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# The diffusion of circular services: Transforming the Dutch catering sector

Rachel Greer *, Timo von Wirth , Derk Loorbach

*Dutch Research Institute for Transitions (DRIFT), Erasmus University Rotterdam, Erasmus Universiteit Rotterdam, PO 1738, Room T16-53, 3000, DR, Rotterdam, Netherlands*

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ABSTRACT

Alternative ways to provide services based on circular economy principles are facing the problem of diffusing beyond local experimentations in niches to become mainstream. This is the entry point for our case study examining niche experimentation in the form of circular catering as developed within the urban living lab BlueCity010 in Rotterdam, the Netherlands, and how it interacted with incumbent actors. This case sets itself against the background of the national policy program "Circular Netherlands in 2050" and larger socio-political efforts to accelerate the transition to a circular economy in the Netherlands. Through a stakeholder analysis and in-person interviews, qualitative data was extracted that helped to map the process of diffusion, the inherent power dynamics, and connecting mechanisms between niche and current regime actors. The results detail various manners through which niche and regime actors connect, including actions taken to facilitate the diffusion of circular catering and settings that created a favorable environment. Our findings also include quantitative values for indicators of success from a Dutch ministry (e.g. $CO_2$ emissions range, percent of animal protein, reduction of food waste), which appear in their very preliminary stage to be on track for meeting their circularity goals within catering. Our research offers novel empirical insights into how to increase and scale cleaner production practices towards a circular economy through circular startups, summarized into 15 observed principles for connecting and integrating niche innovations to incumbent practices. Lastly, these observed practices are discussed in connection to sustainability transitions and in terms of their potential generalizability to cleaner procurement.



## 1. Introduction

Because of a prevalent view gaining traction that continuous optimization within a linear economy will not suffice for sustainable production and consumption patterns, progressively more actors are starting to pursue alternatives. Generally referred to as part of a *circular economy* (CE), these alternatives seek to radically reduce – or in the highest actualization, to eliminate entirely – the production of waste involved in consumption (Geissdoerfer et al., 2017). Operating on this, scientists, enterprises, and decision-makers are opting to take and support steps that pursue a more systemic shift away from the current dominant system of business-as-usual to a circular economy (Ghisellini et al., 2016). This implies an economy based on circular practices, wherein the reigning goal is not to incrementally reduce the environmental impact from products, but to radically shift to new systems of procurement, cleaner pipe, and end-of-life solutions that contribute to closed loops of materials and energy (Tukker, 2015). Within that context, the Dutch government has set an ambition for the Netherlands to become fully circular by 2050 (Ministerie van Algemene Zaken, 2019). To reach this goal, the focus lies first with transforming different pilot sectors – one including a new, circular form of catering. The Ministry's vision of circular catering has been defined to encompass: procurement (choosing products that apply circular principles), production (increasing recyclable bio-based raw materials for disposables, with as little mono-packaging as possible), business operations (minimally burdensome preparation methods and distribution processes), assortment choice (more vegetable proteins, preferably produced locally), and the use of residual flows (e.g. coffee grounds, tomato stems, beet pulp) (Heijink, 2019).

* Corresponding author.
*E-mail address:* greer@drift.eur.nl (R. Greer).

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Catering and its related production and consumption practices are relevant aspects within the food system. Worldwide, around one-third of all food produced for human consumption is lost or wasted (FAO, 2011). This accounts for an estimated 8% of annual greenhouse gas emissions (CAIT, 2018). In response, research on sustainability issues in and circular approaches to catering has begun to emerge, including the role this industry could play in helping to reduce the high levels of food waste. For example, studies explored the gap between reported and actual food waste in Welsh hospital catering (Sonnino and McWilliam, 2011); the ambiguity in sustainability criteria definitions in Finnish food procurement was uncovered (Lehtinen, 2012); and the shaping of strategic procurement and consumption models in food and catering to reduce waste have been studied (Goggins, 2018). These studies have offered contributions for the identification of and reduction of waste involved in catering, as well as ways to improve sustainable practices and procurement in this service model. However, what is lacking is an attempt to go beyond the sheer problem of understanding of food waste from catering practices. Hence, in our study a transformative research lens is taken, building on transition and innovation theory. We will explore how an alternative catering model – made up of a collection of circular approaches – can be diffused and scaled up, to create more widespread and transformative impact.

In their overarching critique of current circular economy research, Kirchherr and van Santen (2019) observe the lack of empirical work on CE in existence, as well as the fact that CE work is by-and-large focused on manufacturing industries. Only 9% of articles focus on the service industries – which is problematic, because most GDP these days in many countries (70% in the European Union) stems from services (ibid.). This makes evident the novelty of our work: studying CE implementation and scaling empirically, and particularly exploring a network of circular entrepreneurs that together offer a service. This is key to CE, because a new economy is not based on singular business models or circular products; rather, it largely incapsulates actor networks and services.

