The renewal of politics through co-creation: the analysis of the case of rainwater and biowaste in Brussels

Simon De Muynck and Dominique Nalpas

Abstract In 2015, The Brussels Institute for Research and Innovation (Innoviris) launched an innovative policy in Europe, inviting Brussels research consortia to propose participatory-action research (PAR) projects. PHOSPHORE and BRUSSEAU worked for three years *in* and *on* Brussels socio-technical systems, respectively on biowaste and water management. These research projects revealed many institutional (governance) tensions, and tackled many political issues which this paper analyses because they are still insufficiently explored in the literature.

The main contribution of the paper is the discussion of the reflexive learning between the two projects concerning the institutional tensions (reductive injunctions, black boxes, antagonisms, post-political) and moments of confluences (impacts on municipalities strategies and policies, rebalancing of distribution of power, removal of regulatory barriers, emergence of a multi-level and multi-technical approach) we encountered.

Keywords: Participatory-action research; co-creation ; political ecology ; post-political ; (ant) agonism

La renovación de la política a través de la co-creación: el análisis del caso del agua de lluvia y los biorresiduos en Bruselas

Resumen En 2015, el Brussels Institute for Research and Innovation (Innoviris) lanzó una política innovadora en Europa, invitando a los consorcios de investigación de Bruselas para proponer proyectos de Investigación-Acción Participativa (IAP). PHOSPHORE y BRUSSEAU trabajaron durante tres años en y sobre los sistemas sociotécnicos de Bruselas, respectivamente en la gestión de los biorresiduos y el agua. Estos proyectos de investigación revelaron muchas tensiones institucionales (de gobernanza) y abordaron muchos temas políticos que este artículo analiza porque aún no están suficientemente explorados en la literatura. El principal aporte del artículo es la discusión del aprendizaje reflexivo entre los dos proyectos en torno a las tensiones institucionales (mandatos reducidos, cajas negras, antagonismos, pos-política) y momentos de confluencia (impactos en las estrategias y políticas de los municipios, reequilibrio de la distribución de poder, eliminación de las barreras reglamentarias, aparición de un enfoque multinivel y multitécnico) que encontramos.

Palabras clave: Investigación acción participativa; co-creación; ecología política; post-política; (ant)agonismo

1. Introduction

Innoviris (The Brussels Institute for Research and Innovation) Co-create research policy call was initiated in Brussels in 2015. Primarily dedicated to sustainable food systems, this research policy then expanded its scope and was consolidated into three pillars: participatory research, social innovation and urban resilience. Within this framework, co-creation was defined as "*a participatory research emerging from users, creating transdisciplinary, cross-sectorial and co-learning spaces rooted in action research*" (Innoviris 2016, pp.3–4). The PHOSPHORE and BRUSSEAU participatory action-research (PAR) had the common intention of respectively transforming the biowaste and water socio-technical systems.

The fundamental hypothesis of this article is that the two PAR tackled many institutional (governance) tensions and political issues that are still insufficiently explored in the literature. In order to understand the tensions and strategies which generate consensual policies, we rely on a number of concepts from different disciplinary fields (Section 2) which is one of the major contributions of this paper.

Subsequent to this conceptual introduction, the concepts will be used to analyse the research trajectories of BRUSSEAU (Section 3) and PHOSPHORE (Section 4) in detail within three common subsections:

Genesis: describes the genesis of the 'knowledge and research communities' of our PAR and the shared objectives. We also describe the respective approaches towards the institutions.

Tensions: describes the institutional tensions revealed by the PAR and the post-political response provided by the institutions.

Confluences: describes the content of some of the proposals co-created by our PAR, the constructive political response that institutions have provided, and the impacts of our PAR on policies.

Then, Section 5 discusses the reflexive learning between our two projects concerning the institutional tensions and moments of confluences we encountered.

The concluding Section 6 shows how PAR processes can make a conceptual and operational contribution to policy, politics and PAR literature, and proposes pathways and areas of attention (refusing "black boxes", proposing agonistic institutions and new hybrid parliaments) for future PAR, that struggle for more sustainable policies.

2. Conceptual section

In order to understand our working methodologies, it is important to understand what action-research and its participatory extension are all about.

Action-research is a scientific research methodology related to Kurt Lewin (1946) which aims to generate a transformation of reality through action/intervention, while producing knowledge about this transformation through an iterative cycle and/or reflexive approach: planning, acting, observing, and evaluating (Lewin 1946, 1952). The method has been progressively used in a very large number of disciplinary fields which have further developed and enriched it over time (such as psychology, sociology, psycho-sociology, socio-clinical, urban political ecology, social work, etc.). According to others, it is the advancement of knowledge

by, and also *for,* the action (Danley & Ellison 1999; Catroux 2002; Baron 2008). Moreover, action research has given rise to *Participatory action research (PAR)* methods and approaches (Chevalier & Buckles 2019). PAR considers the participants as co-researchers actively contributing to the action-research process, from the initial design to the final presentation of the results and discussion of the implications of their actions (Tandon, 1988; Whyte 1991) with a view to transformation of a system and democratisation of research (Aiken 2017). PAR aims to *collectively* choose research questions and reformulate them, develop hypotheses, define modes of data collection, analyse these data, formalise results and disseminate them. The ambition of PAR is to integrate rigorous designs with meaningful questions, respecting principles (McTaggart, 1991) and values (Danley & Ellison 1999) and using reflexivity, creativity and complex techniques (Chevalier & Buckles 2019).

In that sense, *Co-creation,* defined as "*a participatory research emerging from users, creating transdisciplinary, cross-sectorial and co-learning spaces rooted in action research*" (Innoviris 2016, pp.3–4) is here understood as a synonym of PAR.

In order to understand the institutional tensions we have been going through, we developed, as action-research coordinators of our PAR, reflexive learnings based on *institutional (governance) tensions* developed by Manganelli and Moulaert (2018), Manganelli, van den Broeck and Moulaert (2019) and Manganelli (2020). According to them, these tensions "*emerge through the building of relational networks between local* (water and biowaste) *initiatives and key governing agencies and institutions at different scales*" (Manganelli & Moulaert, 2018, p. 4).

In order to reveal the political dimensions and tensions of our PAR, we rely on the work of Rancières (2004), Mouffe (2004, 2010a, 2010b), Swyngedouw (2011), Wilson & Swyngedouw (2014) and Kenis, Bono & Mathijs (2016).

These authors distinguish between:

- "*the political"* ("*le*" politique), defined as "*a space of contestation and agonistic engagement*"(Wilson & Swyngedouw, 2014, p.6) and as a "*discourse in which the existence of power, conflict, and contingency is recognised*" (Kenis, Bono & Mathijs, 2016).
- *"politic"* ("*la*" politique), defined as "*technocratic mechanisms and consensual procedures that operate within an unquestioned framework of representative democracy, free markets economics and cosmopolitan liberalism*" (Wilson & Swyngedouw, 2014, p.6).
- *"policies",* considered as strategic plans, roadmaps or sets of rules agreed by actors (administrations, business groups, political parties or a government).

This distinction between "the political" and the "politic" brings us to Mouffe's fundamental distinction (2010a) between *"agonism", which* recognises the opponent or the challenger to political community as an "*adversary*", and "*antagonism*, which recognises the opponent as a political "*enemy*". This resonates with Rancière's work (2004) on disagreement, and with the notion of *post-political* defined by Wilson & Swyngedouw (2014, p.5) as "*a situation in which the political understood as a space of contestation and agonistic engagement is increasingly colonised by politics – understood as technocratic mechanisms and consensual procedures that operate within an unquestioned framework of representative democracy, free markets economics and cosmopolitan liberalism. In post politics, political contradictions are reduced to policy problems to be managed by experts and legitimated through participatory processes in which the scope of possible outcomes is narrowly defined in advance*". Swyngedouw (2011) further clarifies, "*Although disagreement and debate are of course still*

possible, they operate within an overall model of elite consensus and agreement, subordinated to a managerial-technocratic regime. Disagreement is allowed, but only with respect to the choice of technologies (…) *the detail of the managerial adjustments, and the urgency of their timing and implementation* (…)" (p. 267).

