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On the role of individuals in niche formation

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Abstract

In many sustainable urban innovation projects, the efforts, endurance and enthusiasm of individuals at key positions are considered a crucial factor for success. This article studies the role of individual agency in sociotechnical niches by using Kingdon's agenda-setting model. Although strategic niche management is commonly used to study processes of urban innovation, the process of niche formation and the role of individual agency has been understudied. We will introduce the notion of the 'niche entrepreneur' as an actor who, analogous to Kingdon's policy entrepreneur, connects the elements that are needed to develop a successful niche that allows learning for sustainability transitions. We will study the process of niche formation and the role of individual entrepreneurship therein, and identify the strategies that have been used by individuals to create a successful niche. This will be done for three cases in urban systems integration: the development of Eva Lanxmeer, a residential district in a drinking water retention area in Culemborg, the Netherlands; the transformation of the waste management practices of Lille Métropole Urban Community, France; and the development of the urban district Hammarby Sjöstad, Sweden. Our findings show that for the successful formation of niches, it is necessary to create ambitious, but clear goals and matching concrete operational plans; niche entrepreneurs may play the role of project champions that contribute significantly to the operationalization, monitoring and the effectuation of the original goals of the project; the strategies of niche entrepreneurs emphasize the building of coalitions and the securing of space for learning.

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Introduction

Urban areas play a paradoxical role in reaching sustainable development. They concentrate energy consumption and waste production, while offering possibilities to solve environmental problems by rethinking urban infrastructure and design. In this paper, we are especially interested in *urban system integration* which involves locally closing material and energy loops (Vernay, 2013). Take for instance, the production of biogas from sewage water and its use for transportation purposes. Urban system integration is considered to be of crucial importance in addressing urban resource and climate challenges (Boyer, 2015; Truffer, 2008; Wheeler and Beatley, 2009).

Even though many cities worldwide experimented with locally closing material and energy loops (see Joss, 2010), few examples exist where urban systems have been integrated indeed. Urban system integration requires thinking beyond standard siloed approaches in which urban infrastructure is seen as functioning in parallel to one another (Engel-Yan et al., 2005) and instead imagine possibilities to connect and create synergies between these infrastructures. This also means that organisations coming from different regimes and that have different interests, priorities and ways of working have to overcome their differences and collaborate with one another (Pandis Iverot et al., 2013). Project leaders, or 'idealistic enthusiasts', are known to play a crucial role in this (Klein Woolthuis et al., 2013). In addition, the literature on transition management and niche management tells us that it is more likely to occur when these initiatives can be nurtured in protectives spaces, so-called 'niches' (Kemp et al., 1998; Markard et al., 2012; Schot and Geels, 2008). The uptake of this notion of niches firstly emphasizes that projects in urban systems integration need to overcome the resistance of incumbent actors and their practices, which is done by creating a sheltered environment, and secondly that such projects may generate broader patterns of knowledge about alternative socio-technical arrangements that may be applied elsewhere. However, we do not know how such a niche is established and what the role of individual agency is in this process.

Aiming to fill this gap, we make use of two well-established frameworks, respectively, derived from innovation studies and policy studies: strategic niche management (SNM) theory (Kemp et al., 1998; Schot and Geels, 2008) and Kingdon's 'policy streams' model of agenda setting (Kingdon, 1984). Kingdon's model aims to analyse the way an issue is set upon the political agenda and the role of a so-called 'policy entrepreneur' therein. It has been used before in literature on socio-technical transitions (Elzen et al., 2011; Geels, 2014; Xia and Pahl-Wostl, 2012), however, not to understand the role of individual agency. Here, we will introduce the notion of the 'niche entrepreneur' as an actor who, analogous to the policy entrepreneur, successfully connects the elements that are needed to successfully develop a niche.

Our empirical material draws on three cases of niche formation that pertain to urban system integration. Our first case is that of the development of Eva Lanxmeer, a residential district in a drinking water retention area in the town of Culemborg, the Netherlands. Our second case involves the transformation of the waste management in Lille Métropole Urban Community, France. The third case concerns the development of the urban district Hammarby Sjöstad, Sweden. These cases belong to a small population of successfully created niches on systems integration. Even though they vary significantly with regard

to their decision-making traditions and institutional contexts (De Jong, 1999), the actors involved, and the technical systems that have been integrated, these cases generate insight about the role of niche entrepreneurs. With a growing ambition to connect and integrate urban systems, such as the current focus on the energy-water-food nexus, lessons drawn from past experiences may contribute to the delivery of next urban integration projects.

This paper is organized as follows. Section two introduces SNM and Kingdon's model, and presents our research approach. Section three to five describe and analyse the cases. In section six, the cases are compared, giving rise to further conclusions and reflections in section seven.

An analytic framework for studying the process of niche formation and the role of niche entrepreneurs

Strategic niche management

Niches are spaces, which are relatively sheltered from market pressures in which innovations can be tried, tested, and mature. Niches often start as relatively small-scale projects that aim to generate delocalized knowledge about socio-technical alternatives (Raven et al., 2008). This means that in principle every project that takes place in a protected environment can be labelled as a niche, if it successfully provides insights that can be applied in other cases (cf. Smith et al., 2016). Whereas large, often long-term, changes are difficult to design and manage, niches promise a certain level of influence and control. Their aim is to create a level playing field for sustainable innovations; once they flourish, they can compete with alternative, mainstream technologies (Kemp et al., 1998; Schot and Geels, 2008). As such, niches challenge the existing 'regimes', which are the dominant socio-technical rule-sets associated with a technology. Practices associated with these regimes produce lock-ins and path-dependencies that prevent sustainable disruptive innovations to be taken up by wider society.

Strategic niche management refers to the deliberate formation of niches, which according to SNM scholars can be characterized by three core processes (Geels, 2011; Schot and Geels, 2008). First, there is *the articulation (and adjustment) of expectations or visions*, which provide guidance to the innovation activities, and aim to attract attention and funding from external actors. Second, there is the *building of social networks* and the enrolment of more actors, which expand the resource base of niche-innovations. Third, there are *learning and articulation processes on various dimensions*, e.g. technical design, market demand and user preferences, infrastructure requirements, organisational issues, business models, policy instruments, and symbolic meanings.