Within the Dutch study context, previous research addressed sustainable public procurement (Melissen and Reinders, 2012), and critical success factors in the maintenance of sustainable business models for small and medium-sized enterprises in the food and beverage industry (Long et al., 2018). However, literature surrounding the consideration of actor network effects, and in particular in the case of a governmental body's innovation adoption appears to be absent to date. In this paper, we focus on how circular catering diffused from an alternative niche into adoption by one of the national ministries, and the factors that played a role in this diffusion process.

### 1.1. The transition to a circular economy

There are many definitions and understandings of a circular economy. Some refer to closing and slowing loops (Bocken et al., 2017), and others call for the use of raw materials and energy through multiple phases (Yuan et al., 2006). While we agree with these principles adhering to a circular economy, the definition with which this research identifies most with, for its comprehensiveness in description of various levels and wider goals of CE, is that the one provided by Kirchherr et al. (2017, p. 229). "An economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling, and recovering materials in production, distribution, and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial park) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity to the benefit of current and future generations. It is enabled by novel business models and responsible consumers."

The concept of CE envelops resources, pricing, externalities, and closing loops, but it is also (on a grander scale) about changing economic (i.e. actor) relationships. The general challenge of CE is to deal with all materials through a process of *dematerialization, material substitution, and reuse of materials at the end of their life cycle*. This case study of a transition of services concerns the reduction and prevention of waste, shifting towards providing a different kind of service and embedded products.

Our study builds on the work of de Jesus and Mendonça (2018), who studied the drivers and barriers in eco-innovation related to circularity. We took their work a step further, asking: what might these drivers and barriers to a circular economy be if we examine not only a single innovation, but an entire service consisting of interdependent and interconnected circular innovations and innovators? In a related study, the research by Kirchherr et al. (2018) argued that cultural barriers are the main barriers to scaling circular startups. We set out to investigate if this was also the case in the Netherlands, particularly around catering services. Furthermore, we build on concepts from transition theory in order to understand the dynamics at play when alternative practices of a circular economy evolve and start to challenge existing catering practices. With that transition lens, we understand the current production of goods and waste as deeply embedded in societal cultures and practices, i.e. a "*regime*" (Kemp et al., 1998). When referring to the regime, we mean incumbent thought patterns and dominant structures in society (Schot and Geels, 2008). These develop path-dependently and are locked-in because of embedded routines, vested interests, sunk costs, and institutionalized conditions (Arthur, 1989). *Niches*, in contrast, are experimental deviations from the norm that begin to emerge as a response to increasing pressures on the regime (Schot and Geels, 2008). Changing societal contexts, sustainability concerns, and geopolitics increasingly put pressure on incumbent regimes leading to internal tensions. Hypothetically, this pattern of external pressures and internal regime tensions creates the conditions for disruptive, nonlinear regime change (Berkhout et al., 2004): a transition – in this case, from a linear to a circular economy.

This study builds mainly upon socio-institutional work on sustainability transitions (Loorbach et al., 2017), that emphasizes the plural role of transformative agency and explores mechanisms that help guide and accelerate transitions. These mechanisms relate to new types of discourses, structures, and practices that develop gradually – but under specific conditions, can become relatively rapidly mainstream and embedded social norms. Of particular interest is the idea that to support this shift, new collaborations between actors from niches and from a regime context might help to create such structural changes. As pressures increase, actors within the regime start to engage in the contribution to system transformation, becoming a "proactive incumbent" with a role in the potential phasing out of established institutions (Hengelaar, 2017). Similarly, niches that gain traction and support begin to form their own regimes (De Haan and Rogers, 2019).

We empirically explore how actors operating at a niche level engaged with actors operating at a regime level: sharing a common interest in developing circular catering, but each coming from very different contexts and following different strategies. The differences in language, capacities, networks, skills, and resources must be overcome through mechanisms for diffusion. Smith (2007) also studied the emergence of green niches, the tensions in incumbent regimes that develop and allow space for niches to form, and the processes by which these niche and regime elements interact. Because of his similar work on niche-regime interactions, we adapt

his structuring of analytical foci to cluster and analyze our own results.

Based on the preceding concepts and context surrounding the case at hand, the following research questions about the uptake of a circular catering services guided our study. First, *what are the persistent sustainability problems in catering, and do they trigger regime destabilization?* Within that context, *what are drivers and barriers of multi-level and cross-scale interactions surrounding such innovation diffusion?* Understanding the favorable settings for and possible actions to take to bring together niche and regime elements around circular service innovation would allow us to help create, foster, and support connections between these two generally discrete levels of society. Secondly, *what key elements in the diffusion of a circular service can be observed, and can these be generalized across contexts to prime the conditions for a transition to occur? What is the role of emerging alternatives in a possible future transition?*

Our research adds to studies on the diffusion of a singular innovation – like spent coffee grounds reused as a resource (Matrapazi and Zabaniotou, 2020) – by analyzing the actor network effects in a service system comprised of multiple interrelated and interconnected circular innovations. We unpack a circular service with the lens of the food-energy-water (FEW) nexus, an approach addressing the cross-sectoral and inherently embedded connections between flows of three different sectors, previously considered almost exclusively within their own domains. Studying the case through this nexus lens allowed us to avoid leaving cross-over effects and indirect relationships ignored or overlooked: in comparison to studies such as Neto and Caldas (2018), which reviewed EU schemes for insight into the use of green criteria in the public procurement of food products and catering services, but did not address the FEW nexus. Recent research by Henry et al. (2020) created a typology of five categorizations for 128 circular startups, showing that circular startups tend to embrace strategies corresponding to higher levels of circularity than those of incumbents, and circular startups can indeed make major contributions to transitioning towards CE, which helped structure the thinking of our work. Lastly, in contrast to the majority of current literature that examines circular startups from a bottom-up perspective, our study uniquely takes a perspective slanting towards the existing service functions among incumbent actors.

