

RESEARCH ARTICLE

Implementing the circular economy in the Amsterdam Metropolitan Area: The interplay between market actors mediated by transition brokers

 Jacqueline M. Cramer 

Utrecht Sustainability Institute, Utrecht University, Utrecht, The Netherlands

Correspondence

 Jacqueline M. Cramer, Utrecht Sustainability Institute, Utrecht University Heidelberglaan 8, 3584 CS, Utrecht, The Netherlands.
Email: j.m.cramer@uu.nl

Abstract

This paper analyses the interplay between regime and niche actors in implementing the circular economy through mediation by transition brokers. The study is based on 'action research' carried out in the Amsterdam Metropolitan Area. Innovation science is adopted as theoretical approach. First, the analysis shows that more ambitious initiatives could be taken than by individual market actors. Whether these circular initiatives represent just incremental change—as other studies suggest—cannot be concluded. Rather, it is plausible to conceptualise the transition process as a continuous transformational change. Second, in creating circular initiatives, the interplay between regime and niche actors was evident but varied. Actors could team up more easily where their interests aligned. This conclusion corresponds with recent innovation literature, which emphasises the importance of linkages between processes at niche, regime and landscape levels. Before generalising the results, similar studies in other regional contexts would be valuable.

Short informative

- In moving to a circular economy, the willingness of market actors to innovate is crucial.
- Real-life experiments on the implementation of circular initiatives built by market actors at local level through the mediation of independent intermediaries (here called 'transition brokers') are scarce. This study aims to bridge this knowledge gap by focussing on the interplay between niche and regime actors.
- Action research on implementing the circular economy programme in the Amsterdam Metropolitan Area (2015–2020) represents an example.
- Innovation science is adopted as leading theoretical approach.
- The case shows that more advanced ambitions could be achieved than through individual market actors by themselves. Whether the circular initiatives built represent just incremental change—as suggested in the few other studies—is considered too simplistic. It is concluded to conceptualise the CE transition rather as a continuous, transformational change which takes time.

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- The interplay between niche and regime actors was evident in the case but varied. Niche actors could team up more easily with regime actors where their interests coincided. Niche CE innovations did not necessarily develop in protected environments, as suggested by early MLP studies. They could diffuse more widely if they link up with ongoing processes at regime and landscape level. This conclusion corresponds with the more recent innovation literature.

KEYWORDS

action research, Amsterdam Metropolitan Area, circular economy, niche and regime, transition brokers, transition management

1 | INTRODUCTION

Due to the growing awareness of the depletion of natural resources and the accompanying environmental impact of resource extraction, the call for a circular economy (CE) is intensifying. The CE notion draws on earlier concepts, including the 'Spaceship Earth' analogy (Boulding, 1966) and the concepts of industrial ecology (Frosch & Gallopoulos, 1989), service economy (Stahel, 1997) and cradle-to-cradle systems (McDonough & Braungart, 2002). Due to this varied history, there have been various definitions for the term 'circular economy' (Kirchherr, Reike, & Hekkert, 2017). However, the common denominator is the concept of a cyclical, closed-loop, regenerative system in which resource input and waste, emissions and energy leakage are minimised, and redesign and reuse of products are prioritised (Murray, Skene, & Haynes, 2017). CE aims to overcome the linear take-make-dispose pattern of production and consumption and proposes a circular system, in which the value of products, materials and resources is maintained in the economy as long as possible (Merli, Preziosi, & Acampora, 2018). In order to achieve this, manufacturers need to develop strategies of 'retained ownership' (operational leasing, renting, selling results instead of goods) in order to guarantee the return of their goods after each cycle (Stahel, 1997) and prolong the service life of products (Michellini, Moraes, Cunha, Costa, & Ometto, 2017). New business models are therefore considered as part of the CE approach (Bolton & Hannon, 2016; Heyes, Sharmina, Mendoza, Gallego-Schmid, & Azapagic, 2018; Nußholz, 2017).

In the last decade, much has been published about CE (Ghisellini, Cialani, & Ulgiati, 2016; Khitous, Strozzi, Urbinati, & Alberti, 2020; Merli et al., 2018; Winans, Kendall, & Deng, 2017). However, studies on the actual process of how to implement the transition towards CE are scarce (Franco, 2017; Ghisellini et al., 2016; Kalmykova, Sadagopan, & Rosado, 2018; Lieder & Rashid, 2016). Some analyses highlight the lessons learned in establishing eco-industrial parks (Ehrenfeld & Gertler, 1997) or industrial symbiosis (Boons, Spekkink, & Jiao, 2014; Chertow & Ehrenfeld, 2012). Other papers cover CE implementation at the level of a business sector (Jackson, Lederwasch, & Giurco, 2014), product chain (Fischer & Pascucci, 2017) or a subset of industry (such as SMEs) (Rizos, Behrens, Kafyeke, Hirschnitz-Garbers, & Ioannou, 2015). Only a small number

of studies focus on CE implementation at city level (Ghisellini et al., 2016; Petit-Boix & Leipold, 2018; Prendeville, Cherim, & Bocken, 2018; Campbell-Johnston et al., 2019; Russell, Gianoli, & Grafakos, 2019; Savini, 2019). This is remarkable, as cities are expected to host 66% of the world's population by 2050. They can be seen as 'hotspots' of material consumption, waste generation and disconnected pollution (Campbell-Johnston et al., 2019).