Niche formation thus involves the establishment of spaces for learning. It depends on the successful negotiations with actors who have access to resources that allow the protection of a certain space (Garud et al., 2010; Raven et al., 2016, 2008; Smith and Raven, 2012; Smith and Stirling, 2010; Zietsma and Lawrence, 2010). The formation of a niche entails the struggle for support of institutionally embedded actors by deploying strategies to align discursive, material, and institutional resources and the continuous willingness to make trade-offs between conflicting demands.

While much work has been done to analyse what makes niches successful and how they can contribute to regime change (see for instance Hegger et al., 2007; Schot and Geels, 2008; Van der Laak et al., 2007), these theories have been criticized for their limited interest in the role of politics (Hendriks, 2009; Meadowcroft, 2011; Scrase and Smith, 2009), individual agency (Block and Paredis, 2013; Genus and Coles, 2008; Pesch, 2015; Smith et al., 2005) and the dynamics of niche development (Smith and Raven, 2012). Though we may observe a

growing interest in these topics, the politics involved in the creation of protective spaces is a theme only recently embarked upon (Boon and Bakker, 2015; Raven et al., 2016; Valderrama Pineda and Jørgensen, 2016) and the role that individuals may play in political processes regarding niche formation remains underexposed, in spite of the observed importance of that role (Lockwood, 2016).

Kingdon's agenda-setting process and the role of policy entrepreneur

In this paper, we posit that the formation of a niche resembles the process of agenda-setting in the policy domain, as in both instances, institutional support by political, economic and societal actors is needed. In the model of Kingdon (1984), the process of setting a particular issue on the agenda is described as the simultaneous occurrence of three 'streams' in the policy process. The first of these is the 'problem stream'. The rationale behind this stream is that a given situation has to be identified and explicitly formulated as a problem or issue, before it has the slightest chance of being transformed into a policy. The second stream is the 'solutions stream', which is concerned with the formulation of policy alternatives and proposals. The third stream is the 'politics stream', which is characterized by political events, such as an impending election or a change in government, but could also relate to the general political mood or the availability of political resources.

These three streams are perceived as largely independent entities; their emergence follows different social patterns, which makes their coincidence largely a fortuitous event that takes place when there is a so-called 'window of opportunity'. However, an agent may have the ability to strategically align these streams, so that a concerted policy process can be initiated. Such a 'policy entrepreneur' is capable of observing and communicating a potential window of opportunity (Mintrom and Vergari, 1996).

In this paper, we propose using Kingdon's stream model as an instrument to identify if and how a person – a niche entrepreneur – played an entrepreneurial role in the niche formation process by aligning the streams. In addition, we analyse which strategies this person has used to make sure the niche was created. To this end, we can draw on more recent work in policy studies about the managerial strategies employed by individual policy entrepreneurs to align streams. These managerial strategies can be characterized as follows (see Brouwer and Biermann, 2011; Koppenjan, 2004; Meijerink and Huitema, 2010; Mintrom and Norman, 2009; Williams, 2002):

- Policy entrepreneurs have to *draw attention* to a certain issue;
- They have to *create and to maintain a coalition of actors* that have relevant resources;
- They have to *connect problem definitions to specific policy issues* while making use of the surrounding institutional and political context.

Given the aforementioned similarities between the process of niche formation and political agenda-setting, we argue that the strategies used by niche entrepreneurs to align streams are likely to be similar to those used by policy entrepreneurs. As such, we can refer to the repertoire of strategies presented above to analyse what niche entrepreneurs do to create niches.

Research approach

Our research question is: how do niches emerge and what is the role of individual entrepreneurship therein? To address this question, we will take the following steps: (1) the process of niche formation will be described; allowing us (2) to identify whether

a particular individual played the role of a niche entrepreneur, and (3) to characterize which strategies have been used by the niche entrepreneur to align the streams.

These empirical questions are articulated in terms of the sequence shown in Figure 1. This figure presents the framework that sketches how entrepreneurs can contribute to the formation of new socio-technical niches. This framework will be used to analyse the three cases, and also to allow their comparison. As our case selection depends on the limited availability of successful cases of urban systems integration, it has to be emphasized that our analysis is of an explorative nature. The variety that is manifested in our cases, which differ significantly with regard to policy traditions, urban and institutional contexts, environmental problems, technical solutions, and character of involved actors, allows us to make some provisional answers to our main research question.

The three cases will be described and analysed in section three to five. For the first case, the results are derived from 10 interviews conducted in 2010 and 2011 and official reports and documents dating from 1993 to 2011. Results for the second case are derived from 14 interviews held in 2011 and official reports and documents dating from 1989 to 2011. The third case is based on 23 in-depth interviews and in addition it also uses the results from 5 focus group meetings that were held from August 2008 to August 2009 (see Pandis Iverot and Brandt, 2011). These interviews have been held to map the decision-making processes, based on which we could reconstruct the processes of niche formation and the role and strategies of key persons. The decision-making processes have been traced from the moment when the first ideas were put forward until the moment we considered the policy streams to be aligned, suggesting the niche has attained a level of relative legitimacy, and that it can figure as a stable context in which different learning processes may take place.

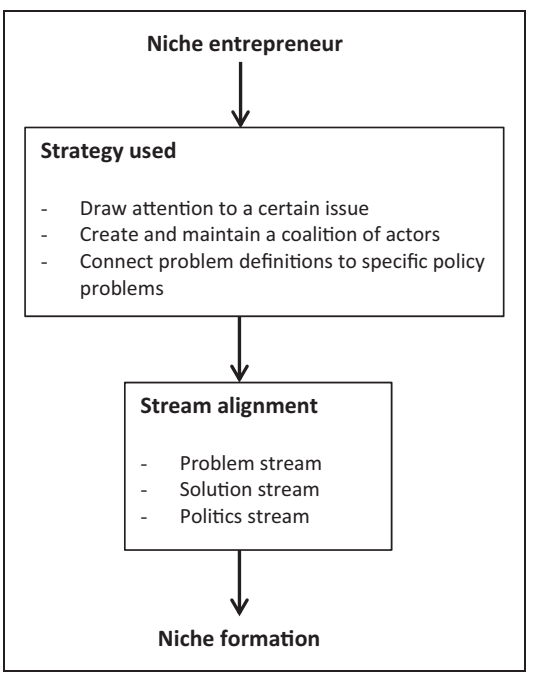

Figure 1. Framework for case analysis.