Finally, *in order to understand the political strategies put in place to generate consensual policies,* frameworks of unquestioned thoughts and paradigms, we use the complex concept of "*black box*" from the sociology of translation. According to Callon and Latour (1981, pp. 285–286), *"a black box contains that which no longer needs to be reconsidered, those things whose contents have become a matter of indifference. The more elements one can place in black boxes – modes of thoughts, habits, forces objects – the broader the construction one can raise". "Only the differences between what can be put in black boxes and what remain open for future negotiations are now relevant for us".*

These concepts are used to analyse in detail the research trajectories of BRUSSEAU (Section 3) and PHOSPHORE (Section 4).

3. BRUSSEAU

3.1. Genesis

BRUSSEAU is rooted in a dynamic of activism, including one developed by the "*General States of Water*" (*Etats Généraux de l'Eau à Bruxelles*) (EGEB), an association of Brussel citizens born out of a triple crisis concerning rainwater management in Brussels.

The activist struggle and citizenship genesis

In 2002, the crisis in the storm water basin of Place Flagey revealed an opposition which had been created by the politicians, between those who wanted to be protected from floods by the construction of a storm water basin, and those who wanted to avoid the gigantic construction site. This tactic has led to disqualification of the latter, and the emergence of the concept of "watershed solidarity"[1] : becoming the object of an open public debate, water became politicised.

In 2010, following an attempt by Veolia to privatise large parts of water management (Laimé, 2010), the Platform Eau Water Zone[2] published a *carte blanche* calling for a broad debate in the Brussels Region based on the hypothesis of eco-systemic and common good management (EGEB 2010). Finally, in 2015, a citizen accessiblele collective mapping work was recognised by the municipality of Forest together, to give a common structure with a programming capacity: "The Solidary Side of Forest" (EGEB 2014a). However, it did not last because the citizens were too weak in the face of official technical expertise. Nevertheless, research questions remained (EGEB 2014b, pp.12–28) which later sustained the new alliance, and therefore a new legitimacy, between scientists and citizens. This alliance is the basis of BRUSSEAU PAR, which was submitted to the Innoviris Co-Create policy in 2016. The BRUSSEAU coalition consortium, created to act as a counter-power, brought together and

1 Concept developed by the Collective "citizen itinerary" (Parcours Citoyen) which assumed that technical choices in the urban environment had to be discussed collectively. This collective has disappeared today.

2 Expert Citizen Platform from the Flagey Square storm water basin conflict.

united seven partners as *co-researchers:* citizens, technicians (Latitude, Arkipel and Eco-technic) and scientists: the Department of Hydrology and Hydraulic Engineering (HYDR) of the Vrije Universiteit Brussel, The HABITER research center (Centre d'études en Développement, Territoire et Paysages) and the Laboratoire interdisciplinaire en Etudes urbaines (LIEU) of the Université Libre de Bruxelles (ULB).

Understanding the water management system: the technical and institutional impasse

Historically, the Brussels-Capital Region "pushed back" water, both technically and psychologically. At the time of the construction of the BRUSSEAU project, the collective understanding of the water management system had evolved significantly from the knowledge available in 2002. The floods are essentially linked to the saturation of the combined sewer systems by runoff water during storms. More generally, flooding in Brussels is caused by numerous disturbances to which the water cycle has been subjected, especially since the 19th century (Deligne, 2003; Kohlbenner, 2015) as well as the more recent significant waterproofing of soils (Vanhuysse, Despireux & Wolff, 2006).

The historical distribution of competences in terms of rainwater and runoff management is unclear, paradoxical and conflicting, between the different levels of power and services (town planning, public works, environment) and operators (BE, Vivaqua, la Société bruxelloise de gestion de l'eau – Brussels Water Management Company (BWMC)). As a significant part of the water flows into the sewerage network, it is the sewage operator (Vivaqua) who is responsible. The most disastrous consequence of this centralised, technical management system lies in the removal of the political dimension, the alignment of policy with technical services, at the expense of Brussels's inhabitants who find themselves forbidden from taking part in the decisions that affect them. This exclusion does not allow them to develop new knowledge and practices in order to respond to the increased risks of flooding.

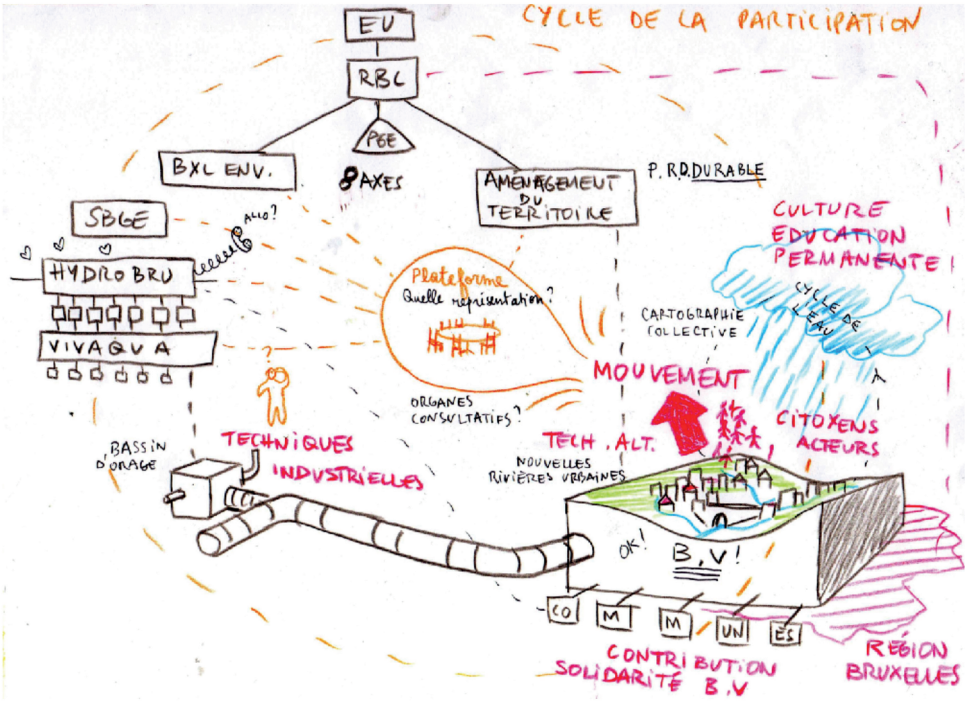
Politicize a technical issue

The main research question of Brusseau's co-researchers was: "*in terms of water management how to transform a technical problem, confined to a restricted circle of experts, to a political problem, involving a wider collective*"[3]. It was thus a question of using theories of source water management (Mahaut 2009), decentralised over an entire river basin, based on low technologies (Bihouix, 2014) that could be appropriated by the inhabitants. For the inhabitants it was no longer a question of simply participating in a debate, but of actively contributing to this new form of water management in a joint co-creative action (Whyte 1991; Chevalier & Buckles 2019).

"The hydrological communities" bring together inhabitants and local stakeholders to discuss hydrological issues, sharing and developing their expertise both in terms of the diagnosis of hydrological flows and modeling and the implementation and monitoring of solutions to flooding problems *before* public institutions enter the scene. Therefore, the inhabitants and users of the city can exercise their right to define their environment by the means of a bottom-up approach.

3 Elements from the final BRUSSEAU proposal submitted to Innoviris at the end of 2016

Figure 1. Water system management in Brussels. (Arnaud Bilande).



3.2. Tensions

BRUSSEAU has developed several devices and intermediary objects (Vinck 1999), such as historical archives, flow measuring instruments, models, etc. Among these instruments, the collaborative Map-it (EGEB, 2014a) has made it possible to establish multiple relationships between the actors involved in the process, territory and future, as well as the articulation of multiple, contradictory and intertwined logics. Around the map, there is equal access to experts, their practices and experience, as well as scientific and technical expertise. If formal equality and law take place around the map, we also observed tensions due to the asymmetry of the positions (scientific argument vs user expertise). One way of resolving this tension has been the use of the concept of "common demand" (Nalpas et al. 2019).

Common demand as a border concept to resolve facts and values linked tensions

Whereas the recourse to the technical and scientific expert is usually the subject of an order, in the context of the co-creation process, it is by mutual agreement that each one makes knowledge available to establish a co-expertise with a new consistency. This border-notion has made it possible to make the political side of co-creation conscious and visible, because it raises the question of *who asks what, to whom, to do what and for whom?* This is the key moment when the Brussels's landscape, with its observations, uses and projected intentions is

translated (Akrich, Callon & Latour, 2006) into a calculation of the volume of water that will not go to the sewers. Many of the questions that came out of the mapping work became hydrological questions, thus, turning them into facts. When facts come back to the hydrological community in order to co-decide on concrete proposals, the discussions necessarily combine facts and values, and become the locus of "the" *political* (Latour 2018). By the means of this action, the *politic* is disinserted from the technical dominance, taking into account the uses and generating *the political* (Wilson & Swyngedouw, 2014; Kenis, Bono & Mathijs, 2016). Common demand expresses knowledge shared by all, co-expertise and co-creation.