The knowledge gap on CE implementation at local scale can be explained by the fact that cities have only recently taken up this issue (Petit-Boix & Leipold, 2018). Moreover, cities encounter numerous constraints, namely, financial, institutional, policy and regulatory, technology and knowledge, and social (Russell et al., 2019). On the basis of a study on CE implementation in six European cities, Prendeville et al. (2018) concluded that many of the initiatives identified could be seen as incremental, without any clear evidence of major investments to transform incumbent unsustainable industries. Even in three pioneering Dutch cases analysed by Campbell-Johnston et al. (2019), CE is commonly presented as a 'transformative' and paradigm-altering new approach to sustainability, yet this element appears not to have manifested in reality. This raises the question of how the implementation of CE at local level can lead to the transformative change that CE entails.

de Jesus, Antunes, Santos, and Mendonça (2016) state that moving away from the linear model will not be an easy task because entrenched technical systems are made inflexible by risk avoidance and special interests, with much to lose in the short run. Regulatory and economic government measures can remove some of these barriers, but much depends on the willingness of the market to implement CE (Fischer & Newig, 2016). The problem is that market actors connected to established technologies (also called regime actors) often tend to be reluctant to adopt alternatives that could interfere with their business (Meadowcroft, 2009). Newcomers in the market (also called niche actors) are less hindered by these constraints but usually encounter difficulties in getting their innovative products and services accepted (Meadowcroft, 2009). Therefore, individual market actors themselves will not necessarily take the lead in transformative change (Fischer & Newig, 2016). Intermediaries are seen as crucial tools in the effective governance of such change, particularly in urban spaces (Burch et al., 2016). Working alongside local government, they

can fulfil a mediating role to help establish collaboration between businesses and create the appropriate preconditions for business development. Such intermediaries are here called 'transition brokers'. Transition brokers orchestrate both the process (learning and communication) and content (providing new information and seeking ambitious solutions) of the CE transition. Empirical studies on how niche and regime actors interact in developing circular initiatives at local level through the mediation of transition brokers are scarce (Fischer & Newig, 2016; Gliedt, Hoicka, & Jackson, 2018; Kivimaa, Boon, Hyysalo, & Klerkx, 2019). This paper aims to fill this knowledge gap.

The following questions will be addressed in this paper:

- Which circular initiatives can be built by market actors at local level through the mediation of transition brokers? And how can these initiatives be interpreted in view of the transformative change implicit in CE?
- What is the interplay between regime and niche actors in this transition process?

The analysis focuses on the implementation of the regional programme on CE being performed in the Amsterdam Metropolitan Area (AMA). The Amsterdam Economic Board (AMEC) took the lead in 2015 in setting up and executing this regional programme in close cooperation with their partners (*viz.*, local government, industry, and research institutes and universities). The AMEC is a triple helix organisation financed by its members. Its mission is to tackle the urban challenges facing the metropolis of the future. One of the six key challenges is the transition to CE. The CE programme is headed by a non-executive member of the AMEC (author of this paper) and her colleague, the Challenge Lead CE, who both act as transition brokers. To analyse the AMA case, an action research approach is followed (Dick, 2004). This choice is in line with those scholars studying transition management from a similar process-oriented perspective (Loorbach, Frantzeskaki, & Avelino, 2017; Wittmayer, Schöpke, van Steenberghe, & Omann, 2014). Below, the theoretical perspective of the study will be further specified building upon innovation science and CE literature. Second, the choice of the case study, the method of data collection and the use of the action research approach will be explained in the methodology section. Third, the actual process of implementing the CE programme in the AMA in the period January 2015 to February 2020 will be described. Next, the data gathered will be reflected upon in view of the theoretical perspective adopted. Finally, conclusions and suggestions for further research will be formulated.

2 | THEORETICAL BACKGROUND

Understanding how to create system change—in this case to CE—is addressed in the field of innovation science. Within this field of research, a helpful framework to conceptualise the overall dynamic patterns in socio-technological transitions is the multi-level perspective (MLP), introduced by Rip and Kemp (1998). The MLP view transitions as non-linear processes that result from the interplay of

developments at three analytical levels: niches, regimes and the landscape (Geels, 2011). Niches are the locus for radical innovations that deviate from existing regimes. Within niches, sub-optimally performing experiments can be carried out away from regime selection pressures (Seyfang & Haxeltine, 2012). Regimes are the locus of established practices and associated rules that stabilise existing systems (Geels, 2011). The landscape represents the broad exogenous environment that niche and regime actors cannot influence in the short run. Landscape pressures involve not only trends, such as globalisation, urbanisation and climate change, but also events, such as wars, natural disasters, pandemics and economic crises (Geels, 2002; Rip & Kemp, 1998).

One of the criticisms of the MLP was the lack of attention for agency, that is, the capacity to influence the transitions described above (Avelino & Rotmans, 2011; Fischer & Newig, 2016; Rauschmayer, Bauler, & Schöpke, 2015). In response to this criticism, Rotmans, Kemp, and Van Asselt (2001) coined the term 'transition management' for a new perspective in innovation science. Transition management is defined as a deliberative process to influence governance activities in such a way that they lead to accelerated change directed towards societal ambitions, such as CE (Kemp, Loorbach, & Rotmans, 2007). This perspective brings a sense of urgency and societal engagement to the research, as well as the necessity to engage deeply in practical contexts where actors deal with transitions (Loorbach et al., 2017). To understand the dynamics of transitions, Loorbach et al. (2017) developed an analytical model, which views societal transitions as iterative processes of build-up and breakdown over a period of several decades. In a changing societal context, established regimes develop path-dependency through optimisation, whereas change agents start to experiment with alternative ideas, technologies and practices (Loorbach et al., 2017). Over time, pressures on regimes to transform increase, leading to destabilisation as alternatives start to accelerate and emerge. The actual transition is then chaotic and disruptive, and new combinations of emerging alternatives and transformative regime elements grow into a new regime. In this process, elements of an old regime that do not transform are broken down and phased out (Loorbach et al., 2017). The roles of the different actors in such change processes are a major object of study in transition management (Loorbach et al., 2017).

Drawing on the CE literature, all actors (government, civil society and business) face challenges in shaping the transition. Governments have the potential to organise key resource flows efficiently, formulate legal frameworks and implement flexibly targeted supply and pricing strategies (Fischer & Newig, 2016). However, contrary to the top-down political steering in, for example, China and other countries, such as European member states, largely depend on multi-stakeholder engagement (McDowall et al., 2017) and are constrained in their efforts to enforce the CE transition (Kirchherr et al., 2018). Consequently, countries like the Netherlands strongly depend on the market and on civil society. Citizens can put pressure on the market and government to take action (Prendeville et al., 2018; Seyfang & Haxeltine, 2012). Although their influence can be substantial, they are constrained by regulatory, political and infrastructural barriers

(Bergman, Markusson, Connor, Middlemiss, & Ricci, 2010). Finally, business is reluctant to take the lead in system change. According to Meadowcroft (2009), regime actors only seem to change when they envisage market opportunities by diversification or redirection, whereas niche actors often struggle with having their innovations accepted by the market. Intermediaries are seen as key actors in enabling market actors to make a system change (Burch et al., 2016). The CE transition process is hardly analysed from the latter perspective (Sengers, Wiczorek, & Raven, 2019; Gliedt et al., 2018; Kivimaa et al., 2019). This paper will contribute to this knowledge gap by analysing the interplay between regime and niche actors in building circular initiatives mediated by two transition brokers.