Even though the literature on agenda-setting and the policy entrepreneur is used as a starting point, we want to emphasize a potential difference between the classic policy entrepreneur and our niche entrepreneur. While agenda-setting processes can be understood against the background of existing institutional frameworks, socio-technical niches, by nature, *challenge* incumbent interests and dominant practices. Niche entrepreneurs will not be happy with just successfully putting an issue on the political agenda; it is their goal, after all, to realize a concrete socio-technical project and thus contribute to a sustainable transition. In other words, the formation of a stable niche poses political, social and a technical challenge that demands a broad repertoire of skills, perhaps broader than that of a policy entrepreneur – a point to which we will return in our discussion.

EVA Lanxmeer, Culemborg

EVA Lanxmeer is a sustainable urban district of 24 Ha developed in the municipality of Culemborg, a small town in the Dutch province of Gelderland. The district was situated in zone protected for infiltration for drinking water production. In total, about 800 people live in the area, which also includes office buildings, schools, and an urban farm, so that residential and professional functions are combined. The urban systems that have been subject of integration include district heating, drinking water, wastewater treatment, and construction of dwellings and offices. Moreover, particular effort was made to create and strengthen the social infrastructure to safeguard a sense of community and empower local inhabitants. The district demonstrates that decentralized alternatives solutions for energy- and sanitary infrastructures are possible, thus allowing building and construction in an environmentally sensitive area, while at the same time showing that the residents can have authority on their own environment.

The creation of the EVA-concept

The district is the result of an initiative taken by Marleen Kaptein, employee of the Dutch Society for Ecological Architecture (VIBA), who was inspired by the momentum for sustainable development in the early 1990s. Kaptein was convinced that to successfully engage people in the environmental debate, it was necessary to let them experience how sustainable solutions could improve their lives. With these ambitions in mind, she proposed developing an eco-district and a demonstration centre (Kaptein, 1993). To further specify this proposition, Kaptein created the EVA-foundation. Using her personal network, she succeeded to have renowned Dutch academics and civil servants with direct connection to the Minister of Housing, Spatial Planning and the Environment as board members of this foundation. Financial support of private donors allowed the foundation to organize a workshop with experts in the field of architecture, landscape architecture, permaculture, water management and energy. The result of the workshop was the EVA-concept, a vision for a sustainable urban district where decentralized solutions for water and sanitation could be experimented with (Kaptein, 1994).

Committing Culemborg to the EVA-concept

The next step was to link the proposed solution to local problems and political agendas, by finding a municipality that was willing to design and build a district based on

the EVA-concept. Thanks to common acquaintances, Kaptein met Jan Goed, head of the spatial planning department of the municipality of Culemborg and persuaded him to organize a formal meeting with the municipal council to present the EVA-concept. During this meeting, the alderman responsible for spatial planning and the environment, Jean Eigenman, saw links between the environmental political agenda of the municipality, the local housing need and the EVA-concept: it could be a way to foster the construction of sustainable building and stimulate citizen participation.

Goed, with the support of the Alderman, convinced the municipal council to allocate a small budget to assess the feasibility of the EVA-concept in Culemborg. In the meantime, Kaptein organized meetings to present the EVA-concept to people in her network and convinced 80 families to sign a document stating that they would like to live in a district based on this concept wherever it would be located (E.V.A., 2012). This showed that the EVA-concept was accepted as a solution not only by experts and academics, but also by future homeowners, raising confidence regarding the feasibility of the initiative. With the positive results of the feasibility study, the municipality concluded that the EVA-concept could be realized in Culemborg, even within the protected zone without jeopardizing the drinking water production. However, additional building permits, beyond the quota for the construction of new dwellings that had been fiercely negotiated between the province and the state, would need to be issued by the Province.

Wider circles of support for the EVA-concept, but not reaching consensus

Kaptein asked the provincial authorities for the additional residential building permits. She introduced the EVA-concept and was able to convince the Province that the project could represent an opportunity to meet its ambitions with regard to urban sustainability; a message that the Province could use to convince the state to allow building in beyond the allocated quota and in a protected zone.

Goed and Eigeman used the additional granted permits to convince the local council that this was a unique chance to develop that area. With the political support in place, the partnership between the municipality of Culemborg and the EVA-foundation was made official in the spring of 1996. With the three streams aligned (problems, solutions and political stream) and the project firmly on the political agenda, concrete actions could be developed to implement the EVA-concept. In 1997, the foundation organized workshops for professionals and for citizens. In the citizens workshops, future residents were given the possibility to express their views and wishes about their future living environment (E.V.A., 2012). In the workshops with professionals energy and water experts, architects and an urban planner were invited to discuss specific technological solutions and the master plan (Van Timmeren, 2006). This resulted in the development of an urban plan, a water concept and an energy concept. The water concept proposed separating greywater from blackwater[1] and treating greywater in wetlands that would be constructed in the periphery of the district. The energy concept proposed building highly efficient dwellings, some of which would be autarkic. In that same year, three international architects and urban planners were invited to a master class to comment the master plan. They supported the water concept and suggested further assessing the feasibility of developing autarkic dwellings. However, the experts did not see the ambitions of the EVA-concept reflected in the urban plan and rejected it. The urban planner that had been appointed by the municipality proposed a traditional urban design and was unable to translate the EVA-concept into a design that also considered the wishes of future residents and valued the specific characteristics of the area, a drinking water retention

area. There was no overarching consensus yet about how the EVA-concept could actually be implemented.

The construction of EVA-Lanxmeer

The permits being tied to the construction of the district based on the EVA-concept, the municipality had to have the support of the EVA-Foundation to construct it. It agreed to meet the demand of Kaptein to make changes in the organization and to hire people who understood the philosophy behind the EVA-concept. Joachim Eble, a German expert in ecological building, who had made innovative suggestions during the master class, was appointed as the new urban planner. Hyco Verhaagen, a landscape architect used to design with water, was also asked to join the project. The new team developed an urban plan that took both the wishes of the inhabitants and the geo-morphological characteristics of the site into account. This revised plan was presented in a municipal council meeting, after which the council gave its unanimous support. Shortly after the meeting, the planning and construction of the district started.

Kaptein had managed to definitively align the three streams by involving experts who were able to translate the solution into a concrete plan that could be implemented and thus the niche was formed. EVA-Lanxmeer offered room to experiment with solutions for decentralized energy production and sanitation. It empowered inhabitants to shape their direct living environment. For instance, they jointly designed the communal gardens around which the dwellings were built and created an association to maintain the green areas in the district. This empowerment was so successful that even today, despite fading municipal interest in the district, EVA-Lanxmeer still acts as a niche where innovative solutions are experimented with (Vernay, 2013).

