

Missions as boundary objects for transformative change: understanding coordination across policy, research, and stakeholder communities

Matthijs J. Janssen^{1,2,*}, Joeri Wesseling¹, Jonas Torrens³, K. Matthias Weber^{4,5},
Caetano Penna⁶ and Laurens Klerkx^{1,7,8}

¹Copernicus Institute of Sustainable Development, Utrecht University, Princetonaan 8a, Utrecht 3584 CB, The Netherlands, ²Dialogic, Hooghiemstraplein 33-36, Utrecht 3514 AX, The Netherlands, ³Technology, Innovation and Society Group, Eindhoven University of Technology, Atlas 8.409, Eindhoven 5600 MB, The Netherlands, ⁴Austrian Institute of Technology, Center for Innovation Systems Policy, Giefinggasse 4, Vienna 1210, Austria, ⁵LISIS, Gustave Eiffel University, 5 boulevard Descartes, Marne-La-Vallée 77454, France, ⁶Faculty of Technology, Policy and Management, TU Delft, Jaffalaan 5, Delft 2628 BX, The Netherlands, ⁷Knowledge, Technology and Innovation Group, Wageningen University, De Leeuwenborch, Wageningen 6700 EW, The Netherlands and ⁸Department of Agricultural Economics, Faculty of Agricultural Sciences, Talca University, Ruta 118, Talca, Chile

*Corresponding author. E-mail: m.j.janssen@uu.nl

Abstract

Recent times have seen the rediscovery and adaptation of mission-oriented innovation policies (MIPs) for driving transformative change. While such policies seek to mobilise and align stakeholders, little is known about how missions feature in policy coordination processes. We argue that to facilitate the still troublesome operationalisation of MIPs, it is essential to understand missions as ‘boundary objects’ that have some shared meanings among the participants they convene, yet are open enough to be interpreted differently by distinct actors gathering in four interconnected policy arenas—i.e. a strategic, programmatic, implementation, and performance arena. By studying the European Commission’s Horizon Europe missions, we unravel how missions as boundary objects enable and disable the coordination of heterogeneous communities. The resulting analytical perspective highlights three key mechanisms for coordinating mission meanings across communities and arenas: convergence–divergence, passage, and reflexive learning. We conclude with research avenues for studying missions as boundary objects for facilitating concerted action.

Key words: societal challenges; innovation policy; transitions; governance; policy mix.

1. Introduction

Rather than only targeting economic growth and productivity, scholars and policymakers concerned with innovation policy increasingly invest in addressing persistent societal challenges (Boon and Edler 2018; Kuhlmann and Rip 2018; Schot and Steinmueller 2018). Over the past decade, new rationales have emerged that expand the scope of innovation policy, foregrounding complementary combinations of technological, organisational, and institutional changes to enable transformations of socio-technical systems in which those challenges manifest (Steward 2012; Weber and Rohracher 2012; Diercks et al. 2019).

A notable development has been the rediscovery and adaptation of mission-oriented innovation policies (MIPs) as a promising approach for driving transformative changes (Foray et al. 2012; Mazzucato 2015, 2016; Larrue 2021a). Missions were once mostly associated with large-scale research and technology policy initiatives (Ergas 1987), motivated in several cases by national pride and Cold War superpower competition, but are now increasingly portrayed as a promising approach to mobilise a broad range of innovation capacities for addressing wicked societal challenges

(Mazzucato 2018; Wanzenböck et al. 2020). This rediscovery takes place amidst a reassessment of the role of the state in innovation, not only in facilitating private entrepreneurship but also in setting directions and pro-actively mobilising many societal actors to address pressing issues (Mazzucato 2015).

Three issues arising in these debates are salient here. First, despite the swelling interest in MIPs, much ambiguity remains regarding the precise nature and potential of the concept of missions and corresponding policies (Janssen et al. 2021). Questions like what constitutes a mission, how MIPs relate to other approaches (e.g. challenge-led or transformative innovation policy), and how they utilise or complement established instruments remain underexplored. Second, it is unclear how closely aligned the academic work and concrete policy practices are. In the European context, for instance, policymakers have moved quickly to propose this concept before it was fully fleshed out in the scientific literature. The dialogue between academic discourse and practice is taking place in heterogeneous ways in distinct policy arenas. For instance, in Norway, MIPs aim to streamline existing instruments to create ‘pipelines’ that articulate policies covering the entire innovation life cycle (Larrue 2021b). Meanwhile, in the Netherlands,

MIPs seek to establish new governance spaces where directional policies are debated among new constellations of actors (Larrue 2021a). Third, the mechanisms through which missions operate need further detailing. Ongoing policy debates offer some guidance on why and how to formulate MIPs (Lamy et al. 2017; JIIP 2018), but policymakers still face major difficulties in designing, implementing, monitoring, and evaluating missions.

Within the field of MIP, there is yet limited analysis that looks at the performativity of the mission concept itself (except, e.g., Pfothenhauer and Juhl 2017; Brown 2021). In this paper, we focus on the processes through which individual missions come to be thought of, framed, and conducted. This entails bridging understandings of missions as a guiding principle in strategic policy debates—where stakeholders engage with the MIP concept but adapt it to their particular challenges—and the actual implementation of the mission they formulate. We argue that to facilitate the so far troublesome operationalisation of MIPs, what is necessary is not a very prescriptive set of design principles, but instead understand missions as ‘boundary objects’ (BOs) around which heterogeneous communities—comprising but not limited to policymakers—gather and craft together shared understandings of what is at stake, what means are necessary, and what processes should ensue.

BOs are concepts that carry some shared meaning, yet are open enough to be interpreted differently by distinct actors (Star and Griesemer 1989; Nicolini et al. 2012). Recognising that missions act as BOs enables researchers to scrutinise the ambiguity in the rationales and applications of MIPs across distinct contexts. While conceptual inconsistencies might hinder effective implementation and muddle the scholarly debate, embracing this ambiguity through interpretive flexibility in the process of defining and conducting missions can also serve to mobilise stakeholders (see Backman and Börjesson 2006). The objective of this paper is to understand the processes through which coordination among policy, research, and stakeholder communities emerges around missions. We do that by exploring the merits of regarding missions—as a policy concept as well as actual societal goals—as BOs and present an analytical framework for studying them as such.

The paper is structured as follows. The conceptual background covered in Section 2 addresses how the notion of missions is inherently also one of policy coordination processes. The section explains the concept of BOs and describes how this applies to missions that bridge communities in four different policy arenas. Each of these arenas is conceptually and theoretically unpacked and interpreted through the lens of BOs in Section 3. Section 4 then illustrates empirically how missions operate as BOs in the respective arenas and what actual forms they take in practice. We provide an example of EU missions as part of the Horizon Europe framework for research and innovation. The discussion in Section 5 pays particular attention to mission coordination across the various policy arenas. We argue that although the malleability of missions as BOs allows for fruitful contestation and negotiation between communities, and therefore learning and setting directions for change, passing missions on from abstract to operational arenas occasionally requires temporary closure. Section 6 concludes with an analytical framework (including diagnostic questions) for examining how missions act as BOs

within and across arenas, thereby also creating a basis for further research and for targeting policies.

2. Conceptual background

2.1 Missions and policy coordination processes

While the rising interest for MIP may also lead non-governmental organisations and other stakeholders to formulate missions (Klerkx and Begemann 2020), most of what we know stems from research on state-led missions and MIPs (Foray et al. 2012; Mazzucato 2018). This includes both missions being labelled as such, like the ones discussed in a recent Organisation for Economic Co-operation and Development (OECD) overview (Larrue 2021a), as well as collectively pursued goals that are categorised as missions with hindsight only. A clear example is Vision Zero (Craens et al. 2022), Sweden’s approach to reducing traffic accidents, which was conceived as early as in 1994.

By setting ambitious time-bound goals, policymakers adopting a missions approach hope to provide directionality to mutually reinforcing experimentation and adoption activities (Janssen et al. 2021). In this sense, missions represent a departure from rationales that are underpinned by neutrality or that focus solely on the rate of innovation (Foray 2018). However, when missions are mobilised to address societal challenges, they evoke and disclose high levels of uncertainty, complexity, and contestation. It is very challenging to ‘pick’ directions, as there is often divergence in how both problems and solutions are defined (Wanzenböck et al. 2020). Establishing processes for aligning the development and deployment of innovative solutions, despite initial divergences, is therefore key for implementing missions. After all, achieving clarity on what directions to pursue is likely to be a precondition for mobilising the diverse innovation efforts required for transformative change (Weber and Rohrer 2012).

Multiple aspects of the policy coordination processes are implicated in the targeting of missions to address societal challenges. Policy science literature recognises different levels, layers, or functions concerned with policy development and the enactment stages of policy coordination processes (Barré 2007; Howlett 2009; Barré et al. 2013). These levels are deeply entrenched in how policy processes happen and are usually taken for granted as necessary features, even when difficulties emerge in between levels (Kroll 2019). Still, the common distinction between levels is clearly a stylistic depiction, as in reality policies do not necessarily emerge from orderly passing these levels. Also, some actors may be active in multiple levels. We therefore rather follow the view that mission directionality is established in arenas of contestation and negotiation (Wesseling and Meijerhof 2021).

The arena metaphor is taken from political and social theory to emphasise its actor-dependent and contested nature (Fink-Hafner 1998; Jørgensen and Andersen 2012) and has had application in analysis of enactment of science and innovation policy to scrutinise processes of agenda and priority setting (Braun 1998; Klerkx and Leeuwis 2008). The arena concept suggests a changing constellation of actors, which forms around a particular task—e.g. framing the overall mission—and includes both invited and uninvited participants. Attending to the shifting constellations of actors in each arena provides a more dynamic account of how missions come

to be formulated and implemented, along with the idea that missions are negotiated outcomes from contested processes (Janssen et al. 2021).

