State-of-the-art report for co-creation approaches and practices with a special focus on the sustainable heating transition

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Itten, A.V.; Sherry-Brennan, Fionnguala ; Sundaram, Aarthi; Hoppe, Thomas; Devine-Wright, Patrick

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State-of-the-art report for co-creation approaches and practices

with a special focus on the sustainable heating transition

SHIFFT WORK PACKAGE 2 DELIVERABLE 2.1.1

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Anatol Itten[1]

Fionnguala Sherry-Brennan[2]

Aarthi Sundaram[1]

Thomas Hoppe[1]

Patrick Devine-Wright[2]

[1] Delft University of Technology
[2] University of Exeter

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Sustainable Heating: Implementation of Fossil-Free Technologies (SHIFFT)

SHIFFT is an Interreg 2 Seas project, running from 2019-2022, promoting cross-border cooperation between 4 European countries: The Netherlands, France, Belgium and The United Kingdom. It has been approved under the priority 'Low Carbon Technologies'.

Space and water heating represent a large fraction of overall energy consumption across the EU Member States, and around one third of carbon emissions. Dependence on fossil fuels has made the heat sector hard to decarbonise in at least three of the four Member States in the 2 Seas region. Further, between 65% and 80% of buildings across these four Member States that will exist in 2050 have already been built, often with fossil fuel heating systems and poor energy efficiency. There is an enormous potential to reduce CO_2 emissions in the sector by shifting to low carbon heating alternatives, but there remain many barriers to doing so.

The main objective of the SHIFFT project is to stimulate the adoption of low-carbon heating technologies in existing buildings. It will take multiple routes to achieving this through its three technical work packages (WP).

WP1 develops city strategies for four small to medium municipalities as well as producing general guidance for cities to make their own strategies for the move to low carbon heating. City strategies will be devised for the Belgian cities of Brugge and Mechelen, the Dutch city of Middelburg and the French city of Fourmies, with planning for each led by the cities as full partners in the project. These will inform a document offering guidance to other cities who want to devise their own strategy.

WP2 focuses on developing strategies for the fullest possible inclusion of communities in developing low carbon heating strategies at the local level. This co-creation process will inform the other WPs so that the views of building users are fully incorporated into decision making. We see it as essential to include communities to the fullest possible extent in decisions about the buildings in which they live, work and play. Partners including community facing energy group De Schakelaar (NL) will be working to incorporate communities in this WP.

WP3 concerns delivery of exemplar community low carbon heating projects; one installation of low carbon heating technology will take place in each of the four INTERREG 2 Seas Member States, with each build led by one of our project partners: Places for People (UK), Fourmies (FR), and Zorgbedrijf Rivierenland (BE). We will aim to capture learning from these developments and pass it on to the widest possible selection of stakeholders in the sector.

Technical support is provided by two universities, the University of Exeter (UK), acting as project coordinator and Delft University of Technology (NL) and by CD2E (FR). These organisations will support city and other partners as regards technology, policy and co-creation of projects with communities.

The specific and measurable objectives of SHIFFT are to assist in the development of city low carbon heating strategies, both within the project and by demonstrating routes to strategy development for other municipalities, to develop exemplar low carbon retrofit heating projects and to work with others to pass on the lesson learned within the project to maximise the value of the lessons learned.

SHIFFT targets local and regional authorities as a primary target group with the purpose of influencing communities, homeowners, districts, cities, energy consultants, energy service companies and SMEs to consider a wider set of heating solutions than is currently the case.

Executive summary

"If you want to go fast, go alone. If you want to go far, go together." (African proverb)

The transition to sustainable heating systems (e.g. district heating systems, heat pumps, solar thermal systems, in combination with thermal insulation) is an essential element of an effective response to climate change. But it requires more than technological innovation alone. It entails a system-wide transition that covers both technical and social components, and addresses the supply, distribution, and demand sides of local energy systems.

Heating is a fundamental aspect of the human need for shelter in our climates, and therefore a significant social, cultural, economic, and psychological phenomenon as much as technological. Heating reaches far into people's homes and private lives, not just workplaces or leisure contexts, involving everyday habits and negotiations between building occupants and family members. Heat is a cultural service that cannot only be seen through the lens of economic efficiencies and return on investments. Providing heat is a key aspect of social life (e.g. entertaining guests) and seasonal cultural practices (e.g. wintertime cosiness). In the transition to sustainable heating, homeowners and local communities therefore form essential parts of the system. Their contribution to this transition by deciding to adopt sustainable heating technology for their homes and buildings is key to making it happen and co-creation provides spaces for citizens to share what heating means to them and for stakeholders to build these insights into their programmes for change.

However, residents and home/building owners are generally considered hard to reach and persuade to make investments, and to let go of currently unsustainable heating systems and adopt those that are more sustainable. This matter is challenging for a myriad of reasons and cost is but one of them. Despite the urgency to lower carbon emissions there is currently a limited market demand for sustainable heating solutions, particularly among building/homeowners in (existing) dense urban areas. Given the urgency of climate change and pressing socioeconomic issues there is a need to develop, implement and test incentives that target home/building owners to make investments. One promising solution is co-creation with citizens and local stakeholders.

This report clarifies the different meanings for key terms used in co-creation by taking stock of the growing vocabulary used in different approaches to public participation: by defining and comparing different terms and how they have been used. The report describes the challenges, as well as the benefits, of co-creation as well as the importance of managing expectations, power relationships, and sharing responsibility.

Co-creation is an intervention which actively involves citizens and stakeholders in making decisions about issues that affect them. The benefits of co-creation, when done well, include helping to deliver sustainable heating solutions in a timely and efficient way, increasing a sense of empowerment and citizenship as well as contributing to building trust between stakeholders and urban communities. Through the process citizens and stakeholders share power and responsibility with a view to improving the social legitimacy of decision-making. This means working together in equal, reciprocal and caring relationships to create a more holistic understanding of context and exploring shared responsibilities for energy transitions.

A range of relevant case studies and good practice are presented that illustrate how co-creation can be used in practice. There is an in-depth section on the best way to organise and manage co-creation for heating transitions including how to identify stakeholders and their motivations, deciding when to engage citizens and how to embed decision-making processes within co-creation.

The report outlines some of the different methods that can be used in co-creation including workshops, storytelling, online tools and participatory value evaluation which provide opportunities for exploring the abilities and capabilities of those involved and help decide who is responsible for making decisions.

The process of co-creation brings citizens and stakeholders together in the early stages of project development through a collaborative process, and the report describes how this is done. During these stages time is taken to ask citizens and stakeholders what they want or need from the process and to listen to these suggestions. Without doing this, there is the risk of proceeding with a project based on incorrect assumptions about what people want or need and neglecting the value of local knowledge. For example, there is evidence that, even when sustainable heating technologies are voluntarily installed in homes by the occupants, they do not necessarily replace previous fossil fuel heating, but complement them, leading to systems installed that are far from optimal. These would not be predicted or expected by technical experts but show how crucial engagement is for effective heat transitions, even when dealing with willing volunteers, before, during, and after installation phases.

The report also describes how co-creation can be assessed, monitored, and evaluated. Organising and managing co-creation are commitments that require thorough preparation, time, and inclusion. In-depth assessments support stakeholders and citizens in making informed decisions about the time, energy, and resource investments necessary for co-creation.

Further exploring the process of co-creation, the report details how embedding co-creation in ongoing planning and formal decision-making processes is ideal for enhancing impact and can help reduce disruption and cost where, for example, new infrastructure might be installed as part of broader neighbourhood developments rather than as a standalone project. An increased awareness of complex and sensitive issues needs to be balanced against the flexibility and practicality of the process and keeping co-creation running closely alongside decision-making helps reduce the potential for conflict.

Using co-creation in sustainable heat transitions means recognising, respecting, and responding to views of the world from the perspective of others. Taking in broader perspectives during heat transitions helps find the necessary balance between competition and cooperation, between self-interest and the interests of others in order that efficient and integrative solutions, that may not have been obvious at the start of the process, can be discovered and put to work. For these reasons, adopting a co-creation process to achieve rapid and extensive transformations to heating systems is necessary, not just an optional extra.

Contents

Abbreviations

Abbreviation	Meaning	Category
AR-TUR	Centre for Architecture, Urbanity, and Landscape	Organisation
CO_2	Carbon dioxide	Environment
DH	District Heat	Technology
DHS	District Heating System	Technology
DSO	Distribution System Operator	Organisation
FAQ	Frequently Asked Question	Information
FIT	Feed-in Tariff	Financial Incentive
ICT	Information and Communications Technology	Technology
n.d.	no date	Referencing
NGO	Non-governmental Organisation	Organisation
PAR	Participatory Action Research	Research
PVE	Participatory Value Evaluation	Research
PVT	Photovoltaic Thermal	Technology
SEE	Schools as Energy Embassies	Programme
TEC	Traais Energie Collectief	Organisation
UK	United Kingdom	Geography
USA	United States of America	Geography

1. Introduction

1.1. Introduction

This report was conceived to inform local policy makers and stakeholders about what co-creation means, and offers **a guideline how it can be applied to develop and implement sustainable heating strategies**. Not only does it focus on the neighbourhood level, it also addresses strategy and policy-making at the city level. To present co-creation in a useful way to sustainable heating strategy, relevant heating technologies are also addressed, and **co-creation approaches are presented that presume the implementation of these particular technologies**.

The transition to sustainable heating systems (e.g. by utilising district heating systems, heat pumps, solar thermal systems, in combination with thermal insulation) is an essential element of an effective response to climate change. It requires more than technological innovation alone, and involves a system-wide transition that covers both technical and social components, and addresses the supply, distribution, and demand sides of local energy systems. A key part of this transition is the demand side of energy supply chains. In the transition to sustainable heating, homeowners and local communities form essential parts of the system. They make an essential contribution to this transition by deciding to adopt sustainable heating technology for their homes and buildings. However, whereas some homeowners have already become 'prosumers' it is generally hard to reach and persuade homeowners to make investments, to let go of currently unsustainable heating systems, and adopt more sustainable ones. This matter is challenging for a myriad of reasons, and cost is but one of them (Frederiks et al., 2015). Despite the urgency to lower carbon emissions (while also lowering cost for energy consumption), there is currently still limited market demand for sustainable heating solutions, particularly among home and building owners in (existing) dense urban areas.

A comfortable home. Source: Les Triconautes on Unsplash

Several interventions – from technical to economic and social ones – have been designed and implemented with the aim to increase end user demand of sustainable heating solutions. In city districts and neighbourhoods an intervention that is of particular interest is the co-creation of sustainable heating solution strategies with local communities. In contrast to traditional policy-making processes, co-creation engages and empowers local communities and allows them to co-design or even co-decide the planning and implementation of sustainable heating strategies. Compared to conventional approaches, co-creation offers multiple benefits. It particularly addresses the perceptions and needs of local communities and seeks to learn what motivates members of these communities to adopt sustainable heating. It also reveals and seeks to address – or even solve – actual and perceived barriers, for example information, established habits, perceived complexity, financial needs – and to identify and co-create the conditions, requirements, facilities, and incentives that communities need to increase the likelihood that they legitimise sustainable heating plans, make investments, and adopt sustainable heating technology.

In this report we present theory and good practice of co-creation in relation to sustainable transitions and specifically to adoption of heating technology. The report presents an introduction to co-creation, participative decision-making, and related concepts. Not only does it cover state-of-the-art in co-creation, it also presents state-of-the-art and good practices in sustainable heating practices with citizen and community energy involvement. To illustrate co-creation and related concepts, tools and approaches the report provides a number of illustrative examples that involve case studies from different European (4 Seas) countries, and countries outside the European Union. To assist policy makers and stakeholders the report also provided an overview of state-of-the-art tools, methods and approaches on how to engage in co-creation, in particular in relation to sustainable heating technology and the urban setting in which it is implemented. Finally, practical suggestions are offered on how to design a co-creation process involving citizens and local stakeholders, with suggestions on how to monitor and evaluate co-creation. To further assist readers the report also provides a glossary and FAQs for practical support.

The report is outlined as follows. In Chapters 1 and 2 we first present co-creation as a concept, we define it, present its meaning, and address what it is meant for. In Chapter 3 we address the state-of-the-art in the co-creation literature. Next, in Chapter 4 we address factors that influence co-creation, and provide pros and cons vis-à-vis its use. In Chapter 5 we present co-creative approaches in the context of sustainable heating systems at the neighbourhood level, in particular good practices. This includes examples of community energy involvement. Finally, in Chapter 6 we present ways to monitor, assess, and evaluate co-creation.

1.2. Defining co-creation and co-production

1.2.1. Importance of defining the growing vocabulary

In the last two decades, several small- and large-scale experiments to actively involve citizens and stakeholders in the work of national, regional, and local governments have become widespread. This has been accompanied by a renewed academic interest in the concept of co-creation since the last decade, which mostly builds upon work pioneered by scholars like Parks et al. (Parks et al., 1981) and Ostrom (Ostrom, 1975). The importance of co-creation in enhancing public service delivery was acknowledged in 2009 when Elinor Ostrom received the Nobel Memorial Prize in Economics for her work on the analysis of common (public) goods. In this work, Ostrom described how users and their

associations are crucial for enhancing the quality and/or quantity of the services related to these goods (Ostrom, 2009).

There has been a growing vocabulary associated with the increased awareness of involving citizens alongside the constantly changing demands and contexts for the provision of public services: bringing together citizens with public organisations to deliver the goods and services needed. Several terms describing the role of the public in processes of participation, governance and decision-making at different levels are identified in the academic literature: social innovation, co-creation, co-production, volunteering, co-governance, co-management, new governance, co-innovation, collaboration, participatory governance and collaborative governance (de Geus and Wittmayer, 2019).

It is important to demarcate the concepts that lie behind the usage of each of the terms, because doing so not only provides clarity on the role of the citizens and public organisations but also on the amount of shared responsibilities.

1.3. Co-creation

1.3.1. Definition

Defined as the involvement of citizens at the co-initiator or co-design level (Voorberg et al., 2015). Another often cited definition is that 'co-creation is the active involvement of end-users in various stages of the design, production, deployment and testing of public services or goods and processes' (Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004). It is important to clarify the use of the term 'citizen' in the first definition, to emphasise that co-creation is interested in the process where ordinary citizens take over the tasks traditionally delegated to public organisations. The term citizen therefore excludes private organisations and other local stakeholders. Citizens are also distinguished from end-users in this context, as the latter term can include private organisations and companies. Co-creation embraces the diversity of views, constraints, and knowledge sharing that sustains the ideation of new scenarios, concepts, and related technology.

1.3.2. How

Co-creation considers citizens as a valuable and critical partner in public service delivery (Baumer et al., 2011; Bovaird, 2007; Cairns, 2013; Meijer, 2012).

Citizens as co-initiators. Here the citizen is represented as the initiator and local government as an actor that follows. A good example pertains to the case when citizens took it upon themselves to initiate restoration of monuments when Naples was opened as a historical centre ((Rossi, 2016).

Citizens as co-designers. Although often enabled by local government, citizens can directly participate in designing how (public) services are to be delivered to them. For example, when citizens co-decide about the design and maintenance of outdoor recreation spaces – like parks – upon being invited by the local government (Wipf et al., 2009).

1.4. Co-production

1.4.1. Definition

Co-production concerns a mix of activities where both public service providers and citizens contribute to the implementation and/or provision of public services (Ostrom, 1996). Co-production can include different levels of autonomy between public administration and citizens which means it is not always the case that they synchronise their efforts. More recently, (Voorberg et al., 2015) define co-production in a fashion similar to that of co-creation by examining the roles that it imagines for citizens in public service delivery. It is worthwhile to mention that while both co-creation and co-production consider citizens as invaluable partners in public service delivery (Baumer et al., 2011; Bovaird, 2007; Cairns, 2013; Meijer, 2012), there is no explicit difference in the degree of involvement that each envisions for citizens in the process of delivery (Voorberg et al., 2015). In summary, co-production is considered as the involvement of citizens in the co-implementation of public services, while co-creation envisions the roles of citizens as co-initiators and co-designers.

1.4.2. Division of roles

Citizen as co-implementer: For example, the participation of citizens in efficient garbage disposal services of a municipality, where citizens perform waste separation at the source. Here, citizens are actually involved in a substantial part of the implementation tasks (Ben-Ari, 2016). Public service delivering officials involved are seen as professionals, or 'regular producers', while 'citizen production' is seen in light of voluntary efforts by individuals and groups to enhance the quality and/or quantity of the services they use' (Parks et al., 1981; Verschuere et al., 2012).

Other terms closely related to co-production are classical volunteering, co-governance and co-management (see below for more detail).

1.5. Classical volunteering

Classical volunteering focuses on working to deliver benefit for others (Bovaird, 2007).[1] In contrast, co-production takes place within a context of professionalised service delivery and it concerns services the people involved use themselves.

1.6. Co-governance

1.6.1. Definition

Co-governance is the process where governments, at all levels, cooperate with citizens and private organisations in defining policies (Brandsen and Pestoff, 2006).

1.6.2. How

This may take place through public consultation or, for example, public participation through representation in policy meetings.

[1] http://www.vrdesk.com/raymond/A%20descriptive%20model%20of%20the%20consumer%20co-production%20process.pdf

1.6.3. Division of roles

Here, non-government actors are involved in making or evaluating policy proposals, but elected or appointed officials usually reserve their statutory rights to make the final decisions (Renn, 2006). However, it is preferable if these officials explain their reasoning behind their acceptance or refusal to accept a particular proposal presented to them.

1.7. Co-management

1.7.1. Definition

Co-management is the process where national and local government cooperates with private sector actors to manage public service delivery (Brandsen and Pestoff, 2006).

1.7.2. Division of roles

Here, non-government actors like private companies, NGOs, or think tanks co-determine along with the government how public services can be delivered and how resources can be distributed and managed in delivery processes. This is similar to public—private partnership models for construction of public infrastructure.

1.8. Similarities and differences between co-creation and co-production

1.8.1. Similarities

Role of citizens

Both concepts consider citizens as valuable partners in public service delivery (Baumer et al., 2011; Bovaird, 2007; Cairns, 2013; Meijer, 2012). A literature study where the terms co-creation and co-production are used in the title/abstract, identifies three types of citizen involvement; two types of involvement (citizen as co-designer or as co-initiator) occur at the early, defining stages of a project process, while co-production mostly involves citizen participation at the co-implementer level (Voorberg et al., 2015). It also shows that the difference between co-creation and co-production does not lie in the type of citizen involvement, as citizens are envisioned as co-implementers 50% of the time in both co-creation and co-production processes. The distribution across the co-designer and co-initiator types are also similar.

Origin

Both co-creation and co-production originate from the business administration domain (von Hippel, 1987). However, important distinctions have to be made to apply the concept in the public sector context where the end-users are typically citizens and public goods are involved. Table 1 shows where the usage of co-creation differs between public and private contexts.

Table 1: A comparison of co-creation in the private and public sectors

Co-creation (Private Sector)	Co-creation (Public Sector)
End-users participate as co-producers that take over specific activities in the production chain (Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004; von Hippel, 2007)	Citizens are identified as co-implementers. Citizens involved in delivering public service along with the authorised personnel for example: community policing, water management, etc.
End-users participate as co-creators whose experience with the product can be useful source of product and service innovation (learning from the customer) (Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004)	Citizens are identified as co-designers or co-initiators. Here, the authorised professionals collaborate with users of the public services/goods to ensure better quality or more effective governance

1.8.2. Differences

The main difference between the two concepts lies in the fact that co-creation puts more emphasis on citizen involvement as a virtue in itself (Gebauer et al., 2010). The implicit assumption that citizen involvement can be seen as an outcome in itself, without being looked at as a means to achieve increased effectiveness or satisfaction, is evident from many studies not mentioning an objective for involving citizens in the process. However, in other studies it was argued that the purpose of co-creation/co-production is simply the involvement of citizens (Lelieveldt et al., 2009). In many cases, this involvement of citizens was considered as a virtue along the likes of democracy, transparency, and accountability and its very inclusion in the process of public service delivery was perceived to be a goal. This lack of objectives for involving citizens in public service delivery does not contribute to conceptual clarity (Osborne and Strokosch, 2013). Since the relationship between the three types of citizen involvement also cannot be established empirically, it is therefore argued that the outcomes of co-creation and co-production remain as topics of further research (Voorberg et al., 2015).

In sum, the term ‘co-creation’ can be reserved to indicate those decision-making or policy-making processes with involvement of citizens as (co-)initiators or co-designers. Co-production is then considered as the involvement of citizens in the (co-)implementation of public services (Voorberg et al., 2015).

1.9. Public participation

Points that set co-creation/production apart from ordinary public participation:

- Ordinary public participation can include passive involvement of citizens and their reactions to public service – for example through surveys or public announcements (Ross et al., 2016). A model that is often referred to, when addressing the different degrees of citizen participation in public decision-making is the Arnstein’s ladder of citizen participation (Arnstein, 1969). With participation levels ranging from low (citizens being manipulated to providing data or support without full information) to high (citizen-control, where citizens assume full ownership of the process starting from planning to policy-formulation to implementation, for example in energy cooperatives). New models of participation have since then evolved to overcome the limitations

of the linear approach of Arnstein's model, such as the 'wheels of engagement' model based on Davidson's 'Wheel of Empowerment' (Davidson, S., 1998).

- Co-creation can be associated with the upper levels of Arnstein's ladder where citizens have more control and access to information. Co-creation, in contrast to ordinary public participation, involves spending time and resources to willingly participate in redistribution of resources and designing processes to improve the effectiveness of public service delivery (Devine-Wright, 2011).
- Co-creation involves the assumption that citizens contribute lay or local knowledge to a process of change, which alongside but not of lower status to expert knowledge is required to implement energy transitions (Devine-Wright, 2017).
- The public participation literature often looks at general acceptance of energy/technology, that often includes top-down approaches known as 'decide–announce–defend' (Devine-Wright, 2011).
- Co-creation involves adopting contradictory role expectations where each side is expected to willingly relinquish/willingly accept an increase or decrease in responsibility (Ewert et al., 2013).
- Co-creation requires an institutional setup and communication infrastructure along a process that involves parties at equal level (Davidsen and Reventlow, 2011), whereas public participation may often resemble the conventional top-down approach of public service delivery itself (Ross et al., 2016).
- Formal public participation procedures often refer to the legal affectedness of people, whereas co-creation can also refer to factual or sensed affectedness (Susskind and Cruikshank, 2006).