The second knowledge gap being addressed relates to the ambition level market actors achieve at local level. A growing number of cities identify with CE as a cause and have adopted it as an aspirational concept (Prendeville et al., 2018). However, analysing their local practices shows that the CE initiatives launched mainly lead to incremental steps (Prendeville et al., 2018). To particularise the ambition level, several authors refer to the so-called R hierarchy. This hierarchy ranges from 3 Rs (reduce, reuse and recycle) (Ghisellini et al., 2016; Ranta, Aarikka-Stenroos, Ritala, & Mäkinen, 2018), 5 Rs (reduce, reuse, remanufacture, recycle and recover) to 10 Rs (Campbell-Johnston et al., 2019; Cramer, 2017; Kirchherr et al., 2017; Reike, Vermeulen, & Witjes, 2018). The 10-R hierarchy refers to the environmental impact of the different R options in a sequential manner. Although the conceptualisation of the 10-R hierarchy slightly differs in the literature, the overall framework is generally the same. The highest priority is given to refusal of use, then to reduction (decrease of material use per unit of product), next to rethinking the product in view of circularity, alongside product reuse options (reuse, repair, refurbishment, remanufacturing and repurposing), then material recycling, and finally incineration with energy recovery (Cramer, 2017).

The few authors to have studied CE at city level mainly focus on the actual outcome in terms of the R hierarchy. Particularly in the Netherlands, some detailed studies have been made. Campbell-Johnston et al. (2019) conclude that the limited scope of instruments at city level to affect and compel stakeholders along the value chain leads to prioritising lower value CE options, namely, recycling. On the same note, Savini (2019) argues that the modern paradigm of waste disposal and recycling fails to cope with increasing waste stock and relatively low recycling rates, especially in urban agglomerations. This argument is echoed by Fellner, Lederer, Scharff, and Laner (2017). They add that a significant share of commodities is still used to build up our infrastructure and thus accumulates in societies' material stock. Only when consumption of resources and generation of waste is more balanced and stocks are rebuilt and maintained can CE evolve to its full potential (Fellner et al., 2017). Not only in Dutch cities but also in other geographic areas (Europe, China and the United States), recycling is the primary CE action, while increasing reuse faces cultural-cognitive barriers (Ranta et al., 2018). Still, a number of cities support several reuse and repair actions, with a variety of remarkable examples in Norway, Spain, Sweden, the Netherlands and the United

States (Petit-Boix & Leipold, 2018). This analysis aims to contribute to the literature by reflecting upon the outcomes achieved by market actors in the AMEC programme through the mediation of the two transition brokers.

3 | RESEARCH METHODOLOGY

The analysis focuses on the implementation of CE in the Netherlands. With a longstanding history in waste prevention and recycling and eco-design of products, this country has built up a good position en route to CE (Cramer, 2017; Savini, 2019; Van Buren, Demmers, Van der Heijden, & Witlox, 2016). In line with the EU's CE action plan of 2015, the Dutch government adopted its government-wide CE programme (Ministry of Infrastructure and the Environment and Ministry of Economic Affairs, 2016), which was followed by an execution programme (Ministry of Infrastructure and Water Management et al., 2019). The Dutch CE policies stress the importance of all 10-R options but raise the bar most explicitly for recycling targets. Local government responded to these national policies, including in the AMA. This region has been selected as exemplary case for several reasons. It is a comparatively densely populated region (2.5 million inhabitants) where large amounts of products and materials circulate. The region comprises a broad spectrum of economic activities and has an innovative startup culture. Moreover, the 32 municipalities and two provinces making up the AMA feel the urgency to meet the CE targets set at EU and national level. They have intensified their CE initiatives, for example, by speeding up the recycling percentages of household waste streams and promoting the separation of waste at source. However, they also promote CE among their citizens and support advanced platforms for reuse, refurbishing and remanufacturing of products (Cramer, 2017). A good example of a city approach is Circular Amsterdam (City of Amsterdam and Circle Economy, 2019). Some CE initiatives require coordination at regional level. The AMEC stepped forward to take up this role, starting a regional CE programme in 2015 that runs parallel to the activities of the municipalities.

The AMEC's CE programme will be analysed from its launch until February 2020. In the programme, four phases can be distinguished. In Phase 1 (2015–2016), the programme was drafted and, after negotiations, adopted by local government and the AMEC Board. In Phase 2 (starting in 2015), the execution of the programme took place, which focused on building coalitions of partners that were willing to develop new CE business. In Phase 3 (starting in 2019), first successful examples are being scaled up. All these activities may ultimately lead to Phase 4, in which CE will become mainstream. This phase has not been reached yet and is therefore not included in this analysis. Studying the first 5 years of the AMEC programme provides valuable insights into the process of creating circular business through the mediation of transition brokers. This case is exemplary for how CE can be established gradually.

During the whole 5-year process, a great number of circular initiatives have been launched in cooperation with market actors. In

accordance with Loorbach and Rotmans (2010), the transition brokers focused on frontrunners in industry (particularly niche actors) but also involved regime actors that were willing to participate. Regime actors can be large or small and medium-sized companies (with a maximum of 250 employees), whereas niche actors can be startups (having developed a prototype of a circular product or service) and scale-ups (having created a small market for their circular product or service). To support circular business in its starting phase, the transition brokers also gained the support of other actors (local government and research and educational institutes). They were able to help create the appropriate conditions and provide relevant expertise. As the Netherlands has a long-standing tradition of cooperation, consensus-building and democratic self-rule (Schreuder, 2001), the AMEC approach clearly fits with this Dutch way of decision-making.