Our main objective was to analyze and unpack an empirical attempt at scaling a complex, radical alternative catering system aimed at the prevention of waste production and increase of efficiencies in the use of energy, water, and resources. Our case directly addresses practices of cleaner production in an international corporation, a governmental body, and an eco-system of startup entrepreneurs. By this, our work makes a novel contribution to the scientific debate about pathways to circularity by studying circular economy empirically and providing insights into the stakeholder interactions in and potential of upscaling an ecosystem of interrelated circular innovations that together comprise a service.

## 2. Methods

### 2.1. Case study context

Circular services and innovations are still a niche, in that incumbent practices are still organized around linear models based on maximization of economic profits, often at the cost of large environmental impacts. Yet, there is a growing interest from incumbent regime actors to explore and proactively engage with such alternatives to help shift their business model, and increasing viable models are emerging (Bocken, De Pauw, Bakker and van der Grinten, 2016).

This is the entry point for our case study in Rotterdam, the Netherlands, which examined the acceleration of niche experimentation and connections made with current regime actors in the catering context. It is an empirical case of a regime under transition pressure, within the scope of circular economy. The concept of circular catering emerged at a niche level and was carried out in a proof-of-concept through a network of circular entrepreneurs at Blue City (BC), an Urban Living Lab (ULL) in the city of Rotterdam. At Blue City, spent coffee grounds on campus are not directly thrown away, but rather, used to grow oyster mushrooms by an on-site startup, which in turn are used to make a vegetarian substitute of a traditional Dutch bar snack by another BC entrepreneur. An in-house microbrewery producing beer creates a residual stream of brewery grain, not dumped but instead used as an ingredient by another local startup to make bread and cookies for the catering service.

In parallel, the Dutch Ministry of Internal Affairs issued a mandate to the Dutch Ministry of Infrastructure and Water Management (*Rijkswaterstaat [RWS]*) to convert all catering units in 16 different locations to a circular alternative from the current linear catering, in an effort to help "change the system" and lead a transformation towards circular initiatives for the country from the inside out. The exact system from BC was not upscaled directly at the ministry, but it offered a space for learning and showcasing how such a model could work.

### 2.2. Empirical procedure

The goal of our approach was to extract qualitative data to understand and describe how the circular catering services developed and fostered in a niche environment connected to, interacted with, and emerged at the regime level. A triangulation of a literature study, actor analysis, and qualitative interviews was carried out to systematically address the guiding research questions for a single case study.

A single case study approach was the preferred approach here, because it provides an opportunity for the researcher to gain a deep holistic view of the research problem, and facilitates describing, understanding, and explaining a research problem or situation (Baxter and Jack, 2008). Because depth achieved through a case study normally must be sacrificed in a comparative study – and the opportunities to study the degree of novelty of the diffusion process of a full circular service are still very rare – we selected this methodology to create the foundation for a scientific understanding of the phenomenon.

A thorough literature review was conducted on niche-regime interactions, augmented by a review of studies on the circular economy, its application, and its potential as a large-scale alternative to the incumbent linear economy. Next, a stakeholder analysis was conducted to identify relevant and prominent actors within the field of circular economy in the Dutch case context, to explore the complex web of loyalties, interests, influence, and alignment of key players around the issue. An initial list of stakeholders was created for the case study region, following the stakeholder analysis technique by Bryson (2004). Per this approach, we compiled a list of key stakeholders considered for interviews on two levels. First, we assessed broadly the relevant actors at the FEW nexus in the Netherlands. Second, we unpacked this further specifically for this case of circular catering, for a more fine-grained actor analysis. The actors considered were categorized into three size groups (large, medium, small), based on a both the size of the organization and their agency. An assessment of the most accessible and most influential was made; these stakeholders were invited for an interview.

Key actors pertaining to four societal domains – government, multinational corporate, intermediary platform, and startup entrepreneurs – were selected to understand the niche-regime

interaction from different perspectives. Eleven in-person interviews were conducted within the time frame of eight months, and all lasted between one and 2 h. For transparency and comparability, individuals were asked to define "circular" – as a descriptor for a type of entrepreneur, business model, catering scheme, or economy – and how they learned of the concept. Among other details, each interviewee was asked to describe their motivation behind the uptake of an alternative catering model and their experience in the process of implementation, the drivers and barriers of adopting circular catering in their organization, what helped accelerate the transition within their system, and what was learned from the process.