The black box

One of the first of these common demands took place around the project of the storm water basin for the northern slope of Forest planned by Vivaqua (and the municipality of Forest) on the site of the "Essential Garden". This magnificent collective garden of aromatic plants was endangered by the construction of a storm water basin, and the hydrological community legitimately wondered if there were other solutions to solve the flooding problem further down the valley. BRUSSEAU took up this request, and concluded that other water paths were possible. Coming from a potential social conflict between inhabitants and Forest politicians, a technical-scientific controversy arose between BRUSSEAU and Vivaqua, the classical expert in the field. To turn this controversy into a debate, we proposed that Brussels Environment (BE) and Forest work together.

However, with BE we went even further. The idea was to co-produce the set-up of a *co-creation space* for all the actors concerned on the northern slope of Forest, from hydrological communities to water operators, together. The BRUSSEAU partners reflected on the framework and minimum acceptable conditions for this co-creation and proposed the importance of transparency, access to information and the possibility of dealing with controversies and disagreements. Things were well on their way to co-producing an inclusive and community-generating co-creative dynamic. Our institutional form was beginning to take shape, but negotiations came to a halt.

We do not know the precise reasons for this new stalemate; we only have presumptions, such as hierarchical political agreements, fear of job losses for Vivaqua, fear of overly complex co-ordination, lack of participation practice, etc. However, there is one explanation that creates a system: the famous "*black box*" (Callon & Latour 1981), which took the form of an agreement that was not very visible, and that we discovered very late.

This agreement, which had been negotiated between the three partners of the Regional Water Co-ordination, determines what needs to be taken into account for the construction of the storm water basin (Brussels Environment, 2018). Consequently, it was unthinkable for BE and the water operators to allow inhabitants, or their spokespersons, to openly express their disagreement on standards that cannot, in reality, be questioned. Things were decided, and controversy was made impossible.

From this perspective, it is easier to understand why BRUSSEAU was subject to reductive injunctions. When we presented a project to extend the BRUSSEAU research dynamic to BE, we were asked to deal only with "*disconnecting the roofs*" and with the tiny parcel of land. Gone was the efficiency of water management at the source, based on a network of interconnected devices and a product of common creation. Gone was the complexity and links between the multiplicity of low tech and solidarity devices.

3.3. Confluences

Nevertheless, BRUSSEAU has worked on multiple situations in which new water paths and flow calculations have been imagined and modeled with the support of the three Brussels's hydrological communities.

A "situation" is defined as the arrangement of a set of elements. Socio-hydro-technical problems are recognised by a certain number of actors (inhabitants, researchers, institutions), and constitute problems over which there is "control".

The administration of the municipality of called upon BRUSSEAU to carry out collective mapping actions that became the basis of their water policy. Jette administration made water management one of its policy priorities after BRUSSEAU explained that there was a bottleneck in the sewerage system that was creating flooding in the neighbouring districts downstream. Furthermore, BRUSSEAU proposed a "storm garden", a very large landscape retention area that could collect rainwater from many neighbourhoods during major storms (Mahaut, 2009). There are also many other socio-technical and co-creative ideas which were brought forth by BRUSSEAU, and which did not leave BE and Vivaqua indifferent.

The new paths of water and governance

Two municipalities in the Molenbeek valley contacted BRUSSEAU to ask for our opinion on the specifications of The BWMC's contract conditions of a new storm water basin. We agreed together that it was necessary to redo the flow calculations according to the new arrangements, and to imagine new forms of governance, including a "common demand". The question which arose forcefully was "*but who is actually asking for this storm water basin?"*

Several "situations" have made their way to various policies/institutions that were sensitive to proposals, from the smallest to the largest scale and often at different project stages (Dobre, Nalpas et al. 2020). However, this is not yet sufficient to produce an instituted form of co-creation in terms of water management. Regional institutions seem to welcome these results as a godsend in some cases, but they do not necessarily care about replicability, sustainability, common demand, nor for the adventure to institute this way of co-creation.

BE explained to us that the hydrological communities endangered the hard-built Regional Water Coordination arrangement (BE, Vivaqua, BWMC). For BE, Hydrological communities appear as systems, making BE afraid of a competition of systems. It is one of the reasons we now prefer to talk about "situations" that take on different accents depending on the scale and project phase where it is situated (Dobre, Nalpas, Verbeiren et al. 2020).

In parallel to the new paths of water, new paths of governance must emerge. We have therefore proposed the creation of a "bridging dynamic" that would not only fluidify, adjust, anticipate and study, without having recourse continuously to public contracts, but would also incorporate at all stages, and on several scales, the continuity of the "common demand" (Dobre, Nalpas et al. 2020). It is on this basis that discussions with BE are currently being resumed, to generate a co-created dynamic, a mechanism that would make it possible to co-produce a multiplicity of situations, at the crossroads of networks and systems, but which would also be pragmatically feasible.

4. PHOSPHORE

4.1. Genesis

The academic genesis and the co-researchers as key players

The genesis of the PHOSPHORE project is to be found in the academic work of Kampelmann (2016). This article directly fueled the proposal content that the PHOSPHORE consortium presented a few months later to Innoviris. The PHOSPHORE's consortium was then composed by:

- the Urban Ecology Centre (UEC) which became the co-ordinator operating as bridging organisation (Folke, Hahn, Olsson et al. 2005 ; Hahn, Olsson, Folke et al. 2006) knowledge broker (Meyer 2010; Meyer & Kearnes 2013;) and systemic intermediary of the project (Klerkx, Hall & Leeuwis 2009).
- the Agence de Bruxelles-Propreté (ABP), the "type A"[4] para-regional institution in charge of the collection and treatment of household waste in Brussels.
- WORMS, a grassroots association in charge of the support and training of "master composters" in Brussels.
- the Université Libre de Bruxelles (ULB) which worked on the aforementioned article.
- Brussels Environment (BE), the other "type A" para regional environmental administration as well as three urban "living labs" (Lehmann, Frangioni & Dubé 2015; Scholl & Kemp 2016).
- Roots, a neighbourhood grocery store intended to experiment with the design and implementation of a circular organic matter collector.
- the green division of the administration of Schaerbeek and BE that aimed to test the recirculation of their green waste and finally.
- Refresh, a neighbourhood restaurant that intended to test several types of decentralised treatments.

These co-researchers: who until then had very diverse world visions (Grisoni, Milanesi, Pelenc et al. 2018), actively contributed to the entire PAR process (Tandon, 1988; Whyte 1991).

Towards a hybrid biowaste system

The common objective of the consortium is to "*collectively developing, debating and experimenting solutions for the transformation and implementation of a management system for available organic matter in the Brussels region that is resilient, circular and meaningful for all Brussels residents, including those who are currently excluded*"[5].

Our pragmatic aim was to bring together the key players in the system (regime and niche) to co-create a hybrid: which Geels and Schot (2007) call a "symbiotic" and more balanced system. "Hybrid" because it would attempt to find systemic complementarities between the actors/techniques of local (decentralised) and industrial (centralised) poles of Brussels's biowaste regime and "balanced" because it would attempt to find a balance between the use of

4 Controlled hierarchically by the Minister in charge
5 Elements from the final PHOSPHORE proposal submitted to Innoviris in 2016.

centralised and decentralised solutions, which is strongly skewed towards centralised solutions today.

The system change strategy

Kurt Lewin once said something along the lines of "*If you want truly to understand a system, try to change it*": however the opposite is true, If you want to change a system, first you must try to truly understand it.

During the three years of the project, the PHOSPHORE consortium had gradually become explicitly situated in a multi-level and transformation perspective (Geels, 2002, 2011; Geels & Schot 2007; 2010) using Reflexive Monitoring in Action (van Mierlo et al. 2010). Landscape, regime and niches were precisely defined (De Muynck, Kampelmann, Dávila et al. 2019, p. 14). Interventions on the socio-technical-ecological system of Brussel's biowaste were carried out, on the basis of six strategic action research activities:

1. Understand the current regime (flows, actors, rules, infrastructures) and the challenges of its transformation (economic, environmental, social and political).
2. Identify and supporting innovative initiatives within the socio-technical niches.
3. Experiment with the most promising initiative es with a view to their development.
4. To remove the barriers related to this rise in power.
5. Co-construct a transition narrative.
6. Defend the narrative and institutionalise innovative actors and practices.