Expanding on the aforementioned policy coordination literature with conceptualisations from the literature on the public policy process, we distinguish four types of arenas:

- (1) The *strategy arena* is concerned with why and how government intervention is legitimised in the first place. Claiming that a policy is needed and suitable to enable changes and allocating public resources to do so is mostly a political process, carried out by politicians (and high-ranked civil servants who occupy, e.g., ministerial positions) from parliament, congress, and executive governments. This arena is what the punctuated equilibrium theory of the policy process (True et al. 1999) refers to as ‘macro-politics’: where new issues move up in the policy agenda through the actions of visible political actors who help legitimise the policy. In the case of a mission-oriented policy, this is where the mission is established through an initial, legitimate framing.
- (2) Proposing how to use such resources to meet strategic goals happens in the *programmatic arena*. In this mostly technical process, theories of change and intervention logics specify through which series of actions and measures the desirable outcome can be achieved and typically involve sectoral ministers and secretaries, in consultation with interest groups knowledgeable or invested in the issues. Punctuated equilibrium theory (True et al. 1999) refers to this arena as formed by ‘policy subsystems’, which is populated by ‘advocacy coalitions’ (Sabatier and Jenkins-Smith 1999): groups of specialists in the bureaucracy, congressional subgroups, interest groups, sectoral stakeholders, etc., who are specialised in a policy domain and often share values and beliefs (Geels and Penna 2015). In the advocacy coalition framework, major policy changes are often accompanied by changes in policy images and beliefs: as a BO, a mission may contribute to policy changes by providing new framings for issue areas.
- (3) The operational design and execution of a policy intervention takes place in the *implementation arena*, which is formed by parts of the aforementioned advocacy coalition: i.e. the group of civil servants (bureaucracy specialists) responsible for implementing the policy itself. The distinction between the programmatic arena and the implementation arena is that the former is populated by a network of actors that form around an issue area and therefore are concerned with establishing a policy programme to address that issue, while the latter is populated by bureaucracy specialists from the statutory agency responsible for the further development, detailing, and actual execution of the statute that results from the programmatic process (Grantham 2001). Other actors may join the implementation arena if the statute mandates so (for instance, when it establishes participatory mechanisms) or the statutory agency invites them to enter in order to exchange key resources (for instance, information that is important for the implementation process) (Matland 1995). Grantham (2001) shows that a ‘policy

frame’ determines the terms by which actors exchange resources; in the case of a mission-oriented policy, the frame is provided by the mission acting as a BO between those agents.

- (4) Finally, actors in the *performance arena* are the ones subject to the policy, like firms, citizens, scientists, and non-governmental organisations (NGOs). This arena is less often conceptualised, although some authors from the literature on ‘issue life cycle’ identify a policy ‘trial period’ (Tombari 1984) or a stage of ‘coping’ with the policy (Rivoli and Waddock 2011). This arena is not only where the results of the policy implementation actually happen, but also the focus of policy monitoring and evaluation, and therefore, bureaucracy specialists (or those involved in monitoring/evaluation) also participate in it.

With missions, it is far from evident which actors engage in what arena relevant for the prioritisation and (support for) pursuit of societal goals. In the case of the Dutch MIP, for instance, the twenty-five focal missions established by diverse ministries are based on various sorts of broad stakeholder consultations (Janssen 2020). Some of the stakeholders involved in, e.g., the ‘climate tables’, from which the sustainability missions emerged, also participate in executing actual innovation and experimentation projects that address the nationally prioritised missions. Also, Germany’s High-Tech Strategy 2025 relies on governance structures that allow universities, firms, and societal stakeholders to participate in both strategic and operational elements of the creation and pursuit of missions (Wittmann et al. 2021).

While there are claims that mission *formulation* should be an inclusive process, engaging a broad variety of disciplines and stakeholders (Foray 2018; Mazzucato 2018), agency and coordination aspects of missions have received little attention. Moreover, the *decision* to pursue particular missions is likely to require a strong role for elected bodies at different scales (parliament and regional authorities). Without it, missions risk emboldening executive bodies and bypassing legislative scrutiny. Previous literature foregrounds state-led agenda setting that is concrete enough to reduce uncertainty, but open enough for mobilising a wide range of disciplines and societal stakeholders (Janssen et al. 2021). The latter matters for both the identification and the acceptance of multiple solution directions and for avoiding the creation of new lock-ins due to closing the search process down early around a single change pathway (Stirling 2008).

For missions to align divergent innovation processes, an ‘ambidextrous’ policy approach based on balancing openness and stability is necessary (Dreher and Weber 2021). Exploring potential solution directions and accelerating the most promising ones require an interplay between forceful top-down guidance (reducing variety in solution directions) and bottom-up experimentation (potentially increasing variety). A resulting requirement for policy development is that, along the way from mission-based strategy formulation to policy implementation, coherence is needed in both the directional scope of the mission itself and the instruments to support it (Larrue 2021a).

In sum, if the ambition of missions is to promote more directional innovation and diffusion efforts, it is pertinent

to understand how coordination across policy arenas and stakeholder types comes about.

2.2 A BO perspective on innovation policy concepts

The concept of ‘BOs’ emerged in debates about how scientific work is carried out by heterogeneous communities (e.g. scientists and non-scientists, entrepreneurs, and managers), as a means to understand how the tension between the actors’ divergent viewpoints and the search for generalisable findings are addressed. Expanding from the work of [Callon \(1985\)](#) and [Latour \(1987\)](#) on the different translations, which are necessary at the interface between scientists and non-scientists, BO emphasises that ‘entrepreneurs from more than one social world are trying to conduct such translations simultaneously’ ([Star and Griesemer 1989](#): 389). These actors must seek to capture and maintain the interest of their audiences to retain them as allies. This approach does not presuppose the primacy of any particular viewpoint (e.g. lay people versus experts), foregrounding instead the ‘processes of management across worlds: crafting, diplomacy, choice of clientele, and personnel’. Hence, [Star and Griesemer \(1989](#): 393) highlight the intertwined processes of methods of standardisation and BOs:

Boundary objects are objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use. They may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation.

In other words, due to a certain degree of openness or ambiguity and therefore malleability, BOs provide opportunities for better collaboration ([Bechky 2003](#)) by allowing different communities to adapt (translate) the object to their realities and, in doing so, relate themselves to others while preserving consistency and integrity.

However, the openness of BOs also poses threats. [Huvila \(2011\)](#) argues that BOs may be vehicles for communities to promote their own particular politics, by projecting their views on the object, while ignoring the alternative meanings that others ascribe to it. If a BO becomes too malleable, then its compelling potential may get diluted at the interface of different communities, with the risk of reducing the concept to a minimum compromise notion. Moreover, the meaning of BOs may change over time because of strategic contestation between different interest-driven actors ([Huvila 2011](#); [Klerkx et al. 2012](#)) and become closed down in terms of its interpretive flexibility. This closing down may occur through standardisation processes that facilitate the ‘passage’ of a particular BO meaning from one community to the other ([Star and Griesemer 1989](#)). When a dominant group reduces openness and instead installs interpretive rigidity, some meanings and communities may be excluded from engaging with the BO—for better or for worse. Alternatively, the complexity of the processes that surround working with BOs may also restrict the participation of actors who lack the resources to sustain protracted processes.

The BO concept has now also spread to other fields, beyond the science and technology studies from which it originated. The organisational change and innovation management literature studies, for instance, provide an extensive body of research on BO-like processes and outputs—tangible or intangible—that serve as ‘carriers’ for uniting different stakeholders around a certain goal (e.g. [Nicolini et al. 2012](#); [Kertcher and Coslor 2020](#)). Also, in design, innovation, and transition studies, the BO perspective has been applied. For example, [Klerkx et al. \(2012\)](#) confirm that the interpretive flexibility of design visualisations can achieve more support and mutual understanding between different actors involved in systemic innovation, and [Franco-Torres et al. \(2020\)](#) analyse how BOs can be deliberately employed by actors to drive transitions through bridging conflicting institutional logics without constraining their diversity. Similarly, [Turnheim et al. \(2015\)](#) argue that establishing shared concepts may help achieve alignment of distinct approaches advanced by experts, practitioners, and social partners.

BO studies are less prevalent in the innovation policy literature. [Sharif’s \(2006\)](#) BO perspective on his sociological and historical discussion of the national innovation systems (NIS) concept is a notable example. Sharif shows that, due to interpretive flexibility allowing different advocates to engage in strategic manoeuvring, according to their specific agendas, the NIS concept could achieve widespread diffusion in both academic and policy-making circles. Similar observations have been made by [Godin](#) on several innovation concepts and how they became prevalent in policy ([Godin 2004, 2006, 2009, 2015](#)), noting their flexibility and how they travel between communities, though without alluding to the BO concept.

Returning to the topic of missions and coordination processes, the question that arises is how heterogeneous communities are engaged in formulating and pursuing mission goals, strategies, and policies. We propose that in each of the arenas as distinguished in [Section 2.1](#), a different aspect of the mission is at stake and functions in a certain way as a BO. In the next section, we further unpack this conceptually and theoretically.

3. Missions as boundary objects in four arenas

Taking the four policy arenas as a starting point, this section discusses the aspects of missions that are at play and how they contribute to straddling the boundaries between distinct communities.

3.1 Strategic arena: missions as an emerging policy metanarrative

The strategic arena provides space for shaping and negotiating metanarratives regarding the place of missions in MIPs. Metanarratives concern abstract and often academic arguments that conceptualise policy problems and legitimise particular approaches for addressing them. They are ‘meta’ because they encompass comprehensive and generic articulations of what the rationales for policy are, and ‘narratives’ as they evolve into compelling stories which inspire actors and give them a sense of shared endeavour.