These interviews were transcribed on-site and recorded for record-keeping; they were then analyzed through a modified template analysis technique (King, 2012) to bring to light clusters of information and commonalities and/or distinctions within each cluster across the different stakeholders. Interview transcripts were labeled, and we organized the qualitative data to identify different themes and the relationships between them. Our manual concept-driven coding process revealed collections of data surrounding the drivers and barriers in the process of upscaling, power dynamics, diffusion pathways, connection-making, and trust-building bridging the niche and regime.

In order to analyze the qualitative data from the series of interviews, we adapted the theoretical framework developed by Smith (2007), structuring niche-regime interactions into "lessons learned" and "practices observed". However, his earlier approach to studying these interactions slanted towards a niche perspective; whereas, our study's lens places more emphasis on the dynamics happening at the regime level. Based on this, we removed the category "niche expectations" for our interviews and data analysis, adapted "technical configurations" to "socio-technical configurations" to accommodate the broader range of coupled socio-technical configuration in society that we include, and we added "observed practices" as a way to further typify our findings of already manifesting new practices.

## 3. Results & discussion

### 3.1. Political and national contextualization

A group of innovative agents within a regime organization introduced the idea of circular catering at a high governmental level. This transformative idea was legitimized by and implemented because of an assignment from the Dutch Ministry of Internal Affairs. It makes an interesting case because the *Rijkswaterstaat (RWS)* had not yet heard of circular catering when the internal attention for the theme began – they only received an assignment to transform their catering model from linear to circular and implement this in practice across physical building locations. The breaking down of linear catering at RWS began with a market consultation in August 2017 and reached a near phase out within two years. The climate innovation funding from the Ministry of Foreign Affairs allocated grants for research into circular solutions (among others, e.g. the Dutch Fund for Climate and Development) was cited as a key contributor for the progression of their transition.

Because of this organizational and structural support from the government, companies were strongly motivated by the possibility of a large monetary win to take up circular catering. This created a recognizable shift in the market, as a wide-spread demand for knowledge and innovation grew to meet the requirements of the tender competition. The figure below gives an illustration of the broader context within which organizations that develop circular catering operate. In this paper, we try to unpack the interactions between these actors within this broader societal context.

Fig. 1 illustrates the empirical context of external pressures exerted, related to the transformative case studied. The dashed circle indicates the organizations and actors directly involved in our study, inside their greater empirical context. Solid lines with arrows between actors indicate a directional relationship of exertion of influence, e.g. the BC entrepreneurs who host educational tours and interactive events to actively involve Dutch citizens, or the current landscape pressure which played a role in propelling the Ministry of Internal Affairs to start valuing circularity, who then in turn issued a mandate for the RWS to adopt circular catering. The dashed lines inside the oval indicate an interaction observed between actors studied directly in the case, e.g. Sodexo's partnership with BC – the former exchanging their broader network and connections for circular consulting and advisory work from the latter – or RWS issuing a tender that motivated catering companies including Sodexo to invest in knowledge and development of circular catering, modeled by Blue City. By examining the interactions between these actors within the oval sketched, we see immense complexity in their relationships. These interactions cannot be simplified into a single direction, so these relationships are illustrated with a line rather than an arrow. Further examples of our empirical findings are expounded upon in Section 3.2.

### 3.2. Empirical data and interview results

Various manners by which a transition to a circular service became further diffused are deconstructed below, based on the qualitative results of the various interviews conducted. The following mechanisms for bridging connections between niche and regime actors and organizations were unveiled – along with actions and settings that allowed for the observed destabilization of the regime and acceleration of niche alternatives – in the empirical case of circular catering in the Netherlands:

One pathway for innovation diffusion is by connecting niche ideas to regime organizations. In the following text, we describe more in-depth the empirically observed practices and illustrative examples of such pathways for the diffusion of circular catering, as listed in Table 1.

#### 3.2.1. Learning

The higher-level sustainability strategy connected to the business structure and culture is highly malleable according to human influence; the interview data indicated a need for learning, awareness, and favorable narratives to positively influence adoption by management. It was considered risky by some to pursue a circular catering model, but the government's innovative attitude steered them away from traditional procurement towards investment in sustainability. The same principle of openness can be applied in human resources: hiring minds that foster and create fresh ideas and innovation at the organization.

Many scholars also argue that universities must assume a role in the age of climate change because of their mission (Bardaglio and Putman, 2009); have a tremendous potential to transform the interface between science and society (Whitmer et al., 2010); and that these partnerships between higher education and the community can be used to promote urban sustainability (Molnar et al., 2010). Universities can play a role in ULLs, giving keynotes and speaking truth to power. University initiatives to co-design and co-produce urban sustainability can potentially provide opportunities for strategic collaboration across differing sectors of the university and institutions, linking global level research and knowledge to place- and stakeholder-specific contexts and implementation efforts at the local or regional scale (Trencher et al., 2014). Yet, engagement and learning on CE is not yet commonly institutionalized or structured at universities; this asks for additional capacity