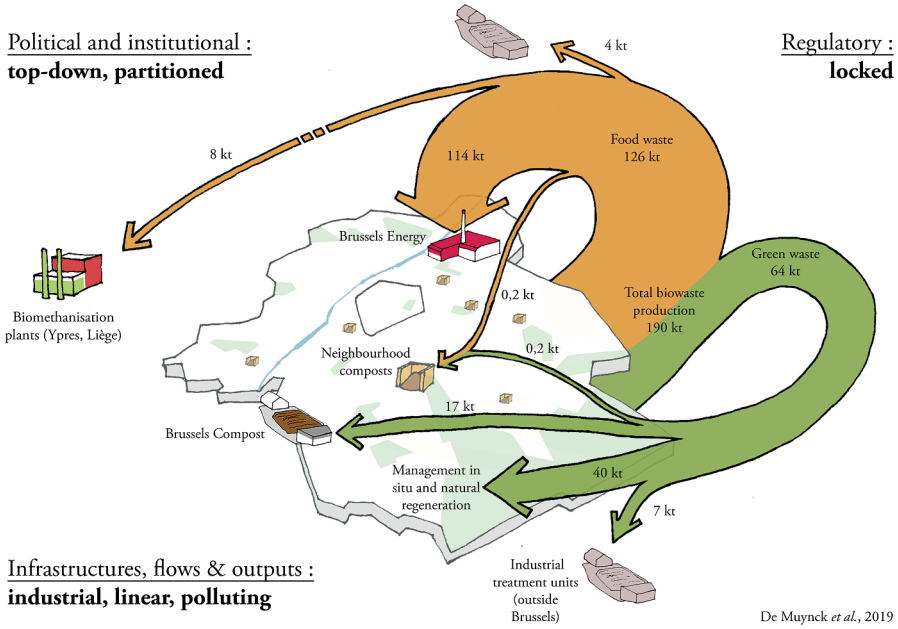
The features of action research were clearly materialised. The final intention was to transform the system (activities 5–6) through actions and interventions (activities 1–4) (Lewin 1946, 1952) and self-reflexivity (Lewin 1946, 1952; van Mierlo et al. 2010; Chevalier & Buckles 2019).

Concerning strategic Activities 1 and 2, PHOSPHORE's co-researchers had considered a detailed understanding of the biowaste system as an absolutely necessary condition for envisaging its transformation. Kampelmann's preliminary work, the corollary studies commissioned by BE, and carried out by part of the PHOSPHORE consortium (UEC, ULB), led to a consensus on the total quantities of food and green waste *produced* and *collectable* (significantly lower than the produced) in Brussels by type of actor (Bortolotti, Aragone, Athanassiadis et al. 2018) as well as on decentralised biowaste treatment techniques (Bortolotti, Kampelmann & De Muynck, 2018). Then PHOSPHORE identified all the innovative actors in Brussels. Rapidly, the socio-technical regime of biowaste collection and treatment was characterised as industrial, linear, polluting, top down, partitioned and locked (Kampelmann 2016; De Muynck et al. 2019).

Then, co-experimentation with the most promising living labs (Baccarne, B., Logghe, S., Schuurman et al. 2016), including Roots and Schaerbeek, revealed a wide variety of barriers that needed to be documented in order to remove them (activities 4–5).

The last two activities (5–6) dealing with the co-construction of the PHOSPHORE scenario are interesting from a sociopolitical point of view, because they revealed institutional tensions.

Figure 2. Sources, flows and infrastructures for the current treatment of biowaste in the Brussels-Capital Region and challenges of transformation (Translated from De Muynck et al. 2019)



4.2. Tensions

Faced with the double challenge of co-constructing a complex and accessible narrative of change (Wittmayer, Backhaus, Avelino et al. 2019), PHOSPHORE co-researchers have used the intermediate object (Mélard 2008; Vinck & Jeantet, 1995; Vinck & Laureillard, 1996; Vinck, 2009) of scriptwriting to 2025. We wanted to consider qualitative (policies, rules, strategies, actors and their relations), and quantitative (numerical objectives, flows) and material (infrastructures) elements at the same time. The PHOSPHORE consortium then recounted the content of the participatory workshops, bringing together numerous actors from the field, in prospective narratives that were critically reread by a broader and transdisciplinary collective (associations, university professors, administration employees, concerned citizens, etc.). This is in line with what Funtowicz and Ravets (1997) call the "extended peer community". The qualitative narratives were then translated into quantitative targets by PHOSPHORE, who estimated biowaste flows until 2025.

The first scenario: the impossible translation into the world of policy planning

The major characteristic of this first narrative (scenario 1) was the upscaling of the most promising niches articulated with a *modular* triple co-composting unit. As the *collectable* Brussels biowaste were estimated to be between 25kt/year and 50kt/year (Bortolotti et

al. 2018), our proposal was to start by building a single co-composting plant. *If* the first plant (17kt/year) was filled, another plant could be built and, *only if necessary*, a third and final plant would be built to complete the installation. This first emerging narrative went unheeded as relations between PHOSPHORE and the newly forming political cabinets became strained as negotiations between political parties progressed. Several hypothetical elements worked against the institutionalisation of this first narrative:

1) It did not correspond to the treatment by biomethanisation that certain members of the cabinets and administration (BE) had decided, *in a restricted circle*, and well *before* PHOSPHORE. According to them, industrial biomethanisation presented better arguments: increase in regional statistics on renewable energy production and recycling, clarity of the political message, increased Brussels regional control over treatment etc.

2) It was not fully matured, and moreover *too complex* (multi-level, multi-technical, multi-stakeholder). Its translation into the world of policy planning and politic was not possible. We were indeed asked to "*synthesise in a few points* (the) *proposal, otherwise it will be inaudible by the cabinet*", and to keep only the recycling and renewable energy objectives in the final proposal.

3) In February 2019, we received the official notice from BE asking us to "*not question the debate on the centralised solution, to admit that it is planned to manage up to 50kt/year of biowaste, and to develop as much as possible scenarios of prevention and local (and meso) decentralised recovery for the rest of the flows. The policy biowaste roadmap will be developed in this way. If we* (PHOSPHORE) *do not work in this direction, we lose our credibility and the results/proposals may not be followed up"*[6].

We were therefore witnessing the "depoliticisation" of an important environmental issue (Kenis & Lievens 2014). Noting that we were asked to stop intervening on essential terms of a complex political discussion, we wrote a press release entitled "*Towards a reasoned strategy for biowaste in Brussels*" (June 2019) which was widely relayed by the media and the grassroots actors of Brussels. The aim was to warn the people of Brussels about the closure of the political debate on the installation of a 50kt/year biomethanisation plant in Brussels[7]. The consequences of this press release were difficult to measure, but for a time our relationship with one of BE's chief of division members who provided the metabolic link between BE and the cabinet was altered. He was at the heart of a compartmentalised world.

The final scenario: playing a post-political game

A few weeks later, when the new government was finalised, the establishment of a 50 kt/year biomethanisation plant in Brussels was explicitly noted in the General Policy Statement of the Brussels Government (2019–2024), which stated that "*the implementation of a biomethanisation plant in Brussels is one of the objectives of the policy*" (…) " *with recovery of renewable energy on the regional territory. The Government will also continue to support the strengthening of the network of decentralised collective composting*" (Gouvernement Bruxellois 2019).

The 50kt/year objective corresponds to the dimensions discussed in the last feasibility study (ULB, OWS & IDEA Consult, 2018), in which part of the PHOSPHORE consortium

6 Personal communication.

7 A few months later, we received unofficial confirmation from an outgoing cabinet member that larger dimensions for the future plant: up to 100 kt/year , (sic)had been discussed and defended by certain parties during the negotiations (personal communication).

participated as a member of the steering committee (UEC, WORMS). The results of this study were never officially validated by us. Launching a feasibility study for the establishment of a biomethanisation plant in Brussels (closed focus) while participating in a PAR that aimed to explore the systemic (and open) possibilities of treating Brussels' biowaste, this is the *tour de force* that BE has conducted, and the politic we agreed to play.