To understand and differentiate relevant policy metanarratives, we propose a two-dimensional diagram. It maps out a conceptual space¹ formed of (1) the perspectives’ attention to

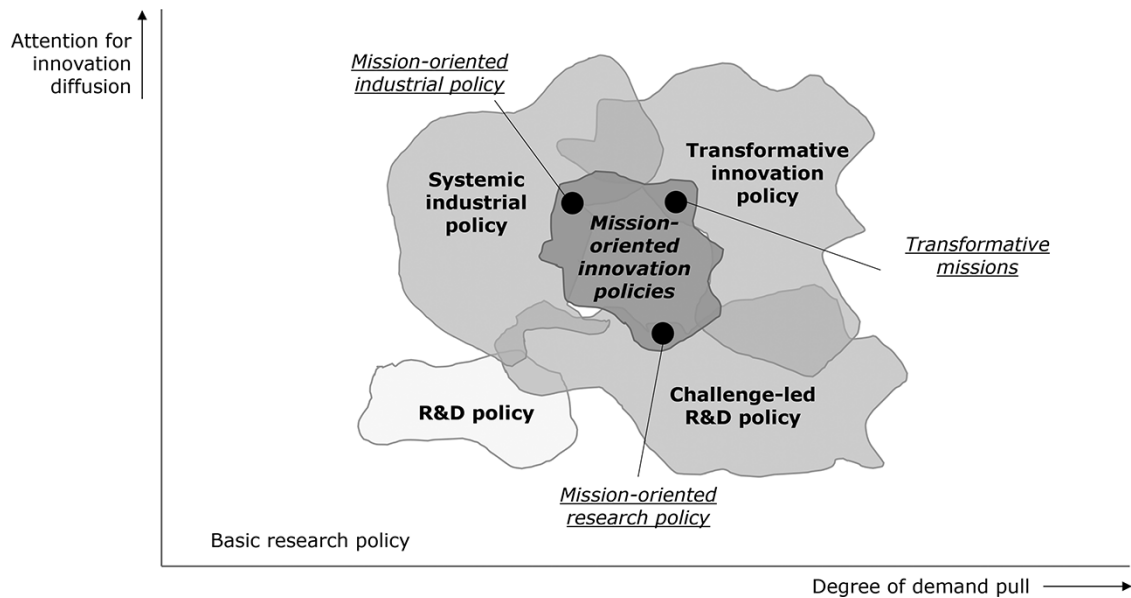


Figure 1. Overview of distinct research and innovation policy perspectives, with MIPs as a BO across them.

societal challenges (‘degree of demand pull’) and (2) its attention to the wider uptake of innovation, see Fig. 1. The resulting space stretches from policies focused on mere knowledge production (e.g. for supporting curiosity-driven basic research), in the left lower corner, to systemic change and diffusion-oriented policies in a societal domain in the right upper corner (e.g. for improving the health or energy system). In this space, we can locate innovation policy traditions like generic *research and development (R&D) policy*, *challenge-led R&D policy*, *systemic industrial policy*, and *transformative innovation policy*. While the traditions are hard to delineate precisely and overlap partially, they do reflect some fundamental differences in how (policies for) change processes are understood. Each of the metanarratives embodies distinct scientific roots, with clear differences in, e.g., their rationales, policies, targeted groups (science, industry, or civil society), and success indicators. The online supplementary data describes the metanarratives in more detail.

The generic features of traditional R&D policy mean that there is little room for mission orientation in this approach; this metanarrative’s goals are limited to the likes of targeting a certain volume of R&D expenditures as a percentage of GDP and give little attention to establishing specific directionalities aligned with societal challenges. The other three policy metanarratives do provide possibilities to address missions, albeit in rather different ways.

Initially, much of the attention for missions corresponded with the challenge-led R&D policy metanarrative. The early discussions go back to Ergas’s (1987) notion of ‘big science for big problems’ and are centred around mission-oriented research policy as well as mission-oriented agencies like Defense Advanced Research Projects Agency, Advanced Research Projects Agency–Energy, and development banks (e.g. Foray et al. 2012; Mazzucato and Penna 2015a,b; Mazzucato 2018). Such initiatives follow the logic of steering publicly-funded knowledge development towards societal goals, hoping that this spawns innovations suitable for both addressing persistent challenges and boosting business performance (JIIP 2018).

Over time, the debate gradually also portrayed missions as a core theme for policies more directly concerned with businesses’ roles in developing and diffusing innovative solutions (e.g. Cantner and Vannuccini 2018). Exemplary is the Mission-Oriented UK Industrial Strategy (UCL MOIIS 2019), which fits in the ‘twentieth century’ industrial policy perspective (Rodrik 2008) geared towards facilitating and guiding entrepreneurial experimentation. In its focus on enhancing capabilities and conditions needed for ensuring that mission-relevant innovations successfully reach the highest stages of development and commercialisation, this perspective shares similarities with transition literature concerned with technological innovation systems (Hekkert et al. 2007; Bergek et al. 2008)—hence the label ‘systemic’ industrial policies in Fig. 1. Drawing on arguments highlighting the importance of market creation for inviting new innovation efforts (Mazzucato 2016), Pianta et al. (2020) propose missions as a key ingredient for novel European industrial policies. Similarly, Foray (2018) reflects on smart specialisation strategies as a case of mission-oriented policy, and Van Reenen (2020) discusses possibilities for taking missions as a basis for US industrial policy.

Recently, the transition literature also inspired a metanarrative highlighting the importance of weighing multiple solution paths (technological and non-technological) and of transforming socio-economic systems (Hekkert et al. 2020; Klerkx and Begemann 2020). Consistent with imperatives discussed in the literature on transformative innovation policy (Steward 2012; Weber and Rohracher 2012; Diercks et al. 2019), it emphasises the importance of orchestrating reflexive processes that lead societies to prioritise problem framings and define viable solution paths (Wanzenböck et al. 2020; Janssen et al. 2021). This view acknowledges that stakeholders’ diverging interests might engender conflict and paralyse progress in completing the goals of ‘transformative missions’, as opposed to accelerator missions for which contestation tends to involve a more limited range of stakeholder groups (JIIP 2018; Wittmann et al. 2021). A suggested way to tackle this is to build governance structures for destabilising

undesirable institutional features of current socio-technical systems, while safeguarding room for experimenting with novel socio-technical options and for building the institutional frameworks on which novel socio-technical systems might be based (Hekkert et al. 2020).

Specific articulations of MIPs can thus be located at the intersection between distinct innovation policy metanarratives, which are accompanied by corresponding academic discourses. The concept of mission (and the narratives justifying MIPs), in this sense, becomes an object around which distinct communities of scholars and practitioners ‘gathered’, sparking debates and mutual efforts of translation and disambiguation on what MIPs are or should be.

As the scope of the academic discourse on MIPs expands and blends these metanarratives, it becomes harder to track the roots of individual studies. For instance, scholars previously highlighting the importance of knowledge spillovers or innovation system views gradually adopt principles derived from transition-based perspectives. By acting as a BO between distinct literature strands and associated communities, MIPs foment more comprehensive debates about how solution development and application may be coupled. Meanwhile, as the diverse theoretical underpinnings for MIP remain poorly acknowledged, scientific progress is hampered. Due to limited common grounds across debates in distinct literature streams, conceptualisations and findings often lack comparability.

Hence, in the strategic arena, MIPs act as a BO around which scholars (and policymakers), reasoning from distinct theoretical perspectives on innovation and socio-economic change, seek to craft cogent strategies for addressing societal challenges and justify profound policy change. The ‘interpretive flexibility’ of MIPs, coupled with their high visibility at the European level, makes the concept the object of interest of scholars and policymakers from distinct innovation traditions. MIPs capture at once the imagination of actors with technocratic leanings, interested in accelerating the development of key technologies, as well as communities emphasising more ‘transformative’ pathways that foreground social or grassroots forms of innovation—and who question the value of technocratic policies. In this strategic arena, MIPs also span the academic boundary to be embraced by other communities. As an emerging policy metanarrative in itself, innovation policies oriented towards missions therefore serve the purpose of legitimising governmental action by inspiring societal stakeholders. The call by Mazzucato (2018) for missions to be bold, inspirational, with wide societal relevance thus relates to mission aspects negotiated in this strategic arena, as they contribute to the legitimacy of the MIP model to society at large.

3.2 Programmatic arena: missions as a vision

As innovation policies oriented towards missions come to be adopted in particular countries, a process begins of envisioning what desirable outcomes are to be achieved. In Mazzucato’s (2015: 6) formulation, for instance, ‘envisioning and picking directions strategically’ is a key feature with regard to which missions differ from other rationales for innovation policy premised on redressing market failures. Similarly, Weber and Rohracher (2012) highlight the lack of shared vision (about goals and directions of transformation)

as a central ‘transformational’ failure. Adopting a mission may form a response to such failures by establishing a shared vision: a grand image for the future to which involved stakeholders inside and outside government can relate to and which serves to guide their otherwise incongruent efforts.

While in the strategic arena debates focus on why to pursue missions, and which societal challenges to prioritise, the programming arena is concerned with proposing a view on which goals to pursue and how to meet them. According to Mazzucato, it is imperative that mission goals have a clear direction and are targeted, measurable, and time-bound (Mazzucato 2018), e.g. decarbonisation by 2050 or no more traffic deaths by 2025. Such goals would then need to be ‘translated’ into specific plans and programmes that identify the challenge’s causes and effects and propose a course of action. In the programmatic arena, missions therefore become the link between the grand societal challenges and an array of efforts that can help to address these challenges (including policies; see next arena). Of course, this mechanistic translation of missions in targets, timelines, and plans becomes questionable in cases of highly uncertain and open-ended transformative missions.

Here, missions act as BOs because they provide a focusing device for policy-making processes seeking to address societal challenges. Using missions as visions can have a guiding, binding, and uncertainty-mitigating effect (see Berkhout 2006). Actors involved in this arena hope missions can provide the inspiring image that can orient a road map for action. Hence, *missions as visions* can act as a basis for getting policymakers from different domains and with incongruent interests on the same page, or at least in talking terms (Miedzinski et al. 2019).

In this arena, a process of debating and articulating a possible vision for a desirable outcome supposedly also involves a broad range of other social actors. Which of these actors are formally invited to the visioning process depends on mission governance. Crucially, how this vision comes to be deliberated greatly influences the perception of a legitimate ‘societal’ goal, as opposed to a goal that advances vested interests. This arena is hence often a very contested space, where participation is highly coveted and ‘uninvited’ participation is very common. Even though visions often lack specificity, actors involved are often keenly aware of the budgetary and regulatory consequences of distinct articulations.

How this visioning process is framed derives in part from the metanarrative surrounding MIP in that context—e.g. whether it is framed as a goal-directed, expert-centric process, or it is a bottom-up, grassroots inclusive affair. It also depends on the relative power between different communities and established institutional arrangements on top of which missions come to sit. An opportunity presented by missions, as BOs, is that they allow for smoothing or temporarily bracketing out discrepancies between those pre-existing institutional arrangements and logics. For instance, in R&I policymakers’ ongoing endeavours to engage sectoral policymakers in supporting the diffusion of novelty, a shared vision around the challenge at stake might lead the latter community to take on more responsibility for promoting innovative solutions. At the same time, there is also a risk that a shared mission becomes nobody’s mission, with R&I policymakers and sectoral policymakers mostly waiting for each other to act.