Within the AMEC programme, two strategies were defined (Cramer, 2016): (a) renewing product chains via circular procurement and (b) closing the loop of resource streams. To assess the ambition level of both strategies, the 10-R hierarchy was used (Cramer, 2017).

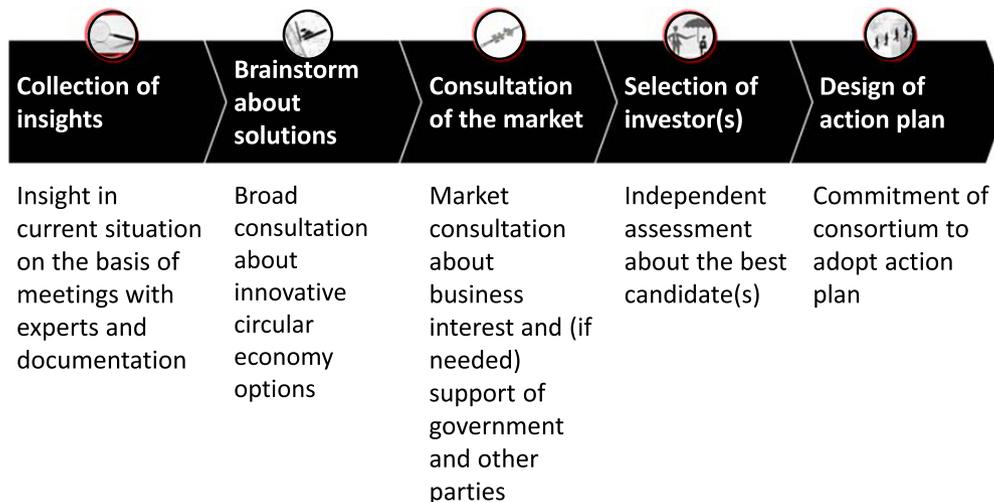
Strategy 1 was directed at circular procurement because this could—according to interviewees in Phase 1—create a market for initiatives high in the R hierarchy (refuse, reduce, redesign and reuse). Instead of the traditional procurement criteria based on the lowest price or overall cost, the focus was on the most value for money, where environmental and social specifications are included (Witjes & Lozano, 2016). This implies a shift to price per delivered service and the application of new business models. Moreover, attention was paid to a collaboration between the procurer and potential suppliers from an early stage in the tender process (Witjes & Lozano, 2016), particularly via a competitive dialogue procedure (Uttam & Le Lann Roos, 2015). Three communities of practice were organised in the period 2016–2019, which were moderated by the author of this paper. The objective was to gain knowledge about circular procurement, exchange experiences

among the participants, coordinate procurement actions and thus jointly create market power for circular products and services. The communities, each consisting of six sessions, involved a total of 31 representatives of procurement or sustainability divisions of AMECs network partners (private sector, local government and research and educational organisations).

Strategy 2 aimed at closing the loop of resource streams. This strategy was chosen by representatives of local government and specific industrial sectors interviewed in Phase 1. They recognised the need of coordinating efforts at a regional scale in order to create high-value products out of resource streams. As this requires building new, circular coalitions, the expertise of the AMEC was welcomed. Priority was given to nine resource streams: construction and demolition materials; end-of-life textiles; plastics; biomass; electronic and electrical waste; diapers; mattresses; information technology (IT) sector servers; and metals. The criteria for selection were high volumes and the scale in which they are a burden on the environment. The ambition was to move away from downcycling (low-value recycling), which is still the most common form of recycling (Reike et al., 2018; Savini, 2019). Instead, priority was given to upgrading resource streams via high-value recycling (making optimal use of the resources available in the resource stream) and depending on the resource stream, also to product reuse and redesign. The overall approach to generate and select the most promising options was similar (see Table 1). However, for each resource (sub)stream, tailor-made implementation strategies were developed, in which market actors were in the lead and experts and local government in a supporting role.

A great number of data were used for analysing the results. To design the programme (Phase 1), 50 interviews and five group sessions with representatives of the AMECs network were held. To get support for the programme, six sessions with local government in the subregions and a meeting with the AMEC were held. The analysis of

TABLE 1 Approach to generate and select the most promising CE options



the results in Phase 2 uses the minutes and final reports of the three communities of practice themed 'circular procurement' (Strategy 1). For Strategy 2, the type of circular coalitions built and their participants is summarised. The preparation of these circular coalitions was based on 48 interviews, 70 informal follow-up meetings, 14 brainstorming sessions and three CE labs. Phase 3 started in the course of 2019 and has delivered some first results. At several moments in the process, reflective pauses were organised to evaluate the results achieved up to this point. These data are used in the discussion paragraph. Table 2 provides a summary of all data sources used.

The case presented here is based on an action research approach. This type of research has a long history, stretching back to the work of Dewey (1938) and Lewin (1957). It allows for the collaborative production of scientifically and socially relevant knowledge, transformative action and new social relations, through a participatory process (Dick, 2004). Various scholars studying the governance of sustainability transitions stress the relevance of action research (Kemmis, 2010; Loorbach et al., 2017; Wittmayer et al., 2014). However, they argue that this type of research is necessarily a predictive endeavour and needs to recognise its fundamental normativity (Rauschmayer et al., 2015). Wittmayer and Schöpke (2014) admit that one becomes part of the high-paced local dynamics through engagement. Therefore, they stress the importance of accompanying action research with an active practice of self-reflection and a critical attitude. In the case presented here, the author of this paper also fulfils a broader, action-oriented role than an academic scholar. By participating as transition

broker, knowledge was gained, circular businesses built and appropriate preconditions created, all alongside a number of partners. Reflective pauses with the main participants were built into the process, which helped the author to interpret the results as a reflective scientist. Moreover, the author acted as self-reflexive scientist, a term referring to being reflexive about one's positionality and normativity, and to seeing oneself as part of the dynamic that one seeks to change (Wittmayer & Schöpke, 2014). In the analysis, a clear distinction has been made between these three roles.

4 | RESULTS

The results of the two strategies executed within the AMECs CE programme are presented below.