In this whirlwind, we found ourselves faced with two options. The first was to make a proposal persisting with the idea of a hybrid/symbiotic system with a triple modular co-composting plant. The second to accept the terms imposed on us and integrate a 50kt bio-methanisation plant in the PHOSPHORE final scenario. We agreed to opt for the second option (De Muynck et al. 2020) and maybe missed the occasion to assume a moment of dissensual politic, as Rancière (2004) says: "*it is not a quarrel over which solutions are best to apply to a situation but a dispute over the situation itself* (Velicua and Kaika 2015).

4.3. Confluences

The effective pragmatic problem-oriented approach

The pragmatic problem-framing and solving approach (Popa, Guillermin & Dedeurwaerdere 2014; Chevalier & Buckles 2019) had rapid and directly visible benefits. We co-designed, identified the barriers, accompanied processes, broke down the barriers, and then implanted two new artifacts unique in Europe and reproducible on the Brussels territory: the biowaste collector for grocery of Roots, and the hybrid compost of Schaerbeek.

We identified the fact that the vast majority of decentralised biowaste collection and/or treatment practices (niches) were illegal, due to strict European regulations and policies and administrative formalities. Thus, with BE's Authorisations Department, the consortium co-edited a new regional biowaste decree that clarified the policy rules of local composting, in order to facilitate the emergence and replicability of decentralised and ecological practices. We also worked on the notion of vegetable "co-products" in order to be able to share shredded vegetable materials, which is an activator of ecological practices. This resonates with the work of Gutwirth & Stengers (2016) which calls for the creativity of law to create new commons. We also facilitated the dynamics of the sharing of 400 t/year of shredded plants from the parks and green spaces managed by BE, benefiting 160 neighbourhood composts. The PHOSPHORE scenario has also served as a working basis for BE's Bioewaste Roadmap policy. To do this, and given the constantly changing political context, we used a quantitative matrix we had developed as an adaptive boundary object to estimate collectively how much each treatment category could treat by 2025. We did that by taking into account food and green waste and three scales of treatment. The adaptive matrix is now used by BE, and it allowed us to demonstrate to BE the *systemic nature* of flows and infrastructures.

The next Section discusses the main reflexive learning of our two projects concerning institutional tensions and the post-political moments we encountered.

5. Discussion

5.1. Genesis

The different emergence dynamics and roles of co-researchers

The emergence dynamics of BRUSSEAU and PHOSPHORE were very different. BRUSSEAU brought together historical actors contesting water management, to rebalance the past and current political-technical expertise coalition. It is made up of a consortium of committed co-researchers whose intentions were to not only to re-legitimise the vernacular and citizen knowledge, but also the contestation resulting from situated technical controversies. In this sense, BRUSSEAU is in line with a critical-emancipatory approach of the PAR that emphasises empowerment and struggles against injustices (Chevalier & Buckles 2019), but also, on the other hand, with a constructivist vision proposing a new technical democracy (Callon, Lascoumes & Barthe, 2001 ; Nalpas, 2014).

Conversely, the PHOSPHORE consortium does not stem from an activist dynamic. Its origin is found in knowledge developed in the academic world, and thereby, the consortium rapidly became a key actor of the sociopolitical process. In this sense, PHOSPHORE is more in line with pragmatic action-research (Popa, Guillermin & Dedeurwaerdere 2014; Chevalier & Buckles 2019): focusing on problem-solving and rationality. Moreover the intention to generate knowledge from the field was also a founding element of the consortium.

The composition of the research consortia is probably, in part, the consequence of these different geneses. PHOSPHORE integrated key actors with the prerogative to modify the system and assume the different roles necessary in sustainability sciences (Wittmayer & Schäpke, 2014), i. e. a reassuring academic champion (Fransolet 2017), an association representing citizen dynamics, and a bridging actor mastering the requirements of PAR (Whyte 1991; Cahour 2002; Aiken 2017; Chevalier & Buckles 2019). With the means of rebalancing the distribution of political power concerning these socio-technical issues, which had historically always been to the disadvantage of weaker citizens, BRUSSEAU has strengthened its citizen dynamics through an alliance with three university partners and other technical expertise in a co-creative perspective.

5.2. Tensions

The black boxes and the post-politics

BRUSSEAU proposed the “hydrological communities” concept to the institutions, because the technical and institutional impasses of large infrastructures in sub-catchments were evident (floods, storm water basin under construction).

PHOSPHORE chose to identify targeted transformation challenges, and tried to address them in a systematic way. In addition, PHOSPHORE’S co-researchers tried to directly influence new hybrid biowaste policies through a systemic scenario of transformation.

Our PAR has sometimes disagreed with existing institutions, politics and policies. In both cases, the response of the institutions on large infrastructures was of a “post-political” nature (Wilson & Swyngedouw, 2014) and revealed black boxes (Callon and Latour, 1981). At key

moments, institutions closed certain terms essential to the discussion: reducing injunctions and agreement on what should be taken into account for the construction of storm water basins, assignation to the hyperlocality or reducing injunctions and agreement on the inputs and dimensioning of an industrial biomethanisation plant. In both cases, the conditions for an agonistic, co-creative and complex research were not met. "The politic" has emptied the sense of "the political" inherent to our PAR.

BRUSSEAU observed sometimes difficult relationships with institutions. The aim was to work on an initial dynamic of empowerment for both citizens and scientists *before* placing these collectives in relationship with institutions. This aspect was debated. Some of BRUSSEAU's co-researchers argued the need for this empowerment, arguing that institutions operate with "black boxes" making internal dynamics opaque which result from power relationships that are not questioned. They also wanted to establish the conditions for co-creation before the public institution entered the scene. Others believed that co-creation must be done from the outset with all the stakeholders and, therefore, with the institutional actors in a more pragmatic approach. The notion of "common demand" emerging from situations made it possible to produce political content and contradictions. However this common demand required spaces for co-creation and, above all, *conditions* for co-creation that were not respected. First of all, as mentioned previously the paragraph on the black box revealed that the institutional system imposed a general norm on itself, obliging the construction of the storm water basin of the "Square Lainé", *regardless of the precise situation* that concerned us all. It was therefore intrinsically unthinkable for BE and the water operators to allow inhabitants or their spokespersons to be able to openly express their disagreement on standards *that could not be questioned.*

For PHOSPHORE, the confrontation of the first version of the PHOSPHORE narrative (the three co-composting plants) with the decision-making authorities (BE and political cabinets) revealed the *same dynamics.* We were also asked to de-complexify our discourse, and to keep only the elements that were resonated most with the politics (recycling rate, share of renewable energy, job creation), which was in contradiction with our transdisciplinary work.

PHOSPHORE was also asked to follow the strategic feasibility study for the implementation of a biomethanisation plant on the Brussels territory (ULB, OWS & IDEA Consult, 2018) *during* the research conduction of PHOSPHORE. The indicators proposed and retained by this study (investment costs, profitability, required ground surface area, labour, energy generated, reusable products) greatly reduced the field of analysis and possibilities. Within the framework of this study, no more broad reflection could be made on the peak production of phosphorus (Cordell, Drangert & White et al. 2009), the quality of the output produced (Weithmann, Möller, Löder et al., 2018), the societal priority to generate energy rather than a healthy soil that can amend crops, the planning of modular treatment plants calibrated on the basis of the real and operational needs of the Brussels territory, rather than an overhanging plant that will have to be filled, whatever happens, for decades to come. Broader, as Rancières (2004) argues (in Velicu and Kaika, 2015 p.3): "*during a dialogue within an established framework, disagreement can only be articulated around opinions and values or around best solutions for a contested situation. The situation itself, the framework itself within which this dialogue operates (e.g. continuous development, neoliberalism, etc.) is not (supposed to be) contested. Therefore, entering a dialogue with a pre-conceived identity and*

position within a pre-established framework, may leave space for consensual politics, but does not allow space for systemic transformative or insurgent politics".

In this sense, the management of BE's Sustainable City Department has clearly placed us in a post-political situation defined by Wilson & Swyngedouw (2011; 2014))

Perhaps , as co-researchers of PHOSPHORE, we placed ourselves in this position and may have served as an exogenous legitimation of a top down choice already made: as Fransolet states (2017, p. 16) "*studies are rather used to justify decisions already taken or to improve someone's relative position in the policy systems compared to opponents*". It is possible that PHOSPHORE's weak positioning on the critical and emancipatory, and therefore *political,* – approach of PAR (Chevalier & Buckles 2019) may have played against the institutionalisation of the first PHOSPHORE narrative. On the other hand, much has been done to mobilise extra scientific actors in our narrative of change, and to challenge the political authorities: proto-discussions with the cabinets, press release, answers to parliamentary questions, etc.