Interpretive flexibility (or conversely, rigidity) is relevant here: a too narrow mission formulation risks disenfranchising many relevant actors, or even triggering their backlash, while too broad missions may lack directional impetus. Hence, these visions centre on broader (but not too broad) directions of change (e.g. decarbonisation) as opposed to particular technologies (e.g. direct carbon capture and storage), as the objective is catalysing wider societal experimentation and mobilisation. How specific and solution-oriented they should be is a contested topic, shaping funding and other R&D resource allocations.

3.3 Implementation arena: mission-oriented policy interventions

The implementation arena consists of the policy domains or ‘subsystems’ (Sabatier and Jenkins-Smith 1993; True et al. 1999) that are involved in driving the actual development and diffusion of solutions for a societal challenge. Traditionally, policy operationalisation has been thought as a remit of policymakers and civil servants, but recent studies on ‘collaborative governance’ challenge this perspective and show that many more actors can be involved in the implementation arena (Stout 2013; Torfing and Triantafillou 2016). Meanwhile, regardless of its diverse backgrounds described in Section 3.1, the literature on missions appears to be uniform in that the process of MIP design and implementation *should* involve a wide range of stakeholders (Mazzucato 2018; Wanzenböck et al. 2020; Janssen et al. 2021; Larrue 2021a).

Missions, as we discussed, involve other policy domains beyond the innovation policy domain. In particular, this third arena also covers policies—and actors—in the sectoral domain(s) facing the societal problem prioritised in the mission, which also pursue transformative ambitions. For example, a mission concerning reducing traffic deaths may involve the transport department and public health departments. A related criterium proposed by Mazzucato (2018) concerns relevance: societal missions should *be ambitious but* [lead to] *realistic research and innovation actions*. In the implementation arena, therefore, missions as BOs serve the purpose of structuring and detailing the portfolio of multiple relevant actions and projects by employing a diverse and flexible instrument mix that distributes responsibilities among the various actors involved.

From the perspective of policymakers active in the implementation arena, missions lend themselves to examining the connections within a spectrum of policy instruments that actors may want to use when developing innovative solutions. Science and research-based solutions typically move from using funding instruments to demonstration support schemes, whereas needs-based solutions occasionally give rise to questions that urge for more R&D. Regardless of the order of policy instrument utilisation, it is helpful if solution progress is not hampered by avoidable administrative hurdles (due to, e.g., inefficiencies in reporting or inconsistencies in how a challenge is understood). Missions as BOs prompt reflection on how smoothly promising innovative solutions can obtain diverse types of policy support, geared to what is needed at a certain stage of development. However, the standing of missions as a BO also means there is always a risk, even with a shared vision and metanarrative, that debates at this stage lead to relabelling policies without actually introducing substantial

changes (Brown 2021), i.e. ‘window dressing’ and dilution of the initial intention. Moreover, layering complementary policy instruments on already complex policy mixes might cause wasteful transaction costs, with actors being unable to navigate through the manifold support options from different departments. Finally, actors intended to undermine or redirect a mission can always interfere in the programming arena, defunding or curtailing crucial policy changes.

3.4 Performance arena: missions as governance structures

In the performance arena, possibly highly heterogeneous stakeholders explore and promote solutions fitting the broad vision as developed in the programmatic arena. By envisaging, developing, and trying actual solutions, they clear a certain route for crossing the problem–solution space (Wanzenböck et al. 2020). Missions may then be regarded as a malleable object for bridging and brokering such stakeholders’ different framings of why a problem is important and what is needed to address it effectively, thereby proposing an answer to the ‘causality puzzle’ of how to tackle a persistent societal challenge. Distinct communities might interpret these issues differently, even when there is a clear and time-bound societal goal. This holds especially for wicked challenges characterised by high uncertainty, complexity, and contestation (Mazzucato 2018).

Explicit involvement of different stakeholders concerned with the prioritised goal is likely to result in learning opportunities and finding a middle ground in the innovation direction that works best for everyone. Yet, more stakeholders require more time and resources, and finding alignment between contrasting views becomes more challenging. The process of giving direction itself might get stuck or diluted. Regarding a given mission as a BO demands considering at which point and which stakeholders are included or excluded when defining possible solutions; too much but also too little openness could potentially limit the commitment of crucial stakeholders. The development of converging directions in the performance arena could thus be seen as a first sign of mission success, rather than as a precondition.

As a BO in the performance arena, missions serve a governance purpose by allowing for the continuous monitoring and evaluation of actions and projects against the goals and visions established in the other arenas. The governance literature is thus a fruitful source of inspiration for providing more prescriptive guidelines on facilitating such multi-stakeholder deliberation processes, which set the mission direction and governance, in a more equal and open way (Janssen et al. 2021; Wesseling and Meijerhof 2021). It is important that practitioners are reflexive of stakeholders’ different problem and solution perceptions when shaping MIP or mission governance instruments (Smith and Stirling 2007), as well as of how to deal with the inherent vested interests that stand to lose from transformative missions and aim to capture the mission (Loorbach 2010). Transitions-oriented governance approaches, like Transition Management, therefore, argue for selective participation in MIP deliberation processes, involving mostly proponents of transition (frontrunners) to prevent capture and delay from opposition (Loorbach 2010). Regardless, transition governance continues to struggle with inclusivity, social learning, and regime persistence (Loorbach et al. 2017).

Table 1. Overview of arenas in which different communities interpret and shape missions.

Arena	Aspect of mission at stake	Spanning boundaries of	Opportunities/pros	Threats/cons
Strategic arena	Mission as an emerging metanarrative	Literature strands (including STI policy, innovation systems, and transitions) and associated epistemic communities; R&I policymakers	Integrating conceptual strengths into synthetic policy approaches (e.g. incorporating user-side in science policy views)	Unclear theoretical starting points obscure comparability of distinct articulations of MIPs and therefore learning
Programmatic arena	Mission as a vision of future developments	R&I policymakers and sectoral policymakers	From ‘innovation for growth via societal challenges’ to ‘solving challenges by mobilising and aligning innovation efforts’	Responsibility for the mission falls in between R&I and sectoral policymakers, or the latter might even ‘hide’ behind innovation instead of showing ownership
Implementation arena	Mission as concrete policy interventions	Policy domains (R&D policy, industrial policy, transformative innovation policy, and sectoral policy)	Streamlining distinct policy instruments into a comprehensive policy mix (also covering application/diffusion)	Window dressing and relabelling to legitimise existing policy initiatives. Poor links/inconsistencies in a patchy policy mix lead to confusion, misalignment, and transaction costs. Possibility of derailing missions by defunding key instruments
Performance arena	Mission as a governance structure for facing the problem–solution puzzle	All stakeholders in an STI system (industry, NGOs, government, knowledge institutes, intermediaries, citizens, consumers, etc.)	Explicit involvement of all different stakeholders results in learning opportunities and finding a middle ground in the innovation direction that works best for everyone	Taking approaches not reflexive of different stakeholders’ problem and solution perceptions and of power imbalances in favour of vested interests that stand to lose from transformative missions, risk capture, and ineffective missions

Table 1 summarises the four arenas, the mission aspect at stake, the communities that are typically involved, and the respective opportunities and threats of openness.

4. Illustrative example from EU missions

4.1 Studying missions as a BO

To explore whether studying missions as BOs is fruitful and appropriate for real policy endeavours, we draw on the illustrative case of the EU missions, adopted as part of the ‘Horizon Europe’ framework programme for research and innovation (2021–7). We aim to understand which communities were involved in translating abstract policy concepts into more concrete visions and interventions—and finally into actions. We trace the role missions played in this respect by investigating the scope and interpretation of key strategies, agendas, and policies embodying or ‘carrying’ the BO, both within and across the four mission arenas. Our explorative approach is guided by the arena type and associated mission aspects, and the communities involved, but remains open when it comes to elucidating the mechanisms by which mission meanings are coordinated across communities and the previously-identified strategic, programmatic, implementation, and performance arenas. We aim to inductively shed light on these mechanisms, as a building block for developing the basis of a framework by which missions are studied as a BO.

The sampling of the selected case is purposive, in the sense that several of the authors have been following developments closely over the course of several years. As independent longitudinal observers, we have intimate knowledge of prominent policy development steps and considerations, without being

involved in deciding upon them. We rely on a combination of desk research (mostly on policy documents), participation in expert and high-level groups advising the European Commission (EC),² extracts from more than thirty-five interviews (with various types of policymakers, policy analysts, and stakeholders like industry, science, and society representatives) conducted as part of exploratory, assessment, and evaluation studies,³ as well as frequent engagements through workshops with public officials at national and European levels addressing monitoring and evaluation questions on the (emerging) governance of EU missions. The use of different sources implies a level of triangulation deemed sufficient for our explorative purposes (Eisenhardt 1989; Yin 2009).

4.2 Missions in the Horizon Europe framework programme

4.2.1 Background

Besides boosting competitiveness and growth, the European Commission’s new framework programme for research and innovation ‘Horizon Europe’ aims to tackle climate change and contribute to achieving the UN’s Sustainable Development Goals. In doing so, it puts an explicit emphasis on the five missions that have been defined at the start of Horizon Europe. These missions can be regarded as the present end-point of a development that started more than 10 years ago. Targeting specific societal goals became effective with the programmatic incorporation of ‘grand societal challenges’ into the Horizon 2020 framework programme (2014–20), but its high programmatic ambitions could not be entirely met, as recognised in its interim evaluation (EC 2017),⁴ subsequent Lamy Report (Lamy et al. 2017), and ex ante impact assessment of Horizon Europe (European Commission 2018).

Although—based on the first suggestions of the Lund summit in 2009 (European Council 2009)—a major pillar of Horizon 2020 was dedicated to societal challenges, the actual revisions to the governance and instrumentation of Horizon 2020 were not up to the new ambitions but largely relied on well-established instruments, structures, and procedures. As a consequence, the cross-cutting, inter-, and transdisciplinary nature of research in support of societal challenges could not be addressed. This recognised deficit underpinned the debate about missions during the preparation of the recently-started new framework programme Horizon Europe, with missions being seen as a means to finally address societal challenges in a much more targeted manner than ever before.

In this light, we interpret the debate about EU missions as an attempt to introduce a new approach in Horizon Europe to fulfilling the promises that had already been made with Horizon 2020. This is a tremendous and challenging effort because the development and design of the missions and their governance have to be made operational in a comparatively short period of time (about 2 years), without having a model to draw upon and involving a wide range of commission-internal and commission-external stakeholders in new forms of co-creation.