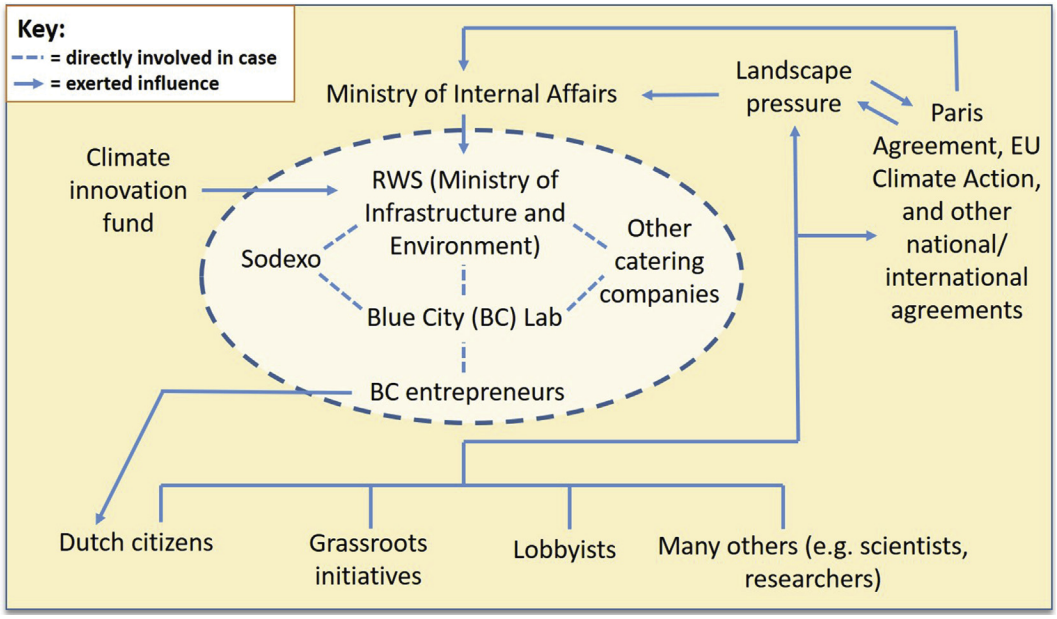


**Fig. 1.** Empirical context of actors developing circular catering.

building for circularity and effects which are not a part of academic and higher education programs. For this reason, researchers such as Kirchherr and Piscicelli (2019) propose a structured education for the circular economy (ECE). We would also recommend that CE themes be explicitly formalized in higher education programs to aid in learning and addressing barriers.

### 3.2.2. Institutional embedding

ULLs allow a physical space for experimentation, valuable for allowing regime actors to become aware of, acquire knowledge about, and have a tangible proof of concept of the processes, symbioses, and nuances related to the realization of circular catering as a service. Testing spaces also allowed regime-level organizations too large to make a body-wide change at once the chance to experiment in a small space and trial-run a circular solution with potential to be scaled to the whole organization. This finding supports recent scientific claims that ULLs are viable platforms for experimental governance across sectors, reaching beyond niche-regime boundaries (von Wirth et al., 2019). The national strategy was an important factor for nearly all actors, directly or indirectly; it provided safety in terms of investments and pilots by reducing risk. This relates to the work of Kirchherr et al. (2018), who argued that cultural barriers are the main barriers to scaling circular startups; we observed conversely that political support and stimulation can be one of the main drivers for scaling circular innovation.

General drivers and barriers to niche diffusion have been addressed in literature, but they miss a level of specificity particularly concerning the role of network effects in innovation diffusion, e.g. changes in procurement systems, interacting network pieces, and peer pressure. The common goal building inherent in a contract between multiple businesses created a mutual understanding and agreed upon vision across peers, e.g. the Plastic Pact, signed by Sodexo and other large organizations: upheld between the government and corporations collectively obligating them to contribute to overall waste reduction. Additionally, an existing personal relationship between members of the connecting niche and regime organizations set a pre-established trust. It paved interconnections and actor networks that facilitated the spreading of ideas, concepts, and lessons on the diffusion of circular innovations; furthermore, it allowed for an internal exchange to avoid labels, relieving paperwork and bureaucracy.

### 3.2.3. Regime tensions

Connections via the value chain allow key players to push certain other actors in the chain. For example, it is an institutionalized rule within Blue City Lab to consider procurement efforts, meaning that all their office suppliers must value and implement sustainable practices to continue business. Similarly, any company applying to win the Ministry's tender must meet the minimum circularity guidelines for eligibility, forcing companies to rise to a higher standard and pressure their second-order suppliers to do the same. In the case of a multi-national catering company, incentives around sustainability were integrated in contracts to make the progression towards circularity more economically viable. Their position as a global organization allowed more room for negotiating power in contracts, and afforded them more reach to startups, both facilitating the diffusion of circular catering practices.

The Climate Innovation Grant awarded by the national government allowed regime-niches to emerge by providing frontrunners in incumbent regime organizations the financial creative space to innovate and experiment with niche concepts. The financial accessibility of innovation funding and entrepreneurial grants from the Dutch government fosters sustainable startups and gives means for the creation and acceleration of innovation diffusion. Similarly, the RWS received money from the *Klimaatenvelop*, a funding agency with temporary money for research on how to make improvements in climate projects, which allowed them to experiment with circular catering.