However institutional (governance) tensions also arose because our PAR consortia wanted to have an influence on Brussels's water and biowaste policies, and because complexity was discussed: or, in the words Manganelli & Moulaert (2018) "*new values were discussed, negotiated, protected or opposed by different institutions.*"

The power relations

One of the specific features of Brussels is also the relationship of authority linking the "type-A" para-regional administrations to their supervisory minister and their respective chiefs of staff and political staff. The analysis of the role of these actors and "technical bodies" (Zitouni & Tellier 2013) is crucial for understanding the shape of the system and the infrastructural choices. PHOSPHORE did not properly identify the pre-existing hierarchical and political/policy stakes within the institutions that collaborated in our PAR (BE, ABP). Benefiting from the fruitful collaboration of several project managers from several different departments was not enough. Major and strategic decisions on infrastructure (and therefore flows) are taken by the Divisional directors, who are in direct connection with the General Board, which is itself in direct connection with the cabinets of the Governmental majority. Understanding the relationships between these "shadow actors" is absolutely imperative for the modification of socio-technical regimes.

In both cases of BRUSSEAU and PHOSPHORE, fundamental elements of the debate have been discussed elsewhere, *outside the co-creative arenas* that we wanted to generate.

5.3. Confluences

The co-creation as a basis of local transitions

The institutional and political response has not always been unfruitful. For BRUSSEAU, it seems that the critical, emancipatory and bottom-up approach has generated multiple situations in which the BRUSSEAU consortium's proposals have made their way through the institutions. BRUSSEAU's growing expertise and the relationship of trust between the municipal actors explain some of these successes. BRUSSEAU has made technical proposals,

proposed local solutions, directly impacted the municipalities strategies and policies, and is currently working on new ways of governance to co-produce a multitude of situations, at the crossroads of networks and systems, but also pragmatically feasible. The General Policy Statement of the Brussels Government (2019–2024) noted that: "(it) *will reduce the construction of storm water basins and promote alternative stormwater management through integrated stormwater management. It will also intensify the renovation of the sewerage system* (Gouvernement Bruxellois 2019, p.99). However, these successes, mainly at the local and regulatory levels, have had too little impact on the systems, and generated very little controversy, debate and substantive institutional dynamics.

In the case of PHOSPHORE, the pragmatic approach worked very well on local and on regulatory dynamics that can be assimilated to problem-situations. PHOSPHORE has directly fueled the Biowaste Roadmap policy, co-drafted a regional decree that set the rules for local composting, and changed the status of shredded material towards a common good, concluded a public space occupation agreement for the Roots organic matter collector. Moreover, the PHOSPHORE scenario is now a solid strategic basis for the BE Waste Department.

In each case, co-creation was the basis of the work. We also learnt that adaptive action-research strategies (Brunner 2010) and bridging actors (UEC for the Roots collector, WORMS for the hybrid compost plant of Schaerbeek and BE for the local composting decree) facilitated the removal of barriers, as well as the intermediation and negotiation with the political stakeholders involved.

The co-creation as a revelator of the need of new systemic arrangements

At the regional level, however, it appears that BRUSSEAU has jeopardised the governance set up within the framework of the Regional Water Co-ordination. It is interesting to note that BRUSSEAU has developed a great deal of knowledge over these years, and that the network is now in a position to enter into co-creation logics in a healthier, more solid position than in the past. The distribution of power has been rebalanced in favour of the citizens, and it is precisely *this rebalancing* that allows the project to envisage new and very ambitious forms of collaboration with BE.

The PHOSPHORE's quantitative matrix is now used by BE for its planning work, and for clarifying the strategic objectives on biowaste. Finally, it should be noted that some members of the consortium are now appointed members of the Biowaste Working Group, in the framework of the "participative governance" process that BE is putting in place for the Resource and Waste Management Plan.

Our research also has shown the need for radically new institutional, legal, financial and democratic arrangements for the social-ecological systems of tomorrow (Berkes and Folke, 1998).

The concluding section shows how PAR processes can make a conceptual and operational contribution to policy, politics and action-research literature.

6. Conclusion

Refusing black boxes

PAR, or research in co-creation, are imperfect frameworks, open to criticism and confined to short-term dynamics of projects. Nevertheless, we hypothesise that these modes of research allow the emergence of the "political", a new political ecology. They allow each actor (citizen, association, administration, academic) who feels concerned by a situation or a socio-technical-ecological issue, to participate in its transformation, while collectively producing knowledge about the transformation (Lewin 1946, 1952) and to scientific elaboration within a hybrid enclosure in which all the "spokespersons" meet (Latour 2018). We argue that these modes of research should be a mode *of political production:* one that can raise new questions, define intentions, methods, new narratives and experiments in laboratories (Tandon, 1988; Chevalier & Buckles 2019; Whyte 1991) with an *instituting potential.*

However, to go beyond tensions generated by reductive injunctions of post-politics (Wilson & Swyngedouw, 2014), and by antagonisms (Mouffe 2010a, 2010b) intrinsically linked to the PAR methods (Whyte 1991; Chevalier & Buckles 2019), and to meet "the political" (Wilson & Swyngedouw, 2014) we must refuse and denounce the "*black boxes*" (Callon and Latour, 1981) that too often operate during the current mode of political production and, thereby, we must adopt an agonistic posture. In order to do so, we must demand agonistic institutions and pay attention to the blind spots intrinsic to the dynamics of participatory research. In this sense, we contributed to the PAR literature by exploring in detail its political blind spots insufficiently explored in the literature.

Towards agonistic institutions

We agree with Chantal Mouffe (2010a) that controversies and conflicts are *inherent* to democratic societies, and that they *can and should not* be eradicated. We believe that controversy precedes the emergence of a scientific content. We also believe that we need to go further and that, based on this controversy, we need to seek pragmatically and, concretely, common socio-technical-ecological worlds. The (political) institutions inscribed in the current modes of representative democracy have neither the culture nor the tools to imagine the pragmatic forms of the living laboratories that we call upon. We believe that institutions have an important role to play in these situations, as long as they are *transparent* and *controversy can arise from them.*

Moreover, we believe that agonistic co-creation as a way of generating collective, transdisciplinary political content should come out of the research institution, and percolate into all other institutional structures and dynamics.

Towards new hybrid parliaments and complexity

In the future, new institutional arrangements and new hybrid parliaments (Latour 2018) will have to be identified and experimented with, in order to accommodate news forms of knowledge creation integrating facts, values, ethics, scientific and extra-scientific knowledge (Jahn, Bergmann & Keil, 2012). We believe that the search for a single, technical and substantively rational response is no longer relevant here (Funtowicz, and Ravetz, 1993) and that we need *complexity.* The task is huge. Tom Dedeuwaerdere (2013) reminds us of the

tendency to return to more classical reductionist and specialised conceptions when it comes to providing advice of a political nature. In our view, however, mobilising these modes of research and new hybrid parliaments is the very condition for restoring meaning to the necessary links between science, research and society, and for attempting to construct, patiently and with humility, a semblance of political ecology, in the full sense of the term.

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References

Aiken, G. T. (2017). Social Innovation And Participatory Action Research: A way to research community? *European Public & Social Innovation Review* (EPSIR),2(1), from https://pub.sinnergiak.org/esir/article/view/53

Akrich, M. Callon M. & Latour, B. (2006). Sociologie de la traduction. Textes fondateurs. Paris : Presses des Mines.

Baccarne, B., Logghe, S., Schuurman, D., & De Marez, L. (2016). Governing quintuple helix innovation : urban living labs and socio-ecological entrepreneurship. Technology Innovation Management Review, 6(3), 22–30. http://doi.org/10.22215/timreview/972

Baron, X. (2008). Quels dialogues entre chercheurs et consultants ? Savoirs, 16(1), 11–52. https://doi.org/10.3917/savo.016.0011

Berkes F, Folke C, eds. 1998. Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience. Cambridge, UK: Cambridge Univ. Press.

Bihouix, P. (2014). L'Âge des low tech. Vers une civilisation techniquement soutenable, Paris : Seuil.

Bortolotti, A., De Muynck, S. et Kampelmann, (2016). " Analyse théorique de la littérature décrivant les outils techniques de valorisation décentralisée de biodéchets des professionnels ". Bruxelles Environnement.