Overall, EU missions met with a lot of interest among policymakers at both EU and national levels, and it is certainly fair to say that the EU-level debate gave the concept of missions a new momentum, while leaving much room for interpretation and narratives suited to the interest of different stakeholders.

4.2.2 Missions as a BO

Figure 2 sketches, for each of the four arenas, which mission object carriers (reports, strategies, objectives, calls, policies, etc.) and which communities have been involved most prominently in interpreting and shaping missions (the light-grey shading at the bottom row indicates that the processes in the performance arena are still very much ongoing).

In the *strategic arena*, three main debates can be distinguished: a scientific debate on the mission concept most suitable for policy, a political-administrative debate on the positioning of missions in the development process of Horizon Europe, and a political debate regarding the mobilisation of stakeholders from a much wider range of realms than ever before and the alignment of EC and member states' policies.

European Commission policies tend to be underpinned by scientific expertise, both for reasons of strengthening legitimacy and to obtain advice on the design of policy approaches and instruments. This was also the case for missions, for which academics had been preparing the way for some years already.⁵ Next to commissioning the study of past experiences with mission-oriented policies (JIIP 2018), the EC established various expert groups to provide scientific advice.⁶ In addition, from the many scientific voices in this debate, Mariana Mazzucato, at the time already a very prominent public intellectual and innovation scholar, was the one who brought it to political prominence and influence with her expert papers on missions (Mazzucato 2018, 2019). Other expert opinions converged on their favourable opinion about missions as a promising approach to R&I policy for addressing societal challenges but differed on the governance of missions, and the experts raised concerns about the Commission's organisational capabilities to adequately implement missions. These scientific debates were also nurtured by activities of the OECD on MIP, which took place in parallel (Larrue 2021a).

The political-administrative debate was very much concerned with the impact of R&I policy and its ability to deliver on the promises made at the outset of Horizon 2020 of providing or at least preparing new solutions to societal challenges, which were also key to justifying the significant increase of its budget as compared to previous framework programmes. In this regard, missions were seen as a possibility to give new meaning and relevance to the framework programme, at a time when more 'societal impact' was sought and expected from it. In other words, European R&I policy became more political in seeking to connect to key European policy goals. After the first phase of Horizon 2020, the European Commission was criticised for not changing enough 'on the ground' in order to achieve a higher impact on societal ambitions. This may have been too much to ask for after just a few years into the Horizon 2020 framework programme, but it showed that something needed to be done. It was the High-Level Group of Experts on the Impact of the EU's Investment into Research and Innovation, chaired by Pascal Lamy, that brought up the recommendation to explicitly pursue a mission-oriented approach in the next framework programme (Lamy et al. 2017). As a 'political' rather than just scientific expert group, it was defining important cornerstones of what was to become the Horizon Europe framework programme. The report also

Arena type	Aspect of mission at stake	Communities			
		STI academics	R&I policy makers	Sectoral policy makers	Societal stakeholders / sectoral academics
Strategic arena	Emerging meta-narrative	Boundary object carriers: Reports by EC; parliamentary motions; Letters to Parliament			
Programmatic arena	Vision		Boundary object carriers: Mission goals; Knowledge and Innovation Agendas; Multi-annual Mission-oriented Innovation Programs (MMIPs)		
Implementation arena	Concrete policy interventions		Boundary object carriers: New 'Mission teams' at the core of the Topsector governance structure; the MOOI scheme and NWO calls		
Performance arena	Puzzle (problem/solution)		Boundary object carriers: Innovation projects fitting R&D&I policies and agendas; project monitoring		

Figure 2. Examples of BO carriers for bridging communities at different arenas related to the EU missions.

set in motion a wave of internal debates within the European Commission and its Directorate-General for Research and Innovation, in particular on how to design and establish missions as part of the European Commission R&I policy portfolio. It soon became clear that missions would pose major challenges, in terms of coordination needs they raise across different Commission policies, in terms of truly connecting to societal needs and citizens' concerns, and in terms of aligning relevant policies at European, national, regional, and local policy levels.

Finally, a third and less visible debate in the strategic arena involves stakeholders from outside policy circles of the EC and its member states. Missions require not only overcoming traditional boundaries of thematic programmes and policy fields⁷ and levels but also making European R&I more 'tangible' to civil society organisations and ordinary citizens, enrolling them in collaborations with science and industry, and leveraging complementary actions in member states. The process that should lead to a sound mission concept for the new framework programme aimed to take into account these different voices and get their support for making missions a success.

In sum, missions operated as a BO around which a fundamental political debate emerged about the role and reach of R&I policy in relation to other policy fields and about the credibility of its claimed societal relevance and impact. Legitimacy derived from underpinning scientific debates about the concept and feasibility of missions was important as the foundation of debates internal to the Commission, with member states and stakeholders.

In the *programmatically arena*, a key challenge was defining the main mission areas and specific missions to be pursued, while helping ensure the buy-in of the various stakeholder groups indicated before. Mission boards played a key role in these tasks. They were established by the European Commission in 2019, following a call for expressions of interest for members.

Prior to the establishment of missions stood the definition of areas in which specific missions should be launched. This definition and selection process was informed by a preceding foresight process and internal preparatory work by the European Commission.⁸ Ultimately, however, the definition of mission areas was a political process, based on proposals of the Commission, which were then negotiated and adapted in consultation with the member states. At the end, five mission boards were appointed in the areas of (1) climate-neutral and smart cities; (2) cancer; (3) adaptation to climate change including societal transformation; (4) soil health and food; and (5) healthy oceans, seas, and inland water. The chairs of the boards were reporting directly to European Commissioners as 'clients' of the missions.

These high-level boards, led by a politically high-ranking chairperson and composed of a very diverse range of about fifteen stakeholders from all relevant societal domains, were highly autonomous in defining the scope of the specific mission(s) to be implemented in their respective areas, as well as the envisaged mode of implementation. They were not only supported by dedicated foresight activities but also maintained a regular dialogue with a range of Directorates General (DG) with responsibilities for sectoral policies of major relevance to mission achievement. In September 2020, the mission boards presented their proposals to the European Commission at the occasion of the European R&I Days, with concrete

proposals and road maps of how specific missions in the five areas shall be achieved by a combination of R&I policy and domain-specific policy measures.⁹ The mission boards' proposals were also presented and discussed at stakeholder events in member states, involving a broad range of stakeholders from science and industry to citizens. So, apart from the composition of the boards themselves, the attention to stakeholders' voices and needs continued also after the work of the mission boards, even though the implementation of envisaged engagement activities was subsequently hampered by the coronavirus disease 2019 pandemic.

On top of defining the specific topics in which missions should be set up, the mission boards also developed operational frameworks on how the different missions should be implemented. Missions as BOs allowed for the creation of dedicated arenas of debate involving many different stakeholders, with the aim of making the relevance of missions to citizens' concerns explicit. Thus, in the programmatic arena, the mission boards shaped BOs (i.e. the specific mission proposals) in a co-creation process among stakeholders.

In parallel to the debate on European missions, the mission concept has also been picked up at the national level, though to a highly varying degree across member states. While countries such as Sweden, the Netherlands, or Germany have explicitly referred to missions as part of their respective national R&I strategies, some even earlier than the European Commission, others either do not use the term 'mission' for what others might actually call missions or refrain from a targeted and directional policy approach, which raises high requirements in terms of governance. The European Commission has also asked member states to build national governance structures to support the implementation of the five EU missions, a call first member states have responded to recently with corresponding national actions.¹⁰

Currently, the *implementation arena* is being defined. Funding for missions will come from the Horizon Europe framework programme, but they will not have a dedicated budget. Instead, they will largely draw on earmarked projects within different lines of funding of Horizon Europe. In addition and given the need to align with member states' activities on missions, funding is provided to nurture the creation of national support structures not only for the five missions defined so far, but also for mission-oriented governance more generally, by way of a series of Coordination and Support Actions that are about to be launched in 2022. The attention paid to member states is important because the five missions cannot be achieved by means of European policy alone but require structures, policies, and R&I actions at lower policy levels, from national to local. While the EC can provide incentives for these actions, the success of the missions will largely depend on these still unfolding local and national actions.

The current debate about implementation modalities is a much more technical debate than those about strategic and programmatic aspects. However, it is clear that the five EC missions will continue to be accompanied and supervised by mission boards, though with a different composition than before. In addition, to achieve the necessary coordination of activities associated with the five missions, mission managers (high-ranking EC officials) were appointed in February 2021. Some of them are placed in sectoral policy DGs, others within R&I policy. In September 2021, the European Commission

also presented a report on the further implementation of missions (EC 2021), together with five implementation plans.¹¹

Even now, i.e. after defining a specific mission, they remain embedded and positioned in the architecture of European policy instruments. They maintain a high degree of autonomy in defining their agendas and bundling resources. Recognising their status as BOs implies that missions will play a key role in coordinating actions across policy arenas and that navigating that process will be a major challenge, with mission managers playing a crucial role in coordination.

As missions remain to be implemented, little can be said about the *performance arena*. Research organisations, industry, stakeholders, cities, and national governments are still preparing for carrying out missions. The EU missions triggered much interest among member states in establishing their own, national missions, and some actors at other levels are also seeking to reframe their activities along these lines, with mission-inspired policies emerging in other areas as well. Examples are industrial policy (with the so-called Important Projects of Common European Interest as mission-like initiatives) or regional policy looking for synergies between smart specialisation strategies and missions (McCann and Soete 2020). Therefore, how and whether missions as a BO will be translated into multiple problem–solution packages or into a single and specific package within and across member states are yet to be seen.

To conclude, EU missions had to be developed in a comparatively short period of time. By building dedicated arenas of debate, missions as BOs were turned from a vague and abstract idea into an operational concept, ready for implementation. The approach is still malleable with major uncertainties. Most missions require complementary actions by demand-side sectoral policies, member states, and stakeholders. These complementarities will be decisive for whether missions will succeed and meet their ambitions. However, the interest is high. EU missions have also generated momentum in other political institutions such as the OECD (see, e.g., Larrue 2021a), which are influential in shaping the ways in which policies are defined across many jurisdictions.