A mandate from a higher ministry to adopt circular catering eliminated time, uncertainty, and dispute about the way to move forward. Having pre-established/non-negotiable collective goal aided in streamlining the progress by jumping immediately to planning for action in the switch to circularity in this sector. The

**Table 1**
Circular catering case study analysis.

| Analytical category | Observed practices | Illustrative examples |
|---|---|---|
| *Learning* | | |
| 1st order lessons about socio-technical performance | Assessing and creating awareness | External consulting for identification + measurement of waste streams<br>"Circular scan" measuring and reporting back to landlord<br>Menu selection based on life cycle analyses |
| 2nd order lessons reflecting upon framing assumptions | Acting on assessment | Innovative reduction of resource input for processes, based on heavily disposed of materials calculated by e.g. Waste Watch<br>Finding new uses for top three company wastes identified in the "Material Passport" |
| *Institutional embedding* | | |
| Socio-technical configurations | Forming and utilizing testing spaces | Space for proof of concept of circular catering<br>Testing new sustainable marketing techniques in certain offices; at university canteens<br>Non-monetary exchange to experiment for mutually beneficial solutions |
| Social network formation | Forming common goal-oriented coalitions | National and international initiatives, e.g. Plastic Pact, INNO9 projects<br>Co-created contract between business peers with clear circular objectives<br>Collaboration through existing personal relationships between actors<br>Internal material exchange in business ecosystem |
| | Sharing places for niche-regime interactions | Initial investment in establishing ULL and other places<br>Integration of outside niche thought through new hiring positions |
| *Regime tensions* | | |
| The form in which environmental pressure is articulated/relieved | Involving links up and down the value chain | Logistics partners, manufacturers, suppliers, and consumers of office canteen and event catering<br>Instant delivery of additional food needed for receptions<br>Involving and educating within value chain, e.g. *Verspillingsfabriek*, *Kromkommer,* and Instock<br>Creating new contracts and negotiations, incorporating innovative procurement |
| | Influencing top-down/creating pressure | Higher ministry commissioning sector mandate in other national ministries<br>High-agency governmental body issuing tender, with qualifying prerequisite of circular catering offered<br>Politicians spearheading |
| | Empowering actors to pursue alternative sustainable pathways | Peer support fostered in daily work environment<br>Government funding for large-scale experimentation in sustainability, e.g. *Klimaatenvelop*<br>Awareness-raising and knowledge within government<br>City government initiatives for financial subsidy and program acceleration |
| | Enabling "just-right" size of circular venture | Catering tender small enough to de-incentivize legal instigation, yet large enough to make an impact |
| | Forming influential and informative narratives | Embodying and exemplifying mission and sustainability values (through steps towards circular services)<br>Education and behavior change in staff through story telling<br>Facility tours with embedded narratives |
| *Niche-regime links* | | |
| Translating sustainability problems/ solutions | Connecting platform/third-party facilitator | External "circular resource coach", internal "circular ambassador program"<br>Green offices, universities as connectors<br>Platform bridging niche and regime, and connecting peers<br>Third-party oversight and facilitation connecting actors |
| | Matching of niche maturation with regime interest | Innovative niche startups must be ready for regime uptake (in preparedness of the business model and product/service), at the same time that a regime actor or organization is open to an innovative solution<br>Appointment or utilization of an internal or external actor designated specifically to match niche maturation (finding circular startups ready for scaling) with regime readiness |
| | Incentivizing competitions for solutions | External innovation challenges, e.g. Circular Challenge, Plastics Design Challenge: solution for food-related plastic waste streams of private and public regime-level organizations<br>Internal innovation challenges: incentivizing win through collegial buzz, travel prize, money for idea implementation, and recognition |
| Adapting lessons | Co-creating solutions involving multi-level and cross-scale actors | Co-creation and interactive workshops with companies and universities, e.g. Future Food Lab at Utrecht University, Food Waste Workshop at Wageningen University<br>Collaboration between competitors<br>Open-source/sharing of information<br>Circular catering transition team in company |
| Altering contexts | Improving the accessibility of wastes as resources | Possibility to use surplus supermarket food already classified as "waste"<br>Spilled, imperfect, or pieces of food unfit for consumption to be utilized in another form<br>Platform for trading waste streams, e.g. Excess Materials Exchange |

role of narratives may have been an influencing factor in the top-down mandate being received positively and willingly. Rather than positing it as an autocratic governmental body forcing unwilling participants to incorporate sustainable practices, it was described as a collaborative co-implementation of circular actions towards a common goal. This created a general mindset of acceptance of the goal, and furthermore, personal belief in the importance, urgency, and benefits of the actions taken, aiding in the acceptance and uptake of a transformational catering model. From a bottom-up perspective, narratives can also help the public learn through preaching and demonstration. Tours of the ULL showcasing circular catering sparked interest and action in visitors.