4.1 | Strategy 1: Renewing product chains via collective circular procurement

Strategy 1 was applied by 31 organisations involved in three communities of practice on circular procurement. The transition broker, who moderated the communities, assisted in exchanging knowledge and experiences and preparing new circular procurement trajectories. However, the purchasing department of the respective organisation was in the lead to determine who was to be contracted for a particular

TABLE 2 Data sources

Phase 1: Drafting the programme and getting support	Phase 2: Building circular consortia	Phase 3: Scaling up successful initiatives	Overarching reflective pauses during the process
Exploring the focus of the programme ■ 50 interviews and 5 group sessions (minutes)	Strategy 1: Renewing product chains via circular procurement ■ Minutes of three communities of practice (each: 6 sessions) and final reports	Strategy 1: Renewing product chains via circular procurement ■ 12 informal follow-up meetings and 1 follow-up meeting (minutes) ■ 1 brainstorming session with the AMEC (minutes)	During sessions of communities of practice 'circular procurement' (minutes) Follow-up meeting with participants in Strategy 1 (January 2020) (minutes)
Mobilising commitment from stakeholders ■ Sessions with local government in 6 subregions (minutes) ■ AMEC Board meeting	Strategy 2: Closing the loop of resource streams ■ 14 brainstorming sessions about innovative, high-value recycling and reuse options (minutes) of 9 resource streams ■ 48 interviews with business representatives of specific resource streams (minutes) ■ 3 CE labs on respectively mattresses, industrial waste streams (including the organic liquid waste stream) and metals (live stream recording, transcriptions and summary reports) ■ More than 70 informal follow-up meetings (not recorded) to negotiate the actual plans.	Strategy 2: Closing the loop of resource streams ■ 20 informal follow-up meetings to scale up successful cases (not recorded) ■ 24 interviews with experts to prepare the selection of industrial waste streams ■ 1 brainstorming session on creating a circular 'textile valley' (minutes)	Minutes of evaluation 'roast' with main stakeholders (January 2019)

product or service. The five product groups most often selected were demolition/construction, office furniture, traffic signs, catering and IT business equipment. Based on the participants' initial experiences with circular procurement in the five product chains, an overview could be made of the regime and niche actors involved by the commissioning parties in these cases (see Table 3). The figure after each product chain indicates the number of cases studied.

Table 3 shows the wide variety of market actors involved by the lead commissioning parties in circular procurement. In all cases except for traffic signs, both types of regime and niche actors participated. For complex products, namely, demolition and construction of buildings and infrastructure and data IT business equipment, the commissioning party usually invited regime actors to take charge but often expected them to involve other actors (including niche actors). In contrast, in the case of simple products such as traffic signs and office furniture, the interaction among regime and niche actors was limited. Each company had its own business proposition. The same goes for catering, in which the bidder contracted several regime and niche actors individually. However, in this case, a regime actor acted as main contractor. It should be noted that in the circular procurement cases, the involvement of startups usually remained limited, because they lack—according to the participants—the necessary proven experience, large stock of products and financial solvency. Only occasionally did the purchasing departments act as launching customer (minutes COP 2, 12-12-2017). An example is a newly built circular meeting place and restaurant, for which experimenting and sharing knowledge was one of the key objectives. Here, the purchasing department received the support of its management to invite startups (minutes COP 2, 16-11-2018). Most circular procurement initiatives focused on higher options in the R hierarchy, often combined with new business models. Examples are leasing office furniture or using it second hand, circular demolition and reuse of building materials, reusing and remanufacturing ICT business equipment and preventing plastic packaging in catering. In the concluding evaluation, all three communities of practice stated that they were better informed about the theory and practice of circular procurement and now knew how to organise market consultation via a competitive dialogue procedure (Uttam & Le Lann Roos, 2015). They acknowledged that collaboration between the procurer and potential suppliers from an early stage in the tender process is key.

TABLE 3 Involvement of different types of regime and niche actors (indicated by ✓) in five product chains selected in the context of circular procurement

Product/type of company	R1	R2	N1	N2
Demolition/construction (3)	✓	✓	✓	✓
Office furniture (4)	✓	✓	✓	✓
Signposting (2)				✓
Catering (1)	✓	✓	✓	✓
IT business equipment (3)	✓	✓	✓	✓

Note: N1, circular startups; N2, circular scale-ups; R1, large companies; R2, SMEs.

4.2 | Strategy 2: Closing the loop of resource streams

Strategy 2 focused on nine major resource streams, each consisting of one or more sub-streams. Twenty-two circular business initiatives were created, five of which were organised by others (particularly innovative companies), whereas the AMEC only played a supportive role. The remaining 17 initiatives were orchestrated by the two transition brokers. To help select the most promising circular options, research institutes and market actors provided input. After a market consultation, a lead market actor was selected. This company was asked which preconditions should be fulfilled to develop a viable business case. A number of general preconditions turned out to be crucial: an appropriate collection and logistics system, a guaranteed volume of waste, an articulated demand for the recycled material and a quality standard for the recyclates accepted (Cramer, 2018). Moreover, local incentives (e.g., circular procurement) could speed up the process. To help create these preconditions, the transition brokers approached other actors, particularly local government and other market actors. Based on the efforts made, an overview can be provided of the type of circular coalitions built and the niche and regime actors involved (see Table 4).

Table 4 shows the variety of niche and regime actors needed to build a circular initiative. In the case of circular demolition and construction, all types of market actors are involved. The same goes for reclaiming sewage sludge and reusing components of data servers. In other cases, only a few market actors participate, but the involvement of only one type of market actor is an exception. The AMEC worked with regime actors as leading partner (particularly large companies) in eight of the 17 cases. These circular initiatives connected well with their existing activities. The main reasons to participate were expanding their current business, diversifying their portfolio, responding to political pressure and gaining more control over the product chain through data management (see Table 4). In nine of the 17 cases, the AMEC has worked with niche companies (particularly scale-ups) as lead actors. This has happened when new business had to be created and only niche actors were directly willing to come forward as first mover. In five cases, regime actors were presently not involved. In the other four cases the AMEC found regime actors (including procurement departments of government agencies), in order to meet the necessary preconditions to scale up the initiative.