5. Discussion

MIPs promise to generate directional (innovation) policies that can mobilise actors across various sectors and catalyse a range of innovations and institutional changes necessary for addressing particular societal challenges. According to our conceptualisation, this process takes place among heterogeneous communities who gather around distinct BOs in at least four interconnected policy arenas. Missions are performative here as concepts and also in their concrete operationalisation; the meaning different communities assign to a mission can legitimise the scope of their own actions and influence those of others. The illustrative case of the EC Horizon Europe missions showed that which specific communities get involved depends on the context and on the pre-existing arrangements on top of which these arenas are constructed. That example also invites for discussion of how BO processes in various arenas relate to each other, which we explore further in this section.

5.1 Key mechanisms for the emergence and transfer of meanings

Approaching missions as BOs reveals different aspects in each arena: metanarratives at the strategic arena, visions at the programmatic arena, packages of policy interventions at the implementation arena, and concrete problem/solution puzzles at the performance arena. As noted in the EU missions, negotiation and contestation surround each of these aspects, implicating different groups and interests. The confrontation between them has an impact on the meanings that gain dominance. These meanings are not necessarily consistent across arenas, as certain communities will be more vocal in some arenas than in others. Achieving closure in one arena can provoke misalignments with the ongoing process of negotiation happening in other arenas. In the case of the EU missions, sectoral policymakers tend to be interested in shaping specific visions and the packages of policy interventions, while science, technology and innovation academics most actively engage with the metanarrative and the vision. The fact that missions demand action in four distinct arenas means that few actors have a sufficient overview of the entire process. The ensuing complexity can hinder that a mission exercises its catalytic effect as a BO and justifies its analysis within and between arenas. Even if missions are framed as a means to streamline different kinds of innovation efforts, they depend on achieving some level of alignment in these distinct arenas.

Based on our empirical illustration, we distinguish three key mechanisms (Fig. 3) that form a starting point of such an analysis. They enable the (1) emergence of particular interpretations and meanings within communities and eventual *convergence and divergence* between communities ensuing from coordination within a given arena; (2) *passage*, referring to the transfer of BO carriers across arenas, with either alignment and misalignment in mission orientation; and (3) *reflexive learning* within and across arenas.

5.1.1 Convergence and divergence

In each arena, communities debate their interpretation and negotiate how to proceed with missions, foregrounding distinct aspects (as a concept, vision, policy mix, etc.). Whether they converge and what interpretations or meanings they converge on can differ per arena, including also how specific that is (see the varying sizes of the ‘convergence’ spaces in Fig. 3). Partial convergence over some debates—e.g. the importance of initiating a mission—can coexist with divergence over others—e.g. the timeline and budgets necessary for completion.

The mechanism underlying the emergence and evolution of convergence and divergence largely rests on who is engaging in a mission arena, which perspectives the participants bring, and how they (alone or via intermediaries) work out possible differences. A formal governance structure may require stakeholders to reach a consensus, as embodied in, e.g., the allocation of budgets, but it can also allow differences to remain in place. For instance, joint innovation road maps might seem to advance specific priorities, while actually still allowing for different interpretations of what has been written down. Moreover, practices like creating room for contestation, e.g. by inviting possible sources of resistance to the table,

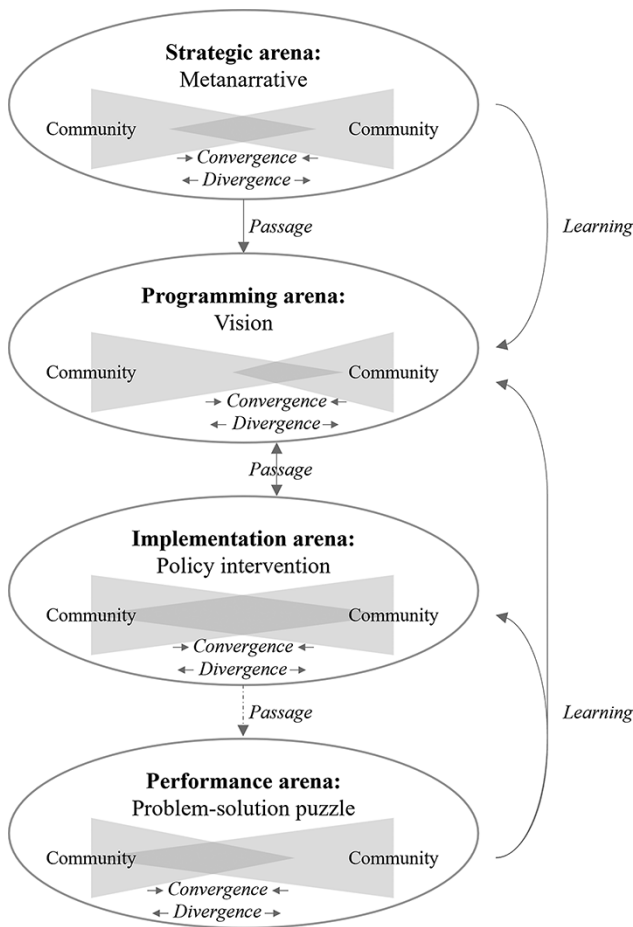


Figure 3. Mechanisms (in italics) involved in how missions can drive coordination across communities and arenas.

can also foster (temporary) divergence, for instance, including in a mission formation process an ‘opening up’ approach to the appraisal of different (technological) options and the comparison of different pathways for responding to the challenges (Stirling 2008). This form of appraisal results in advice that is both plural and conditional: ‘systematically revealing how alternative reasonable courses of action appear preferable under different framing conditions and showing how these dependencies relate to the real world of divergent contexts, public values, disciplinary perspectives, and stakeholder interests’ (Stirling 2008: 280). Moreover, where ‘closing down’ around a particular option or set of options may be necessary, bypassing the deliberation with resistant actors often leads to protracted forms of conflict. When not formally invited, opponents of a certain interpretation may engage by publicly articulating their views or even deploying co-opting strategies.

In the EU missions, the strategy arena stakeholders debated an R&I-led interpretation of MIP, as well as a political-administrative and political interpretation. None of the interpretations appears to be dominant, but they are all rather different from the interpretations surfacing in the programmatic arena. In turn, in the latter arena, the views on missions differ substantially between the four ‘transformative’ mission areas on the one hand (cities, soil and food, climate, and water) and the ‘science mission’ on cancer on the other hand,

depending also on the different communities that engaged in shaping a vision.

As argued by Brown (2021), a lack of convergence may impede effective policy-making as it fails to provide guidance. In such cases, ‘mission-oriented policy constitutes “fuzzy” policy making which is highly opaque, lacking sufficient detail’ (Brown 2021: 741) for bringing about alignment between policies and innovation capacities. In our interpretation, the issue Brown is mainly referring to concerns of BO that reached closure—where negotiation has stopped and centred around a particular path—but remains fuzzy. It is, however, important to discern situations where fuzziness is a sign that contested issues are being worked out and may eventually converge, where the fuzziness comprises a plurality of options that are valid articulations for the issue and situations where the underlying disagreements are not surfaced in the process, and the BO is constructed around a ‘lowest common denominator’, insufficiently specified.

This underlines the importance of coordination and negotiation processes between arenas, through which a widely shared understanding of the mission can emerge.

5.1.2 Passage

The translation of mission interpretations from one arena to another demands ‘points of passage’ where, through standardisation processes (Star and Griesemer 1989), some degree of closure of it as a BO is achieved, which can be clearly communicated to other arenas. It is evidently a challenge to navigate these exchanges between arenas to maintain sufficient coherence of mission interpretations. At each arena, closure emerges when the BOs become more consolidated and rigid as they undergo formal policy processes and become embedded in legal instruments or publicised via other media. BO carriers like reports, letters to parliament, and formal agendas are important coordination tools, as they may provide some temporary closure and facilitate translations across arenas. The passage of BO carriers is a key mechanism for one arena to exert influence on the workings of another arena. When this passage contrasts with the convergent elements of another arena, it may reveal misalignment and delegitimise the mission as a BO, echoing ideas of Klerkx et al. (2012) that too much interpretive rigidity acts as an exclusion mechanism (for actors, possible solutions). This is particularly critical when it disenfranchises actors who were already engaged.

In the EU missions case, it is not clear yet how passage from the implementation arena to the performing arena will play out. It is imaginable that actual mission-inspired problem solving is already taking off without clarity on available instruments. This illustrates the relative autonomy of these distinct arenas. Moreover, at the interface of the implementation and programmatic arena, there appears to be passage with an upward direction. While in the co-creation of visions for the mission areas, there was ample attention for engendering socio-economic transformation, the strong link with Horizon Europe funding schemes is now leading the visions more towards an R&D-based view on driving change.

5.1.3 Reflexive learning

Besides passage through BO carriers like policy documents that implicitly help institutionalise the converged-upon interpretations, there might be feedback loops deliberately aimed at aligning the mission interpretations between arenas, based

on learning. Learning may take place within arenas when different communities interact and experiment, leading to new mission interpretations. But lessons may also be the result of reflexive coordination of how adjusted mission interpretations in one arena relate to the interpretations in another arena. Instead of only being regarded as a barrier, misalignment between arenas can thus also be an important source of learning. Recognising disagreements may lead actors to reconsider their positions, preferences, and assumptions.

Lessons from different arenas may circulate through formal and informal means, carried by actors themselves who enter different spaces and bring particular expertise and tacit knowledge. Such lessons may connect ‘bottom-up’ ideas and demands to top-down directionalities. For instance, via learning by doing, bottom-up initiatives may reveal which mission directions are regarded as feasible and legitimate in the performance arena, and these lessons may form the basis for adapting the scope of, e.g., the mission’s vision or its supporting instruments. Learning processes like these can be instrumental in dealing with the paradox that missions require both strong directionality and openness (see [Section 2.1](#)); this might be a matter of implicit passage and deliberate feedback loops across arenas. A possible parallel here is seen in ‘local–global’ articulation found in transition studies ([Geels and Deuten 2006](#); [Geels and Raven 2006](#)). Experience from concrete experiments in the performance arena can be aggregated and abstracted, generating more generic formulations.

Learning processes can also move from the higher arena to the lower arena. For example, the implementation of mission instruments may have preceded a clear programmatic vision, and when such a vision is finally converged upon, the already implemented instruments may need to be realigned with the vision. Also, the reshaping of mission metanarratives in the academic community may translate into slightly adjusted mission visions. For the EU missions example, the initial rather technocratic perspective on missions, emphasising bold goals and clearly defined targets ([Mazzucato 2018](#)), gave way to a more nuanced governance perspective that paid much more attention to the need for adjustment in time and the inclusion of stakeholders in the process of defining and implementing missions ([Mazzucato 2019](#)). The evolution can be interpreted as a result of learning processes between strategic and programmatic, involving domain experts familiar with the true nature of the missions in question.