1.10. Community engagement

1.10.1. Definition

Community engagement concerns to work collaboratively with and through groups of people to address issues affecting the social well-being of those people (Fawcett et al., 1995; Scantlebury, M., 2006). The motivation behind involving citizens in public service delivery ranges from wanting to strengthen democratic practices to empowering citizens with a voice in policy choice to institutionalising the relationship between governments at all levels and citizens (Bishop and Davis, 2002; Head, 2007). Community engagement is like stakeholder engagement with the difference that it follows rather a continuous involvement into the communities of the affected (Head, 2007).

1.10.2. Differences

Community engagement and citizen participation differ across a range of relevant policy and administrative arenas. Arrangements that apply in health, for example, might be different from those found in education, agriculture, tourism, transport, the environment, defence, policing, and so on. These policy arenas will typically vary in terms of the openness or closure of group processes and the scope for various forms of citizen participation (Head, 2007). For example, some sectors like technology policy and defence maybe the preserve of a few tightly knit groups whereas, social policy involving healthcare and water management are more inclusive of more dependent actors.

- Aslin and Brown (Aslin et al., 2004) point out that, engagement requires a commitment (from citizens) to not just the process (of public service delivery) but also its outcomes and consequences. This deeper level of involvement expected from engagement implies that people may be consulted, may participate, or even be involved in the process without being engaged.

1.11. Stakeholder engagement[2]

1.11.1. Definition

In this process, governments engage stakeholders through a variety of forums, the most common of which are focus groups, panels, and roundtable meetings (Sanderson, 2001).

1.11.2. How

Governments usually draft a stakeholder map and engage with the most obvious parties that have an interest in the decision or enough power to block or delay implementation. Governments often consult stakeholders in developing strategic and operational plans (M.W. and T., 2000; Osborne and Gaebler, 1995).

1.11.3. Division of roles

The approach is typically still relatively top-down, as it is often within the government's ambit of control to choose to involve citizens in the process. It is essential to realise the accountability mechanism that underlies this process: governments may be using this consultation process to respond to demands for increased accountability and thereby placate stakeholders (Friedman and Miles, 2006).

1.12. Co-innovation

1.12.1. Definition

Co-innovation defines an innovation paradigm where new ideas and approaches from various sources are integrated in a platform. It originates from a corporate approach to generate new organisational and shared values. The core of co-innovation includes engagement, experience, and co-creation for value that is difficult to imitate by competition. The co-innovation platform is built on principles of convergence of ideas, collaborative arrangement, and co-creation of experience with stakeholders (Lee et al., 2012).

1.12.2. How

Innovation in the public sector rose from governments' needs to improve responsiveness of citizens towards services delivered to them in order to develop policies tailored to meet local and individual citizen needs. Approaches included improving interaction and communication between citizens and the government, reaching out to gauge public expectations and leveraging latest developments in information & communication technologies (Bason, 2010; Kaul, 1997; Mulgan, G. and Albury, D., 2003; Pinto, 1998). Bason (Bason, 2010) claims that one of the most important ways to face new challenges in governance is through co-creation of new solutions with citizens. Other ways include establishing partnerships with the private sector, civil society, and community-based organisations. This will not only foster innovation but also generate innovative solutions (Australian National Audit Office, 2009).

1.13. Co-creation for co-innovation

Co-creation, as a concept, is central to the process of co-innovation as is evident from Von Hippel et al.'s (Hippel et al., 2011) definition of co-innovation as a platform where new ideas or approaches

[2] https://www.tandfonline.com/doi/full/10.1080/01900691003606006

from various internal and external sources are applied differently to create value or experiences for all stakeholders including consumers. With societies, cultures, and technologies influencing each other in more and more complex ways today, it is no longer possible for an organisation (be it private or non-profit or public) to depend entirely on its internal competencies to develop services for continually changing environments. This is especially true for governments facing changing political and ideological landscapes along with imminent wicked problems of, for example, climate change or social inequality: wicked problems being those that are difficult to define and inherently unsolvable (Rittel and Webber, 1973). Sticking to traditional images of self-sufficient organisations is therefore becoming an impossible goal (Tapscott and Williams, 2006). Therefore, innovation through co-creation of value, whereby governments actively take steps to foster citizen value creation by endowing them with knowledge, information, and capacity to access and utilise these services. Co-creation opportunities should similarly be factored into the design of service provision processes (Alves, 2013)[3].

A community cannot be motivated to feel engaged in a theme which is not coming from the community itself (Cappellaro et al., 2019).

Empty chair next to heating. Source: Dominik Kuhn on Unsplash

Including a broader range of stakeholders and citizens in co-creation also means that change occurs at the organisation level. A particular approach that explores these organisational changes is social innovation. The focus here is on innovating structures and redrawing boundaries at an organisational level with the active participation of all constituent actors. This also includes stakeholders from the

[3] Co-creation and innovation in public services, May 2013, Service Industries Journal 33(7-8), DOI: 10.1080/02642069.2013.740468

private sector who are not direct consumers of public services intended for citizens. In order to facilitate social innovation the role of the state is seen as an important actor in the need to develop new institutional settings. Both co-creation and co-production seek to innovate how end-users are recognised and can participate in improving public service delivery. This process of recognising and working with citizens and other stakeholders can change the social framework underlying existing relationships between public service providers, stakeholders, and citizens. Even though co-creation and co-production mainly focus on the end-users or intended beneficiaries of the public service, they also focus on the newly imagined roles of the end-users in which they actively contribute to different stages of service provision in a manner that mutually benefits both sides and which can influence a broader focus shift at the structural level.

1.14. Visualisation of co-creation research

The fact that co-creation in sustainability transition is a relatively new field of research can be best explained through visualising the results (of a combination) of search terms in scientific databases. In the following we present a keyword "extraction"[4] on articles matching specific co-creation themes in renewable energy, climate, sustainability, and environment related studies. The extraction brought something more than 1000 documents. A search specifically conducted on co-creation in sustainable heating transition produced less than ten results. By using the program Vos viewer (developed by Van Eck and Waltman), we were able to visualise a network analysis related to the frequency of keyword co-occurrence in papers per year (Figure 1), as well as the regional affiliation of the papers per region per year (Figure 2). In Figures 1 and 2, the size of the label and the circle of around it are determined by number of occurrence of the label. Moreover, each link in between labels has a particular strength. This is determined by the number of publications in which two terms occur together. The closer two concepts are located, the more frequently they are mentioned together in the literature.

[4] The terms co-design and co-production were added to the overarching theme co-creation, to ensure all parts of the definition are portrayed in the search results. Every study selected should contain one of these three terms, either in the title, the abstract or on the keywords. To reduce the article in the database to those relating to citizens-government relations the following two groups, the actors and their actions were added with the AND syntax (citizens; stakeholder; community; cooperative; government; public; policy) as well as (participation; engagement; deliberation; gamification; negotiation). The extraction brought about 1,003 documents, in the time range of 1960–2019, as far back as the database Scopus could provide. All results for each search combination were retained, while duplicates across search term combinations were removed from the final pool of documents.

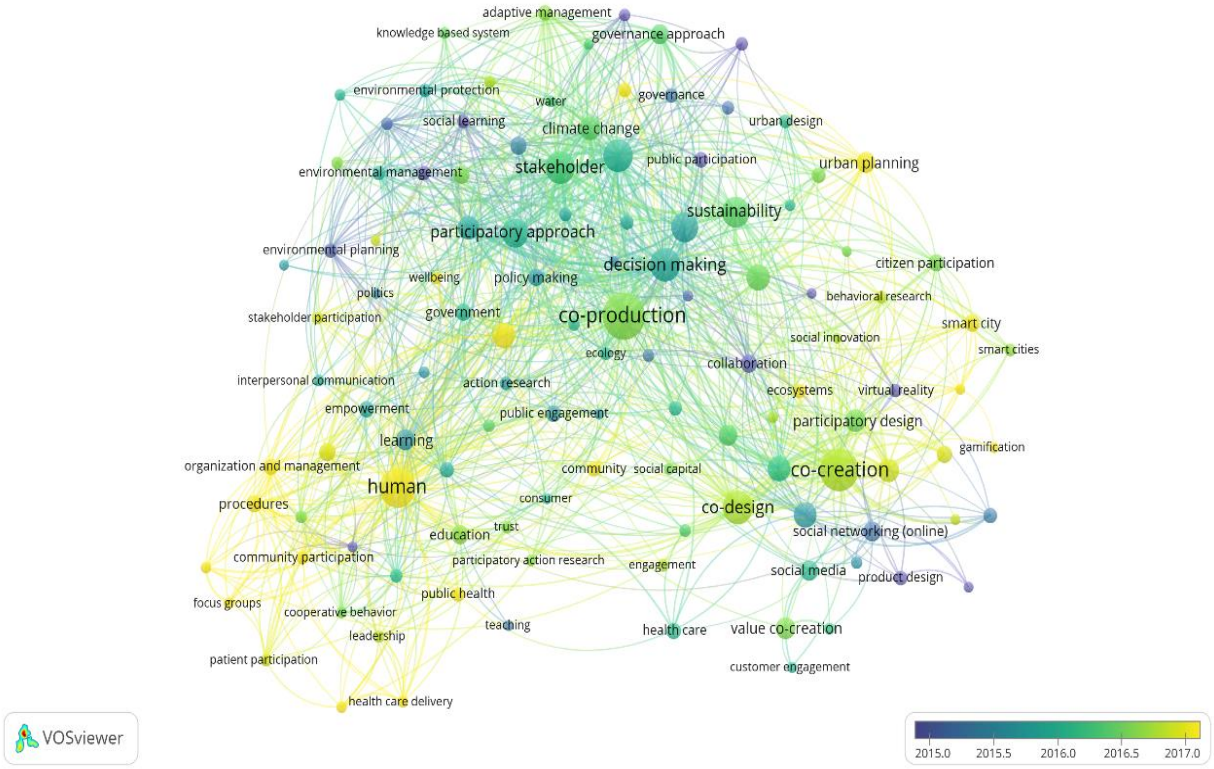


Figure 1: Frequency of keyword co-occurrence in papers per year

The network analysis of the co-occurrence of the key words is first of all a confirmation that co-creation and co-design are in closer proximity than co-production. Moreover, to some extent there is a clustering of themes like social innovation, collaboration, value co-creation that has a stronger relation to co-creation, than stakeholder participation, governance, and policy-making. The latter cluster has a more established connotation in climate change, environmental protection, and sustainability related papers. There is further a third cluster of human centred research, that apparently a strong network of learning, community, and trust, which are central ingredients to the forming of social capital and public health.

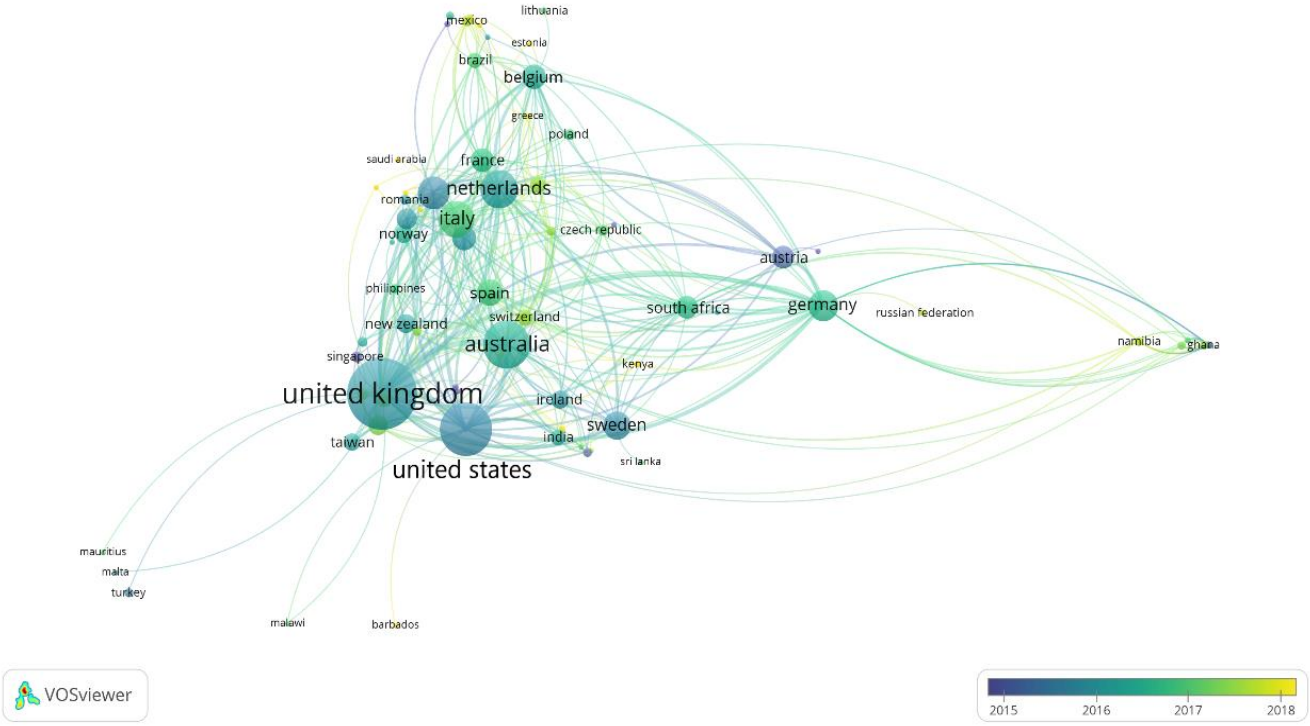


Figure 2: Regional affiliation of the papers per region per year

The regional affiliation of the papers, respectively of the authors reveals that co-creation has a strong western, and particularly UK, research focus (see Figure 3).

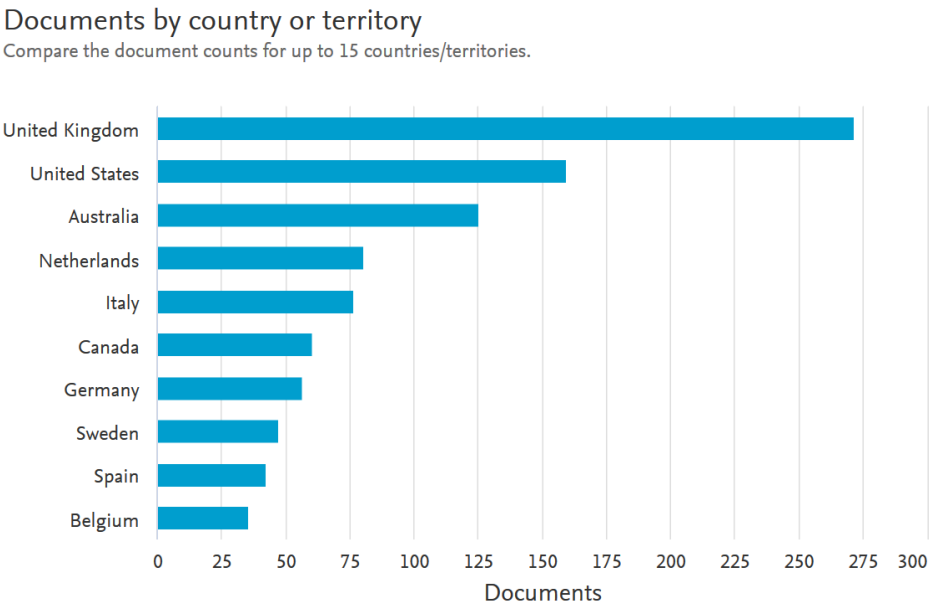


Figure 3: Publications on co-creation classified per country

Lastly, as can be seen in Figure 4 the majority of the published papers stems from in between 2012–2019, which means that co-creation in various sustainability transformations is a relatively recent studied phenomenon. Reasons can be speculatively related to the upcoming of new co-creative forms such as energy communities and urban Living Labs in the late 2000s, the financial crisis, which reduced financial means to govern and stimulate the transition (thus increasing the need for shared, collaborative efforts), or the increasing protest for climate action and against renewable energy infrastructure. In every case, co-creation has gained more attention in research and practice throughout recent years.

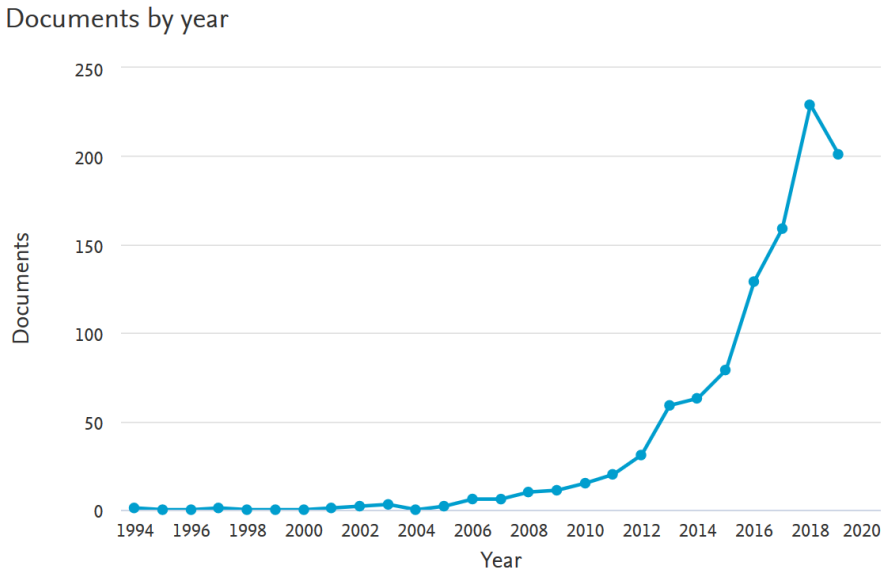


Figure 4: Publications on co-creation per year

2. What co-creation is

2.1. What is co-creation?

To summarise, combining the definitions of the previous section, co-creation at its simplest is generally taken to mean:

Citizens **and professionals sharing power and responsibility to work together in equal, reciprocal, and caring relationships** (Noreen Blantulet, n.d.).

And woven into this definition is the assumption that:

Citizens are involved as co-initiators and/or co-designers of the product or service.

This assumption specifically considers co-creation in a planning and development framework where there are several stages. For example, new services or technologies evolve in several stages, i.e.:

- initiation;
- design;
- implementation;
- evaluation.

Depending on the technology or service being developed, co-creation generally removes citizens from the implementation part of the process, focusing instead on initiation and design. However, this is dependent on three factors:

1. which technologies are being developed;
2. where the technologies will be used;
3. which stakeholders are involved.

In addition to considering these factors, getting citizens and professionals to work together is important in co-creation to not only **remain focused on outcomes** but also for the process itself **to explore how sharing power and responsibility can improve public services or technology design and development**.

Sharing power is an important aspect of co-creation which is intended to help **build trust** between people involved in the process. This feeds into shared decision-making and increases understanding of what matters to people.

2.2. Moving beyond existing boundaries

Co-creation challenges the traditional separation of culture, values, emotion, and politics from facts, reasoning, and objectivity (Jasanoff, 2004). Embracing collaboration through co-creation processes enhances citizen participation and engagement which helps looks outwards beyond the academy, for increasing the impact of academic research, and, for stakeholders, helps move perspectives past existing silos. Technological systems, societies, and cultures are deeply interconnected which means that no technological system, society, or culture can exist or be understood without acknowledging

connection with the other (Stephens et al., 2008). Co-creation therefore aims to gain a more holistic understanding of context as a means to explore shared responsibilities for energy transitions.

2.2.1. Co-creation as prescriptive

There are many different ways of defining co-creation, but one in particular highlights its descriptive/prescriptive characteristic (Lovbrand, 2011) that helps to understand why particular approaches and methods are used in co-creation processes. Co-creation as prescriptive takes a normative perspective that co-creation per se improves science–society relations. This aspect contributes to raising awareness and building evidence which:

- supports the benefits of engaging widely;
- opens the process up to different stakeholders and non-researchers;
- maintains a broad perspective on which issues of significance have validity in the process of co-creation.

2.2.2. Co-creation as descriptive

Co-creation as descriptive builds on the prescriptive aspect by defining how we use our knowledge of the world to enable us to be in the world in a particular way. It sees community members as 'experts of their own reality' (Ambole et al., 2019). Co-creation therefore seeks to reveal, explore, and understand the worldviews and perceptions held by different stakeholders, which may be currently unknown to researchers, in order to discover:

- what is important to whom;
- how the knowledge and experiences of others shape how they live;
- how citizens and stakeholders may be affected by changes to their immediate environment; for example, through the introduction of a new technology.

2.3. Why use co-creation?

Co-creation at its core works with a range of stakeholders and citizens with a view to providing robust evidence that informs:

1. policy;
2. technology development and implementation;
3. service delivery.

Research has looked at which aspects of research increase the use of research evidence by policymakers (Oliver and Cairney, 2019). Several aspects were found to be important including the availability, clarity, and reliability of research evidence, and co-creation, collaboration, and building relationships. The research also found that policymakers made use of more informal local data and tacit knowledge as a source of information, which is why co-creation includes an exploration of this knowledge. Combining the viewpoints of multiple stakeholders enhances the research evidence base and its applicability in policy development and implementation.