None of the 22 consortia focused on incineration or low-value recycling. Most cases focused on high-value recycling (13 cases), for example, generating new products from recyclates, such as flavour additives, phosphate and calcite, insulation material and regenerated clothes. Some addressed sorting of materials (four cases) or refusal (one case: plastic). Others paid particular attention to reuse and/or redesign (five cases), mainly in the industrial sectors selected: construction, mattresses, data servers and metal. New business models were also introduced, particularly the 'shared costs and benefits model', which reflects the share of each actor in a well-balanced manner.

TABLE 4 Involvement of different types of regime and niche actors (indicated by ✓) and lead actors (indicated by!) in nine resource streams selected in the context of redesign, reuse, and high-value recycling

Circular initiative/actor	Type of circular initiative	R1	R2	N1	N2
1. Biomass					
a. High-value recycling of waste streams in food industry via biorefinery	Production of flavouring additives	✓	✓	✓!	
b. High-value recycling of organic waste from public green space	Production of insulation material and energy	✓		✓	✓!
c. Prevention of plastic/creation of mono-streams in offices via sorting of bio-waste, plastic, paper	Collaborative effort of main offices in business quarter	✓			✓!
d. High-value recycling of resources from sewage sludge	Production of phosphate, calcite, cellulose, humic acid, and energy	✓	✓	✓	✓
2. Demolition/construction					
a. Reuse/high-value recycling	Circular demolition	✓	✓	✓	✓
b. Redesign/reuse	Circular construction	✓	✓	✓	✓
3. Electronic/electrical products					
a. Creation of mono-streams via sorting	Development of service centres: expansion or diversification of business	✓!	✓!		
b. High-value recycling of plastic, cables, and printed circuit boards	Plastic/cables: expansion of business Printed circuit board: new plant for reclaiming metals, for example, lithium	✓!			✓!
4. Non-wearable textiles					
a. Creation of mono-textile streams	Development of specialised sorting machines			✓!	
b. High-value recycling via generating fibres	Production of clothes from recyclates			✓!	✓!
5. Plastics					
a. Creation of mono-plastic streams	Development of specialised sorting plant				✓!
b. Mechanical recycling	Creation of market for products from recyclates				✓!
c. Chemical recycling	In development	✓			✓
6. Diapers					
High-value recycling	Development of new plant focused on reuse of materials for new products: diversification of business	✓!			✓
7. Mattresses					
a. Redesign	Design of mattresses in view of reuse and recycling: due to political pressure	✓!	✓		✓
b. High-value recycling	Expansion of recycling facilities for discarded mattresses: due to political pressure	✓!		✓	
8. Data servers					
a. Refurbishment/reuse of components	Promotion of reuse options: Expansion of facilities	✓!	✓!	✓	✓
b. High-value recycling	Tracking/tracing discarded servers via block chain technology: gaining more control over product chain	✓!			✓
9. Metals					
a. Reuse	Promotion of reuse of metals in building sector	✓	✓		✓
b. High-value recycling of aluminium cans	Separation of metal stream: expansion of recycling facility	✓!			
c. Next steps in high-value recycling	Development of new plant✓			✓	✓!

Note: Resource stream in italics: Not the AMEC but others (particularly bidders or innovative lead companies) are in charge of creating a consortium. N1, circular startups; N N3 must be N2, circular scale-ups; R1, large companies; R2, SMEs

To evaluate the results gained after 4 years, a 'roast' session was organised in January 2019 with 12 main stakeholders. Their comments (minutes Circular Roast, 30-1-2020) included the following:

- The results of Strategy 1 on circular procurement are encouraging. However, collective circular procurement has not taken place yet. It is recommended to use a uniform roadmap to promote joint efforts.

- Concerning Strategy 2, the AMEC can make a huge difference when the Board shifts its focus from the end of the product chain (waste streams) to the beginning. This fills a gap often neglected by municipalities, who focus their efforts on waste separation and recycling.
- The big challenge is to scale up the circular initiatives that have been developed.
- More use can be made of ICT-driven data gathering and monitoring.

Based on this evaluation, the AMEC has issued a follow-up programme (Cramer & Teurlings, 2020), in which an update is given of the two adopted strategies. In the first strategy on circular procurement, more purchasing departments are encouraged to join and the ones already participating are motivated to continue their circular procurement efforts. At the same time, the AMEC and the participants have selected a limited number of product chains (e.g., ICT equipment and servers), which can potentially be transformed more fundamentally. At the follow-up meeting in November 2019, the participants of the communities of practice welcomed this joint initiative (minutes COP alumni 25-11-2019). They confessed that lack of knowledge, time and money hampered the systematic search for building completely new, circular product chains. However, they were willing to join such an initiative if the AMEC would take the lead. This strategy is now being implemented. In addition, they requested help from the AMEC in securing higher levels of commitment from their directors or CEOs and through this also from middle management. As long as other departments in the organisation do not fully cooperate, circular procurement is doomed to fail (minutes COP alumni 25-11-2019). To start this process, a circular roadmap had been designed that can be used by all participants as a standard.

Strategy 2, on closing the loop of resources, now aims at scaling up the successful business cases. Sometimes, this implies the duplication of the business elsewhere in the region or in the Netherlands, whereas in other cases, it concerns the adoption of a broader ecosystem approach. An example is the development of a textile hub in which high-value recycling of non-wearable textiles combined with various other circular textile options related to refusal, redesign and reuse is jointly promoted. Besides scaling up, new circular initiatives are launched, which shift the attention from household to industrial waste streams. These latter waste streams will be traced back to their source in order to include prevention and reuse in the analysis at the outset. Use will be made of ICT-driven data gathering.

5 | DISCUSSION

Below, the two questions raised in the introduction will be answered from the position of a reflective scientist.

The first question was as follows: Which circular initiatives can be built in the particular local context of the AMA by market actors through the mediation of transition brokers, and how can these initiatives be interpreted in view of the transformative change implicit in

CE? Reflection on the implementation of the AMEC's CE programme reveals some progress towards CE but not yet a fundamental renewal of sectors and product chains. The circular initiatives taken can be considered as building blocks on the road to CE, which can be scaled up and extended to other initiatives. The whole pipeline of circular initiatives to be developed may ultimately lead to a mainstreaming of CE (Cramer, 2020).