Finally, reflexive learning can take place in different ways, ranging from organisations that issue an ad hoc strategic document about a better alignment between communities operating in the strategic arena to a mission governance structure that is dedicated to safeguarding the alignment of mission meanings across arenas ([Larrue 2021a](#)).

5.2 Coordination within and across policy arenas

What follows from our conceptualisation is that missions are all about coordination—and not just policy coordination. In particular, for state-led missions, policymakers may be influential in facilitating or even leading the process that leads to mission formulation. However, how different mission aspects (visions, policies, etc.) will be interpreted, and thus what activities they will engender, likely depends on the composition of communities participating in the various mission arenas.

By affecting the three key mechanisms described earlier, these communities play a role in coordination dynamics via which missions obtain their meaning. They can also make the prevalent interpretation of a mission deviate from its initiators’ intention. This process cannot be fully controlled—by governments or by other individual stakeholders—for two main reasons: (1) missions are simply too complex to be taken as a whole and need to be parsed in different settings, with various constellations of actors, and (2) in these constellations, the participation can be both invited or uninvited. Other actors concerned with the mission and its effects may ‘barge in’, protest, and mobilise to oppose current processes. The advantage of the approach we propose is to unpack missions in a way that makes it easier to understand how they obtain their scope and framing. Parcelling questions around coordination at different arenas adds granularity and highlights intervention opportunities.

When shaping and promoting a mission, through policy coordination, policymakers should be aware of the possibilities and limitations that apply. Their intervention repertoire should not be narrowed to imposing a monolithic mission and crafting neatly configured policy mixes, as both might be impossible and insufficient. After all, pre-existing logics and policies can be hard to unite in a coherent and widely accepted uniform policy strategy ([Flanagan et al. 2011](#)). In the face of that reality, a striking opportunity provided by missions is to allow different actors to engage with and contribute to a mission without requiring a complete overhaul of policy instruments and policy responsibilities. Such a perspective offers a way to understand how MIP can be governed via decentralised rather than centralised control, which, as recounted by [Mazzucato \(2018\)](#), was already advocated by [Soete and Arundel \(1993\)](#). An explanation for why this principle has received so little attention might be the current debate’s focus on bold governments and strong directionality.

In our view, these two important topics do not imply a plea for top-down leadership and incrementally modifying R&D schemes. Instead, the missions and accompanying policy mixes can be constructed in a distributed fashion and invite concerted action in which actors are mutually aware of each other’s actions and adjust their activities accordingly ([Kuhlmann and Rip 2018](#)). Compared to a single actor attempting to orchestrate directions and lining up policies (as a maestro), facilitating concertation (or horizontal coordination) is a fundamentally different way of pursuing missions.

Accordingly, policy coordination via concertation (and non-policy) efforts entails providing a common focus and vocabulary for different communities and moderating how these communities engage in interpretation and negotiation processes. From a BO perspective, such policy coordination efforts should be targeted at warranting a clear direction, while also ensuring a mission’s legitimacy among relevant communities ([Larrue 2021a](#)). This is primarily a matter of balancing a mission’s openness and (temporary) closure, for instance, by stressing a particular interpretation of a mission aspect (via releasing BO carriers like strategy documents) or by engaging underrepresented communities in an arena. Indeed, the arenas not only are spaces within which coordination takes place but are also an outcome of coordination. Policymakers may also seek to establish alignment across arenas, e.g. by creating a joint sense of urgency and by inviting

Table 2. Overview of BO aspects and key mechanisms by which to study missions as a BO and associated diagnostic questions.

BO aspect	Associated diagnostic questions
Arenas	<ol style="list-style-type: none"> (1) Are missions performative at all four arenas identified here or just a few of them? (2) Are there other types of arenas in which heterogeneous communities adhere to distinct meanings? (3) What key debates demand most attention in these arenas, and which debates are being avoided?
Communities	<ol style="list-style-type: none"> (1) Who is engaging in the formulation and use of missions? (2) Are different types of stakeholders (e.g. scientists and citizens) acting as univocal communities, or are communities organised along alternative lines? (3) What preconceptions and/or interests determine how communities interpret a mission in a particular way? (4) Which actors are present across different arenas?
BO carriers	<ol style="list-style-type: none"> (1) Through which types of statements, documents, and artefacts do missions get a particular meaning? (2) How do those carriers differ in substance and detail?
Key mechanisms	Associated diagnostic questions
<i>Convergence</i> : the (lack of) convergence on similar mission meanings <i>within</i> an arena	<ol style="list-style-type: none"> (1) What mission interpretations does each arena converge on, and in what mission aspects (e.g. viability or legitimacy of solutions) is convergence not achieved? (2) What are the consequences of (a lack of) convergence? (3) Which such meanings are considered non-negotiable or stable by most actors? (4) Which such meanings are considered most controversial?
<i>Passage</i> : the transfer of mission meanings from one arena to another	<ol style="list-style-type: none"> (1) In what ways are these mission meanings similar, and in what ways are they different across arenas? (2) Via what processes are mission meanings passed on between arenas? (3) How are these meanings integrated or rejected in the receiving arenas?
Learning	<ol style="list-style-type: none"> (1) What processes of learning about mission meanings take place within each arena? (2) Via what processes are lessons learned in one arena transferred to other arenas? (3) What are potential pitfalls of dissimilarities in convergence (i.e. misalignment) between arenas? (4) Where lies potential for improving processes of passage to overcome the negative consequences of misalignment of mission meanings across arenas? (5) Which actors have a good overview of distinct arenas and can facilitate reflexivity?
(1) <i>Within-arena learning</i> : the development of new insights <i>within</i> arenas that translate into new meanings	
(2) <i>Reflexive learning across arenas</i> : the deliberate reflexivity on whether mission meanings are coherent <i>across arenas</i> and the sharing of lessons across arenas to enable or maintain (re)alignment of mission meanings	

active but unconnected communities to interact more intensively and directly with each other. Selectively engaging and connecting communities concerned with a shared goal and supporting them to understand each other's position maybe a promising way to obtain the buy-in and legitimacy needed for actors to effectively join their forces (Wittmann et al. 2021; de Boon et al. 2022). Nevertheless, further research is needed to clarify what ensues when intentionally obstructive actors seek to disrupt these arenas.

6. Conclusions

According to the conceptually novel interpretation advanced in this paper, missions are not a policy instrument nor a policy domain in itself. They can be perceived as malleable concepts that allow different communities to adjust their activities and remain engaged in an otherwise complex process of coordination. Reasoning from their own views and interests, stakeholders in those communities can engage with the (supposedly shared) goal and with each other—thereby potentially resolving constructive ambiguity as the growing alignment of different parties ensues. Then again, while the BO's interpretive flexibility can effectuate alignment of framings and activities, it might also be abused for capture (and subsequent interpretive rigidity), window dressing, and relabelling of pre-existing strategies.

Treating missions as BOs can enhance our understanding of their nature and potential, making it possible to trace their development—across time and policy arenas—as they are formulated and operationalised. This treatment is a step towards grasping the coordination dynamics engendered by a mission. For instance, with the purpose of designing policy interventions, a primary issue is to examine how a mission is gaining gravity and where misalignment or deadlocks may emerge. To this end, we propose that the analytical perspective advanced in this paper can be articulated as a framework for studying how missions are being shaped in processes of contestation and negotiation. The framework and associated diagnostic questions are presented in Table 2 and highlight which aspects and key mechanisms to consider when analysing the performativity of missions.

6.1 Avenues for further research

On the one hand, the ambiguity of missions permits action, ensures freedom for the exploration of alternative solutions, and allows the concept to travel. On the other hand, due to malleability, different arenas may converge on conflicting formulations—thereby generating misalignments and hampering mission progress. Our hypothesis is that sometimes it is important for concepts like missions to 'solidify', so they can be passed on to more operational levels. Convergence can benefit dynamics within an arena, e.g. when translation

efforts result in a concrete MIP view that allows for defining relevant monitoring practices and evaluation approaches. It can also support passage to other arenas, e.g., so that activities in a lower arena can be aligned with directives set out in a higher arena. The observation that temporary closure inherently leaves less room for interpretive flexibility (by introducing a degree of ‘functional interpretive rigidity’), however, gives rise to questions on how convergence relates to inclusivity and democratic principles in innovation and transition processes (Hendriks 2009). To address such concerns, we encourage follow-up research that extends the exploration of (ways to mediate) trade-offs that come into play when coordinating the meanings of mission orientation across communities and arenas. This also entails a close examination of the processes through which missions come to be associated with certain meanings.

Considering missions as BOs suggests that it is insufficient for policymakers to focus efforts only on improving policy instruments: they must first ‘manage the object’. As an alternative to centralised policy coordination, one can conceive of a more distributed set-up based on concerted action (Kuhlmann and Rip 2018) and ‘coordination without consensus’. By creating strong and high-level commitment to a specific societal goal, policymakers might already set meaningful alignment processes in motion. Further research on this account may draw inspiration from the emerging literature on governance through goals and assess the respective importance of normative, institutional, and discursive steering (Biermann et al. 2017). It is too early to know which approaches work best, but it is safe to recommend the exploration of more deliberate strategies for framing missions and orchestrating arenas that mobilise heterogeneous communities around them. One direction for follow-up investigations, for instance, concerns assessing the role of dedicated multi-stakeholder governance structures to organise debates. In doing so, the BO conceptualisation may also be extended towards other interacting ‘boundary elements’ such as boundary organisations and boundary spanners (Klerkx and Leeuwis 2008; Kimble et al. 2010). This has been captured in the concept of ‘boundary infrastructures’ (Star and Bowker 2006; Vilas-Boas et al. 2022), which may also be a fruitful concept to advance research on mission arenas.

Taking a BO perspective also begs for a reconsideration of the design of learning and evaluation practices. When there is a fluid rather than monolithic mission, it becomes impossible to use a static monitoring framework to accurately track whether activities in line with a missions direction have intensified. Analysts would (first) have to study how the scope and framing of a mission emerged and evolved, which in itself can also provide useful lessons about how successful MIP was in respecting principles like inviting diverse views, creating legitimacy, or ensuring reflexivity. From a formative point of view, such insights may be critical for early-stage adaptations in MIP processes and policies (Janssen et al. 2022).