Case analysis

Figure 2 summarizes the niche formation process. It shows that Kaptein played the role of niche entrepreneur. Typical of this case is that before any urban district existed, there only was a concept: a *solution* that intended to resolve the *problem* of unsatisfactory results regarding sustainable building and citizen participation. To be able to create the niche and align the three streams, Kaptein connected the EVA-concept with local political ambitions, created a coalition of actors, including experts, political leaders and future inhabitants, both at the local and provincial level and mobilized the coalition of actors to promote Lanxmeer as a learning environment and to protect the core of the concept, making sure it was translated into a concrete plan. This was not straightforward as the concept challenged incumbent procedures and processes of planning and construction.

Lille Métropole Communauté Urbaine, LMCU

The Lille Métropole Communauté Urbaine (LMCU) has been created in 1968, in order to provide public services for 85 municipalities. Among these services are wastewater treatment, public transport, household waste collection and treatment, and urban planning. The region covered by LMCU has 1.1 million inhabitants and has been a forerunner for the implementation of integrated urban waste management in France. The municipality has developed a multi-system integration approach to waste treatment, which includes the conversion of waste to electricity, compost, and biogas and the use of alternative approaches to transport waste streams.

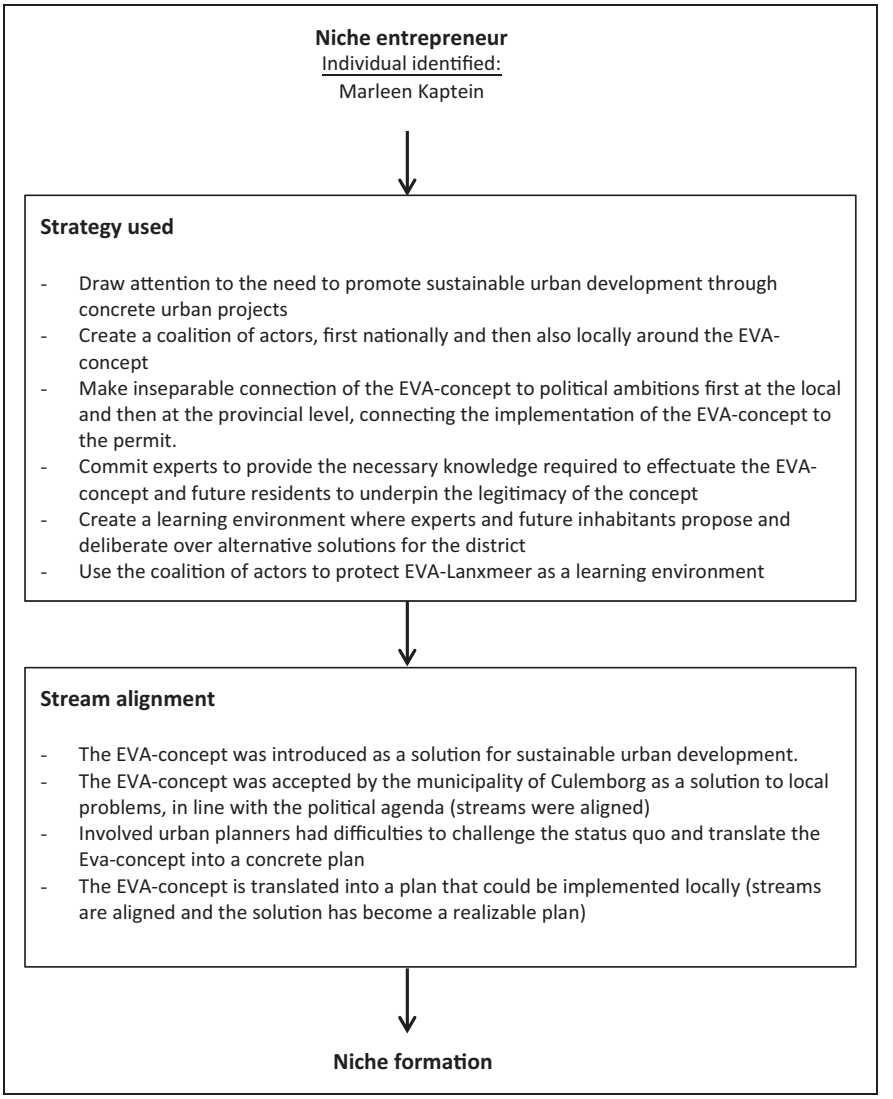

Figure 2. Niche formation in EVA – Lanxmeer.

The increasing need to manage waste

In the late 1980s, about 600,000 tons of municipal waste was managed by LMCU each year. Two-thirds of this amount were processed by three incinerators, and one-third was landfilled. At the end of the 1980s, there was a growing need to adapt the existing infrastructure to the increasing volume of waste and to renovate the installations. As a solution for this problem, the LMCU proposed to incinerate all of the waste in one single treatment unit. This implied that a plant should be constructed that had the capacity to treat 550,000 tons of waste per year. In 1989, however, municipal elections were held and the new incineration plant became the subject of tumultuous debates. Citizens in France and neighbouring Belgium felt the quality of their local environment was at stake and

organized protests during the election campaigns (Adam, 2004). This unrest invoked a strong political commitment to develop new effective methods to manage waste. Besides political unrest, new EU regulations also posed stricter constraints regarding emissions from incineration plants. Moreover, the French government restricted the use of landfills as means of municipal waste disposal and asked local authorities to develop strategies to dispose of municipal solid wastes. The LMUC was faced with multiple problems regarding waste management and solving these problems became an important political issue.

Finding new ways to deal with waste

Following the elections, Pierre Mauroy, who was appointed as new president, decided to put the project on hold and start completely anew. Mauroy personally contacted Paul Deffontaine, who was mayor of one of the rural towns in the agglomeration, and offered him the position of vice-president for urban waste. Mauroy and Deffontaine negotiated about the specifications of the task description of a vice-president for urban waste and came to the following agreement:

- To start anew with the local waste management practices;
- To abandon the plans to build a large incineration plant;
- To make sure that new solutions are not be more costly than current practices.

Between 1989 and 1992, Deffontaine initiated seven preliminary studies to investigate developments that could be expected in EU regulation; which types of treatment facilities would be suitable for the area; which sites in the agglomeration would be available for treatment facilities; and which communication approaches could be used to gain the support of inhabitants.