Bortolotti, A., Aragone, A., Athanassiadis, A., De Muynck, S., & Kampelmann, S. (2018). " Potentiel des biodéchets collectables en Région de Bruxelles-Capitale". Bruxelles Environnement.

Bortolotti, A. Kampelmann, S. & De Muynck, S. (2018). Decentralised Organic Resource Treatments – Classification and comparison through Extended Material Flow Analysis. Journal of Cleaner Production. Volume 183, 515–526. https://doi.org/10.1016/j.jclepro.2018.02.104

Brunner, R.D. (2010). Adaptive governance as a reform strategy. Policy sciences. 43, 301–341. https://doi.org/10.1007/s11077–010–9117-z

Bruxelles Environnement (2018). " Pluies de re´fe´rence pour le dimensionnement des ouvrages de gestion des eaux pluviales et des eaux re´siduaires urbaines en Re´gion de Bruxelles-Capitale. Guidelines". 17p.

Cahour, B. (2002). Décalages socio-cognitifs en réunions de conception participative. Le travail humain, vol. 65(4), 315–337. https://doi.org/10.3917/th.654.0315

Callon, M., Lascoumes, P., Barthe, Y. (2001). Agir dans un monde incertain. Essai sur la démocratie technique. Paris : Seuil.

Callon, M., & Latour, B. (1981). Unscrewing the big Leviathan: How actors macro-structure reality and how sociologists help them to do so. In K. Knorr, & A. Cicourel (Eds.), Advances in social theory and methodology (pp. 277–303). Boston: Routledge & Kegan Paul.

Catroux, M. (2002). " Introduction à la recherche-action : modalités d'une démarche théorique centrée sur la pratique ", Recherche et pratiques pédagogiques en langues de spécialité, Vol. XXI N° 3 | 2002, 8–20. https://doi.org/10.4000/apliut.4276

Chevalier J.M., & Buckles, D.J. (2019). Participatory Action Research. Theory and Methods for Engaged Inquiry. London: Routledge.

Cordell, D., Drangert J.-O., et White, S. (2009). The story of phosphorus: Global food security and food for thought. Global Environmental Change 19, 292–305. https://doi.org/10.1016/j.gloenvcha.2008.10.009

Danley K.S, Ellison M.L. (1999). A Handbook for Participatory Action Researchers. Implementation Science and Practice Advances Research Center Publications.. Boston: Boston University Center for Psychiatric Rehabilitation

Dedeurwaerdere, T. (2013). " Les sciences du développement durable pour régir la transition vers la durabilité forte ". Rapport scientifique sur l'organisation de la science. FNRS.

Deligne, C., (2003). Bruxelles et sa rivière : Genèse d'un territoire urbain (12e-18e siècle), Turnhout, Brepols, coll. Studies in European Urban History, n°1.187–189. https://doi.org/10.4000/dht.1126

De Muynck, S., Kampelmann, S., Dávila, F. Amaz, A., Scherrier, N., Dennemont, L., Bosteels, O. & Eudier, L. (2019). Opération Phosphore. Rapport scientifique #2. " La stratégie de changement de système ". Bruxelles : Innoviris Co-create.

De Muynck, S. Kampelmann, S. Dávila, F. Amaz, A. Dennemont L. et Savino J.-M. (2020). " Opération Phosphore : le système de collecte et de traitement des biodéchets bruxellois en 2025". Bruxelles: Innoviris Co-create

Dobre, C., Nalpas, D., Tondeur, K., Bastin, M., Verbeiren, B., Crespin, D., Panneels, P., Aragone, A., Ranzato, P., Bernard, C., Deligne , C. & Kohlbrenner, A. (2020). BRUSSEAU. Rapport Scientifique III. janvier 2019 – mars 2020. Bruxelles. Innoviris.

EGEB (2010), Réconcilier la ville avec l'eau, Position de base des EGEB – Carte blanche, IEB.

EGEB (2014a). Aux origines du Versant Solidaire de Forest.

EGEB (2014b), Actes de naissance. Cahiers 6. Questions de recherche, question d'avenir.

Folke, C. Hahn, T., Olsson, P., Norberg, J., (2005). Adaptive governance of social-ecological systems, Annual Review of Environment and Resources, 30: 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511

Fransolet A. (2017). "What are the conditions for scenarios to configure policy making? A comparative analysis of four energy foresight studies for Wallonia (Belgium) ". 18th International Futures Conference – Futures of a Complex World (Turku, Finlande, 12–13 juin 2017).

Funtowicz, S. & Ravetz, J. (1993). Science for the Post-Normal Age. *Futures* (2) 739–755. https://doi.org/10.1016/0016–3287(93)90022-L

Funtowicz, S. & Ravetz, J. (1997). Environmental problems, post-normal science, and extended peer communities. *Etudes et Recherches sur les Systèmes Agraires et le Développement, INRA,* 169–175.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research policy* 31(8–9): 1257–1274. https://doi.org/10.1016/S0048–7333(02)00062–8

Geels, F.W. (2011). The multi-level perspective on sustainability transitions : Responses to seven criticisms ", *Environmental Innovation and Societal Transitions*, 1, 24–40. https://doi.org/10.1016/j.eist.2011.02.002

Geels, F.W., & Schot, J.W. (2007). Typology of sociotechnical transition pathways. " Research Policy, 36, 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Geels, F.W., & Schot, J.W. (2010). The Dynamics of Transitions: A Socio-Technical Perspective ". London : Routledge Studies in Sustainability Transition., 1–93.

Gouvernement Bruxellois (2019). Déclaration de politique générale commune au Gouvernement de la Région de Bruxelles- Capitale et au Collège réuni de la Commission communautaire commune. Législature 2019–2024. Bruxelles.

Grisoni, A., Milanesi, J., Pelenc, J., & Sébastien, L. (2018). *Des plumes dans le goudron, Résister aux grands projets inutiles et imposés. De Notre-dame-des-Landes au Val de Suse.* Paris : Textuel.

Gutwirth, S., Stengers I. (2016). Le droit à l'épreuve de la résurgence des commons. *Revue Juridique de l'Environnement* (RJE) 2016/1.

Hahn T, Olsson P, Folke C, Johansson K. (2006). Trust-building, knowledge generation and organizational innovations: the role of a bridging organization for adaptive co-management of a wetland landscape around Kristianstad, Sweden. *Human Ecology* 34, 573–592. https://doi.org/10.1007/s10745–006–9035-z

Innoviris (2016). Co-Create pour une résilience urbaine en Région de Bruxelles-Capitale. Modalités de l'appel à projets. Bruxelles. 17p.

Kampelmann, S. (2016). Mesurer l'économie circulaire à l'échelle territoriale. *OFCE*, (1), 161–184. https://doi.org/10.3917/reof.145.0161

Kenis, A. & Lievens, M. (2014). Searching for 'the political' in environmental politics, *Environmental Politics*, 23:4, 531–548. https://doi.org/10.1080/09644016.2013.87006

Kenis, A., Bono, F., Mathijs, E. (2016). Unravelling the (post-)political in Transition Management: Interrogating Pathways towards Sustainable Change. *Journal of Environmental Policy & Planning*, 18, 568–584. https://doi.org/10.1080/1523908X.2016.1141672

Klerkx, L., Hall, A. & Leeuwis, C. (2009). Strengthening agricultural innovation capacity: are innovation brokers the answer?, *International Journal of Agricultural Resources, Governance and Ecology*, Vol. 8, Nos. 5/6, 409–438. https://doi.org/10.1504/IJARGE.2009.032643

Kohlbrenner, A. (2015). Sortir la pluie des tuyaux. Des débordements d'égouts aux nouvelles rivières urbaines : récit d'une expérience citoyenne. Urbanités.

Laimé, M. (2010). Toulouse-Bruxelles : l'axe du mal de Veolia. Le Monde Diplomatique. Les blogs du " Diplo ". Carnets d'eau. Toulouse-Bruxelles : l'axe du mal de Veolia

Latour, B. (1993). *We Have Never Been Modern.* Cambridge (MA): Harvard University Press.

Latour, B. (1995). Moderniser ou écologiser ? A la recherche de la 7ème Cité, Paris : Presse de Science-Po.