2.3.1. The issue is not the issue

In the context of co-designing sustainable energy solutions in developing countries, research has described how contrasting priorities in multi-stakeholder engagement raised important issues for

research and the evidence it provided to policymakers. In this study, the intention to create a supportive sustainable energy policy was found to be entwined with other priorities, such as health, housing, and gender (Ambole et al., 2019). This was an unexpected finding which the research found needed to be addressed in the development of a sustainable energy policy. The co-design approach used in this research indicated that policy options needed to be considered in 'bundles' whereby sustainable energy solutions could be delivered but only in conjunction with increased access to alternative energy services, efforts to reduce energy-related health impacts, and programmes to stimulate entry of the urban poor into energy businesses. In cases such as these where community value systems and realities are recognised, research has found that, through co-creation, a greater focus on topics needing attention leads to solutions being developed that are more likely to be adopted (Yang and Sung, 2016).

The multi-stakeholder environment of co-creation brings together groups of people whose expertise can be calibrated within the group and which avoids potential risks, such as bias, that can arise from research conducted with homogenous groups (Sutherland and Burgman, 2015). Working in this fashion also increases the accuracy of evidence generated by research as researchers work with, and help solve the problems of, people who are 'not like them' (Saunders, 2018). Furthermore, involving a wider group of people in discussions about technologies that may affect them, can lead to a collaborative resolution of key issues, and build a sense of trust between stakeholders where purpose and values become aligned (Saunders, 2018).

Co-creation can therefore be understood as a normatively and ethically desirable process which aims to improve the social legitimacy of decision-making by:

- opening up to new audiences;
- including and empowering citizens;
- increasing engagement with diverse stakeholders;
- working towards greater collaboration and resolution of key issues (Cliquet et al., 2010; Devine-Wright and Sherry-Brennan, 2019; Flinders et al., 2016).

There is no one-size-fits-all method used in a co-creation process. For example, co-creation may mean bringing more people 'around the table' than first imagined and by thinking more broadly about who is affected by the technology (Ambole et al., 2019).

Co-creation has been chosen in this context as a process which has been seen to enable change, permit stakeholders to do what they're best at, and better respond to stakeholders' needs (Camden et al., 2015).

2.4. Obstacles in co-creation

Despite all the positive effects, impacts, and outcomes of co-creation, there are many potential barriers and side-effects that can disrupt, distract, and potentially disempower stakeholders and citizens involved in the co-creation process. For example:

- There is little consensus on what co-creation actually is, which runs the risk of overlooking or side-stepping the contexts and agendas that gave rise to co-creation as a practice of engagement in the first place (Fransman, 2018).

- There is a lack of evidence on how to monitor and evaluate co-creation processes and outcomes as well as a lack of evidence on the impact of co-creation, such as may be seen in terms of changes in behaviour, policy, and technology development or integration (Gagliardi et al., 2016).

Each step of the co-creation process therefore has the potential to become a barrier to its uptake, process, commitment, and outcome.

2.5. The 'costs' of co-creation

There are a variety of 'costs' of co-creation (Flinders et al., 2016):

- practical costs of administration (including the input of staff over time);
- professional, reputational costs to stakeholders and researchers as independence and credibility may be brought into question;
- having to take time away from work or being co-opted into the agenda of others.

A broad review of co-creation practices and outcomes has identified three "critical risks" and two "limits" of co-creation.

2.6. Critical 'risks'

There are three critical risks in co-creation:

1. expectations;
2. power;
3. values.

2.6.1. Managing expectations

The first critical risk – expectations – is due to the multi-stakeholder nature of co-creation which means that expectations need to be managed. This is because different stakeholders not only have different agendas and definitions but can also hold different expectations of particular outcomes which contrast with perceptions held by other stakeholders. In the literature this has been referred to as the 'expectations gap'. This is when the expectations a stakeholder brings with them into the process are not met. Throughout the whole process of co-creation, expectations need to be managed.

2.6.2. Power

The second critical risk in co-creation addresses a different dynamic which moves power from one stakeholder to another. This can be shifting power either in terms of resources or in terms of knowledge. An unequal shift in power also carries the risk of disempowering citizens and stakeholders, especially if their involvement in the co-creation process carried an expectation of equality.

2.6.3. Values

The third critical risk refers to stakeholders' and citizens' aims and goals, and the ways (public) values are embedded in them. This is simply that, 'the timescales, pressures, politics and pressures of [stakeholders]... may not be shared by communities' (Durose et al., 2013). For example, academic stakeholders may value intellectual esteem and publication; industry stakeholders may value product design, development, and installation; and individual citizens or communities may value income generation or protecting the local environment.

Contrasting values may result in tension between all participants in co-creation, not least from the potential conflict around 'whose knowledge is best'. There may also be concerns around legitimacy which contrasts the value of different types of knowledge, for example knowledge derived from academic research and knowledge derived from personal experience (Fransman, 2018). Fundamentally, co-creation challenges existing social norms and roles, which can create conflict before anything 'co-creative' has even been done. In this sense, co-creation can present a difficult context as it challenges:

- existing social hierarchies;
- professional incentive structures;
- cultural assumptions (Flinders et al., 2016).

2.7. Critical 'limits'

There are two 'limits' of co-creation":

1. validity;
2. pragmatism.

2.7.1. Validity

The first 'limit' of co-creation means finding out what validity means. This can be done by asking, 'What do we mean when we say that a fact or opinion is valid?' (Flinders et al., 2016). In co-creation, stakeholders and citizens offer multiple perspectives. Those stakeholders guiding the process itself are most likely to shape the questions being asked and, therefore, how participants respond. It is also possible that these stakeholders have specific outcomes in mind (Mosse, D., 2001). There is therefore the risk that the boundaries of co-creation is defined *before* having consulted with those who may be impacted by it. This means that stakeholders in this position are playing the role of advocate rather than maintaining a more objective position (Orr et al., 2012).

2.7.2. Pragmatism

The other 'limit' concerns pragmatism. All co-creation projects have limits (e.g. funds, time) and there is, by definition, a limited capacity for co-creation. All stakeholders need to decide on answers to these questions:

- What is "good enough" to be acceptable?
- What can be achieved against the reality of practical limits?
- What compromises have to be made?
- Which decisions may be sub-optimal to the process?
- What effects would sub-optimal decisions have on the co-creation process and outcome?

Co-creation also carries (in connection with the expectation gap) with it the risk that stakeholders may expect researchers or stakeholders such as local government to provide the 'right' way or method, providing details on 'what works'. However, co-creation is a far more complicated space than it might at first appear. Co-creation can be a 'slow' process, one that can be difficult to initiate and sustain, and can lead to options or outcomes that are neither expected or desired (Ambole et al., 2019).

These are serious claims both for and against the value of co-creation. On the one hand, the challenge for any stakeholders, researchers, and citizens brave enough to embrace co-creation requires a commitment to what can be seen as an unknown, ill-defined, poorly evaluated process that carries with it no guarantee of success. But, on the other hand, the normative rationale for involving people in the design of their own futures can be seen as imperative for empowering and legitimating the rights of citizens to participate in shaping their worlds. Co-creation requires careful forethought and the seeking of a delicate balance to reap the full benefits offered.

2.8. Enabling or preventing success in co-creation

Taking the negative aspects of co-creation into account provides us with a starting point from which to design a process that enables, rather than prevents, successful outcomes. Co-creation requires a deeper, closer look at all stages within any engagement process, even those that may have previously been taken for granted. Three examples here give a brief idea of potential challenges that may need to be addressed in the research.

1. **Working in alternative social structures**. For example, co-creation has a potentially disruptive nature. Stakeholders need to be mindful of reinforcing hierarchical social structures, which co-creation aims to dismantle. This can happen when the significance of local knowledge is determined by those setting the research agenda as they decide which local knowledge is relevant. This reinforces a top-down structure disguised as a participatory practice (Mosse, D., 2001).
2. **Awareness of different local knowledges**. Local knowledges need special attention. This is because they are created and communicated by different groups who compete for dominance of their particular flavour of local knowledge. Participation in a co-creation process is a way of groups seeking legitimacy for their particular way of seeing the world (Kothari, U., 2001).
3. **Overriding existing decision-making processes**. Co-creation may also be used as a means to override existing, legitimate decision-making processes (Cooke, B. and Kothari, U., 2001). Getting to **know and understand how decisions are already made**, how they are influenced, and which stakeholders are involved is one way of addressing this issue.

3. State-of-the-art co-creation practices and case studies

Neighbourhood construction. Source: Scott Blake on Unsplash.

As the previous sections have shown, a more collaborative involvement of citizens plays an increasing role in many municipal attempts towards sustainable transitions. This reflects a departure from a deficit model[5] of public participation or a 'decide–announce–defend' approach towards engaging citizens in a more open-ended and equal status process of decision-making (Horsbøl, 2018). The notion of co-creation and co-production has gained importance as a way of organising citizen involvement (Verschuere et al., 2012; Voorberg et al., 2015). This underlines that citizens are necessary partners in pinpointing critical opportunities in their communities and generating creative ideas for solving multiple challenges at once.

Because terms like "co-creation" or "co-production" still leave much room for interpretation in practice (Horsbøl, 2018), this section provides **an illustrative selection of co-creation cases** and elements in the renewable energy, low carbon and built environment sectors (see Table 2 for summary of case studies). The cases have a twofold structure:

1. The first part traces the process of co-creation. Cases that highlight critical moments during collaborative sustainable transitions have been selected. This process starts with bringing a **diverse set of stakeholders together and drafting common rules and visions** and progresses

[5] The deficit model, which is also referred to as the "public education model," works from the premise that only experts or policy makers are able to grasp the full complexity of public policy making, rather than ordinary citizens. This notion leads to an erroneous assumption about the production of legitimate knowledge.

towards developing neighbourhood ambassadors and revitalising community life towards dealing with potential upcoming conflicts.

2. The second part focuses on **specific groups involved in sustainable transitions**. Different lessons from collective models such as energy communities are presented as well as low-income communities who are less active in energy transitions.

The cases also describe what is uniquely related to a particular case study and what is transferrable. A lot can be learned from past co-creation cases such as improved results, due processes, or lessons from failure. A summary of all cases states what worked and what did not work. In this balanced learning about the process of co-creation, and more clarity for the reader on how co-creation in sustainability transitions has already been applied in practice, is provided.

Table 2: A summary of case studies

Case	Location	Period	Subject	Co-creation highlights
Process-focused cases				
Energy avantgarde	Saxony-Anhalt, Germany	2013–2017	Co-designing the necessary technical, economic, sociocultural, and political changes for establishing a fully integrated regional energy system	• Bringing a diverse and fragmented set of stakeholders together • Creating a common narrative
Natural gas-free neighbourhoods	Delft, The Netherlands	2018	Co-developing a document for the city council for the city heat plan	• Agreeing on common rules • Focusing on recognition and community building around the gas transition
Schools as energy embassies	Utrecht, Amsterdam, the Netherlands	2017–2019	Co-creating visions and actions around sustainability by which schools collaborate with local stakeholders	• Using schools as neighbourhood hubs • Inquiry and design-based learning • Education for sustainability
Neighbourhood engines	Kempen region, Belgium	2018–2019	Co-generating knowledge on how to renovate homes in a circular and sustainable way	Converting neighbourhood capital in the form of people, tools, and resources into added value

The Oberlin project	Oberlin, Ohio, USA	2011–2015	Transformation and revitalisation of the entire town of Oberlin by resolving environmental degradation and economic decline using co-creation	Local knowledge institutions as frontrunners dedicated to co-creating societal transformations
Heat transition conflict resolution	Freiburg, Germany	1997	The municipal strategy of efficient district heating systems (DHS) clashed with the citizen-driven approach of reducing heat demand	Joint fact-finding process to resolve the most controversial issues
Group-focused cases				
Collective energy communities				
Traais Energiecollectief	Drimmelen, the Netherlands	Since 2018	Co-developing a district heating system	Innovating ways to extract heat
Meer Energie	Amsterdam, the Netherlands	Since 2015	• Co-developing a DHS • Focusing on circularity by using excess heat	Reducing costs through coordination with other maintenance projects
Thermo Bello	Culemborg, the Netherlands	Since 2008	Co-operating a DHS	Strong community building, with members taking extra efforts to be inclusive
Eno Energy	Eno, Finland	Since 1992	Co-operating a district heating system	Identifying converging motives among forest owners and supporting their ideas to implementation
Low-income communities	Portland, USA	Since 2013	Co-designing an ecodistrict by defining sustainability as an anti-poverty strategy	• Creating co-benefits such as employment opportunities • Recreational improvements were done with respect to the local cultures

Tool-focused cases				
EBO Consult	Copenhagen, Denmark	Since 2009	Community energy cooperative managing a DHS and expanding it by persuading households connected to a natural gas grid to switch to a DHS connection	Key steps involved: • a district heating 'package' • an instrument to help customers save energy • the customer journey, to unburden householders who switch from conventional gas to collective district heating
DampBusters	Bristol, UK	2015	Collective design, data gathering, and problem solving in damp homes	High activation and commitment either due to their involvement with the subject matter, i.e. they live in damp homes, or their interest in creating change through co-design and using technology
Participatory value evaluation (PVE)	Utrecht, the Netherlands	2019–2020	Using PVE, a novel online tool, the municipality gave residents the opportunity to give advice on different strategies for making 22,000 homes natural gas-free by 2030	The low barrier to participation in PVEs makes participation accessible to a larger group of citizens, ranging from 500–5,000
Green transitions	Four municipalities –in Sweden and Denmark	2016–2018	Exploring the changing roles for public officials in co-creating green transitions	Public officials become brokers or advisers, using their competencies and their network in leveraging citizen initiatives or offer public spaces

Case studies

3.1. Connecting diverse stakeholders through a common narrative

3.1.1. The regional energy avantgarde (Saxony-Anhalt, Germany)[6]

This project focused on co-creating a decentralised energy system in the rural–industrial Anhalt-Bitterfeld-Wittenberg region in Saxony-Anhalt with approximately 400,000 inhabitants. The project was aiming to design the necessary technical, economic, sociocultural, and political changes for establishing a fully integrated regional energy system. Essential to achieving this was drafting a common narrative around the socially unbalanced distribution of the burdens and benefits of the energy system transformation.

For many people in Saxony-Anhalt, the energy transformation is perceived as a threat.

> *"The traditional energy industry played an important role in the region and strongly shaped its identity. Fossil energies required a great deal of work to extract coal from the earth, transport it to power plants and burn it there. This has brought many well-paid jobs into the region and shaped it for over a century. People are afraid of losing this plus factor."* (*Project initiator (Janssen, 2019)*).

Moreover, scepticism remained strong against future energy-related economic promises. The region had once tried to build up a second energy economy pillar, dubbed "solar valley" which, at its height, served around 3,000 jobs in solar cell production. Since 2012, solar cell production in Germany has been collapsing. Today only a few hundred remain. On top of that, Saxony-Anhalt has lower purchasing power than other parts of Germany.

The key to the success of the project was drawing a common narrative that the fragmented local actors, citizens, and stakeholders could subscribe to. The narrative became to be *avantgarde* again. With this claim, a Living Lab was launched to reconcile:

1. the economic requirements of energy system transformation with those of climate policy and society at a regional level;
2. to develop a decentralised energy system.

Another key to this integrative approach were intermediary organisations such as the 100% renewable foundation in Berlin and the Bauhaus Foundation in Dessau. These players did not only combine their local and nationwide network but also linked their profound knowledge of the German energy transition with cultural and social aspects that were previously underrepresented. Their joint effort allowed them to institutionalise a cooperative between twenty privately-committed individuals as well as representatives from foundations, municipal utilities, local authorities, and the Federal Environment Agency. This was a diverse set of regional actors that would have otherwise not met. The aim of the project was to empower everyone, from regional citizens to local businesses, to generate, consume, and trade energy according to their own preferences.

[6] http://energieavantgarde.de/

However, as the Energie Avantgarde Anhalt project team admitted, it was not able to translate the question of how to design, deliberate, and implement a regional energy system into the everyday life and concerns of its citizens. Hence, despite many offers of participation, it remained an expert co-creation which resulted in a structural disadvantage (Reimann, 2017). Even though the locality in itself was helpful in creating and integrating many diverse stakeholders through intermediary organisations it did not prevent its energy transition project from being simply a local expert project. The project further showed that only solutions that touch upon everyday problems perceived by the consumer lead to active participation. Complex and abstract problems on the other hand remain the subject of expert discourses, without concrete options for action for the consumer.

3.2. Setting common rules before starting the transition

3.2.1. Natural gas free neighbourhoods (Delft, the Netherlands)[7]

In recent years, the use of natural gas for household heating systems has become controversial in the Netherlands. An increase in earthquakes and damage to private property because of gas extraction in the Province of Groningen, as well as a push for more renewable sources of heating has led to a national exit strategy for the use of natural gas in households. In the transition to natural gas free, municipalities and cities are expected by the national government to develop neighbourhood-level strategies for alternative sources of heat, such as an all-electric system, district heating, or hybrid systems.

The municipality of Delft has chosen to open up this discussion to its inhabitants by organising several information and discussion events on natural gas free neighbourhoods, in which citizen involvement in policy and project development was encouraged. In 2018, three information and discussion meetings were held with the goal to develop a document for the city council with starting points (‘uitgangspunten’ in Dutch) for the heat plan, which the city council has to establish in 2021. It specifically asked which actions should be taken when to make sure the municipality of Delft will have a heat plan adopted by the city council in 2021 (Spruit, 2019).

By providing these starting points residents could shape the document, and indicate ‘what they find important’ in the formation of energy policy. The meetings took a stepwise approach:

1. In the first meeting, a general brainstorm was held in which inhabitants could voice concerns and values they deemed important for the topic. Over a hundred ideas were collected.
2. The second meeting set to prioritise these concerns and reformulate them into several key topics.[8]

[7] https://www.delft.nl/milieu/energie/aardgasvrije-wijken/denkt-u-mee

[8] Discussions were held around following key topics (amongst others): “The central government must only provide financial assistance to homeowners and entrepreneurs who are unable to make investments in gas-free living.” “Natural gas-free, that's a step-by-step approach. The municipality must provide clarity and incentives in the short term.” “Natural gas-free is not automatically sustainable, reliable and safe: it requires much more”. “Knowledge is crucial and Delft has it like no other”. “Transition to natural gas-free: own initiative or centrally managed? (bottom up or top down) - tension between regulation and rule-free”. “Private initiatives must be stimulated and facilitated by the municipality and can take place at different levels of scale: district, neighbourhood or street level. The most important thing is that this is done jointly, in cooperation where possible.”

3. The last meeting presented a summary of common rules, focused on recognition (did participants recognise themselves in the summary?) and identifying relevant actions for establishing a heat plan.

Besides voicing values, concerns, and critiques these meetings had an additional effect. They created a sense of community around energy policy (Spruit, 2019). In the third meeting it was suggested that a platform was created to share knowledge about the energy transition and the technological options available to residents. This would be a new platform that distinguished itself in its open-ended character. Everybody was welcomed because they were living in the city of Delft, not because they already had a specific interest (e.g. in setting up an energy cooperative or making their household more sustainable). It was proposed to run a pilot test of the district approach. The participants agreed that it is all about when and how which district will become natural gas free.

The process involved some unexpected turns:

- The municipality initially merely aimed at achieving input legitimacy of the future energy policy in 2021 but it turned into a much more active and living community.
- One of the struggles of the municipality was how to deal with the new natural gas free platform, since it was not foreseen.
- The users on the platform were very enthusiastic and offered to help in writing energy policy, which caused unease amongst the public administrators, while the same time they were eager to facilitate this new community.
- There was also a sense in which the administrators involved wanted to keep the participatory and political trajectories separated. The meetings seemed to be intentionally depoliticised, in order to promote 'unspoiled' (apolitical) citizen views (Spruit, 2019).
- The municipality had to admit that the group of residents present at their meetings were not fully representative of their total community.

Despite this, however, the municipality emphasised that the turnout was much higher than normal and that part of the output (the platform), the social capital (networked expertise, mutual trust), and the sense of community that it created amongst a subset of residents did create a legitimate approach to the natural gas-free transformation (Spruit, 2019).

The question remained what was, precisely, to be co-created? In some way or another, the discussion on common rules, the formulated starting points, and the platform will influence the new municipal Delft energy policy since the municipality of Delft was precisely aiming for that. It remains unclear, however, how far-reaching the impact will be. In terms of co-creating projects this may be a long-term goal of both the municipality and the citizen platform (they may want to share responsibility) once the pilot districts have been chosen and the energy strategy implemented (Spruit, 2019).

3.3. Participatory action research in schools

3.3.1. Schools as neighbourhood energy embassies (Utrecht and Amsterdam, the Netherlands)[9]

Schools can play an important role in spurring energy transition at the neighbourhood level. There are several reasons for this:

1. School buildings can be used to install solar panels, heat pumps and so forth or adopt energy saving equipment, and serve as (visible) landmarks in neighbourhoods: showcasing or even branding their ecological intentions.
2. Pupils can be educated about sustainability, 'environmental literacy', '21st-century skills', and conservation behaviour like energy saving. Pupils also indirectly influence their social environments and may enthuse their parents to engage in environmentally-friendly behaviours.
3. Schools can be seen as social hubs in neighbourhoods as many neighbourhood residents have children at school and meet each other in walk in-events at school.

Recently, in the Netherlands a co-creative approach using participatory action research (PAR) was developed to generate sustainable energy initiatives at the neighbourhood level. The approach seeks to actively educate pupils with action research and outreach to neighbourhood stakeholders. 'Energy embassies' can be established in schools, which allow for generation of low carbon initiatives using local stakeholder co-creation, and eventually generate low carbon projects.

The intervention at schools consisted of series of workshops that aimed to involve pupils as researchers and designers in the "Schools as energy embassies in neighbourhoods" (SEE) programme. By challenging pupils to come up with their own ideas for a sustainable energy transition they would be able to contribute to the co-creation of sustainable initiatives together with stakeholders, while at the same time learning about sustainability. These interventions also aimed to satisfy a third programme objective: supporting schools in providing education in three interrelated areas:

1. science and technology education;
2. inquiry and design-based learning;
3. education for sustainability.