In the circular procurement strategy of the AMEC programme, the bidders took ambitious steps, particularly aimed at product redesign and reuse and new business models. However, when mainstreaming circular procurement, two problems stood out, which are hardly addressed in the literature on sustainable procurement (Witjes & Lozano, 2016). First, the bidders need the commitment of crucial actors (CEOs and middle management) as they cannot implement circular procurement alone. Other departments within their organisation (e.g., finance, human resources, product management and shop-floor employees) should also integrate circular procurement in their daily processes. Moreover, the bidders often lack the knowledge, time and money to look for promising circular options that go beyond those already available in the market. Only a joint effort orchestrated by an organisation such as AMEC can convince them to help transform product chains more fundamentally.

In the second strategy—regarding closing the loop of resource streams—the major focus was on high-value recycling and the creation of mono-streams via sorting. In some cases, steps higher up in the R hierarchy were implemented (e.g., redesign/reuse and refusal). Regularly, solutions were combined with new business models. These results differ from the few other studies on CE that address CE implementation at local level, particularly in the Netherlands (viz., Fellner et al., 2017; Campbell-Johnston et al. 2019; Savini, 2019). These authors argue that the cities they studied (among which Amsterdam) prioritise lower value CE options, namely, recycling, and end up with relatively low recycling rates. These arguments were exactly the reason for local government in the AMA to join forces at regional level with the AMEC. Through the mediation of the transition brokers, a shift was made from incineration, low-value recycling and low recycling rates to high-value recycling and sometimes even reuse and redesign initiatives. The transition brokers ensured that the most promising circular options were prioritised in building the CE initiatives. In this process, they deliberately involved experts and niche actors to raise ambitions and standards. Only companies that could fulfil the ambitions set from the start were asked to take the lead or join the initiative. This often led to more advanced ambitions than individual market actors could achieve by themselves. This issue has not been studied before (Gleidt et al. 2018). Admittedly, the AMEC strategy did hardly manage to influence the increasing waste stock (Campbell Johnston et al., 2019; Savini, 2019). This was also concluded at the evaluative roast session in 2019. Therefore, the next step in the AMEC programme will be to include refusal, redesign and reuse more explicitly from the outset.

The AMA case shows that the objective of moving to CE can be predefined in general terms. However, the steps leading towards that goal will be specified in the transformative practice by the actors

involved. Critics argue that this methodological starting point may blur the final objective of CE and lead to incremental changes (Rauschmayer et al., 2015). Being aware of this risk, the transition brokers optimally challenged the actors involved to choose the most promising changes. Moreover, in line with the transition management literature, only those actors were invited to participate that expressed their willingness to engage proactively in CE, had new ideas and were able to transcend organisational boundaries (Sengers, Wiczorek, & Raven, 2019). This measure was intended to avoid the problem of becoming locked in conventional innovation trajectories such as low-grade recycling (Korhonen, Honkasalo, & Seppälä, 2018). Whether the steps taken as part of the AMEC programme should be considered incremental or transformational is hard to assess. Transformational change is often associated with a shift that is comprehensive (fundamental, truly new and revolutionary), large-scale (including the whole system) and/or quick (a sudden jump, achieved in a relatively short amount of time), whereas incremental change is often portrayed as shallow, partial and slow (Termeer, Dewulf, & Biesbroek, 2017). However, it is impossible for in-depth change in society to occur overnight on a large scale (Keast & Brown, 2006). People have to disrupt their routines and experiment with, and learn about, different modes of behaviour in order to incorporate change. At the same time, the notion that incremental change cannot ultimately lead to big steps forward can be challenged. In line with Termeer et al. (2017), it seems to be more effective to go beyond the dichotomy between transformational and incremental change and instead use the conceptualisation of continuous transformational change. Within this concept, a variety of changes can occur that differ in depth, scale and speed, depending on the context (Termeer et al., 2017).

A similar dichotomy problem arises in applying the analytical model of Loorbach et al. (2017). A straightforward assessment of how far the process of breaking down the linear system and building up the circular system has proceeded is impossible. There can just be an observation of which signs of CE are already visible, which conventional, linear activities still prevail, and which have been discarded. The results of the AMEC programme show examples of both. The circular procurement initiatives are a case in point of building up the CE system, whereas refusal of plastic packaging is a sign of phasing old elements out. However, these initiatives are just nuclei of a new, more circular world, representing a great variety of industrial sectors and product chains (Campbell-Johnston et al., 2019). As Loorbach et al. (2017) also acknowledge, the sustainability transition is an iterative, often chaotic process which covers a period of decades. Consequently, their analytical model should be used as an aspirational model to indicate the direction of change, rather than as a template by which to measure the progress made.

The second question addressed in the paper was as follows: What is the interplay between regime and niche actors in the change process of the AMEC programme? The analysis shows that regime and niche actors clearly interact but do so in a manner that is tailored to the specific situation. In the strategy on circular procurement, it is case-dependent whether regime and niche actors interact or follow an independent strategy. When they need each other to win a tender,

they join forces, but they operate independently where they are competing for the same tender. The latter is often the case when it concerns simple products.

In the strategy regarding closing the loop of resource streams, the practices of regime and niche actors reinforced each other, as long as their activities were complementary and their interests coincided. Regime actors were willing to cooperate with niche actors when they expected market opportunities through expansion or diversification of their business, felt political pressure or could gain more control over the whole product chain. Niche actors on the other hand envisaged the potential of scaling through the support of regime actors.

How can these results be interpreted in view of the transition management literature? The analysis supports the view that niches are to be perceived as crucial for bringing about regime shifts, but they cannot do this on their own (Schot & Geels, 2008). They need other actors to scale up. This confirms the hypothesis of Gleidt et al. (2018). In the analysis presented here, niche actors do not struggle against existing regimes, neither do they wait in a protected environment until their technological novelty has become strong enough. This latter view was expressed in the early strategic niche management literature (Schot & Geels, 2008). Instead niche actors respond positively to the invitation of the AMEC to join circular initiatives and sometimes even launch their own solutions without immediate cooperation with regime actors. This observation corresponds with the more recent MLP literature, in which the importance of linkages between niches and external processes at regime and landscape level is emphasised (Schot & Geels, 2008). In line with Loorbach and Rotmans (2010), this paper also shows that regime actors can accelerate transformation and co-create new societal regimes with the newly emerging niches. However, when the new circular business cannot be aligned with their own economic or socio-political strategy, they abstain from cooperation. This confirms the view expressed by among others Meadowcroft (2009) and Russell et al. (2019).