Supported by the results from the preliminary studies, Deffontaine proposed to introduce waste sorting, with the aim to recycle 50% of the total amount of waste (Communauté Urbaine de Lille, 1992). Moreover, treatment facilities should be state of the art and allow for as much recovery of energy and material as possible, a first, more common form of integrating the waste and the energy system. He came to consider two complementary forms of systems integration: the construction of a waste-to-energy plant to dispose of combustible waste and the construction of a recovery centre to transform organic waste into compost and biogas.

Establishing broad support for waste management

After coming up with a preliminary solution, Deffontaine had to gather political support for his ideas. He created a slogan: ''jeter moins, trier plus, traiter mieux'' (throw away less, sort more, treat better), which was widely used to communicate the project and which embodied the new political discourse on waste management practices. Moreover, he organized meetings to discuss the options considered to improve waste management with all of the 85 municipal councils. During these meetings, Deffontaine presented his solutions, and showed how they could help to solve local waste problems and prepare for upcoming regulations. He also encouraged council members to openly discuss their points of concerns in order to find acceptable compromises. While council members appreciated the innovative propositions of Deffontaine, they wanted assurance that his plan was feasible and they also negotiated the conditions for its realization. One of the topics discussed concerned the fear of the municipalities that were candidates for the waste-to-energy plant to have

no control over its exploitation. Moreover, there was doubt whether the new plant would really meet the targets that were agreed upon. To address these apprehensions, Deffontaine suggested setting up a ''local commission for information and feasibility study'' that would check whether the company exploiting the installation complies with the targets. This commission would be composed out of local officials, representatives from local associations of inhabitants, and of actors from LMCU. By meeting, discussing and adapting his plans to the demands of the various municipal councils, Deffontaine could raise trust among local stakeholders.

In parallel, Deffontaine started a pilot project where 10,000 inhabitants would start sorting their waste, to further convince local municipal councils about the credibility of his plans. This pilot project allowed testing and gathering knowledge about different techniques and tools to sort and collect waste.

Because no solution would be considered as viable unless a location could be found for the waste-to-energy plant, Deffontaine had to find the most suitable venue. Three municipalities were considered as appropriate sites, either because they were already hosting one of the incineration plants, or because the sites could make use of the excess heat (Adam, 2004). Deffontaine organized meetings together with local stakeholders to hear their opinion, and to come to an agreement. This led to very intense debates, as local stakeholders rejected the idea to have a waste-to-energy plant located in their vicinity. While Deffontaine's solution received political support, it was challenging to actually implement it. Only in Halluin, a rural municipality on the edge of the agglomeration where one of the existing incinerators was located, resistance was not so strong. Hence, this municipality was chosen to host the incineration plant. However, because of the limited local heat demand, it was decided that the waste-to-energy plant would produce only electricity instead of combined heat and power. Deffontaine had to adjust his original ambitions in order to ensure that his solution – his overarching plan for transforming local waste management practices – could be politically accepted and realized.

After three years of work and consultation, Deffontaine succeeded in gathering support for his solutions to local waste problems. In June 1992, an integrated plan for household waste collection and treatment was unanimously signed by the members of the LMCU. The ratification of this plan meant that the political conditions were met for the niche to develop. The integrated plan made it possible to experiment with innovative waste management solutions. An organic recovery centre was constructed to produce compost and biogas from organic waste. LMCU pushed for the biogas to be injected in the natural gas grid. This led to changes in the regime of natural gas and created opportunities for similar initiatives. Alternative solutions to transport waste were also tested, such as the LMUC experiment with transporting municipal waste by barges, which was unique in France at the time.

Case analysis

Figure 3 summarizes the niche formation process in LMCU. It shows that Deffontaine played the role of niche entrepreneur and was dedicated to the realization of an integrated plan for waste management practices in the agglomeration. The case of LMCU started with a problem resulting from civil unrest and new regulations that called for new solutions. To be able to create the niche, Deffontaine had to first develop a solution and then build political support around it. In order to attend the first issue, Deffontaine deliberately stimulated the creation of a knowledge base that could be used to support and develop integrated waste management. To establish the political and public back-up needed for his

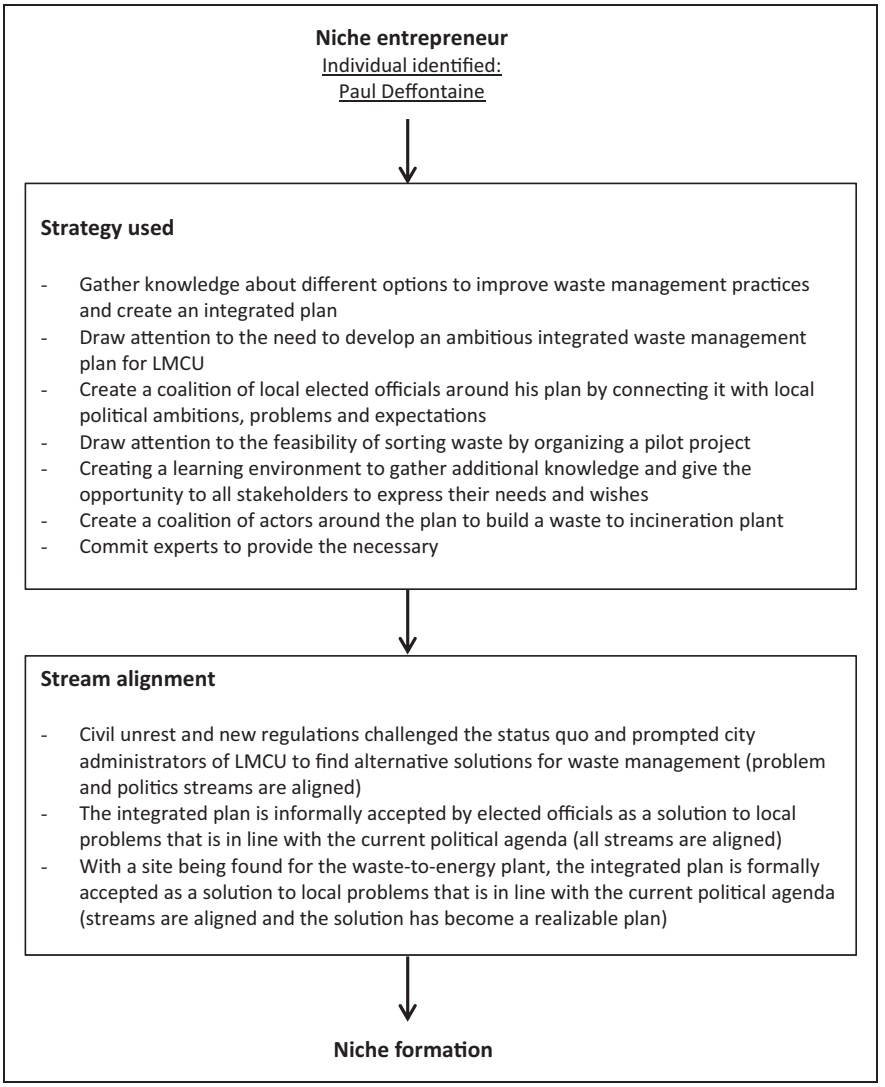

Figure 3. Niche formation in LMCU.