The interventions in the neighbourhood consisted of a series of activities with a group of stakeholders connected to the school or neighbourhood. This included representatives from local government, housing association, distribution system operator, neighbourhood corporation, community energy collective, energy service company, and local entrepreneurs. Stakeholder interviews followed by a set of co-creation workshops were carried out. The activities with stakeholders aimed to stimulate the process of co-creation of local sustainable initiatives. Throughout this process the (potential) role of schools and pupils in such initiatives was emphasised. Additionally, people closely connected to the school (such as members of the management team, teachers, and parents) were involved as stakeholders. In this way, the interventions also stimulated new collaborations between the schools and other stakeholders.

[9] https://projecten.topsectorenergie.nl/projecten/scholen-als-energieambassade-in-de-wijk-actieonderzoek-naar-de-rol-van-scholen-in-de-energietransit-00029194
https://www.energie-u.nl/wp-content/uploads/2019/12/STT-Actieonderzoek_slotbrochure_nov19.pdf

The PAR approach taken in the SEE used a participative inquiry action research method. Figure 5 illustrates how it works in practice and breaks it down in two parts: **addressing school pupil action** and addressing local stakeholder action. Figure 5 also reveals that multiple action research methods were used, including stakeholder interviews, photo voicing, village mapping, visualisation, focus groups, and follow-up supportive actions.

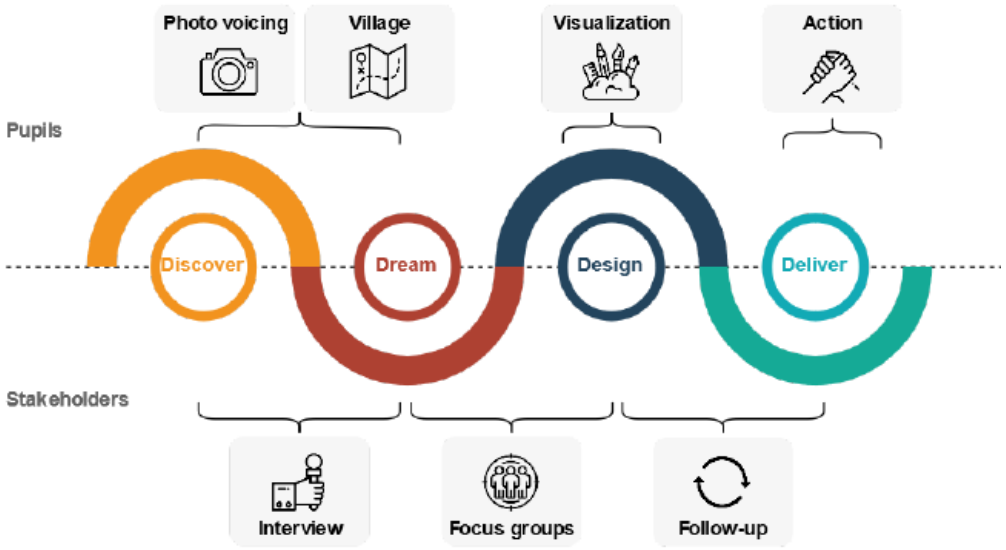


Figure 5: The participatory action research process. (Source: (van Gelder, 2019))

The Dutch project SEE was implemented over a two-year period (2017–2019) with eight Living Labs in Utrecht and Amsterdam. Each of these Living Labs consisted of one school and a network of stakeholders connected to the school or neighbourhood. Ultimately, Seventeen new initiatives were generated, including energy renovation of school buildings, generation of innovative new smart and renewable energy projects, new energy services and awareness campaigns, and initiatives that addressed other pressing needs in neighbourhoods like a litter reduction campaign and the installation of smart waste bins. Other positive effects of the programme pertained to schools adopting sustainable education curricula and teaching methods, increased environmental awareness in pupils, and intention vis-à-vis sustainable heating and other sustainable development topics.

3.4. Neighbourhood engines for collective inspiration

3.4.1. Neighbourhood engines ('Wijkmotor' Kempen region, Belgium)

In two neighbourhoods with high (cultural) heritage value, the Centre for Architecture, Urbanity and Landscape in the Kempen region (AR-TUR) set up a Living Lab to generate knowledge on how to sustainably renovate homes: Egelsvennen in Mol en de Parkwijk Turnhout.

The neighbourhood engine is a model that can be used to convert neighbourhood capital in the form of people, tools, and resources into added value for the neighbourhood. This added value can manifest economically and socially, and it also results in better environmental quality and greater comfort for the homes in the neighbourhood. The neighbourhood engine involves five steps:

1. Co-initiate - A neighbourhood collective is formed, a neighbourhood director is appointed, and expertise is involved.

2. Co-sensing - Challenges and opportunities are identified, and ambitions are set.
3. Co-creation - A joint vision and process are co-designed.
4. Prototyping - Sub-projects are carried out.
5. Co-evolve - Quality monitoring, evaluating, and adjusting governance incentives are used.

In September 2018, the project started with a neighbourhood exploration involving stakeholders and experts. This was followed with a workshop in which neighbourhood qualities and challenges were identified. This resulted in developing several studies, including resident narratives, neighbourhood photography, and neighbourhood design research. This was performed in the winter of 2018–2019. Based on the results several neighbourhood scenarios, that were discussed during a scenario workshop in April 2019, were developed. To inspire residents, informative talks were given on how to renovate neighbourhoods. Multiple good practice examples were presented and discussed with residents and stakeholders in May 2019. Because the two neighbourhoods included social housing and tenants as occupants an approach had to be developed for engaging with private homeowners. To accommodate this group a workshop was organised in July 2019 to address how homeowners could get involved collectively in neighbourhood renovation processes. A major output of the project was a renovation project toolbox, including neighbourhood renovation concepts[10].

The process resulted in a working model with recommendations that offer starting points for a future-oriented approach. Figure 6 illustrates a model for a neighbourhood engine.

Figure 6: The neighbourhood engine. (Source: The neighbourhood engine is a concept by AR-TUR, developed in Kempenlab Neighbourhood Renovation 2019.[11])

[10] Wijkmotor is een concept van AR-TUR, ontwikkeld in Kempenlab Wijkrenovatie 2019.
[11] https://arturarchitectuurcentrum.files.wordpress.com/2019/11/ar-tur-cahier-9-web-spread.pdf

3.5. Sparking urban revitalisation

3.5.1. The Oberlin project (Oberlin, Ohio, USA)[12]

The Oberlin project is an example how co-creation was able to transform and revitalise the entire town of Oberlin, Ohio, USA (population approximately 8,000). Located in the 'rust belt' extending over the mid-Western and north-Eastern states, Oberlin is surrounded by cities and towns struggling for survival with the decline of localised, heavy industries.

At an official level, the project was an alliance between Oberlin College and the city of Oberlin. Yet on the ground the collaboration involved numerous civic groups, think tanks, local 'sustainability champions', investors, and private enterprises. Largely initiated by David Orr – one of the forefathers of the academic sustainability movement – its origins lie in a resolve to simultaneously address the interlinked and converging crises of climate change, peak oil, environmental degradation, and economic decline (Orr, 2011). The physical core of the Oberlin transformation was the development of a 13-acre 'green arts district'. The goal is to create local employment, increase local revenue, and revitalise the liveability and attractiveness of downtown Oberlin (Orr, 2011). Ecological reform was further driven by the acquisition of a 20,000-acre patchwork of land to be permanently designated for the provision of local food, timber, biofuel, and carbon sequestration projects. Funds for the various goals were sourced from a combination of private investments, state and federal support, tax credits, philanthropy, and savings generated from improvements in energy, materials, and water efficiency. The Climate Action Plan of Oberlin of 2013 is one example of co-created knowledge being transferred into actual policy.

The Oberlin project shows that there is clear potential for local knowledge institutions to be frontrunners dedicated to co-creating societal transformations. It is a move away from the idea of simply contributing to economic and societal development via technology transfer (Trencher et al., 2014). However, transforming and co-creating sustainable development via a much broader range of channels, approaches, and actors demands flexibility and new engagement paradigms from all actors involved (Trencher et al., 2014).

3.6. Resolving conflict in sustainable futures

3.6.1. Resolution of public conflict in urban heat transitions (Freiburg, Germany)

While a certain level of friction and contestation around infrastructures, new technology, and social change is not unusual, there are particular periods and constellations in which such friction can become more salient and potentially game changing.

A conflict with such character erupted in Freiburg, Germany, when two strategies for reducing the environmental impacts of space heating were to be applied in the Vauban 'model district'. The municipal strategy of efficient co-generation of heat and power combined with district heating systems (DHS), clashed with the citizen-driven approach of reducing heat demand by low-energy designs and ambitious energy standards ('passive house standard') (Späth and Rohracher, 2015). In the example of Freiburg, a critical 'junction' (Jensen et al., 2015) emerged between the development of passive houses and district heating, which made evident that both concepts were not discussed

[12] http://www.oberlinproject.org/

together, let alone co-integrated in the initial design phase. The conflict reopened old sociotechnical frictions between city strategies and community strategies, which became 'hot' and problematic. In the end, these junctions opened up opportunities for renegotiation and successful contestation. The environmental department of the municipal administration acknowledged the arguments of both parties to be valid. In order to settle the dispute, a form of "exemption clause" was developed (Späth and Rohracher, 2015).

To support 'non-violent' transformation into sustainable communities 'mediative decision-making' has been proposed (Susskind et al., 2018). In a fictional but realistic example (imagine construction of a heat district or renewable power plant), the authors explain what can happen in a traditional approach:

- The developer is required to undertake a set of technical studies that several municipal and regional bodies must review before a permit can be granted.
- In case of a disagreement, the representatives might first attempt to negotiate problems weighing up various alternatives to see which is 'best'.
- Which is most affordable and feasible?
- Which will have the most impact in the shortest amount of time?
- Might there be further implications, like public health risks?
- Local government and contractors may find it useful to assess public opinion using, for example:
- telephone or online polling;
- organising a town hall meeting, or;
- testing ideas with focus groups.
- After the official objection period, the most crucial points are economically incorporated in the drafts.
- The municipal or regional council might call for a non-binding referendum and/or vote on its own, going beyond normal zoning and planning requirements.

However, experience shows that, at some point, proponents or opponents of the project might go to court to contest an approval procedure, or a decision made by one of the municipal agencies as (Susskind et al., 2018). Confrontational acts such as protests, lobbying efforts, or political threats might rise as well. The court then must decide on the legality of the procedures or decisions and assess the fulfilment of 'public interest' parameters.

Standard procedures are becoming increasingly insufficient for preventing or mitigating deep social divisions. However, ensuring the presence of some basic features in controversial decision-making can be included in any change process:

- Before starting a planning approval procedure, municipal and state departments should identify and assemble representatives of all relevant stakeholders.
- A neutral and independent mediator or facilitator acceptable to all parties should be appointed.
- The mediator initiates and manages a joint fact-finding process for the most controversial issues, rather than giving the stakeholders an opportunity to merely exchange opposing claims. This can move the conflict interaction to a qualitatively different level of abstraction. The proposition of a conflicted party that states, 'I don't want this project in my neighbourhood' can, for example, be

supported by the propositions 'I don't want to be exposed to any health risks', 'Everyone has the right not to have his or her health damaged'.

- Moving to a level of greater particularity and fewer generalisations can produce outcomes better than any compromise and might include the role of community life in such solutions.

3.7. Community energy collectives and sustainable heating transitions

Having presented cases which illustrate the different phases of co-creation the focus now turns to two specific groups, which are of greater importance in co-creation than in average stakeholder engagement. The first groups are community energy collectives and the second are low-income communities.

Working with community energy collectives in sustainable heating projects offers certain benefits over working with conventional parties only. In this section the added value of collaboration with groups is highlighted. There are several reasons that these specific groups are better positioned to accelerate sustainable transitions than other energy service providers (Coenen et al., 2017):

1. Community energy members live in the neighbourhood itself, are familiar with local circumstances, and are recognised and familiar to the local community.
2. Community groups have capacity and critical mass.
3. They are embedded in the local, social network.
4. They are involved in awareness raising and education activities.
5. Particular social norms apply in energy communities that support pro-environmental behaviours.
6. Trust amongst community energy members.
7. Tailoring energy production and services to local needs.
8. They engage in collective action seeking to avoid commons tragedies from happening.
9. They are keen to balance interests on social acceptance concerning the siting of renewable energy projects.
10. They invest financial gains (from energy production) into actions and projects that benefit the local community.
11. The scale level of collective district heating facilities is, in principle, within the reach and sphere of influence of a neighbourhood community energy cooperative.

3.7.1. Professional support for community energy development: 'Energie Samen' (Energy Together, the Netherlands)

Energie Samen is a membership association founded in 2018 that represents the interests of renewable energy initiatives organised by citizens. Control and ownership of the local environment by local citizens is considered of great importance. In the Netherlands, the majority of community energy initiatives (mostly cooperatives) are members of Energie Samen. The association has developed professional support for community initiatives that want to engage in the sustainable heating transition (and are in need of guidance). This is called 'Buurtwarmte' ('neighbourhood heat' in English). It supports initiatives and provides advice on:

1. designing a neighbourhood process with the neighbourhood and developing a sustainable heat source;
2. exploring technical heating options and heat plans;
3. organising a cooperative;
4. developing a (feasible) business case;
5. raising awareness about available funding and subsidies;
6. managing and supporting planning and implementation processes (towards cooperation with municipalities, DSOs, etc.).

3.7.2. Community energy action in sustainable heating transition

The case of Traais Energiecollectief (Drimmelen / Terheijden, the Netherlands)

In the municipality of Drimmelen in the South of the Netherlands the energy cooperative *Traais Energie Collectief* (TEC) and the municipality have taken major steps to develop a DH system. The energy cooperative is co-initiator of a plan to install an innovative heat network in the centre of the village of Terheijden. The idea is to extract heat from the River Mark, supplemented with heat from biomass, to provide public buildings and facilities such as a church and swimming pool, but also to provide households in the centre of the Terheijden village with heat. Households decide themselves whether or not they want to participate, but are engaged by Traais Energiecollectief to switch off from the natural gas grid, and connect to the DH system. The municipality of Drimmelen received a government subsidy of €3.4 million from the Ministry of the Interior and Kingdom Relations under the testing grounds for natural gas-free neighbourhoods. The construction of the heat pipes (already) started in 2019. The construction of the heat pump and heat-cold storage and the connection of the first customers will follow as per 2020 (HIER Opgewekt. Lokale Energiemonitor 2019).

The case of Meer Energie (Amsterdam, the Netherlands)

One of the first new heat cooperatives was created in Amsterdam in 2015: Meer Energie (More Energy). In 2015 the idea arose to use residual heat from the Equinix data centre for heating homes in Watergraafsmeer (around 5,000 households, the largest cooperative heat network project in existing buildings). The technical idea is that water goes to the neighbourhood via a (pipe) where a district heat pump raises the water to 70 degrees Centigrade. It goes further into the neighbourhood via the heat network. The residents wanted to start their own energy company. A lot of work still needs to be done to reach the project goals, but a number of important steps have already been taken. In 2018, Meer Energie, Alliander DGO and the Equinox data centre stated that they wanted to develop the network together in a declaration of intent. In July 2019, the Amsterdam city council approved the construction of the pipelines for the heating network in (city district) Middenmeer Noord. A big advantage in the project pertains to fact that the streets are already open for major maintenance (HIER Opgewekt. Lokale Energiemonitor 2019).

The case of Thermo Bello (Culemborg, the Netherlands)

Thermo Bello is a small-scale power-to-heat district heating (DH) system operator located in the district of Culemborg, drawing heat from a drinking water basin situated there. The heat is supplied to 210 households and around seven commercial buildings. EVA-Lanxmeer, the heating cooperative,

is described as a very strong and well-knit community, with its people having been previously involved in several collaborative efforts to improve their local environment, for example, the citizens manage the greenery of the district on their own (Doci and Vasileiadou, 2015).

The idea for DH started when four residents of the district saw potential in the DH system to cater for the area's heating needs through a DH cooperative and decided to investigate. Active participation in the cooperative increased when a business development committee, VOEW (*Vereninging Ontwikkeling Explotatie Warmtene*t) was established. In total, 68 residents joined the association and four working groups (financial, organisational, communication, and technology) of five to six people each, worked on feasibility studies and business plans (Verschuur, 2010). The plans, when presented to the wider community, gained popular support leading to the formal opening of Thermo Bello in 2008. A distinct role was played by the Municipality of Culemborg who were receptive towards incorporating sustainable technologies and thereby facilitated the process. The overall process was however strongly community driven, with its members taking extra efforts to be inclusive, for example, the initiators drew up a 'programme of requirements' that made the business plan understandable to everyone in the community without getting bogged down by technical details. Surveys were frequently taken to gauge opinion of the local residents which improved transparency (Verschuur, 2010).

The case of Eno Energy (Finland)

Eno energy cooperative is a community-based enterprise located in Eno, Finland. It was established in 1999 by twelve local forest owners. Currently the cooperative is owned by 55 local forest owners and the aim is to produce inexpensive district heat (DH) for the local community with locally-grown wood. The wood is used in a DH system which heats local public buildings and private households.

With members themselves providing about 20–30% of the wood required for heating the operation of the cooperative has a strong local approach starting from wood procurement and including other services such as administrative services. The main benefits that have led both members of the cooperative and other stakeholders, including the municipality, in actively encouraging the activity is the affordable price of heating; municipality buildings and private customers have saved 4.1 million euros over the last fifteen years. Apart from the affordability of heat through the DH system, another benefit is employment generation; an additional seven to ten workers are employed per year. This activity encourages energy wood harvesters and entrepreneurs and gives income to wood collectors and sellers. Thinning of the extremely dense young forests improves the growth of the remaining trees and thereby the quality of the wood. One of the main benefits is the sustainable heating practice that results from this activity; net carbon dioxide emissions are reduced because imported oil is replaced by renewable forest chips (five million kg annually) and local networks are created.

The role of the Finnish Forest Centre has been important and several of their projects concerning the use of wood and heat entrepreneurship have developed the groundwork required for energy cooperatives in the region. Structural funding for construction costs of heating plants was vital and this was facilitated by the forest centre. Quickly identifying convergence of motive and initiative among the forest owners, and actively furthering their ideas to implementation, was a key role played by the forest centre.

Community members showed reluctance at the beginning of the project: there were doubts about the skills of the citizens and also around the sufficiency of energy wood resources in providing a reliable heat source. Yet, as perception of the concrete benefits to local residents and inclusion of residents increased, openness of the operations increased due to more members showing an active interest. While more households were willing to join the DH network, it was clear that it was not accessible to those living in more remote areas too far away from the network.

3.7.3. Lessons from local energy communities

Key conditions for promoting local energy community models and practices:

- There should be a clear political commitment either through binding policies or voluntary commitments in the framework of initiatives, for example, a Covenant of Mayors. Without motivation or direction from a political authority it is difficult for individual members of the community to step up to a leadership role.
- Energy communities are vulnerable to policy changes as seen in Germany where a key driving force behind the emergence of energy communities in Germany has been access to the country's feed-in tariff (FIT). However, the reform of the renewable energy law in 2015 introduced bidding schemes which heavily disadvantaged small and local energy communities.
- Renewable energy projects typically require significant up-front investment while operation and maintenance costs are low in the long run. If it is not possible to raise these investments from those interested in building the community, then external financing is required. Many banks and financial intermediaries have low awareness of community energy structures, and convincing them of the business case for investment can be challenging. Financial support to help de-risk their investments at the beginning of the installations can be helpful.
- Community project developers may also run into barriers related to permits and environmental impact assessments that they are not equipped to overcome.
- Communities can also face challenges in entering the energy market, gaining access to grids, and competing on a fair basis with energy utilities, where distribution system operators may not recognise a community energy structure as a supplier, or may prioritise energy from other resources.
- Cultural issues relating to common ownership of resources will also affect how quickly a community adapts to these set-ups. While Denmark, Germany, and the Netherlands have had a long history in cooperative ownership traditions many other countries are still in the process of uptake. Hence, collective energy solutions must be tailored, adapted, and communicated to the local culture.
- There should be a clear regulatory base and legal framework that governs the functioning of the local energy cooperatives, e.g., FITs, shareholder rights, etc.
- There need to be good communication frameworks to increase cooperation between the local energy communities and local authorities before, during, and after the project.

3.7.4. Co-creating sustainability with low-income communities (Portland, Oregon, USA)

Whereas community energy collectives often make sustainability the core of their engagement, marginal or non-represented groups are commonly less engaged in environmental or climate protection and certainly invest less into renewable energy. The following case in Cully, a

district in Portland, Oregon, USA, shows how it is possible to lower the barrier that often exists between sustainability programmes and low-income communities.

Cully neighbourhood in Portland has suffered from high poverty, high unemployment, and lack of basic neighbourhood amenities such as street connectivity, parkland, and open space. A coordinated effort to develop an ecodistrict "Living Cully" was set up in 2013. The ecodistrict concept differed significantly, as it viewed sustainability as an anti-poverty strategy. As one of the initiators explained:

> *"Because often what happens is you get a new street, or a new park, and there is no effective activity around having affordable housing nearby or hiring people from the community to perform the construction."*

In practice, employment opportunities rarely benefit local residents and the streetscape improvements are not done with respect to local cultures (Wilson, 2018).

Living Cully was set up through a non-profit initiative (called 'Verde') which was established based on:

1. a shared commitment of actors from different sectors (affordable housing, cultural identity; environmental wealth, home ownership);
2. a common agenda (sustainability);
3. solving a specific social problem (i.e. poverty).

Verde functioned as the management body helping to coordinate different stakeholders. One of their lighthouse projects was the co-creation of a former brownfield site, into Cully Park, now a popular park in Portland.