*3.2.4. Niche-regime links*

Niche knowledge was received and symbiotically exchanged for expansion, venture capital, and/or global network contacts from the multinational corporation – resulting in mutually beneficial outcomes and further emergence of circular innovation. Public events – such as innovation challenges– served as learning spaces for incumbent regime actors (including average citizens) to acquire knowledge about circular innovations, a space for exposure of circular entrepreneurs, and physical platform for connecting. This engaged regime actors while empowering niche innovators, providing space for creation, diffusion, and support. Internal and external competitions offered another novel pathway for circular innovation diffusion as a cross-sector and cross-societal domain innovation platform, while also allowing for collaborations between actors to be developed. Similarly, volunteer opportunities integrated actors with niche thought into the dominant thought pattern at the regime level, making breakdown possible from the inside out.

Co-creation of solutions between actors of multiple levels of governance was seen to be successful in idea creation and solution pathway development, because it involved co-design and co-visioning between actors across multiple sectors. At the Ministry, the circular catering team was made up of a variety of actors to co-create contracts, including internal and external advisors and experts – also creating a shared sense of responsibility. University groups served to bridge actor types and facilitate or participate in the co-creation.

Two unique startups at the ULL caught regime interest; one had a developed business model, while the other was not prepared to scale up. A third had a viable business case but did not capture regime interest and therefore stayed at the niche level. It was observed that two critical timelines must align serendipitously: an intersection of niche maturation and regime receptivity. A later interview added that having a designated person to take on the role or responsibility of being the "matchmaker" was key in capitalizing on naturally aligning timelines, scouting disruptive ideas and models, to match with current business needs. As an example, a "Circular Ambassador" program, with 5–6 business experts collecting best practices in circular catering from all around the country, was a successful example of a proactive way of institutionalizing insights in circular practices at a corporation's headquarters. An online presence also contributed to the coming together of previously unconnected actors and organizations, and thereby, to the diffusion of circular practices.

This niche-regime connection became more complex, however, when regulations impeded the exchange of materials. For example, the legal definition of waste in the Netherlands created undesired bureaucracy in the protocol for the procedure of selling, exchanging, or even giving away food – giving niche innovators less access to material for developing circular food solutions. This same principle also led to a logistics inefficiency in the case studied: a company's top waste stream was orange peels. Because they were strictly considered waste, they had to be disposed of as such. Thus, a truck delivered food to the building and then left empty, while another empty truck drove to the company site to then pick up the orange peels for disposal. Because of the characterization of the orange peels as a waste rather than a food, every delivery like this one requires two superfluous trips, compared to if they were legally permitted to be transported in the same truck.

*3.2.5. Validity and intended impact*

To monitor the effects of adopting circular catering, the RWS developed several key performance indicator (KPI) sets measuring: $CO_2$ emissions range, percent of animal protein, reduction of unsustainable single packaging, increased use of return packaging, and reduction of and reporting about food waste. Of these KPIs, the following quantitative effects were measured at RWS and reported by the circular caterer in relation to their initial annual goals, after 3 months' introduction of the circular catering concept:

- $CO_2$ footprint (Scope 3 measurement on food and drinks): Reduction of 19,260 kg $CO_2$-eq.
  - o Goal after 12 months: Reduction of 53,930 kg $CO_2$-eq.
- Protein shift: Reduction from 67% animal protein to 65% animal protein.
  - o Goal after 12 months: Reduction to 50% animal protein.
- Food waste in kitchen and banqueting: Net reduction met.
  - o It increased 1.15% due to client wishes to open the restaurant in the Christmas vacation.
  - o Nominal week food waste was about 1.5% lower than at the start of the contract.
  - o Goal after 12 months: Reduction of 0.27%.
- Percentage of products with sustainability certificate: Increase of 0.9%.
  - o Goal after 12 months: Increase of 1.5%.

Because the implementation at RWS is still so new, only one set of quarterly indicator measurements have been recorded to date. From this very preliminary data, it appears they are on track to successfully meet their yearly targets; however, it would be unwise to extrapolate this and make assertions about what will or will not happen in the future. Examining the progress (or lack thereof) in these KPIs would make an excellent starting point for future research, building on our study.

## 4. Concluding remarks

This case raises questions on dynamics between the niche and regime levels in the context of a transition to a circular catering sector. It helps to understand the drivers and barriers of the emergence of a *niche-regime*: when a collection of niche actors and businesses with like-minded thoughts, values, and objectives start to form their own regime with a collective understanding and a common goal (De Haan and Rogers, 2019). We examined how this connected to a *regime-niche*: a small niche questioning business-as-usual within its respective regime context, open to and seeking radical change. In this paper, we have identified the dynamics and dialectics between these two entities. This is relevant to science, society, and policy, because they could provide clues for transitions in general on how to overcome the divide between levels of niche and regime.

Drivers for circular innovation uptake and diffusion at a service level included market pressure and peer competition, meeting a growing demand for sustainable alternatives and products, a mandate from a higher-level institute, upholding international

treaties, entering climate agreements, contracts negotiated to financially or socially incentivize sustainable alternatives, (inter) national competitions, and a platform for communication that engaged emerging niche innovations with regime organizations. However, regime-level organizations should thoughtfully consider the size of their ambition; when too radical or expansive, it may lead to backlash – when quick results do not materialize and setbacks are encountered. The tender put forth by RWS would award the winner all of the catering and restaurant businesses within 16 different building locations of the ministry for years, a volume that drove unsuccessful catering companies to wager fees in court, hoping to legally overturn the decision and win the new business and revenue streams.