solution to be accepted as one, he had to coordinate heterogeneous actors. He did so by drawing attention to the issue of integrated waste management, building coalitions of elected official and citizens, and creating space for learning where all stakeholders could express their needs and wishes.

Hammarby Sjöstad

Hammarby Sjöstad, which literally means 'city around Hammarby lake', is an urban district situated in the southern part of Stockholm. Its development was initiated in the mid1990s. In 2017, the district is covering an area of 200 Ha and accommodates around 25,000 people. It is widely known for its so-called eco-cycle model (see Pandis Iverot and Brandt, 2011).

This model shows how waste management, public transport, wastewater treatment and energy supply can be locally integrated. This makes Hammarby Sjöstad a showcase of sustainable urban development (Suzuki et al., 2010).

From urban redevelopment to an eco-district for housing the Olympics

As the demand for housing in Stockholm rapidly increased in the early 1990s, the former large industrial harbour area around the Hammarby lake became attractive for residential purposes, allowing thousands of new apartments without any further exploitation of green spaces (see Pandis Iverot and Brandt, 2011). In 1991, a first detailed comprehensive local area development plan for the district, now named Hammarby Sjöstad, was presented (Wennersten and Spitsyna, 2011). This plan was largely influenced by Jan Inghe-Hagström who was the city's head planning architect. At that time, the political leaders of Stockholm municipality were only lukewarm to the idea of engaging in such a large scale redevelopment project (Levin and Pandis Iverot, 2014). This changed in 1995, when the city of Stockholm decided to make a bid for the Olympic Games, and Hammarby Sjöstad was suggested as a residence for the Olympic village (Pandis Iverot and Brandt, 2011). This plan was supported by Börje Berglund, real estate director in Stockholm at the time, and Mats Hulth, Commissioner of the Finance Department of the Stockholm City Administration. The International Olympic Committee demanded a strong environmental focus, bringing about a previously non-existent attention for the environmental performance of the district. The notion of 'eco-cycles', the integration of infrastructures and services so that they resemble natural cycles, was presented as one of the main routes towards high environmental performance. At this stage, we have a political ambition (to win the Olympic bid), two problems (lack of housing and a need for a good environmental performance of the area) and a preliminary solution (the development of a district based on eco-cycle principles).

To develop the final solution, the city authorities created a specific steering committee, which was in charge of realizing the Hammarby Sjöstad project (Bodén, 2002; Engberg and Svane, 2007; Green, 2006). Serving this steering committee, a sub-group was created to specifically take care of environmental questions. This group consisted of the heads of the city of Stockholm's offices and representatives for the three local infrastructure companies in Stockholm. These companies were: Stockholm Vatten, responsible for drinking water and wastewater treatment; Stockholm Energi producing electricity, district heating and district cooling; and SKAFAB responsible for waste management. They came to be known as the 'eco-cycle companies'.

The steering committee, with the support of their respective administrations (the City Planning Administration, the Environment and Health Protection Administration, and the Streets and Real Estate Administration) developed an environmental programme for Hammarby Sjöstad. Signed in 1996 by Stockholm City Council, it would serve as a planning tool, support the coordination of the various activities and help find consensus between the various environmental objectives (Pandis Iverot and Brandt, 2011). This environmental programme can be seen as the first step towards defining a final solution to integrate environmental objectives in the design of Hammarby Sjöstad.

The development of the Hammarby model

With the acceptance of the environmental programme, Hammarby Sjöstad could start functioning as a learning experiment. The steering committee asked the eco-cycle

companies to translate the environmental programme into concrete technical solutions. They had to jointly develop an integrated solution for the district. However, CEOs of these companies did not see the need to develop solutions specifically for Hammarby Sjöstad, as the existing infrastructure already performed well in Stockholm as a whole. Half-hearted technical solutions were presented by the CEOs to the steering committee and the political referees, Börje Berglund and Mats Hulth among others. They were not impressed by the propositions and rejected them. The demand of the political leaders created a sense of urgency among the eco-cycle companies to propose solutions that went beyond their standard regime practices. Political leaders managed to push companies in the niche to experiment and really engage in a learning process. This led to Stockholm Energi hiring a new manager and Stockholm Vatten involving more employees in the project.

Between late 1996 and spring 1997, multiple workshops took place in which employees of the eco-cycle companies brainstormed about possible technological solutions for the district. Stockholm Vatten, and especially Berndt Björlenius, a developing engineer, took the lead in developing alternatives for Hammarby Sjöstad. Björlenius stood out during the meetings with his enthusiasm and innovative ideas and was appointed head for the development of what later would be called the Hammarby Model. He showed how the existing infrastructural system could be improved by adding some innovative technical solutions. He was for instance the mind behind the idea to increase biogas production from wastewater sludge in order to use it as vehicle fuel and to power the Olympic flame. He also fought for the installation of urine-separating toilets as well as for the realization of Sjöstadsverket, a local wastewater treatment plant for Hammarby Sjöstad.

Results were frequently reported to the steering committee and via them to the political referee group with Börje Berglund and Mats Hulth among others, which had to check whether the eco-cycle companies were working in the right direction. In April 1997, a second proposal was made, which basically presented the first version of the Hammarby Model (Pandis Iverot et al., 2013). This second proposal was well received by the municipality and the political referees, encouraging the eco-cycle companies to work further in the same direction. The Hammarby or eco-cycle model was born.