Latour, B. (2018). Esquisse d'un Parlement des choses, *Ecologie et polique*, Editions du bord de l'eau, N ° 56, 47–64. https://doi.org/10.3917/ecopo1.056.0047

Lehmann, V. Frangioni, M. & Dubé, P. (2015). Living Lab as knowledge system: an actual approach for managing urban service projects?, *Journal of Knowledge Management*, 19 (5), 1087–1107. http://dx.doi.org/10.1108/JKM-02–2015–0058

Lewin, K. (1946). " Action Research and Minority Problems ". *Journal of Social Issues*, vol. 2 : 34–36. http://dx.doi.org/10.1111/j.1540–4560.1946.tb02295.x

Mahaut, V. (2009). L'eau et la ville, le temps de la réconciliation : jardins d'orage et nouvelles rivières urbaines. UCL – FSA/AUCE – Département d'architecture, d'urbanisme et de génie civil environnemental, Thèse de doctorat. Université Catholique de Louvain.

Manganelli, A., van den Broeck, P., & Moulaert, F. (2019). Socio-political dynamics of alternative food networks: A hybrid governance approach. Territory, Politics, Governance, https://doi.org/DOI:10.1080/21622671.2019.1581081

Manganelli, A. & Moulaert, F. (2018). Hybrid governance tensions fuelling self-reflexivity in Alternative Food Networks: the case of the Brussels GASAP (solidarity purchasing groups for peasant agriculture), *Local Environment, The International Journal of Justice and Sustainability* https://doi.org/10.1080/13549839.2018.1477745

Manganelli, A. (2020) Realising local food policies: a comparison between Toronto and the Brussels-Capital Region's stories through the lenses of reflexivity and co-learning, *Journal of Environmental Policy & Planning,* 22:3, 366–380, http://dx.doi.org/10.1080/1523908X.2020.1740657

McTaggart, R. (1991). Principles for Participatory Action Research *Adult Education Quarterly* 41: 168. http://dx.doi.org/10.1177/0001848191041003003

Mélard, F. (éd.) (2008). *Écologisation : Objets et concepts intermédiaires.* Bruxelles.: P.I.E. Peter-Lang.

Meyer M. Kearnes, M. (2013). Intermediaries between science, policy and the market. *Science and Public Policy*, 40 (4), 423–429. https://doi.org/10.1093/scipol/sct051

Meyer, M. (2010). The rise of the knowledge broker. *Science Communication.* 31 (1). 118–127. https://doi.org/10.1177/1075547009359797

Mouffe, C. (2004). Le politique et la dynamique des passions. Collège international de Philosophie. *Rue Descartes* 45–46 (3), 179–192. https://doi.org/10.3917/rdes.045.0179

Mouffe, C. (2010a). Politique et Agonisme. Collège international de Philosophie. " *Rue Descartes* "67 (1), 18–24, from http://www.jstor.org/stable/40979135

Mouffe, C. (2010b). Communisme ou démocratie radicale ", *Actuel Marx* 2 (48). https://doi.org/10.3917/amx.048.0083

Nalpas, D (2014), La démocratie technologique peut-elle réinventer la démocratie ? Etude en Education permanente. Inter-Environnement Bruxelles, from https://www.ieb.be/La-democratie-technologique-peut

Popa, F., Guillermin, M. & Dedeurwaerdere, T. (2014). A Pragmatist Approach to Transdisciplinarity in Sustainability Research: From Complex Systems Theory to *Futures.* https://doi.org/10.1016/j.futures.2014.02.002

Rancière, J. (2004). Introducing disagreement. Angelaki: *Journal of the Theoretical Humanities* 9 (3), 3–9. https://doi.org/10.1080/0969725042000307583

Scholl, C., & Kemp, R. (2016). City Labs as Vehicles for Innovation in Urban Planning Processes. *Urban Planning*, 1(4): 89–102. http://dx.doi.org/10.17645/up.v1i4.749

Stengers, I. et Drumm, T. 2013. *Une autre science est possible !* Paris : La Découverte.

Swyngedouw, E. (2011). Depoliticized Environments: The End of Nature, Climate Change and the Post-Political Condition. *Royal Institute of Philosophy Supplement* 69, 253–274. http://dx.doi.org/10.1017/S1358246111000300

Tandon, R. (1988). Social transformation and participatory research. Convergence, 21 (2/3), 5–14.

Université Libre de Bruxelles (Louise), OWS NV & IDEA CONSULT, 2018. " Étude de faisabilité d'une unité de biométhanisation en Région de Bruxelles-Capitale ". Pour le compte de Bruxelles Environnement.

Vanhuysse, S., Depireux, J. & Wolff, E. (2006). Etude de l'évolution de l'imperméabilisation du sol en Région de Bruxelles- capitale, Université Libre de Bruxelles, IGEAT, Brussels, Belgium.

van Mierlo B., Regeer, B., van Amstel, M., Arkesteijn, M., Beekman, V., Bunders, J., de Cock Buning, T., Elzen, B., Hoes, A.-C., et Leeuwis, C. 2010. " Reflexive Monitoring in Action. A guide for monitoring system innovation projects. " Communication and Innovation Studies, WUR; Athena Institute, VU

Vinck D., Jeantet A. (1995). "Mediating and Commissioning Objects in the Sociotechnical Process of Product Design : a conceptual approach", p. 111–129, from https://halshs.archives-ouvertes.fr/halshs-00273437

Vinck D. & Laureillard P. (1996). " Coordination par les objets dans les processus de conception ", p. 289–295. *Représenter, Attribuer, Coordonner.* Paris: CSI, Écoles des Mines, from https://hal.archives-ouvertes.fr/hal-00134434

Vinck, D. (1999). Les objets intermédiaires dans les réseaux de coopération scientifique. Contribution à la prise en compte des objets dans les dynamiques sociales. *Revue française de sociologie,* 40–2, 385–414. http://dx.doi.org/10.2307/3322770

Vinck, D. (2009). De l'objet intermédiaire à l'objet-frontière. Vers la prise en compte du travail d'équipement. *Revue d'anthropologie des connaissances.* Vol. 3, n° 1, 51–72. https://doi.org/10.3917/rac.006.0051

Velicu, I. and M. Kaika (2015). Undoing environmental justice: Re-imagining equality in the Rosia Montana anti-mining movement. Geoforum . https://doi.org/10.1016/j.geoforum.2015.10.012

Weithmann, N. Möller˙ J.N.,Löder, M. G.J., Piehl, S., Laforsch, C. & Freitag, R. (2018). Organic fertilizer as a vehicle for the entry of microplastic into the environment, *Science Advances* 4(4), 1–8. https://doi.org/10.1126/sciadv.aap8060

Whyte, W. F. (1991) *Participatory Action Research*, Sage, Newbury Park, CA. Maclean D., Saviotti P., Vinck D. (eds.). *Designs, Networks and Strategies.* Vol.2, Bruxelles: EC Directorate General Science R&D.

Wittmayer, J.M. & Schäpke, N. (2014): Action, research and participation: roles of researchers in sustainability transitions. *Sustainability Science* 9 (4), 483–496. https://doi.org/10.1007/s11625-014-0258-4

Wittmayer, J.M., Backhaus, J. , Avelino, F. Pel, B., Strasser, T., Kunze, I. & Zuijderwijk, L. (2019). Narratives of change: How social innovation initiatives construct societal transformation. *Futures.* 112.

Wilson, J. & Swyngedouw, E. (2014). *The post-political and its discontents : spaces of depoliticization, spectres of radical politics*, Edinburgh University Press.

Zitouni, B. & Tellier, C. (2013). Comment les corps techniques construisent la ville. *Brussels Studies.* Collection générale, 64. 1–18. https://doi.org/10.4000/brussels.1124

About the authors

Simon De Muynck Coordinator of the Urban Ecology Centre, Scientific collaborator of the Institute for Environmental Management and Land-use Planning (IGEAT), Faculty of Sciences, and Researcher at the Laboratory Landscape Urbanism Infrastructure and Ecology (LoUIsE), Faculty of Architecture La Cambre-Horta, Université Libre de Bruxelles, at the intersection of the research and associative worlds. He's currently working on urban political ecology and participatory sciences.

Dominique Nalpas is an activist and a member of the Brussels-based civil society. He has contributed in particular to the development of citizen sustainable neighborhoods, co-founded the General States of Water (EGEB) in Brussels and is contributing to the reflection and action on commons and commoning. His current centers of interest are to test new forms of technical democracy.

Authors' addresses

Simon De Muynck
282, Chaussée de Saint-Job, 1180 Uccle, Brussels
Belgium
simon.de.muynck@ulb.be

Dominique Nalpas
Rue du Collège 154, 1050 Ixelles, Brussels
Belgium
dominiquenalpas@gmail.com