This research constitutes the first study of its kind, examining the scaling of circular economy at a service level through a network of circular startups. It covered a specific case in which the circumstances were such that a live, physical proof-of-concept on how waste and resource flows could be connected between businesses to form a circular catering model emerged; this idea caught the interest of RWS, a regime-level governing body which then issued a tender to contract a circular caterer many building locations and incited financial incentive for incumbent catering companies to begin learning about and taking up such a circular practice.

We believe our results also may be of global relevance, because we hypothesize that these conditions would also facilitate the furthering of a transition in another industrial, cultural, or political context. We speculate that some of the observed principles in cleaner catering would be interesting for other sectors, considering what would be needed for a multi-industry transition to CE. For example, size and ambition of a tender to adopt a radical innovation would likely be key in another sector as well. Additionally, we hypothesize that awareness-raising, testing spaces, common goal-oriented agreements, co-creation, university partnerships, and connecting platforms could also be tools for scaling CE through circular startups in sectors outside of catering. Thus, it would be very valuable for future researchers to study and compare additional similar cases.

A future cross-case comparison applying our approach to another economy would make an interesting addition to the results of this first study uncovering the system dynamics involved in scaling a circular service. Future research may further unpack some of the observed practices and settings and test these insights in a new, distinct context to broaden empirical support across sectors and countries in the advancement towards the solidification of universal critical elements; the results of this study may provide important insights into principles that are more generally relevant for transitions and the governance thereof.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## CRediT authorship contribution statement

**Rachel Greer:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization. **Timo von Wirth:** Methodology, Validation, Project administration, Funding acquisition, Supervision, Writing - review & editing. **Derk Loorbach:** Methodology, Validation, Supervision, Writing - review & editing.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2020.121906.

## Appendices

**Table A1**
List of interviewees and role

| Source | Role | Date | Societal domain |
|---|---|---|---|
| BC general manager | Project coordinator and managing director | 2/4/19 | Connecting platform |
| Sodexo innovation manager | Lead of innovation team: creating, capturing, and taking up new innovations at Sodexo | 30/7/19 | Multi-national private corporation |
| BC communications officer | Interacts with external organizations, bridging gap | 22/1/19 | Connecting platform |
| FnF founder | An entrepreneur creating new uses for otherwise disposed foods; also partially in charge of catering procurement at BC | 10/4/19 | Entrepreneur |
| BC office manager | Orders and organizes office and its supplies | 20/3/19 | Connecting platform |
| Sodexo business manager | In charge of internal and external business affairs and relations | 30/7/19 | Multi-national private corporation |
| RWS category manager: catering | In charge of catering procurement, tender issuing, and change management | 27/3/19 | Public governing body |
| Impact Express co-founder | Studio co-lead with the aim of creating societal impact; works closely with BC | 10/4/19 | Private local organization |
| Fruit Leather co-founder 1 & 2 | Two entrepreneurs using tarnished fruit to create leather-like products | 16/1/19 | Entrepreneur |
| RWS procurement officer | Works in national and international contexts to change procurement models and value chains to become more circular | 5/12/18 | Public governing body |

**Table A2**
Additional documents reviewed

| Source | Content | Link (where applicable) |
|---|---|---|
| Document: "A Circular Economy in the Netherlands by 2050: Government-wide Programme for a Circular Economy" | National vision, interventions, innovative financing, and priorities in CE | https://www.government.nl/topics/circular-economy/accelerating-the-transition-to-a-circular-economy |
| *Green Deal Circulair Inkopen* (GDCI) | Circular procurement goals | https://www.gdci.nl/ |
| Document: "RWS Vision and action plan towards a circular catering category" | Setting of the circular catering tender and concrete steps for reaching their goal | Document shared via email |
| *Nederland Circulair 2050* from the *Rijksoverheid* | Dutch national circularity goals | https://www.rijksoverheid.nl/onderwerpen/circulaire-economie/nederland-circulair-in-2050 |
| Blue City website, internal documents, tours, and co-working | Intimate knowledge about inner workings of Blue City 010 and circular business models of startups | https://www.bluecity.nl/ |
| Book: *Following-up on opportunities for a circular economy: better data for robust policy making* | Definitions of circular economy, related indicators and monitoring, and policy implications | Report number: TNO 2019 R11712 |
| CAIT (Climate Analysis Indicators Tool) | Emissions related to food waste | http://cait.wri.org/historical |
| FAO (Food and Agriculture Organization of the United Nations) | Global food losses and food waste | ISBN 978-92-5-107205-9 |
| Ellen MacArthur Foundation | Case studies and conceptualizations | https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy |
| *Nederland Circulair Versnellingshuis* | Acceleration pathways for circular startups | https://versnellingshuisce.nl/ |
| Platform for Accelerating the Circular Economy (PACE) | The role of the Netherlands in accelerating a circular economy, in relation to other global leaders | https://pacecircular.org/ |

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