What remains of Hammarby Sjöstad after losing the Olympic bid

In September 1997, the Olympic Committee chose Athens as the host of the 2004 Olympic Games, causing uncertainties about the future of the project. Still, Hammarby Sjöstad had gained so much momentum that the political leaders of the city decided to continue and turn the project into a model for urban sustainability (Pandis Iverot and Brandt, 2011). The project had become too important for political leaders to question its realization, so that the political stream remained in place. Nonetheless, important changes did take place. First, the confines for the project became tighter and some of the budget was reallocated to other funds. Moreover, the steering committee lost some of its strategic importance and the political referee group was dissolved resulting from changing in political leadership after the municipal elections.

As a result of the new conditions, Hammarby Sjöstad became a project with tighter boundaries than those initially in place. Financial support was mostly beneficial to technical solutions that fit the Hammarby Model and that could help optimize existing infrastructure (Vernay, 2013) and many of the innovations pushed forward by Björlenius were not realized. Nevertheless, this model is used often as a selling point for Swedish expertise in sustainable urban design, showing how local infrastructures have been combined and material and eco-cycles created.

Case analysis

Figure 4 summarizes the niche formation process in Hammarby Sjöstad. It shows that in Hammarby, the role of niche entrepreneur was not played by a single person. Instead, different actors took on this role, to different purposes, in the niche formation process. The political leaders Börje Berglund and Mats Hulth played a crucial role in overseeing the alignment of the problem and the politics stream and protecting the niche as a learning environment. It has been Björlenius, however, who was able to translate the overarching solution into concrete proposition for the district.

The case of Hammarby started off with the political ambition to participate in the Olympic bid, the problem that this bid demanded that the Olympic village had a high

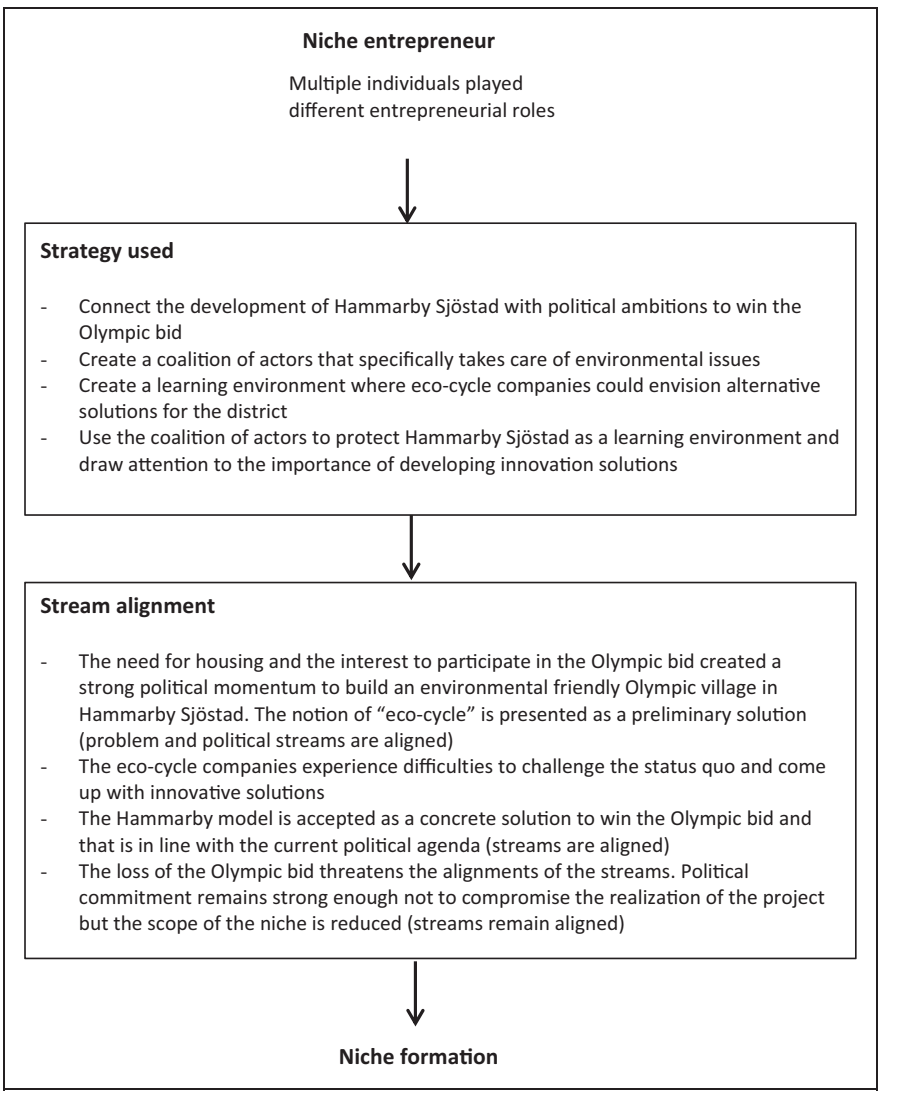

Figure 4. Niche formation in Hammarby Sjöstad.

environmental profile and the pressing housing demands. During the niche formation process, the focus was on aligning the solution stream and translating it into a concrete plan for the district. To this end, the niche entrepreneurs created a learning environment where eco-cycle solutions could be envisioned. Moreover, because eco-cycle companies were reluctant to challenge incumbent relationships and practices, the niche entrepreneurs also had to create and use a coalition of actors to protect Hammarby Sjöstad as a learning environment and force them to make really innovative propositions. However, as Stockholm lost the Olympic bid, political support decreased and so did the scope of the niche.

Case comparison and discussion

This section compares and discusses the cases and aims to draw more generic lessons from our research. In spite of the heterogeneity that our cases reveal, the following patterns emerge in the urban system integration projects studied: to successfully align streams, it is necessary to create clear goals and concrete operational plans; niche entrepreneurs may play the role of project champions that contribute significantly to the monitoring and the effectuation of the original goals of the project; the strategies of niche entrepreneurs emphasize the building of coalitions and the securing of space for learning.