In line with Smith, Voß, and Grin (2010) the regime niche distinctions are therefore rarely so clear cut as suggested in the MLP literature. Instead, various kinds of alignments between regime and niche actors can take place, depending on the timing and nature of multi-level interactions according to Geels and Schot (2007). The latter authors developed a typology of four transition pathways. Three of the four pathways (transformative path, de-alignment and re-alignment path and technological substitution path) are not in line with the transition pathway being created in the AMEC programme. The broader landscape has a major impact in these three pathways, which is not the case for CE in the AMA. The broader landscape has clearly increased the attention for CE during the 5-years AMEC programme but has not enforced measures, except for regulation in specific domains (e.g., plastics). The fourth 'reconfiguration' pathway comes closest to the analysis presented here. According to this pathway, symbiotic innovations, which developed in niches, are initially adopted in the regime to solve local problems. They subsequently trigger substantial changes in the basic architecture of the regime (Geels & Schot, 2007). Unlike the authors suggest, innovations that developed in niches do not necessarily need to be initially adopted by

regime actors as 'add-ons' to solve local problems. As illustrated by various examples of the AMEC programme, niche actors can also launch their own circular solutions and involve regime actors, if needed. Whether these innovations will change the regime's basic architecture substantially in line with the reconfiguration pathway or lead to slight adjustments resembling the transformative pathway cannot yet be assessed. Only with hindsight will it be possible to conclude whether or not disruption has occurred in the sectors and product chains studied.

Finally, it should be noted that the results gained in the AMA case were clearly influenced by the intermediary role fulfilled by the author of this paper together with the other transition broker. They have built coalitions with those actors that were willing to join more ambitious circular initiatives. As they also helped to create the appropriate conditions with support of other actors (e.g., local government), market actors were more easily inclined to join. Particularly, niche actors felt encouraged to step forward and acquire a more embedded and influential position vis-à-vis regime actors (Smith et al, 2010). Without the help of the transition brokers, these results would probably not have been gained. From a self-reflexive stand, this might be conceived as a problem as the results are unavoidably coloured by the author's actions. However, despite this constraint, the results could still be reflected upon as a reflective scientist.

6 | CONCLUSIONS

The analysis of the AMECs CE programme shows that first steps have been made into the direction of CE but not yet a fundamental change as is conceived in CE literature. This can be explained by the fact that such a fundamental transition takes time and cannot be realised overnight. Compared with the few related studies, the initiatives taken here were more ambitious. Through the mediation of the transition brokers, the most promising circular options viable were leading in building a CE initiative. This meant that only those companies were asked to take the lead or join the initiative that could meet the ambition set from the start. This often led to higher ambition levels than individual market actors could achieve by themselves. Whether these circular initiatives represent just incremental change—as other studies suggest—cannot be concluded. In accordance with Termeer et al. (2017), it seems more plausible to conceptualise the transition process as a continuous transformational change. Over time, a variety of changes can occur, which differ in depth, scale and speed, depending on the context (Termeer et al., 2017). Every circular initiative amounts to a building block, which can be scaled up and broadened in scope on the road to CE. The whole pipeline of initiatives to be developed may ultimately lead to a mainstreaming of CE. This implies that the CE transition should not be assessed in a simplistic dichotomy of incremental versus transformational change. Similarly, the analytical model of Loorbach et al. (2017) should not be applied as assessment tool to measure the progress made in either breaking down the linear system or building up the circular system. Rather, it should be seen as an aspirational model to indicate the direction of change.

The analysis also reveals that within both strategies, a variety of market actors were active. The interplay between niche and regime actors was clearly evident, but this does not imply that they always mingled. Niche actors could team up easily with regime actors where their interests coincided. The more regime actors protected their current business, the more obstacles to cooperation the niche actors encountered. Consequently, the cooperation between niche and regime actors largely depended on their willingness to participate in circular initiatives mediated by transition brokers. Regime actors agreed to cooperate with niche actors when they expected market opportunities through expansion or diversification of their business, felt political pressure or could gain more control over the entire product chain. The importance of such economic and socio-political drivers corresponds with the literature on CE (Russell et al., 2019). At the same time, niche CE innovations did not necessarily develop in protected environments, as suggested by early MLP studies. They can diffuse more widely if they link up with ongoing processes at regime and landscape level. This conclusion corresponds with the more recent MLP literature (Schot & Geels, 2008). The transition pathway emerging from the analysis comes closest to the fourth 'reconfiguration' pathway described by Geels and Schot (2007). In this pathway, symbiotic innovations can trigger substantial changes in the basic architecture of the regime. Unlike these authors suggest, niche innovations do not need to be initially adopted by regime actors as 'add-ons' to solve local problems. As illustrated by various examples of the AMEC programme, niche actors can also launch their own circular solutions and involve regime actors, if needed.

Admittedly, the results achieved in the AMEC programme were influenced by the transition broker, who is also the author of this paper. With hindsight, it is plausible that these results would not have been achieved without the intermediary role of the transition broker. As this role has not yet been incorporated in the literature, this may have implications for theory building. When intermediaries orchestrate change processes and can facilitate market actors to jointly achieve higher ambitions, the interplay between regime and niche actors differs from traditional innovation processes. Therefore, it is recommended to better examine the role of intermediaries in further research. Moreover, the case presented here is being carried out in a particular socio-political context. Before drawing general conclusions from it, studies in other regions would be valuable. For instance, pressure through government intervention may be higher elsewhere (e.g., in China), leading to a different interplay between regime and niche actors and a different transition pathway. Finally, this analysis has not touched on the role of the consumer, which clearly impacts the way circular products and services are adopted by society and the volume of waste that can be reduced. Understanding the dynamics of consumer behaviour in transitioning towards a CE is a necessary, complementary study to the one on business innovation presented here.

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ORCID

Jacqueline M. Cramer  <https://orcid.org/0000-0001-7573-9019>

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