The co-creation process reached deep into the community. It not only asked people what they wanted from the park, but allowed citizens to actively take part in its development. The idea was that they are able to come back to the park with their family and friends and say, 'I built this'. As such, the play area was co-designed with students, Verde, and a local design company, combining typical playground features with nature play elements. Other middle school students co-designed the community garden in collaboration with a local landscape architecture firm. Indigenous and cultural groups co-designed an inter-tribal gathering garden highlighting food and cultural practices. Living Cully raised more than six million US dollars to implement this plan and entered into a public–private partnership with the Portland Parks and Recreation Department. The Living Cully programme further ensured that roughly 20% of those hired to work on the development of the park were lower-income Cully **residents** (Holliday et al., 2015).

Living Cully is now a robust network of community organisations. Six years later, in 2019, the district is indeed rapidly gentrifying with entire apartment buildings being purchased by outside investors and doubling in value. Despite their efforts, many partners involved question if this enough to prevent displacement (Wilson, 2018).

3.8. Lessons learned from the case studies

In this section we summarise some key lessons from the case studies to highlight what worked, what didn't work, and how this might be useful for actors involved in sustainable heat transitions.

Co-creation on a municipal, district, or neighbourhood scale has the advantage of reduced complexities, higher familiarisation (people know each other), and making positive impacts directly visible in the living environment. It enhances the chance of finding a common narrative for the transition, such as in the cases of Saxony-Anhalt. Key to co-creation approaches are intermediary organisations. They can reach out to a diverse set citizens and stakeholders and bring them together. Intermediary organisations can also create social hubs in neighbourhoods. The SEE project in Utrecht and Amsterdam transformed schools into 'energy embassies' which sparked the co-creation of low carbon initiatives.

Working with community energy collectives in sustainable heating projects offers benefits over working with conventional parties only. These collectives foster trust and awareness of critical opportunities in districts and neighbourhoods, where many of their members are rooted. They also balance interests on social acceptance for their own renewable energy projects and reinvest financial gains back into the local community.

Residents play another key role in the sustainable heat transition:

1. The interventions necessary for this transition take place 'behind the front door' in residents' private spaces, generally considered off-limits for municipalities.
2. This transition can only be done working with residents as many of the burdens (costs as well as disruptions) fall upon them. Cases that can provide an unburdening and early involvement are generally better suited to integrate citizen needs and preferences into transition projects.

In case the sustainable heat transition causes friction, the parties involved should appoint a neutral and independent mediator or facilitator acceptable to all parties who then initiates and manages a joint fact-finding process for the most controversial issues. This is in preference to giving stakeholders an opportunity to merely exchange opposing claims. A mediated discourse can move the conflict interaction to a qualitatively different level of abstraction and eventual resolution.

The human factor is central to successful sustainable transitions. Cases that focus equally on building social capital (sense of community, networked expertise, mutual trust) and yielding co-benefits (public health, well-being, economic opportunities) besides reaching carbon emission targets, are likely to gain more public support and ownership.

3.8.1. New roles and responsibilities

From being passive participants to active initiators, designers, and implementers, **co-creation implies changing roles for citizens through the increase in citizen agency and professionalisation**. For example running local heat and energy grids smoothly through communities, such as the local cooperative heat network of Thermo Bello in Culemborg, the Netherlands, needs a responsible operator that takes decisions on behalf of the whole community and in consent with municipal oversight. To take such decisions, the operator needs a certain degree of unilateral authority to control production and storage within the microgrid. This may require participants to give up some of their freedom to do things differently. Market and regulatory arrangements on the other hand need to be able to make provisions for local energy communities to receive remunerations for their provision of grid services: something which has been a roadblock for many despite EU mandates.

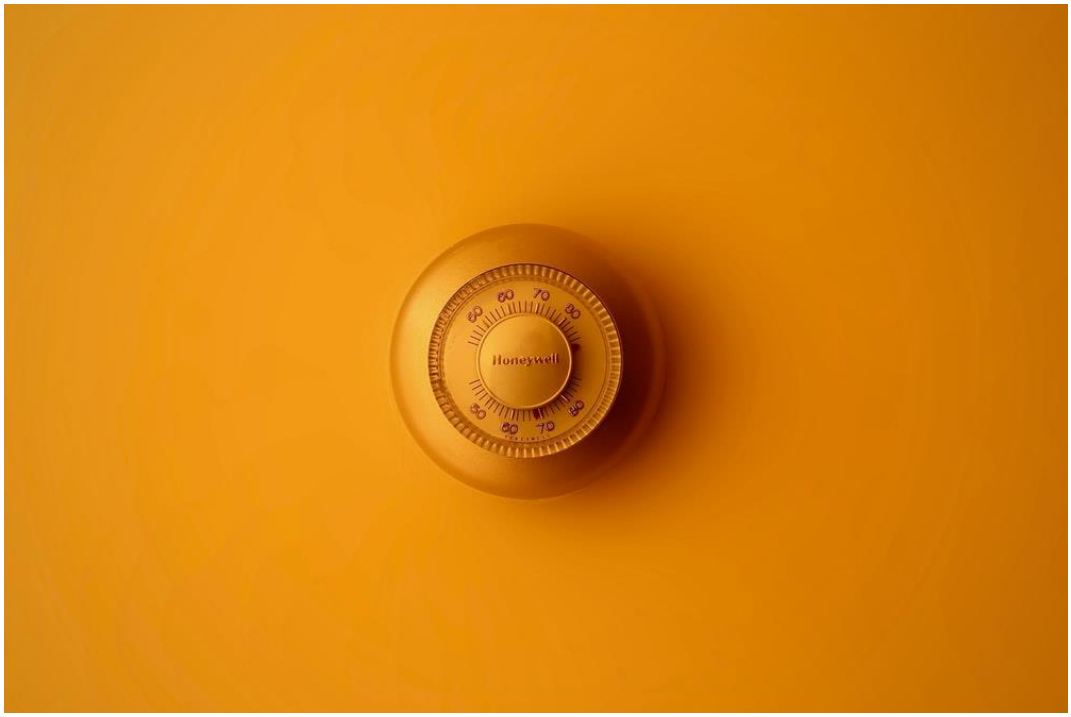
At the same time, **co-creation implies new roles for public officials too, as brokers or advisers, using their competencies and their network in leveraging citizen initiatives**, or offering public spaces and infrastructure to be used by citizens, social entrepreneurs, artists, and other actors of urban change. Recent attempts to explore these changing roles like the EU Interreg project "Co-creating Green Transitions" (2016–2018) involved municipalities from Sweden and Denmark dealing with different but similar problems related to energy transition. Towards the end of the co-creating process, the four project partners' positions were more aligned towards citizen-oriented poles indicating that the adoption of contradictory roles and perspectives enabled a convergence of interests as a result of co-creation. While the public officials prioritised "achieving environmental goals" over "citizen participation in the process" at the very beginning of the project, a reversal was observed at the end of the project where citizen participation was prioritised far more, as a means of gaining environmental efficiency (Horsbøl, 2018).

Co-creation is a process that develops on a shared platform that is driven less by rules and more by initiatives taken by both parties (citizens and public authorities) to involve each other in ensuring better governance in sustainable transitions. **The process of co-creation will be rendered more efficient when the authorities themselves realise the importance of looking outside the bounds of legal role and professional expertise and leveraging citizen perspectives in order to create a joint understanding of problems and solutions**. Changing roles need also to be transparent about power dynamics that are involved when public authorities relinquish powers bestowed upon them by laws to other stakeholders. Sometimes, responsibilities are not seen to be directly bound to a group involved in co-creation. Private businesses might consider investors' interests, political parties about their electorate and environmental organisations about their donors. This has parallels with public officials who are often bound to their administrative procedures and must safeguard public laws and budgetary decisions.

In addition to adopting these changed dynamics within administrative procedures, it is also important to explore **under what conditions public authorities actively take the initiative to change the status quo through co-creation**. In Delft (the Netherlands), co-creation on the heat transition process brought about a new citizens' platform, which turned into an advocacy body that was very enthusiastic and offered to help in writing energy policy. This unforeseen role caused unease amongst public administrators. While they did not want to slow down the newly gained engagement of the platform, the public officials involved wanted to keep the co-creative and the political trajectories separate.

To sum up, in dealing with changing roles and responsibilities, **the key is to adopt a learning attitude** where citizens, stakeholders, and government officials learn from each other. This will ideally lead to a sense of common ownership of multiple social, economic, and technological transition challenges. Clear communication about the roles of everybody involved, e.g. how involved each party is expecting to be in different stages of the process including planning, designing, implementing, decision-making, and so on, will reduce the impact of misplaced expectations or misconceptions of "rights" involved.

4. Organising and managing co-creation for sustainable heat transitions



Thermostat. Source: Moja Msanii on Unsplash.

In many cases, citizen involvement is clearly subordinate to environmental efficiency, to accelerate the transition process and behavioural change. It is generally the degree, scope and timing of citizen involvement that is raised as an issue as well as which tool is best to apply in each case. Approaching co-creation with a strict, linear rationality mindset informed by a discourse on project management and characterised by an orientation towards clear objectives, milestones, and follow-ups on these (Horsbøl, 2018) is only one aspect of co-creation. The social side of the transition to sustainable heating and gas-free living is complex and not linear. This results in a new tension between the iterative and reflexive co-creation process on the one hand and linear participation approaches on the other. A second inevitable tension exists between the principle that a broad range of affected and interested parties should be included and the reality that intensive deliberations on complex issues require thorough preparation, time, commitment, and inclusion, which not everyone is capable or willing to provide (Emerson et al., 2009). Denmark is the leading country on sustainable heat, which is why, before providing an own 'how to' guideline, we present three key inspirations from 'how the Danes do it' and start our recommendations from there.

4.1. Denmark as a guiding country

In Denmark 65% of all homes are supplied with heat from a heat network. Consumer-owned district heating facilities (heat source, network, and supply) produce 36% of this. Of the 430 Danish heat networks, 360 are owned by residents through a cooperative. Specialised service companies are responsible for the development and operation of these heat networks.

Denmark has a long tradition of 'doing things' using cooperative formulas making use of three key approaches to stimulate householders in existing gas-fired neighbourhoods to connect their homes to district heating (DH):

1. a district heating package;
2. an instrument to help customers save energy;
3. the customer journey to persuade and unburden householders who switch their connection from the conventional gas grid to the DH system (Coenen and Hoppe, 2018).

What does such a process look like in practice? EBO Consult, an independent Danish administration company, manages the administrative and technical tasks for several local DH non-profit companies, Hvidovre Fjernvarme, FDHvidovre, and Avedøre. Each company is owned and directed by citizens and consumers. One of the administrative and technical tasks that EBO Consult manages for Hvidovre Fjernvarme is to expand DH in Hvidovre, which is a suburb in Copenhagen. The expansion of DH is accomplished by separating the expansion area into projects. The green colour in Figure 7 (Source: (Coenen and Hoppe, 2017)) demonstrates the existing areas that DH supplies. The areas with a colour other than green are future or current DH projects.

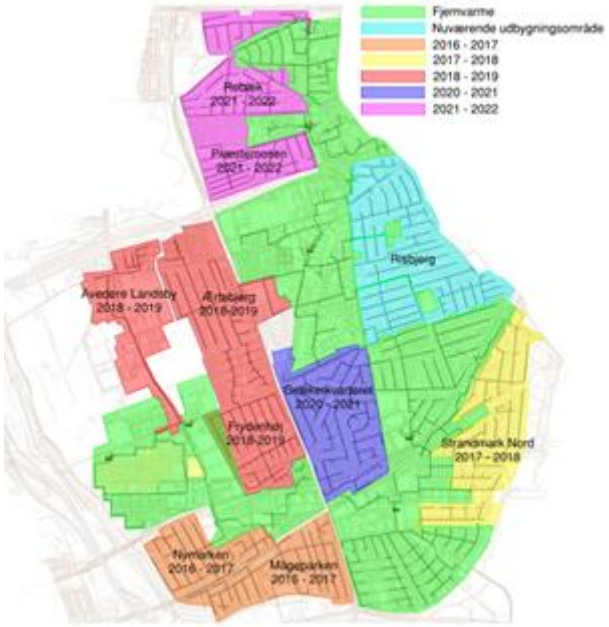


Figure 7: Expansion area installed (Source: (Coenen and Hoppe, 2017))

In order to begin and realise a project, 30% of homeowners (i.e. 30% of the heat demand) in each project have to accept a conversion to DH from natural gas, electricity, or oil. Therefore, each project starts with a marketing period. A measure that is used to achieve the 30% is the Pakkeløsning – a conversion package for the homeowner. The Pakkeløsning is:

1. a home visit and an agreement of where the DH unit is going to be;
2. establishing a heat service line to the consumer's house and a restoration of the garden;
3. removing the consumer's existing heating source;
4. delivering and installing a new DH unit.

Therefore, the Pakkeløsning is a total DH installation. It is offered at 6,716 euros. The usual price for installing DH is 8,732 euros.

4.1.1. Helping consumers with energy saving

In 2015, the energy saving committee in Hvidovre Fjernvarme decided to give DH consumers the opportunity to improve their energy efficiency and save money on their heating bill by offering them the FJR-ordning for free. The FJR-ordning is a survey of the consumer's heating installations every second year.

The first survey checks the DH unit and provides a thorough energy analysis of the house, that is, how the consumer can save energy in their house. At the end of the survey, the consumer receives an energy report for their house. In the report, the consumer can gain an impression of whether their heating consumption is below or above the average consumption and the report gives guidelines for what the consumer can do to optimise their energy efficiency. This type of check is repeated every sixth year. Two years after the first check a maintenance check of the DH unit is performed.

4.1.2. The customer journey

The customer journey is a method used to evaluate DH projects. The main goal is to understand the process of getting DH from the customer's point of view in order to optimise the customer experience. The process of getting DH can be divided into four phases:

1. Deciding (the customer decides whether to get DH or not).
2. Going (the customer has decided to get DH).
3. Doing (installation of DH in the customer's house).
4. Using (the customer uses DH to heat the house).

4.2. SHIFFT guidelines for co-creating sustainable heat transitions

Based on the previous study of terminology, barriers, critical phases, specific actors, and a series of inspirational case studies, state-of-the-art guidelines for co-creation in the heat transition are provided. The guidelines are illustrated in Figure 8 and are separated into process, community, level of application, methods, and evaluation.

Co-creation is an iterative and non-linear process. It reflects a circular rather than a step-by-step mindset. However, certain premises need to be ensured to increase the likelihood of a productive and meaningful application of co-creation. To begin with, a co-creation process can only get off the ground if someone takes the initiative and identifies the benefit(s) or the need(s) for cooperation between the government, citizens, and other stakeholders. For example:

- The municipality might approach the energy cooperative in order to learn how to better reach out to citizens who are unfamiliar with fossil-free heating.
- A collaborative scenario planning for a district heating (DH) network could be initiated by a knowledge institution together with neighbourhood groups.
- A housing association might want to cooperate with tenants and the city council to ensure a high level of efficiency and maintenance as well as trust in newly installed sustainable heating technology.

And yet, these guidelines are written as recommendations, which are far from perfect, for anyone involved in the sustainable heat transition, not only for initiators and drivers of co-creation. They are certain to need adaptation to local cultures and contexts.

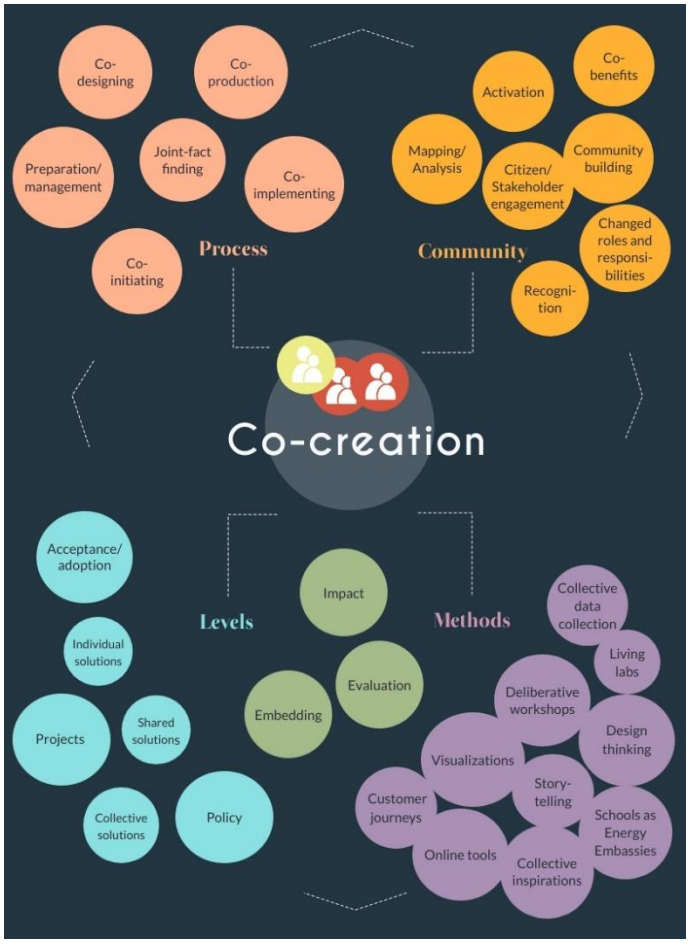
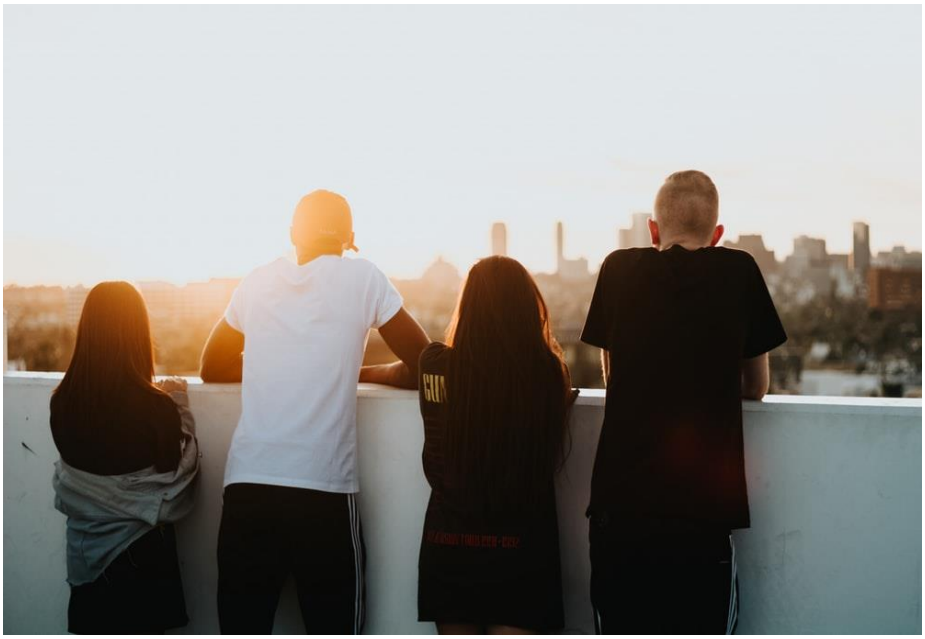


Figure 8: Co-creation - Process, community, levels and methods

4.3. Co-benefits: What do stakeholders and citizens gain out of co-creation?

Energy, climate, or environmental officials easily slip into the roles of stressing advantages and sort of "selling" environmental change (Horsbøl, 2018). Many citizens react critically to this and can become suspicious due to the resemblance of advertising practices or unwelcome paternalistic behaviour. Public officials can too quickly find themselves defining what is important for the citizen (for instance a job, housing comfort, etc.) instead of "taking a step back" and letting citizens define what is important to them (Horsbøl, 2018).

Engaging in a co-creation process means addressing matters that are already emerging within a community. A community is unlikely to be motivated engage in a project which doesn't come from the community itself (Cappellaro et al., 2019). Citizens become involved in co-creation for different reasons. For example, someone who is about to buy an apartment and is concerned that in a few years' time the expensive heating system will need replacing may be seeking clarity on sustainable heating. Another person, who loves cooking with gas, might be reluctant to give up on this known technology.



Citizens observe city life. Source: Devin Avery on Unsplash.

A good example of how to tap into 'what matters for communities' stems from the Knowle West Media Centre in Bristol, UK, an arts organisation and charity that supports people to make positive changes in their lives by using digital technology and the arts.

Over a period of three months in 2015, the organisation conducted a 'network analysis', held conversations and inquiries to discover the issues that people most cared about. It discovered that over 30% of homes in Bristol were affected with the problem of damp and mould, which was impacting on people's mental and physical health. Individuals further felt that local authorities and landlords often ignored the problem, leaving them without solutions. The organisation set up the DampBusters pilot project to gather damp homes data and to see if sensor technology could make a difference to the issue. People wanted to join the project either due to their involvement with the subject matter, i.e. they live in damp homes, or their interest in creating change through co-design and using technology.

4.3.1. Discovering objectives: What co-creation can achieve

Co-creation can discover complete new meanings. Sustainable heating initiatives that produce such additional benefits and speak to community interests will generate more resources and increasing acceptance during implementation.

Co-creation is able to realise broader co-benefits for the neighbourhood and the built environment. Using co-creation means asking whether the transition to sustainable heating can:

- Create recreational open space?
- Upgrade neglected neighbourhoods?
- Increase housing comfort?
- Reduce energy bills?

- Stimulate business development or job creation? It can even go so far as the case of Brugge where a well-known local brewery is considering participating in setting up a district heating system and contributing the excess heat created in the brewing process. The brewery needs to channel the excess heat outside the residential area as it would overheat the groundwater in the immediate area. Imagine if you knew that drinking beer from your local brewery will heat your home?

4.4. Stakeholder identification

Deciding which groups, or which representatives, need to be present in co-creative decision-making processes is a sensitive matter and conveys a decision that should be made collectively. There are different strategies for this but, ultimately, it should serve the objective of inclusiveness. This, in principle, simply means that everyone who is affected by the issues and the outcome of a decision should have the right to participate or to be represented in that process. No one should be prevented from exercising these rights.

