge of their environment and self-governance and autonomy on urban planning, water, waste and public transportation (Erickson and Tempest, 2014).

Globally, 'circular economy' (CE) principles are being adopted by businesses and governments, as a route to resource efficiency in the face of rising material prices and climate change. The Chinese government, through the CE, aims to maintain

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economic growth while improving environmental quality and maintaining social progress (UNEP, 2016). The European Commission adopted its CE Package, which includes legislative proposals to stimulate Europe's transition towards a CE, to boost competitiveness for sustainable economic growth and jobs (European Commission, 2015). Lately, we see evidence of the CE narrative emerging at the city-level: London's Waste and Recycling Board (funded by the Greater London Authority) is developing a Circular Roadmap[1] and the French environmental agency Ademe has produced a circular city white paper for Paris.[2] CE is interesting at the city-level for a number of reasons. For instance, technical and biological 'nutrients' become aggregated within city boundaries and can be found in quantities worth harnessing through urban mining (Li, 2015). In addition, stakeholders are geographically close and this in itself can aid collaboration to close resource loops (Morlett, 2014).

Nevertheless, the concept of the CE in itself is over-hyped, scarcely investigated and therefore as yet ill-defined. What is somewhat clear is that it is so far dominated by a business-focused narrative for competitive advantage, raising questions about the placement of the CE within a broader urban sustainability agenda. Given that the *circular city* is the latest in a host of urban sustainability trends, that have arguably failed, it should be scrutinized. In this research, we initiate a critical discussion on the concept of the circular city, through six European case studies. The aim is to undertake exploratory research into early examples of city managers initiating CE activities within their cities: *How are cities adopting CE as a strategy*? We review and critique the emerging body of CE literature from an urban sustainability perspective. By examining six cities through semi-structured interviews and desk research we describe the approaches and key activities of each city, leading to an overview of emerging CE cases.

2. Literature review

This section reviews and critiques the literature on the CE from a macro-level (city) viewpoint, as well as how dual approaches (top-down and bottom-up) to urban sustainability can contribute to the CE.

2.1. Urban environmentalism over the years

Since the early nineties, city actors have been forging sustainable development on a regional scale (Bulkeley, 2010). This has given rise to multiple initiatives and alliances uniting mayors and city policymakers, such as the World Mayors Council on Climate Change (WMCCC) and the Cities for Climate Protection Network (ICLEI, 2014). More recently (2005) the C40 Climate Leadership Group was founded, connecting more than 75 of the world's largest cities. Acting as a voice for cities, the organization is focused on "developing and implementing policies and programs that generate measurable reductions in both greenhouse gas emissions and climate risks" (C40, 2015). These organizations focus on environmental challenges including energy transition, transportation, construction, water and waste, inter alia (C40 et al., 2014).

Originating in the 1980s, the concept of 'urban environmentalism', which focuses on redeveloping cities' industrial centers through industrial metabolism projects, is prominent in the eco-cities or eco-towns movement. The related term of 'urban metabolism' considers "*the sum total of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy, and elimination of waste.*" (Kennedy et al., 2007, p. 44). Urban metabolism activities range from adapting biomimicry concepts at the city level (Buck, 2015) to unpacking how circular metabolism has been applied to cities (Spiegelhalter and Arch, 2010). Future-oriented eco-cities (Caprotti, 2015) are motivated by the need for knowledge of resources nearing exhaustion (Kennedy et al., 2007) as well as an increasing strain on landfills (Ghisellini et al., 2015), which in combination lead to waste-reduction or zero-waste programs. To this end, Zaman and Lehmann (2013) developed a Zero Waste Index to measure progress on cities' zero waste plans. The zero waste goal was included in European Union policy in 2013 and that initial plan has grown into a comprehensive strategy for a CE in Europe (European Commission, 2015).

The eco-city movement and urban environmentalism concepts have seen some successes, but rely heavily on subsidies and remain too focused on industrial parks and not necessarily yet cities as a whole (Van Berkel et al., 2009). Some successes have been seen, and several 'dense' cities are efficient in terms of their public transport systems (e.g. New York; London) (Newman, 2006), yet there is still much more to be achieved. Notwithstanding this, the paradox is such that 'urbanites' have typically higher environmental impacts than those who do not live in cities (Vergragt et al., 2014) and yet cities can play a role in achieving a more sustainable society overall (Vergragt et al., 2014; Loorbach and Shiroyama, 2016). Loorbach and Shiroyama (2016) implore that radical urban governance strategies are needed to achieve deep systemic change of socio-technical systems and upend unsustainability. Furthermore, this requires that all of the various actors that make up a city (companies, institutions, citizens, Non-Governmental Organisations (NGOs)) must work in concert for long term goals.

The concept of the smart city has been gaining ground for some time and is seen as a vehicle for urban sustainability (Bakıcı et al., 2013; Cocchia, 2014; Bodum, 2015; Caragliu et al., 2011; Hollands, 2008) and more and more as an enabler of CE initiatives (Nobre and Tavares, 2017). Neirotti et al. (2014) describe how new digital capabilities can benefit sustainability through "wise management of natural resources, through participatory governance." The smart city movement is concerned with gathering data to monitor and optimize resource use through technology, a key principle in the concept of CE (EMF,

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[1] http://www.lwarb.gov.uk/what-we-do/accelerate-the-move-to-a-circular-economy-in-london/.
[2] https://api-site.paris.fr/images/77050.