Creating niches by aligning streams

This article aims to understand how the process of niche formation evolves, by adopting concepts from theories on strategic niche management and on agenda setting. Our cases show that, as in Kingdon's model of the policy process, for a niche to be formed, the three streams – problem, solution and politics – need to be aligned. We have witnessed that this process of stream alignment can take various forms and have very different driving forces. The Dutch case started off with a solution for which political support was sought at local and provincial levels. The French solution was initiated because of a pressing problem that gained priority on the political agenda due to expected changes in EU-regulations. The Swedish case started with an urgent problem on the national political agenda, one that could easily be connected to a local problem. They also reveal that the process of niche formation has a *reiterative* character: in different stages, the different policy streams had to be addressed and adjusted in order to arrive at the successful formation of a new niche. Even though each process was and will always be unique, we could identify one recurring pattern. In all three cases, a generic solution was first aligned with the other streams. In Lanxmeer, it was the EVA-concept, in Hammarby, it was the environmental program and in Lille, it was Deffontaine's vision to "throw away less, sort more and treat better". These solutions then had to be translated into concrete operational plans that could be realized. Cases suggest that this is the most challenging step in the niche formation process because it is this phase that challenges the incumbent actors, institutions and practices. In Lille, it was difficult to convince local stakeholders that alternative solutions for waste management could be implemented. In Lanxmeer, it was difficult to find experts able to understand and translate the EVA-concept into a concrete plan. In Hammarby, the challenge was to push regime actors – the eco-cycle companies – to think of solutions that went beyond their standard practices. In all, our research indicates that aligning streams is not sufficient to create a niche. The process can only be completed when concrete and realizable solutions are proposed. It is crucial to have a general innovative concept that both challenges incumbent stakeholders *and* succeeds to commit them to develop ways to implement this concept.

Niche entrepreneur

In addition to understanding niche formation, the paper focuses on the entrepreneurial roles of specific individuals in the niche formation process. Our findings show that niche entrepreneurs can be identified in each of the cases, that they are not necessarily one individual and that different entrepreneurs may be needed to translate the generic solution into a concrete plan.

In our first two cases, it is relatively straightforward to identify specific individuals who played the role of niche entrepreneur: respectively Marleen Kaptein in the EVA-Lanxmeer case and Paul Deffontaine in the LMCU-case. In the Hammarby case, the role was shared between different individuals based on their professional responsibility. On a very preliminary basis, our findings suggest that a project champion, in the form of a niche entrepreneur, helps to guard the process of niche formation as a whole. To be able to negotiate the demands of regime reproduction and niche formation and to oversee the effectuation of the project, it seems advantageous to have one person who is able to keep oversight of these conflicting goals. Otherwise, as the Hammarby case suggests, the process may have the propensity to become the victim of political contingency – in the sense that nobody feels responsible for the niche and it becomes basically a question of luck whether and how a niche comes into being.

The cases also show that translating the generic solution into concrete plans may require additional entrepreneurs, with particular knowledge, skills, or positions, in specific phases of the process of niche formation. They may act alongside the niche entrepreneur that is concerned with the process as a whole. Such additional entrepreneurs could be found in Lanxmeer with Eble and Verhaagen and in Hammarby with Björlenius. The need for them in the process may have resulted from the technical nature of the niche. This requires specific knowledge and expertise. It suggests that once the three streams are aligned, the niche entrepreneur should create the conditions for others to take on an entrepreneurial role, in support of translating the generic solution into a concrete plan so to complete the process of niche formation.

Strategies used by the niche entrepreneurs

Finally, the paper aims to identify the strategies used by entrepreneurs to form the niche. Our cases suggest that the strategies used by policy entrepreneurs may also be used to characterize the activities of niche entrepreneurs. In literature on policy entrepreneurs, there is a strong focus on the strategies that these individuals deploy in order to align the policy streams. Drawing attention to an issue, creating and maintaining a coalition of actors that dispose over relevant values, and connecting problem definitions to policy issues given the existing political and institutional context were introduced as key strategies for policy entrepreneurs. In many regards, the niche entrepreneurs in our cases used these strategies, with quite some emphasis on creating coalitions: Kaptein and Deffontaine succeeded to mobilize and convince existing networks to participate and created new ones.

What our cases also show is that niche entrepreneurs used various strategies to create and secure spaces for learning. In Lanxmeer, workshops were organized where experts and inhabitants came to share their knowledge and develop ideas. The same was done in Hammarby with eco-cycle companies. In Lille, pilot projects and public debates were organized to gain knowledge and trust about the solutions that should be further tested in the niche. Finally, in both Lanxmeer and in Hammarby, niche entrepreneurs used the coalition of actors to protect the project as a learning experiment. In Lanxmeer, this instance took place when the masterclass was organized that rejected some of the

propositions. Similarly, in Hammarby, this happened when political leaders rejected the half-hearted propositions made by the eco-cycle companies.

Conclusions and reflections

In literature on sustainability transitions, socio-technical niches are presented as local contexts that allow learning for global transitions. As such, niches are not seen as a goal in themselves, but as instrumental to facilitate a sustainable future. Niches are then often addressed from the perspective of a desirable outcome (cf. Stirling, 2011). Our research had a different starting point. It has featured the formation of a socio-technical niche as a process that is to a significant extent a political endeavor: niche formation depends on the mobilization of a resource base that is, by definition, controlled by regime actors. Convincing these actors to give up their control requires persuasion and negotiation.

As such, just as the process of agenda-setting benefits from the effort of a policy entrepreneur, the formation of socio-technical niches may also benefit from the efforts developed by an individual niche entrepreneur. To a large extent, these efforts resemble one another – especially with regard to the family of strategies that may be deployed by this individual. At the same time, there are salient differences between the process of niche formation and that of agenda setting: with some exaggeration, it can be said that a policy entrepreneur can sit back and relax whenever the streams have been successfully aligned and an issue has entered the political agenda, while for a niche entrepreneur things just get started. The niche entrepreneur has to make sure that once the niche is formed, it allows learning about new sociotechnical settings (cf. Evans et al., 2016). As such, it seems sensible to also look at the process of niche formation as a learning experience. Our cases emphasize that the formation of niches not only pertains to learning *from* niches, but also to learning *for* niches. Niches do not start with a clearly defined body of knowledge or a univocally functioning form of technology; these are developed in the real life negotiations that take place within the regime context, with incumbent actors acting according to incumbent rules. The kind of technological solutions and new socio-technical practices to be experimented with are dependent on the room that is provided by the specific regime constellation. Identifying the characteristics of this constellation and learning how to strategically involve regime actors in the construction of a niche is what makes a successful niche entrepreneur. Research should provide the concepts and tools that enable entrepreneurs to do so, which demands the opening up of niches and regimes as contexts that are heterogeneous and to at least a significant extent malleable.

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Note

1. Greywater is all the wastewater produced in a house with the exception of that coming from the toilet which represents so called blackwater.

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