One of the best ways of identifying all relevant stakeholders is to start with identifying key internal colleagues within your organisation. Internal stakeholders represent those within the organisation that might have important knowledge or authority over certain domains or policies that touch upon sustainable heating, fossil-free living, urban design, and co-creation. Examples of this could be colleagues from departments such as those listed in Table 3.

Table 3: Departments that may be connected with sustainable heat

• Energy and environment	• Health
• Sustainability and circularity	• ICT and digital city
• Building	• Planning
• Social affairs	• Economic development
• Finance	• Democratisation
• Housing	

These colleagues might be helpful in drawing a first map of who needs to be invited. It is also crucial to keep them in the loop about the process as, without their consent, you might run into blockages, mostly at a later stage, within your organisation.

Outside your organisation there are many stakeholder groups that can be included, especially considering the heating transition at the city district and neighbourhood level. Table 4 lists some stakeholders that can be considered.

Table 4: A summary of some of the stakeholders who may be involved in co-creation

<table>
<tr><th>Demand side</th><th>Supply-side</th><th>Regulatory institutions</th></tr>
<tr><td rowspan="2">• Landlords
• Tenants of privately owned properties
• Project developers
• Housing associations or cooperatives
• Tenants of social housing or cooperatives
• Social housing agencies
• Private homeowners
• Local businesses
• Public sector buildings
• Industry buildings
• Condominium associations (associations of homeowners in multi-storey buildings)</td><td rowspan="2">• Energy providers
• Heat sources (including businesses who produce excess heat)
• Energy utilities
• Local community energy collectives generating energy of their own
• Contractors
• Prosumers
• Construction companies (contractors, subcontractors)
• Technology solution providers
• Architects
• Installers
• Electricians
• Plumbers</td><td>• Distribution system operator
• Public agencies (planning, procurement, environmental protection, etc.)
• European regulations</td></tr>
<tr><td>Investment, trading sector
• Property / real estate owners
• Investors (like pension funds, banks)
• Energy data-base or platforms
• Energy brokers</td></tr>
<tr><td colspan="3">Intermediary organisations</td></tr>
<tr><td>• Cultural institutions
• Energy poverty groups
• Tenant ambassadors
• Consultancy agencies and engineering companies
• Knowledge institutes
• Process managers</td><td>• Local politicians
• Local NGOs
• Local media
• Local influencers
• Neighbourhood cooperatives
• Neighbourhood managers</td><td>• Governmental organisation delivering intermediary services
• Citizen initiatives (including community energy collectives)
• Energy balancing managers</td></tr>
</table>

Stakeholders are groups who have made it clear that they are affected by the issue, and/or have a stake in the outcome either by being affected or having a serious interest. They may have the power to block or delay a decision, they may have a certain expertise, they may own infrastructure or land, or they may be simply too important to be left out.

Imagine if that happens to you. You are left out, even unintentionally, but you have the means to block the subsequent actions. What would you do? One of the first cooperative attempts to solve long-standing controversies over a proposed flood control dam on the Snoqualmie River in Washington State (Dukes, 2006) is an example of short-sighted inclusion. This pioneering case succeeded in drafting a settlement between the proponents and opponents of the project, but implementation became bumpy as the solution demanded zoning changes. This required approval by two counties and fifteen towns. However, the representatives of these governments had unfortunately never been consulted or involved in the process and thus delayed the necessary changes to the zoning plans.

Certain stakeholders may be highly affected by a project or a policy even though they don't show a high level of interest. Thus, it is important to differentiate between pure interest and the extent to which stakeholders are affected by certain outcomes.

4.5. Sustainable heating technologies and stakeholder selection

Selecting stakeholders with which to work in co-creation is connected with the type of sustainable heating technology chosen**.** Figure 9 and Table 5 provide an overview of alternative heating solutions for the built environment and suggest how co-creation might take shape depending on the technology. Individual and collective heat systems (district heat networks) are differentiated providing further clarification for the application of co-creation.

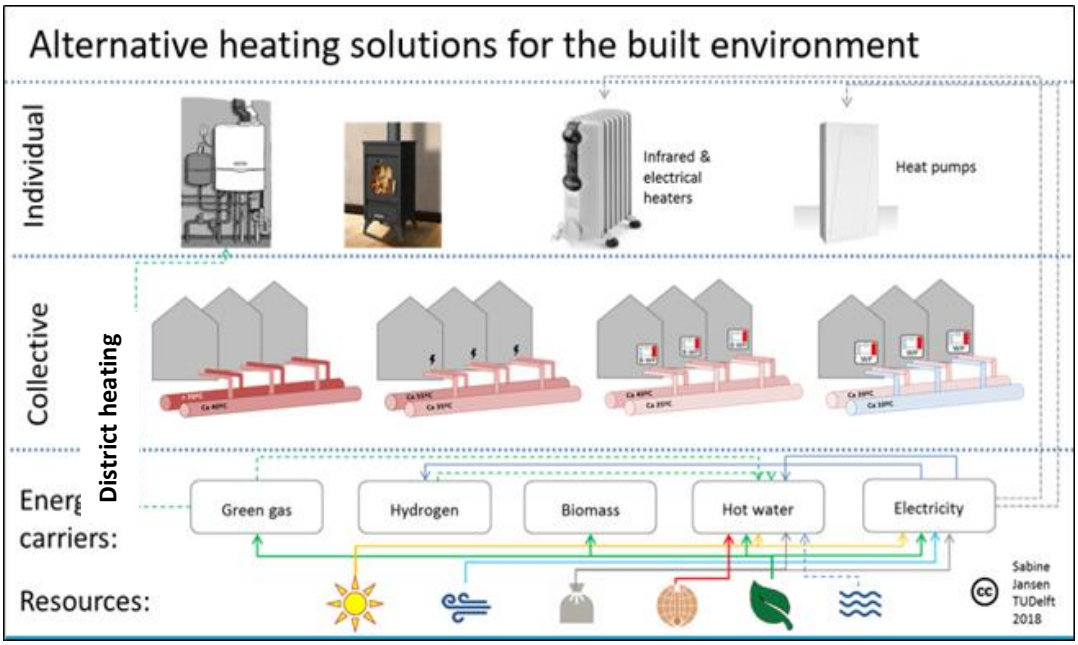


Figure 9: Alternative heating solutions (Source: SUI Project Jansen, S.C., et al, 2018)).

Table 5 gives an overview of different sustainable heating solutions and how co-creation differs in terms of the scope and site of co-creation, the actors or stakeholders involved, and the potential implications of co-creation processes.

Table 5: Overview of sustainable heating solutions, scope and site of co-creation, actors involved, and implications

Technology	Scope and site	Actors	Implications
Individual solutions (Home and building owners)			
• Heat pumps • Solar thermal • (Geothermal) • Biogas, biomass • Insulation	• Co-initiating thematic workshops on how co-benefits can be realised through individual solutions • Co-researching homeowner preferences • Co-creating a local platform on opportunities and learning experiences • Co-designing customer journeys • Co-creating the communication on the difference between a heat price and a gas price • Co-creating demand side management for electric solutions • Collective procurement	• Private homeowners • Local businesses • Local media • Local influencers • Neighbourhood cooperatives • Energy communities • Prosumers • Construction companies (contractors, subcontractors) • Architects • Installers • Electricians • Plumbers	• Increasing trust in novel technical solution • Voluntarily installed sustainable heating technologies, do not necessarily replace previous fossil fuel systems, but complement them, leading to systems that are far from optimal • Raising comfort level, health, and well-being, reducing prices are important considerations but there is no clear knowledge over each individual households' preferences • Unclear knowledge over which households are in the process of buying or renovating a home
• Individual storage • Electric or pump solutions	• Co-research for storage opportunities • Co-testing individual storage applications	• Similar actors to above	• It is not yet clear which storage technologies will prevail and become affordable
Shared solutions (Owners and tenants)			
• Heat pumps • Solar thermal • (Geothermal) • Biogas, biomass • Insulation	• Co-writing feasibility studies • Co-designing combination of solutions	• Investors • Developers • Housing associations • Housing contractors	• Complex models of actors and aligning their interests • Trust in novel technical solution

Technology	Scope and site	Actors	Implications
	• Co-implementing user guidelines and maintenance strategies • Co-creating a local platform on opportunities and experiences • Collective data collection • Collective procurement	• Tenants • Management firms • Energy communities	• Voluntarily installed sustainable heating technologies, do not necessarily replace previous fossil fuel systems, but complement them, leading to systems that are far from optimal • Creating diverse and inclusive engagement of homeowners and tenants
• Shared storage • Electric or pump solutions	• Co-research for storage opportunities • Co-testing shared storage solutions	• Similar actors to above	• It is not yet clear which storage technologies will prevail and become affordable
Collective solutions (Urban, district, or neighbourhood)			
• District heating networks • District heating network with PVT and seasonal storage • Sewage water exchanger • Mini district heat network with individual heat pump • High temperature district heat network with solar collectors and storage • Biomass in district heat network • District heat network on industrial waste heat • Mid-temperature district heat	• Co-writing feasibility studies and action plans • Co-initiating thematic workshops on how co-benefits can be realised through collective solutions • Co-initiation Living Labs • Collective deliberation on preferred scope, scale, and sources of district heating network • Co-designing customer journeys for switching to a DH system • Co-designing communication campaign towards large and small customers	• Distribution system operator • Public agencies • European regulations • Energy providers • Businesses who produce excess heat • Energy utilities • Local community energy collectives - Construction companies (contractors, subcontractors) • Local politicians • Local media • Local influencers • Neighbourhood managers	• Network route is passing properties • Experience of disruption and nuisance • Ensuring connectivity to households • Willingness to pay for connection is unclear • Freedom of choice is reduced if there is mandatory connection requirement • Energy source or facility might be popular or unpopular locally

Technology	Scope and site	Actors	Implications
network on residual waste heat • Power-to-Heat in a district heat network		• Energy balancing managers	
• Collective storage • Heat hub • Borehole thermal energy storage • Aquifer thermal energy storage • High temperature seasonal thermal energy storage in underground closed systems • High temperature storage in the ground	• Co-research for storage opportunities • Co-design of storage facilities • Deciding on preferences	• Similar actors than above	• It is not yet clear which collective storage technologies will prevail and become affordable • Dense areas, technological and geological constraints will reduce available alternatives

4.6. Stakeholder drivers and barriers

One of the most pivotal steps is to understand, from every stakeholder, whether they are from within your organisation or external, what their main drivers and barriers are that can either lead to engagement, resistance, or ignorance of the policy, the project, or issue at stake.

4.6.1. Exploring and aligning interests and motivations

The interests and motivations of the stakeholders might not align in the first place, but it is crucial to know what everybody wants to get out of co-creation. The following questions will help to gaining insights into the distinct drivers and barriers of the various stakeholders:

- What are the stakeholders' interests in the project and in collaboration? Do they for instance have interests in claims, positions, public resources, and technology or do they have financial–economic motives?
- What private or public values do they adhere to? And are these short-term or long-term interests with a public or private sector character?
- What would be a good co-creation result in one-, three-, or five-years' time? An improved quality of knowledge, a higher amount of CO_2 reduced, more and more diverse citizens reached, better incorporation of citizen's needs into policy, higher satisfaction among citizens, a higher acceptance and adoption of renewable heating technology, managing resources more efficiently, integrating isolated and fragmented low carbon heating systems into a larger network, etc.?

Financial motivations. Source: Ibrahim Rifath on Unsplash.

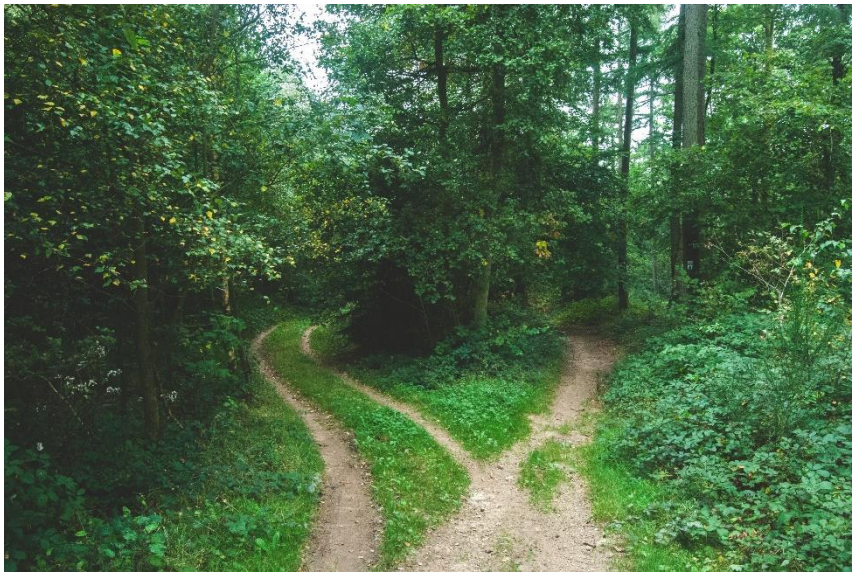
4.6.2. Spokesperson authority

It is crucial that stakeholder representatives involved in participatory processes have sufficient authority to make commitments on behalf of their organisation. Without this authority there is the risk that a solution or compromise obtained through co-creation may not reflect the interests of the represented group and could easily be rejected by its members. Moreover, every party, whether private, public, non-governmental or citizen-based comes with a set of constraints born out of its own identity, organisational structure, or internal politics. Stakeholder representatives need to be in constant feedback with their members to ensure they are working within the constraints of their organisation, are reporting ongoing developments and are able to adjust preferences in the course of the process.

Power station. Source: Diana Parkhouse on Unsplash.

4.6.3. Extent of stakeholder influence

Some actors have decision-making power while others have the power to block decisions. Yet others may make use of formal objections and exert informal power through social media campaigns, online petitions or protest movements. An often-neglected point is that effective sustainable heating initiatives require on-the-ground knowledge and sustained community support for implementation and long-term operations and maintenance. Hence, it is important to determine the amount of influence citizens and actors exert over certain parts of the project.



Convergent paths: Source: Jens Lelie on Unsplash.

4.6.4. Intermediary organisations and networks

Many stakeholders will not only be engaged more effectively through a third party whom they already know and trust, but also because that third party might be able to better translate or connect to their needs and interests. If the adoption, maintenance and trust in new heating technology is to be encouraged, intermediary organisations will play an important role in reaching out, encouraging and involving citizens since decisions that are made in heat consumption are largely a matter of personal and private interests.

4.7. Managing co-creation: Investing time, energy, and resources

A thorough assessment of the necessary time, energy, and resources that co-creation requires can support the municipality as well as stakeholders in making informed decisions about whether they are realistically prepared to invest in co-creation. An assessment like this includes aspects such as:

- What kind of feasible procedures within the organisation need to be set up?
- What kind of infrastructure is needed to communicate with citizens?

In the early stages of co-creation, it is key to balance flexibility and practicality of the process against the increase in complexity and sensitive issues. Therefore, it is very important to support these processes with experienced process and communication management, which can be a collaborative task. A lack of prior preparation causes missteps, which not only affects the motivation and intention of relevant parties and stakeholders to participate but also contributes to failure. Experience has

shown that the preparation of co-creation procedure and the broad involvement of stakeholders in the groundwork are crucial for its success. If all the interests of the stakeholders are recorded it is easier to integrate those interests into co-beneficial solutions and it frees stakeholders from competing for attention. It also opens up the possibility of engaging in active listening and solution finding.

4.7.1. Supporting citizens

Getting the communication departments on board is a must. Not only are they familiar with which language to use with citizens, they may also have internal expertise, tools, and contacts that will come in handy during the process. For example:

- they could help in setting up an operative engagement plan together;
- advise on when to use mailing lists;
- when to use social media;
- when to use a good old letter.

They might also be knowledgeable in:

- avoiding stakeholder fatigue or;
- preventing over- or under-frequent communication.

Typewriter: aid to communication. Source: Peter Pryharski on Unsplash.

Some municipalities and organisations have dedicated stakeholder or citizen engagement departments, which could probably take over some of the responsibilities in initiating and managing a co-creation process in sustainable heating.

If not, it is advised to set up a periodical task-force that combines different skills, makes use of existing contacts, resources, and established communication channels within your organisation. This is to make sure there are the necessary capacities to manage and process communication, which will naturally be a two-way process, not just information from the municipality to another stakeholder. Communication needs to be responsive and have a clear purpose. Engagement must be thought through and well organised, and the relevant data stored and properly analysed. Long gaps in communication should be avoided or explained.

4.7.2. Using external support

If you conclude that you might need external support, make sure facilitators or consultants meet the following criteria:

1. they should be impartial;
2. possess process management skills;
3. have excellent listening skills;
4. must understand and be able to explain complex issues;
5. display patience and creativity;
6. be persuasive;
7. have experience and legal expertise with the issue.

However, bear in mind that if an external party is leading the stakeholder engagement you might lose authenticity, knowledge, direct stakeholder relationships, or raise suspicion. This can lead to a disconnect between the stakeholder and the ongoing process.

4.8. Embedding co-creation in ongoing planning or formal decision-making processes

Will co-creation be embedded in an ongoing planning or formal decision-making process?

If you answer this question with a yes, then you need to think about possible constraints and limits due to this embedding. If the answer is a no, it is crucial that you ponder how co-creation can be meaningful as an end in itself and deliver a concrete impact nonetheless.

Along with this question comes the paradox that participation and dialogue processes can still be detached from current decision-making even though that might not be initially intended. In the beginning, the intention is that involving citizens takes place in close proximity to decision-making processes and has a significant influence on decision-making. In reality, however, many citizen involvement processes set off a participation biotope with scope for creative ideas but very limited intersect with political decision-making. Beware that, despite good intentions and competences, citizen and stakeholder engagement may be completely disconnected from political activity, as if it is happening in a parallel world.

Embedding collaborative heating systems adaptation in an ongoing planning or formal decision-making process can reduce disruption and cost. For example, new infrastructure might be better installed as part of a broader neighbourhood development or reconstruction project rather than as a standalone project, that would require digging up the road, thus creating less nuisance to citizens living close to construction sites.

Reduce disruption and cost. Source: Jamie Street on Unsplash.

Furthermore, it may contribute to achieving multiple goals (e.g. installing district heating infrastructure to support lowering the carbon footprint in a given neighbourhood while at the same time contributing to becoming more resilient to extreme weather events). This will also contribute substantially to the cost-effectiveness of construction activities by reducing the risk of unexpected consequences, foot-dragging, or resistance.

4.9. Inviting stakeholders and citizens

Having identified the most obvious stakeholders, a small group of these stakeholders should be contacted and informed early on that the municipality (or other organisation) seeks to initiate a co-creation process, related to sustainable heating. These pre-identified stakeholders should be asked if they would be interested in engaging in such a process and to specify who, in their eyes, seems to be a further relevant or affected party that should be represented in the systems or the decision-making level of the heat transition. To reduce the risk of excluding non-visible groups, the municipality or an external facilitator can also actively decide to include groups that are typically underrepresented, or hard to mobilise.

When you try to involve citizens in co-creation this can be a small or large group. It should be an inclusive group and a more or less representative sample. The sample is based on the critical mass needed for transition, i.e. not the 10% most advanced in sustainability or the 10% most reluctant to it, or the 10% who may not care about anything but the 60–65% of remaining middle group.

To activate those middle groups make use first of existing contacts, resources, and established communication channels within your organisation. Are there citizen panels, ambassadors, neighbourhood committees? Are there other project partners or intermediary organisations already involved that can co-invite? Make use of established contact points such as direct mailing, social media, apps, or office branches. The earlier stakeholder identification process should yield clear information on:

- where the different subgroups of stakeholders can be found;
- through which channels, platforms, intermediaries or previous contacts they might be best approached;
- which type and complexity of language they use;
- which incentives or triggers they need to engage in co-creation.

The last point cannot be overstated.

To increase participation, use a catchy entry questions and communicate clearly about the transparency of the process and provide answers to what happens with the results.

It is not only pertinent to identify and activate less powerful and marginalised groups but also to organise the co-creation processes in such a way that allows these groups to participate in a meaningful way. Thus, provide low entry barriers:

- design and use language as close to the private sphere as possible;
- combining on- and offline co-creation spaces;
- foster trust in individual competence/expertise to participate;
- demonstrate the potential impact of participation;
- enable the possibility of passing the invitation on to someone else;
- offer incentives, e.g. compensate participants or provide them with a special experience.

4.9.1. Timing

As a baseline, the earlier the involvement with citizens and stakeholders starts, the more everyone will have the feeling of an equal partnership. A good indicator is to look into previous experiences with stakeholders and citizens and understand their opinion on the timing of their involvement. Another option is to find out if there is already an ongoing community initiative around sustainable heating or a third-party project that the municipality might get involved with. Timing also depends heavily on clarifying the stage at which stakeholders, citizens, and the municipality get engaged; determine if is this in co-initiating, co-designing, or co-implementing sustainable heating initiatives.

Planning is essential. Source: Plush Design Studio on Unsplash.

5. Co-creation methods

Do you want to invite citizens and stakeholders to face-to-face meetings to deliberate on starting points, common rules, strategies? Be part of a co-designing Living Lab? Or do you want them to collaborate through innovative software?

There is no one-size-fits-all approach to co-creation. The method will be influenced by whether or not solving financial, technical or social challenges around the heat transition are important: and if those challenges occur at a policy, project, or acceptance level. **The overarching advantage of co-creation is that local stakeholders can be asked to help illuminate critical opportunities in their communities and generate creative ideas for solving multiple challenges at once**.

5.1. Deliberative Workshops

Creating opportunities for stakeholders often requires an initial set of workshops. One possibility is to invite around 15–20 representative of the obvious stakeholders identified earlier in the process to meet for a preparatory workshop to learn about the topic, the objectives, or common problems.

5.1.1. Preparatory workshop

A preparatory workshop should be open enough to discuss several angles and ideas around a challenge, and focus on establishing a co-designing framework rather than looking for solutions.

Group discussion: Source: M.D. Duran on Unsplash.

5.2. Workshop example

In a second workshop, participants might work in small, facilitated groups to refine the framework and create subtopics of the challenge. Experts and decision-makers could be present to support and discuss questions brought up by the participants. Moreover, the groups might also begin to draft recommendations to challenges around the social feasibility, accessibility, and acceptability of

sustainable heating systems related to different subgroups in a given neighbourhood. A follow-up process can also be drafted.

The following example (Table 6) illustrates what such a workshop or series of workshops could look like.

Table 6: An example of what a co-creation workshop could look like

1. To foster some early trust between the participants the facilitator asks each what they value about something more general (such as their neighbourhood, or warm, comfy home) in very general terms.
2. The facilitator then highlights all the given positive attributes around the objective under discussion. “You see, living in your neighbourhood has positive aspects to you, but for different reasons. This is similar to the sustainable heat transition. There are different ways to go and our opinions and preferences about them arise because each of us sees the same things differently.” The facilitator then might continue with a statement like “Today, we take conflicting viewpoints as a given, even if some of them might be strange or intolerable. Bias is critical to how we view things, so let’s work with that premise.”
3. Give an overview and transparency over what is going to happen. “What we try to do in the next hour is to see what possibilities there are, how we rate them, and if there might be some common ground between your opinions.”
4. A productive environment is further relevant. “Each of you write down two or three ideas or suggestions on how to improve the transition to low carbon heating or what else you find most pressing around that topic.” The facilitator can then go round by asking the participant’s name and their most important idea, preference, or motivation and writes them on a whiteboard or flipchart.
5. It is important that participants demonstrate respect for different ideas, thoughts and values, and must not interrupt each other. Emphasis should be on expressing ideas, explaining and clarifying personal points of view, and not immediately debating them. Each participant should have time to express and explain but, due to limited time and limited attention spans, budget for around 5 minutes per participant.
6. To get closer to the bottom of the iceberg, questions to be asked might be: “What are the reasons behind your suggestion? Why is this for you the most important issue or motivation?”
7. If participants use abstract or very general terms ask questions like: “What do you mean precisely by this? Can you describe a situation from your everyday life where you experienced this?” Or it might be a good strategy to ask the other participants whether they understood what is meant.
8. It can also happen that participants do not know how, or do not want, to further explain their motivation, e.g. “that’s just it, or it’s a gut feeling, or its just super important to me”. The facilitator can again ask for more clarification such as why it’s difficult to explain for them. At last, ask if the participant if they want to add anything else.

9. After such a round has been completed, **the group can sort the statements into agreements and disagreements**. This gives an overview of where there is consent within the group and, interestingly, where do they really disagree? Let the participants formulate the source of the agreement and disagreement. The facilitator can help in clarifying: "If I understand it right, the source of disagreement must be located in the following (priorities, arguments, values, interests, facts). Is this correct? What needs to be added? (new disagreements can be added during the conversation)". Questions like "**Which of the challenges and disagreements do you think are most important to look at during this workshop**? Now you have the chance to discuss matters since you are all sitting together" might help to prioritise the top issue to work on, otherwise it is also possible to allow participants points to rate different issues.
10. "What would need to happen for you to agree on a common recommendation for your municipality or neighbourhood, one that would include all your viewpoints?" The facilitator then highlights all given criteria that were stated. The facilitator then picks out some controversial conditions: e.g. someone might state "that if person A or group B or department C would behave differently, if they would just understand the situation correctly, it would be easy to find a solution". The facilitator then asks "What is the underlying reason for this statement? Can this be reformulated? How do the others in the group see this?" The point of this initial exercise is to create a sense of understanding of the reciprocal dependency that influences the well-being of the participants as well as the respectful treatment of arguments and counter-arguments.
11. The next part focuses on a **structured debate with the aim to reach a greater consensus on common challenges and possible solutions**. The facilitator might ask "Now we go back to the substantial matter. Let's sketch out some scenario-alternatives based on the first discussion and debate how they would affect the public, how effective they are in addressing the challenges around the heat transition, and the probability that everyone would be better off". **The groups can be split into smaller groups according to the most important challenges and disagreements**. The participants should choose one that is more relevant to them, but each sub-group should have more or less equal participants.
12. "**Be open to nuances; try to not agree or disagree immediately, but see the source of your disagreement as the starting point**." If it helps, experts may be present to provide clarification on a certain topic. Participants should try to jointly formulate fact-finding questions that they pose to the experts. The aim is that participants come to formulate a scenario and a process that they can agree on agree on and to reflect on what was most helpful in achieving this? It is important for all participants to explain their arguments and to jointly fact-check what they've stated during the debate. If there are some dominant voices the facilitator might need to intervene and reformulate the discussion.

13. When the participants present their results, the facilitator might want to ask: "**How would you describe your outcome**? Is it a consensus? (did they come to a common understanding of the problem and the solution); a compromise? (that they all agreed to relax some of their claims but are still satisfied with the outcome); is it a narrative? (they agree on a story, on something that characterised their collaboration or common faith, but they could not really agree on a specific scenario or a solution); a dissensus? (they agree that their disagreement has to be solved through other means, like majority-voting?" It might, of course, be a mix of the above.

14. Good questions to reality check results are: "**Are there any people in the room or not in the room that would object with what you just came up with**?" What would the barriers be in scaling this up or transferring it into other neighbourhoods?" "Do you think this solution will be easy to accept by groups other than you? Like, for example, big industries or politicians?" "What would potentially oppositional or blocking groups needed to change from refusing to supporting your recommendations?"

15. The group might want to take a further step in co-collecting further data, **co-design visualising scenarios in real or virtual environments** (e.g. using virtual reality or augmented reality applications) that can support further understanding about the public and private effects of alternative heating systems and scenarios. As design requires time and iteration it is important to test a pilot or a prototype then rework failures and integrate learned lessons rather than perfect each piece in isolation. Open source approaches further help to integrate knowledge from citizens and experts that are not locally present. It is better to delay the introduction of different types of technology in the workshop in order to keep the focus throughout the process on the people. This will create an inclusive environment where everyone is valued for their knowledge and expertise – whether tech or 'non-tech'.

5.3. Collective data collection

Substantive changes in socio-technical systems, such as the heat transition have no clear boundaries. Collective data collection can help to understand how different actors define the system and its problems depending on their perspectives. Collective data collection can lead to a compilation of images, data and arguments. The results are often a new type of meta view, created from the activities of hundreds to thousands of people. It is important that data is collectively assembled and that the results are collectively interpreted and conclusions agreed upon to avoid public dispute such as happened in Freiburg (in Chapter 3, section 3.6). In Freiburg, the government and citizens involved would have profited if the disputed issues around district heating had been jointly researched and understood.

Collective data collection can include:

1. Collective assembled documentation such as internal records, statistics, reviews, research reports, project plans, research diaries, etc.
2. Participatory observation and fact finding including data related to direct observations, sensoring and records.

3. Physical artefacts including prototype products, animations, posters, documentary films, and photos of the designs.
4. Collective interviews with experts and policy-makers.

5.3.1. Citizen sensing: The case of the DampBuster project (Bristol, UK)

The DampBuster project of The Bristol Approach in 2015 gives an example how collective data collection works in practice. Everyone involved in the Bristol co-creation process acknowledged that community training, human-data collection, and face-to-face work had to go hand-in-hand to solve the problem of damp homes. A prototype frog-cased sensor for collecting data in individual homes to better understand the intensity and source of the problem was created by the group. The frog gathered temperature and humidity data in homes affected by damp. The sensor sat on a paper lily pad which acted as a 'data diary' for people to record their own human-data notes: e.g. 'did lots of washing'. A reporting map was created so people could record the damp and mould in their home. Open source software was used and tested by residents, community groups, and damp experts. By testing these prototypes with people in their homes the co-creation team was able to write detailed instructions on how the protype could be developed further.

> *"For these things to catch on there needs to be an emotional engagement with the technology and what it can do and how it engages with one's community. There's not going to be an engagement with a black box in the corner. There needs to be an aesthetic and a feel and a relationship with these things," said an artist involved in the project.* (The Bristol Approach, 2019)

5.4. Visualisations

Visualisation through visual imagery is an effective way to communicate both abstract and concrete ideas. Visualisation has ever-expanding applications, with interactive multimedia and game-design elements, and is also found in techniques of futuring, such as fore- and backcasting, anticipatory thinking, and visioning.

If visualisations of the heat transition are designed and created collectively, they can be a powerful approach for understanding highly integrated, large-scale transformation where many actors are involved. Simulation games are especially useful in representing these dynamic situations, including the social or human factor. A simulation game can, for example, help participants to understand heating markets and technologies. Players can interact on the basics of the energy transition and experience first-hand the dilemmas that accompany collective and individual investment decisions, based on deep uncertainty. Visualisation tools references in this report include the green transitions project in Sweden and Denmark which visualised new roles for public officials (Chapter 3, section 3.8), schools as energy embassies (Chapter 3, section 3.3), and the PVE online tool described in Chapter 5, section 5.6.

5.5. Online tools

Setting up deliberative online spaces, data-gathering platforms or using scenario software needs guidance and mechanisms to create a space for productive discourse.

The aim of online co-creation tools is to provide a forum for participants where they co-create advice on different scenarios and can state preferences in discussing the pros and cons of the available options for sustainable heating. At the same time, these tools and forums provide spaces for participants to suggest ideas from their own community or ask questions to experts or other participants with everyday experience in a topic. They can do so at home in front of their devices at any given time which reduces the threshold of participation. Online tools help to see if the larger (and often younger) group of participants has diverging perspectives and new insights on the options presented. They also provide an additional means of communication and engagement which increases the flow of information about the transition to increase awareness and inform choices.

5.6. Participatory Value Evaluation (PVE) tool

Participatory Value Evaluation (PVE) is a method developed by TU Delft, VU Amsterdam, and the University of Leeds, that seeks to identify the social costs and benefits of government policy as effectively as possible (Mouter et al., 2019). At the same time, PVE is a tangible method for facilitating co-creation. The essence of PVE is that participants are confronted with a restriction (e.g. a government budget or a sustainability objective to be achieved) and a number of possible policy options, including the effects of the policy options, in an online experiment. On the basis of the choices made by participants, it is possible to determine the social costs and benefits of various policy options and determine the optimal portfolio of projects.

Brainstorming. Source: You X Ventures on Unsplash.

How does the tool work in practice? The municipality of Utrecht aims to have 40,000 homes and other buildings free of natural gas by 2030. 22,000 homes still need to begin with the transition. However, there are different alternatives and costs to achieve this goal. Through applying PVE, the municipality gives residents the opportunity to give advice and state their preferences on different strategies.

In the first step of the PVE, residents can divide 100 points between four approaches to achieve the target. The first approach is the cheapest. The financial support from the government is high enough to ensure that the housing costs of residents do not rise. The other three approaches are more expensive. Residents receive financial help from the government, but they also have to pay part of the costs themselves. The second approach gives residents the most freedom to choose how they use natural gas. The third approach scores best on reducing CO_2 emissions. The fourth approach starts in the neighbourhoods where residents have the most money and can pay the costs the easiest.

Residents can assign many points to the approaches that appeal to them and assign fewer points to approaches that do not appeal to them. In the experiment, residents are given information about the characteristics of each approach and the neighbourhoods that deviate from natural gas when this approach is chosen.

Much of the co-creation lies essentially within the operationalisation of the PVE, since regulative documents provide hardly any substantive instructions as to how co-creation should be implemented in sustainability transitions. PVE has been designed to improve the process through the basis of a number of strict principles (Table 7).

Table 7: The principles of participatory value evaluation (PVE)

1.	The process is an operationalisation of welfare economics theory. This theoretical basis provides the initial benchmarks for the design of a PVE experiment. For example, it is important to make all financial flows transparent in the experiment. For example, it is not possible to allow citizens to choose between two government projects that require a different government investment without showing what happens to the money if the cheapest project is chosen.
2.	All citizens have an equal voice (one-person-one-vote). The voice of rich citizens or informed citizens does not count for more than the voice of poor or poorly informed citizens.
3.	The method is non-paternalistic. Citizens are not instructed to make a choice from a certain perspective (such as the general interest or their own interest).
4.	The instrument is based on a pluralistic democracy model. There is no goal to reach a consensus, even though the tool is designed to inform citizens about the range of impacts of different alternatives for different groups and subgroups before they arrive at an opinion.

A key benefit of PVE is that the entry barriers for participating are relatively low. Participants generally spend 20 to 30 minutes submitting their choices, and the respondents can choose themselves when and where they conduct the PVE. As a result of the low entry barriers not only the passionate proponents and opponents but a more diverse set of citizens can participate in the evaluation of public policies. The socio-demographics of the respondents reveals that all relevant segments of the population are represented to a fairly equal extent. The low barrier to participation in PVEs makes participation further accessible to a larger group of citizens. The PVE for the Amsterdam Transport Region was attended by 2,500 citizens and the PVE for the Dutch Ministry of Infrastructure and Water Management was completed by 2,900 citizens. A large-scale PVE may include as many as 8,000–10,000 respondents.

Another potential virtue of PVE relates to communication/awareness raising. That is, citizens better understand the dilemmas public bodies are faced with in making complex decisions when participating in the PVE, because they have to make – consequential – choices themselves. For instance, citizens learn about scarcity of public resources (not everything is possible) and the cons and pros of the alternative policy options.

The process of an ideal type PVE including deliberative workshops is shown in Figure 10. In collaboration with scientists, experts, and citizens the municipality develops several strategy options in subsequent workshops that are presented online for all citizens of Utrecht to evaluate.

5.7. Living Labs

Living Labs bring together interdisciplinary experts to develop, deploy, and test – in actual living environments – new technologies and strategies for design that respond to changing and uncertain futures. Living Labs usually engage all stakeholders, especially citizens, residents, or user communities, at the earlier stage of the co-creation process for discovering emerging scenarios, vulnerability, and behaviours through live scenarios in real or virtual environments (e.g. virtual reality, augmented reality). Subsequent collaborative exploration can lead to a rigorous assessment, focusing on alternative scenarios and their associated risks. The assessment ought to identify key physical and social vulnerabilities, study their likelihood, timing and consequences, and, develop and prioritise strategies for addressing them and their consequences. The core of Living Labs is then to experiment with the proper level of technological change to experience live scenarios with a large number of users in real-life situations; while collecting data to make observations on the potential for social adoption, confrontation or refusal (Voytenko et al., 2016).

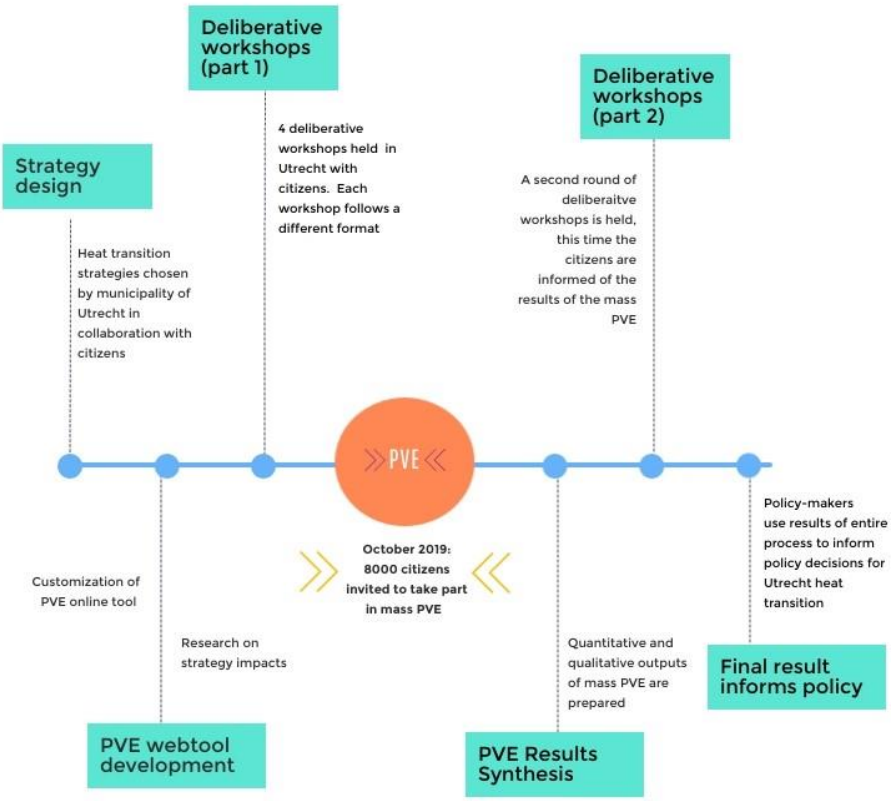


Figure 10: Co-testing in urban areas through Living Labs. (Source: TU Delft.)

5.8. Collective inspiration tools

As artists look for inspiration in creating their artwork so too can citizens and governments look for inspiration in co-creating sustainable transitions. Residents can inspire each other through informal walks and visits looking at how to renovate neighbourhoods and homes. Telling stories can connect generations and diverse groups around the social aspect of heating. Good practice examples from other cultures can shed light on possible alternative scenarios. Inspiration tends to happen to people spontaneously in the natural context of everyday life. Authentic inspiration experiences are not usually the result of the deliberate effort of one party to inspire another. Inspiration refers to "breathing in", not to being "blown into" (Thrash et al., 2014). Thus, inspiration methods are creative processes that transform (i.e., they are novel), evoke (i.e., they arise spontaneously), and motivate (e.g., to approach a goal) before the light goes dim (i.e., once you have a goal worth pursuing, pursue it). A case of collective inspiration in this report is the 'neighbourhood engines' in Chapter 3, section 3.4.

5.9. Design thinking

Design thinking focuses on understanding people's needs and creatively designing a solution to address those needs. The process is characterised in stages based on gathering ideas about what people need, generating ideas, and testing or experimenting with what works (Liedtka, 2015). This can also be extended to five stages (Dunne and Martin, 2006):

1. Empathise or understand. Use interviews to find out what is important to people. Ask for personal stories.
2. Define the problem/Explore. The interviews help to understand what people's needs are.
3. Ideate. Challenge assumptions and create ideas.
4. Prototype. How does your idea fit into the idea of people's lives?
5. Test/Evaluate. Test the prototype with different users to find out what works and what doesn't work.

The process can be repeated, revising the solution or prototype until it suits the needs of everyone involved.

5.10. Customer journeys

The aim of customer journeys is to understand, from the customer's perspective, the sequence of events that customers go through to learn about, adopt, and use a specific product or service ((Norton and Pine, 2013). Mapping the customer or user journey helps to discover how to create value for the customer, generate profit for the organisation, and differentiate from existing or other alternative solutions. Customer journeys are a sequence of steps which relate to decisions around the produce or service (Muhoza and Johnson, 2018).

An example of exploring the customer journey can be found in the case study on EBO Consult, Copenhagen, Denmark (Chapter 4, section 4.1), where the EBO Consult aimed to encourage and simplify the process of transitioning from gas to district heating. The process used in this example was divided into four phases (Coenen and Hoppe, 2018):

1. Deciding (the customer decides whether to get DH or not).
2. Going (the customer has decided to get DH).
3. Doing (installation of DH in the customer's house).
4. Using (the customer uses DH to heat the house).

Each phase can be further unpacked by talking with, or observing, customers and perhaps telling stories of how the experience might play out for them. Co-creation helps not only identify the customer journey but also refine it as the process progresses to address any barriers to adoption that may arise (Jürisoo et al., 2018).

5.10.1. Unburdening homeowners: The case of 'Buurkracht'

In the transition to adopt sustainable heating technology, it is off great importance to gain the trust of homeowners. When confronted with potential investment in sustainable heating options homeowners face many uncertainties. If one expects them to invest and adopt the technology one thing to make sure is that homeowners are 'unburdened', i.e. remove perceived uncertainties and risks that prevent homeowners from making the necessary investment. One promising way in which unburdening can be applied is via intermediary intervention. One such intermediary organisation is 'Buurkracht' – established in 2013 as a program of the Enexis group (an electricity network operator) - whose model is homeowner-based, and is strongly embedded in social structure and social norms of the neighbourhood.

'Buurkracht' uses the 'customer journey' approach to 'unburden' homeowners, offering support to in all decision-making moments homeowners encounter in relation to increase energy performance of their homes. The 'Buurkracht' approach assumes creating favourable conditions to effectively support homeowners in the – often lengthy, time consuming – journey to make their homes achieve better energy performance levels. Incentives offered the intermediary organizations, are e.g. digital energy scans, energy saving tests, cooperation with certified providers, or via delivery of guarantees. Trust is essential in this process. For homeowners trust pertains to three dimensions: 1) Trust in people, organisations and institutions (including the intermediary); 2) Trust in knowledge, experiences and competences, and 3) Trust in the materials and technology they deliver.

Because 'Buurkracht' engages with local communities, using existing local culture, rules and language – e.g. via the local football club or the local renewable energy cooperative – and 'energy ambassadors' – i.e. well-known local persons with a high degree of local authority and reputation – they collaborate with local messengers who are trusted. This is also related to 'Buurkracht' getting in touch with or even generating neighbourhood (civic) initiatives and connecting fellow neighbourhood residents.

As 'Buurkracht' supports projects with smart phone applications – showing information on both individual household and neighbourhood progress – it also allows homeowners to monitor the process, observe how many neighbours are also involved or have adopted energy technology options, and become active in sharing peer-to-peer expertise. In addition, neighbourhood newsletters are also used to convey messages in project progress. Once projects are finalized 'Buurkracht' shares the

message of project completion (and results) with the neighbourhood residents. As per December 2019 'Buurkracht' is or was active in 185 neighbourhoods in cities across the Netherlands[13].

5.11. Storytelling

Stories are a 'mechanism that human beings evolved to tell as packages of information about who we are, how we survive, what we care about, and then spread those ideas through time and space' (Neeley, 2020). Stories, or narratives, are understandable, relatable, and can help listeners engage in the motivations expressed in the stories. Stories can be scenarios describing futures, exploring possibilities, and providing opportunities to 'move beyond the facts of the past and the perceptions of the present' (Shearer, 2004).

Using storytelling as part of co-creation can, for example, ask people to tell their stories about how they use heat at home (Groves et al., 2016) or to imagine what using a sustainable heating system would be like for them (Shirani et al., 2016). This method can also include showing videos to help prompt discussion about what future heating could look like and explore the stories behind different futures.

5.12. Schools as energy embassies

The idea of using school as examples of energy innovation is described in Chapter 3, section 3.3 where schools in Utrecht and Amsterdam were chosen as host sites for renewable energy technologies. A series of workshops was carried out at the schools that involved pupils as researchers and designers in the "Schools as energy embassies in neighbourhoods" (SEE) programme. By challenging pupils to come up with their own ideas for a sustainable energy transition they would be able to contribute to the co-creation of sustainable initiatives together with stakeholders, while at the same time learning about sustainability. A participatory action research (PAR) approach was used which is summarised in Figure 5.

[13] https://www.hieropgewekt.nl/kennisdossiers/onderzoeksrapport-samen-op-reis-naar-een-energiezuinige-woning Reference: Wilde, M. de, Spaargaren, G. (2018). Samen op reis naar een energiezuinige woning; Het belang van vertrouwen in bewonersgerichte aanpakken energiebesparing. Wageningen University, Wageningen, The Netherlands, pp. 1-43

6. Evaluation

"An evaluation serves as a systematic and objective assessment of a planned, ongoing, or completed project or programme, it's design, implementation and results." *(Development Assistance Committee Working Party on Aid Evaluation, 2010)*

Evaluation captures how change happens (Hobson et al., 2016). **The evaluation process, in the spirit of co-creation, is developed throughout the process itself**. This means that all partners involved in the co-creation process actively begin to define indicators that can be used to monitor and evaluate the project. Because co-creation is a non-linear method establishing effective monitoring and evaluation as ongoing processes is essential. The practice of co-creation is necessarily reflective as reaching out to, and receiving feedback from, different stakeholders takes time not only to carry out but also to integrate. Some examples of how to reflect broadly on the process of co-creation include:

- discussing how spaces were created for expectations to be clarified and for any concerns to be raised and acknowledged;
- exploring how risk management strategies are being or have been created;
- how ongoing communication was maintained;
- whether or not enough time had been set aside for consulting stakeholders and citizens in order to understand the needs of different groups and integrate feedback from stakeholders (Camden et al., 2015).

6.1. Participatory evaluation

Participatory evaluation is where some or all of the parties involved in co-creation participate in designing, carrying out and interpreting evaluation (Development Assistance Committee Working Party on Aid Evaluation, 2010). Some examples of how this can be done include:

- Take a high-level snapshot of what's happening and compare it to objectives.
- Make a diary of events as a way of capturing what's happening when and to monitor involvement and timelines.
- Conduct interviews with stakeholders to determine how they feel about the process and their involvement.
- Carry out satisfaction questionnaires with all stakeholders and gather feedback to further refine the process. This could include asking questions such as "how would you define the quality of the relationships between all involved parties?" (Kressel and Pruitt, 1985) and "to what extent is the process responsive to your needs?"
- Taking time to determine how committed participants are to a shared outcome.

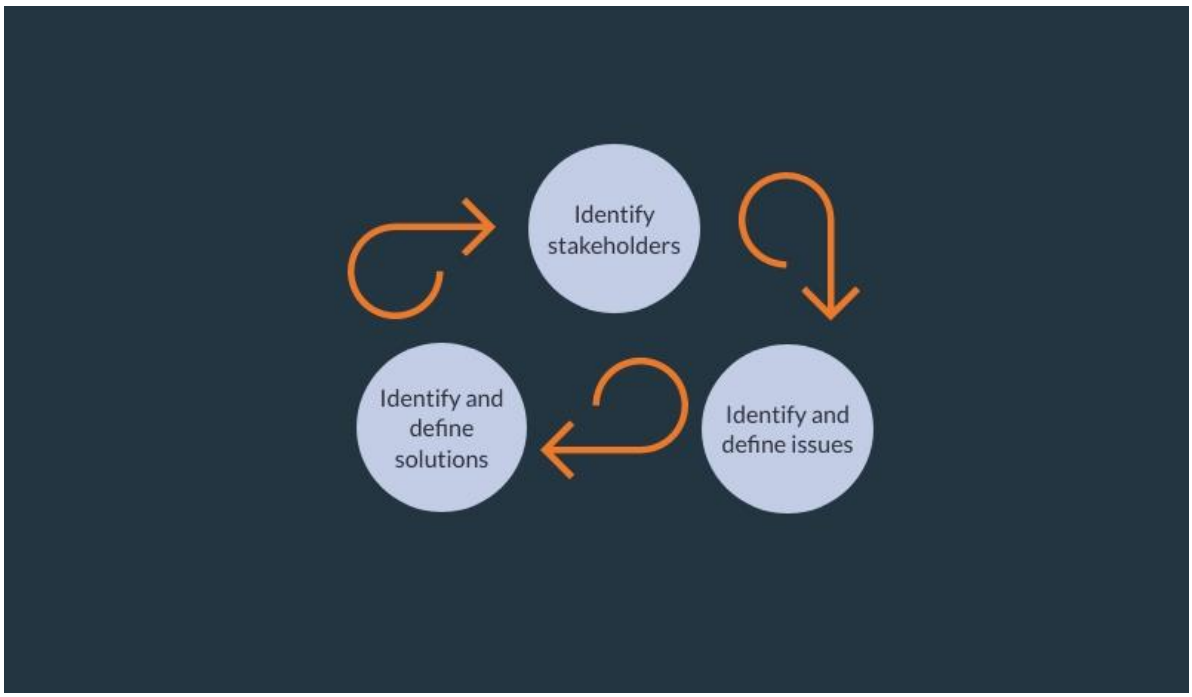


Figure 11: Broad aspects of co-creation used in monitoring and evaluation

6.2. Ongoing monitoring

An ongoing monitoring process can touch on the main, broad aspects of co-creation, such as which stakeholders are involved, which problems have been identified, which potential solutions have been developed, and which actions have been planned or taken place (Figure 11).

6.2.1. Identifying and defining issues

Through the various processes of engaging with stakeholders and citizens ideas, problems, insights, and solutions will arise. When taking time to monitor change in the project some points that may be useful to reflect on include describing the project from different perspectives. How would the following stakeholders describe the project?

- Different institutions and organisations.
- The locality or neighbourhood.
- Policy makers.
- Technology designers and developers.
- Citizens.

This process informs an overview of the project which can help to map out or trace the development of different points of view and how they are affecting the project. This includes developing an awareness of the variety of viewpoints that have been voiced and the need to create a space in which all opinions and knowledges can be expressed. This is essential in being able to capture expectations from everyone involved. This process can then connect with decisions and actions.

6.2.2. Identifying and defining decisions and actions

Monitoring co-creation requires looking at decisions and actions that have already taken place and thinking through future decisions and actions.

In this part of the process there are several points to consider:

- Who makes the decisions?
- Who decides who is involved?
- Who decides when different stakeholders and citizens are involved?
- Where and how are decisions made?
- Which stakeholders? (notice where the boundaries are between stakeholders)
- Using which processes? (note the familiar and accepted methods used for making decisions; e.g. think of a previous project or experience that shares some similarities with the current project)
- To what extent are citizens enabled to envisage their own energy future?
- To what extent is space for consideration of alternative low carbon energy futures provided (e.g. energy efficiency and conservation)?
- Sketch the decision-making 'hierarchy' before and after the co-creation process.

Co-creation has been described in terms of having three critical 'risks' and two critical 'limits'. Risks and limits feed into an evaluation. For example, when monitoring and evaluating critical 'risks' the following questions can be considered:

1. Expectations - How are expectations being managed in the process? What effect is this having on the process and outcomes?
2. Power - How are resources and knowledge being shifted around as a result of the co-creation process?
3. Values - How are stakeholder values informing the process? Note that this connects with whose knowledge is considered 'valid' in different domains/contexts as one of the critical limits.

A similar process of questioning can be used in monitoring and evaluating critical 'limits':

1. Validity - How were different perspectives determined as 'valid' or not?
2. Pragmatism - How are the economic and capacity costs of co-creation being expressed and taken into account.
3. Observe how long the process is taking and compare this against expectations of timeliness. Which practical aspects were easy or difficult to initiate and sustain? Why was that? What effect did it have?
4. What is 'good enough' to be acceptable? (Was what was 'good enough' to be acceptable in the end? For whom? Why?)
5. How did the reality of practical limits affect what was achieved? (In what way?)
6. What compromises have to be made? (How did compromises affect the process and outcome?)

6.2.3. Questions for a short-term evaluation

Some or all of the following questions (Table 8) can be used in a periodic evaluation process.

Table 8: Questions for use in a period evaluation process

Experience
• How did participants like the overall experience?
• What did participants feel before, during, and after the experience?
• Did they find any common ground in the process? On what precisely? Was there anything particular that helped in that respect? (e.g. a common reference, concern etc.)
• Did they feel the conversation increased or decreased the distance (trust) to the other person?
• What was their expectation going into the process? And did the experience confirm this expectation?
• What would they tell their peers about the experience of cooperation with someone from the other side of the political spectrum? (was it worth it, not worth the effort?)
Selection/motivation for participation
• What was their motivation to participate?
• How much importance did the respondent attach to the themes covered by the project? (Survey question along the lines of: how important is this topic in your everyday life?)
• What was the reasons of those who did not participate (non-show)?
Suggestions for improvement
• What kind of questions improvements would they prefer should they participate again?
• Did they like the setting as it was or did they miss something?

6.2.4. How to evaluate "co-creatively"

There are various methods that can be used for evaluating co-creation. **As there is no standard method for evaluating co-creation** evaluation needs to be developed throughout the process itself, meaning that all partners involved in the co-creation process actively begin to define indicators that can be used in evaluation.

To begin, both the outcomes and process of co-creation need to be evaluated:

1. The outcomes of co-creation.
- What is the purpose of the project?
- What are the outputs of the project?
- What actions are needed to achieve project outputs? (Funnell and Rogers, 2011).
2. The process of co-creation.
    - Is co-creation adding value? (value can be different things here, not simply economic value).
    - Is co-creation creating and maintaining quality (ask around all stakeholders what 'quality' in the process means to them).

Glossary

Adoption
The decision of a person or household to accept using a new technology or other innovation. For example, a householder decides to start using a heat pump, makes the investment, gets the heat pump installed, and starts using it.

Ambassadors
Users who are not only aware of socio-environmental challenges but are already making decisions towards environmentally driven solutions while also continuously seeking to change their behaviour. These users are also affiliated with sustainability issues in their daily lives, which motivates them to advocate for new solutions that can contribute to sustainability. They are actively engaged in the innovation process and also take the initiative to spread information and promote the system among their family, friends, and peers (Sopjani et al., 2019).

Citizen
Refers to an inhabitant of a particular town or city. Just as consumers are end-users of the product produced by the private sector, similarly citizens are the end-users of the public services provided by the government.

Co-benefits
Co-benefits are positive impacts accompanying the implementation of climate mitigation policies and do not address (merely) CO_2 reduction but also additional benefits such as the transformation of the energy sector or creating more jobs ("Focusing on the Co-benefits of the Energy Transition," 2019).

Co-creation
Co-creation envisions involvement of citizens as co-initiators and co-designers in the process of policy-making or public service delivery.

Co-design
Co-design is a process that envisions inclusive problem solving, placing citizens and stakeholders at the centre of the policy design process, focusing on outcomes that benefit citizens.

Co-innovation
Co-innovation defines an innovation paradigm where new ideas and approaches from various sources are integrated in a platform. It originates from a corporate approach to generate new organisational and shared values. The core of co-innovation includes engagement, experience, and co-creation for value that is difficult to imitate by competition. The co-innovation platform is built on principles of convergence of ideas, collaborative arrangement, and co-creation of experience with stakeholders.

Co-production
Co-production is considered as the involvement of citizens at the *co-implementation* level of public services, as opposed to the initial levels of co-design or co-initiation.

Deliberation
Deliberation is a process of thoughtfully weighing options, usually prior to voting or other forms of decision-making. Deliberation emphasises the use of logic, reason, and truthful conversations over manipulative and strategic interactions.

District heating
To use local fuel or heat resources, that would otherwise be wasted, in order to satisfy local customer demands for heating by using a heat distribution network of pipes as a local marketplace (Frederiksen and Werner, 2013).

Energy cooperative
Energy cooperatives are characterised by their cooperative business model, where citizens are involved in decision-making and financial and economical participation. Energy cooperatives are led by citizens instead of industries that typically manage energy market assets.

A cooperative is defined as "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise" (United Nations, 2012).

Energy cooperatives have several internationally agreed principles governing their operations (International Co-operative Alliance, n.d.).

They are open and voluntary in nature: they are open to all members of the community who are willing to participate and take on membership roles.

Democratic ownership: each member contributes equally, financially and is each bestowed with one vote that is used to decide collaboratively upon policies governing operations and decisions of the cooperative with some members being elected representatives.

Shared ownership: each member is a shareholder, owning part of the cooperative through economic participation (buy-in fee). All members receive a limited and equal compensation for their contribution, with surpluses flowing back into funding the operation of the system.

They are autonomous and independent in decision-making; they are not controlled by any private or public authority.

They provide information and training to members on technical know-how, in order to facilitate effective contribution by individual members in the functioning of the cooperative. They also participate in raising awareness in the general public on the benefits of such a cooperative.

Cooperatives work for the benefit of their communities and ensure their sustainable development

Gamification
Gamification is the application of game-design elements and game principles in non-game contexts (Robson et al., 2015). It can also be defined as a set of activities and processes to solve problems by using or applying the characteristics of game elements.

Governance
Refers to the creation, execution, and implementation of activities backed by the shared goals of citizens and organisations, who may or may not have formal authority and policing power (James N. Rosenau, 1992). Another, more up to date definition, addresses governance as, "All processes of governing, whether undertaken by a government, market, or network, whether over a family, tribe, formal or informal organisation, or territory, and whether through laws, norms, power, or language.

Governance differs from government in that it focuses less on the state and its institutions, and more on social practice and activities" (p.1) (Bevir, 2012).

Heat pumps
Heat pumps move thermal energy in the opposite direction of spontaneous heat transfer, by absorbing heat from a cold space and releasing it to a warmer one. A heat pump uses external power to accomplish the work of transferring energy from the heat source to the heat sink (Jochen Bundschuh and Guangnan Chen, 2017).

Mediation
Mediation of public conflicts is a process to reach an agreement between representatives from politics and public administration and substantially affected stakeholders (e.g. citizens' action groups, associations, project developers, etc.). The process is led by an external impartial third party who lacks decision-making authority.

Private sector
Part of the economy that is not government controlled but is largely commercial and profit oriented.

Public participation
Public participation is process of citizen involvement in public service delivery, regardless of the point of intervention (be it at the design or process or implementation level). Public participation may range from considering passive involvement of citizens and their reactions to public service – for example through surveys or public announcements to active participation through ownership of the process itself (Ross et al., 2016).

A model that is often referred to, when addressing the different degrees of citizen participation in public decision-making, is Arnstein's ladder of citizen participation (Arnstein, 1969).

Public sector
Part of the economy that is government controlled, run by the government to provide public services, construct, and maintain public infrastructure. This involves government organisations, public organisations, and semi-public organisations.

Public service delivery
Refers to a mechanism through which public services are delivered to the public by local, municipal, or federal governments. Examples of public services are education, healthcare, waste management, or the drinking water supply.

Public services/goods
Pertains to a good or service that is non-competitive and non-excludable; people cannot be excluded from using or benefitting from the service and can often use it without paying. For example: the air that we breathe, an army, or a dike that protects the hinterland from flooding.

Social innovation
Social innovations are innovations that are social in their means and contribute to social goals that pertain to the general well-being of communities

Another definition focuses on the role of civil society by defining social innovation as the reconfiguring of social practices in response to societal challenges, with the aim of improving societal well-being through the engagement of civil society actors.

Stakeholder engagement
It is the process of government engaging stakeholders through a variety of forums, the most common of which are focus groups, panels, and roundtable meetings, in the context of policy-making and public service delivery.

Wicked problems
Wicked problems are problems that are difficult to define and inherently unsolvable. They have been defined as lacking a 'stopping rule' that determines when a solution has been found, being good or bad solutions rather than true or false, lacking immediate and ultimate tests of solutions, lacking criteria indicating that all solutions have been identified, being unique, employing 'one-shot' solutions rather than using trial and error, are symptoms of another problem, and contain discrepancies which could be explained in different ways (Rittel and Webber, 1973).

7. FAQs

7.1. What is the first step in starting co-creation?

Stakeholder analysis: Before starting a co-creation process, municipal departments or any other initiating organisation (e.g. housing association, knowledge centre) should identify and assemble representatives of all relevant stakeholders. There are internal stakeholders and external stakeholders. The former are those within the organisation that might have important knowledge or might have authority over certain domains like energy and environment, sustainability, etc. Without their consent, you might run against blockages, mostly on a later stage, within your organisation. External stakeholders are organisations or persons outside the municipal organisation that directly or indirectly have a stake or interest in sustainable heating transition.

Preparation: Experience has shown that the preparation of co-creation procedures and the broad involvement of stakeholders in the groundwork are crucial for its success. Lack of prior preparation not only affects the motivation of stakeholders in participating, but also further lowers commitment of participants. If all the interests of the stakeholders are recorded, it is not only easier to integrate those interests into co-beneficial solutions, it frees stakeholders from competing for attention. It opens up the possibility of engaging in active listening and solution finding.

7.2. How can a municipality encourage homeowners to invest in sustainable heating?

Cost is just one of the factors that deters active adoption of sustainable heating technologies. To tackle limited market demand, several interventions – from technical to economic and social – can be designed and implemented to increase end user demand of sustainable heating solutions. In city districts and neighbourhoods: co-creation of sustainable heating solution strategies along with local communities. This empowers local communities to co-design or even co-decide the planning and implementation of sustainable heating strategies. This can solve actual and perceived barriers, like information, established habits, perceived complexity, and financial needs. By identifying what motivates and deters communities from investments in sustainable technologies, municipalities can then co-create the right incentives and process.

7.3. How are co-benefits realised between the municipality and citizens?

The municipality, along with the citizen community, can co-initiate thematic workshops to decide how co-benefits can be realised through individual and collective solutions.

7.4. How can ambassadors (who have already made the transition, e.g. citizen committees) motivate other citizens within their district? (Sopjani et al., 2019)

Ambassadors, through their proactive environmental choices, have already shown their ability to look past the immediate functional and economic benefits of transition to see the larger, positive environmental impacts their actions can have. They therefore have an important role to play by

creating new linkages within the community, enabling those 'sitting on the fence' to reflect on broader transformations brought about by sustainable heating technologies by sharing their own experiences. They help challenge the status quo and enable dialogue by driving engagements within the community.

7.5. How do we decide who the target stakeholders are?

Answering questions, like those below, for every stakeholder or group involved will reveal how invested or critical they are to the issue.

1. What is their scope of interest?
2. What are the stakeholders' interests in the project and in collaboration?
3. Do they have financial–economic motives?
4. Are these short-term or long-term interests with a public or private sector character?
5. How affected are, or will they be, by the project?
6. What is the impact (financial, social, etc.) on the stakeholders? It is important to distinguish between pure interests and affectedness, because there are some stakeholders that show low levels of interest in the issue despite being greatly affected by it and vice-versa.
7. What is their scope of influence?
8. Which of the stakeholders have decision-making power?
9. Which of them have the power to block decisions?
10. Which of the stakeholders make use of formal objections and exert informal power through social media campaigns, online petitions, or protest movements?
11. What is the scope of their responsibilities and constraints?

Co-creation brings about new roles and responsibilities, which can be changed and redefined over time. But it is beneficial to consider the key roles in co-creation, for the municipality employee, the citizens and the stakeholders. Are they acting as:

- Authority?
- Initiator?
- Adviser?
- Designer?
- Facilitator?
- Implementer?

7.6. How can communication address the different interests and values of citizens, and not just those of the municipality?

By providing low entry barriers through methods such as:

- Designing and using language as close to the private sphere as possible.
- Combining online and offline co-creation spaces.
- Fostering trust in individual competence/expertise to participate.
- Showing the amount of impact of participation
- Illustrating the possibility of delegating the invitation to someone else.
- Incentive: compensating participants or providing them with a special experience.

7.7. How can we raise awareness of our renewable energy project?

Municipalities can initiate the co-creation process by organising several information and discussion events that are open to all members of the community and any interested stakeholders. This is key to inviting citizens to take up more involved roles in policy and project development. (Refer to the case: Natural gas free neighbourhoods, Delft, the Netherlands). By voicing values, concerns, and critiques these meetings create a sense of community around energy policy (Spruit, 2019).

7.8. How do we handle expectation management?

- Outcome transparency: Clear communication of objectives and expected outcomes of the co-creation process between authorities and citizens will reduce the impact of unexpected outcomes.
- Process transparency: Clear communication between the two parties on the level of commitment (time and money) that is required, the distribution of rewards, incentives (if any) for levels of involvement, the financial and legal aspects of the process, etc., will ensure that the process allows for informed participation only. This will help citizens to determine their levels of engagement.
- Role transparency: Clear communication between authorities and citizens about their roles (how involved each party is expecting to be in different stages of the process, e.g. planning, designing, implementing, decision-making, etc.), will reduce the impact of misplaced expectations or misconceptions of 'rights' involved. Consider:
    - How do we get the interests aligned?
    - If and how can co-creation standards in any kind of (re)development projects be embedded?
    - Can there be a business side to this as well (value for money)?
    - Which tools can be used in the co-creation process (e.g. cognitive mapping)?

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