Finally, this paper illustrates the BO framework with the specific case of EC Horizon Europe missions. Validation of the framework with case studies across political–economic and geographical contexts is needed to assess if the four mission arenas adequately capture mission BO dynamics and reflect similar aspects (i.e. metanarratives, visions, policy mixes, and concrete problem/solution puzzles). Such further studies also help create insights into what organisations or (multi-level)

governance structures may effectively be involved in mission arenas and how different public administrative traditions influence mission arena dynamics (Braams et al. 2021).

Supplementary data

Supplementary data is available at *Science and Public Policy* online.

Conflict of interest statement. None declared.

Acknowledgements

The authors would like to thank Iris Wanzenböck for her valuable contributions to discussions from which this study greatly benefitted. We also thank our colleagues for providing feedback on our working paper presentations at the 2021 annual conferences of EuSPRI and DRUID.

Notes

1. Diercks et al. (2019) proposed a conceptual space in terms of the underlying view of the innovation process (narrow/broad) and the goal of the policy agenda (economic/societal) of innovation policy traditions, which results in four similar categories of innovation policy.
2. In particular, the following groups deserve mentioning: ‘High-Level Group on Innovation Policy’, ‘Research, Innovation and Science Policy High-Level Expert Group’ (RISE), and Expert Group ‘Strategic Foresight for R&I Policy in Horizon 2020’.
3. Beyond the Horizon: Foresight in Support of the EC’s Future Policies on Research and Innovation (on behalf of European Commission, 2015–7), MIPs in Austria; a case study for the OECD (on behalf of the Austrian Federal Ministry for Transport, Innovation and Technology, 2018–20), Agilität in der F&I Politik (on behalf of the German Expert Commission for Research and Innovation, 2020–1), and Evaluation Study on the Relevance and Internal Coherence of Horizon 2020 and Its Policy Mix (on behalf of the European Commission, 2021–2); and Post-commencement Assessment of the Mission-Oriented Topsector and Innovation Policy (a case study for the OECD, on behalf of the Dutch Ministry of Economic Affairs and Climate Policy, 2020).
4. As stated in the interim evaluation (EC 2017: 159), ‘Horizon 2020 has not yet met the targets for expenditure on sustainable development and climate action but it is expected that they will be achieved by the end of the programme’, and ‘Stakeholders are less convinced about the role of Horizon 2020 in resolving societal challenges than in achieving knowledge-related objectives, which seems to call for better involvement of end-users and communication with citizens on the contribution that R&I can make to tackling societal challenges.’
5. See 2012 Special Issue in Research Policy on missions, edited by D. Foray, D.C. Mowery, and R.R. Nelson, which was still inspired by experiences with ‘old-style’ missions, but drawing on their potential for addressing societal challenges.
6. For RISE and the expert group on the economic and societal impact of research and innovation, see RISE (2018).
7. In the fifth framework programme, an earlier attempt of setting up initiatives that cut across the boundaries of established thematic programmes was already made under the title of ‘key actions’.
8. See project BOHEMIA—Beyond the Horizon, Foresight in Support of the EU’s Future Policies on Research and Innovation, Weber et al. (2018).

9. The five missions are now called (1) Conquering Cancer: Mission Possible, (2) A Climate Resilient Europe—prepare Europe for climate disruptions and accelerate the transformation to a climate resilient and just Europe by 2030, (3) Mission Starfish 2030: Restore Our Ocean and Waters, (4) 100 Climate-Neutral Cities by 2030—by and for the citizens, and (5) Caring for Soil Is Caring for Life.
10. See, e.g., the case of Austria where an Inter-Ministerial Working Group on EU missions has been set up, complemented by five mission action groups to mobilise national communities (Naczinsky 2021).
11. See the five mission implementation plans: https://ec.europa.eu/info/publications/implementation-plans-eu-missions_en.

References

- Backman, M. and Börjesson, S. (2006) 'Vehicles for Attention Creation: The Case of a Concept Car at Volvo Cars', *European Journal of Innovation Management*, 9: 149–60.
- Barré, R. (2007) 'Essai d'interprétation de l'évolution 2006-2007 du SFRI: la réforme à la croisée des chemins? (chapitre 4)', in Lesourne, J. et al. (dir.), *La recherche et l'innovation en France – Rapport Futuris*. Odile Jacob.
- Barré, R., Henriques, L., Pontikakis, D., et al. (2013) 'Measuring the Integration and Coordination Dynamics of the European Research Area', *Science and Public Policy*, 40: 187–205.
- Bechky, B. A. (2003) 'Object Lessons: Workplace Artifacts as Representations of Occupational Jurisdiction', *American Journal of Sociology*, 109: 720–52.
- Berkhout, F. (2006) 'Normative Expectations in Systems Innovation', *Technology Analysis & Strategic Management*, 18: 299–311.
- Bergek, A., Jacobsson, S., and Carlsson, B. (2008) 'Analyzing the functional dynamics of technological innovation systems: A scheme of analysis', *Research policy*, 37: 407–29.
- Biermann, F., Kanie, N., and Kim, R. E. (2017) 'Global Governance by Goal-Setting: The Novel Approach of the UN Sustainable Development Goals', *Current Opinion in Environmental Sustainability*, 26: 26–31.
- Boon, W. and Edler, J. (2018) 'Demand, Challenges, and Innovation. Making Sense of New Trends in Innovation Policy', *Science and Public Policy*, 45: 435–47.
- Braams, R. B., Wesseling, J. H., Meijer, A. J., et al. (2021) 'Legitimizing Transformative Government: Aligning Essential Government Tasks from Transition Literature with Normative Arguments about Legitimacy from Public Administration Traditions', *Environmental Innovation and Societal Transitions*, 39: 191–205.
- Braun, D. (1998) 'The Role of Funding Agencies in the Cognitive Development of Science', *Research Policy*, 27: 807–21.
- Brown, R. (2021) 'Mission-Oriented or Mission Adrift? A Critical Examination of Mission-Oriented Innovation Policies', *European Planning Studies*, 29: 739–61.
- Callon, M. (1985) 'Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay', in John Law (ed.) *Power, Action and Belief, Sociological Review Monograph No. 32*, pp. 196–230. London: Routledge & Kegan Paul.
- Cantner, U. and Vannuccini, S. (2018) 'Elements of a Schumpeterian Catalytic Research and Innovation Policy', *Industrial and Corporate Change*, 27: 833–50.
- Craens, J., Frenken, K., and Meelen, T. (2022) 'Mission-Oriented Innovation Policy: The Case of the Swedish "Vision Zero" Approach to Traffic Safety', in J. A. Annema, J. Köhler and B. van Wee (eds) *Innovations in Transport: Success, Failure, Societal Impacts*, pp. 343–358. Edward Elgar.
- de Boon, A., Sandström, C., and Rose, D. C. (2022) 'Perceived Legitimacy of Agricultural Transitions and Implications for Governance. Lessons Learned from England's Post-Brexit Agricultural Transition', *Land Use Policy*, 116: 106067.
- Diercks, G., Larsen, H., and Steward, F. (2019) 'Transformative Innovation Policy: Addressing Variety in an Emerging Policy Paradigm', *Research Policy*, 48: 880–94.
- Dreher, C. and Weber, K. M. (2021) 'Agile R&I Policy: Better Coping with Disruptive and Transformative Change'. Paper for the EU-SPRI 2021 Conference, Oslo: EU-SPRI.
- EC (2017) 'Interim Evaluation of Horizon 2020', Commission staff working document, Brussels: European Commission.
- (2021) 'European Missions, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions', Brussels: European Commission.
- Eisenhardt, K. M. (1989) 'Building Theories from Case Study Research', *Academy of Management Review*, 14: 532–50.
- Ergas, H. (1987) 'Does Technology Policy Matter?', in H. Brooks and B. Guile (eds) *Technology and Global Industry: Companies and Nations in the World Economy*, pp. 191–245. Washington: National Academy Press.
- European Commission (2018) 'Mission-Oriented Research & Innovation in the European Union: A Problem-Solving Approach to Fuel Innovation-Led Growth', Brussels: European Commission, Directorate-General for Research and Innovation.
- European Council (2009) 'The Lund Declaration', *Europe must focus on the Grand Challenges of our time*. Brussels: European Council.
- Fink-Hafner, D. (1998) 'Organized Interests in the Policy-Making Process in Slovenia', *Journal of European Public Policy*, 5: 285–302.
- Foray, D. (2018) 'Smart Specialization Strategies as a Case of Mission-orientated Policy—A Case Study on the Emergence of New Policy Practices', *Industrial and Corporate Change*, 27: 817–32.
- Foray, D., Mowery, D. C., and Nelson, R. R. (2012) 'Public R&D and Social Challenges: What Lessons from Mission R&D Programs?', *Research Policy*, 41: 1697–702.
- Franco-Torres, M., Rogers, B. C., and Ugarelli, R. M. (2020) 'A Framework to Explain the Role of Boundary Objects in Sustainability Transitions', *Environmental Innovation and Societal Transitions*, 36: 34–48.
- Flanagan, K., Uyarra, E., and Laranja, M. (2011) 'Reconceptualising the 'policy mix' for innovation', *Research policy*, 40: 702–13.
- Geels, F. W. and Penna, C. C. R. (2015) 'Societal Problems and Industry Reorientation: Elaborating the Dialectic Issue LifeCycle (DILC) Model and a Case Study of Car Safety in the USA (1900–1995)', *Research Policy*, 44: 67–82.
- Geels, F. and Raven, R. (2006) 'Non-linearity and expectations in niche-development trajectories: ups and downs in Dutch biogas development (1973–2003)', *Technology Analysis & Strategic Management*, 18: 375–92.
- Geels, F. and Deuten, J. J. (2006) 'Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete', *Science and Public Policy*, 33: 265–75.
- Godin, B. (2004) 'The New Economy: What the Concept Owes to the OECD', *Research Policy*, 33: 679–90.
- (2006) 'The Knowledge-Based Economy: Conceptual Framework or Buzzword?', *Journal of Technology Transfer*, 31: 17–30.
- (2009) 'National Innovation System: The System Approach in Historical Perspective', *Science, Technology, & Human Values*, 34: 476–501.
- (2015) 'Models of Innovation: Why Models of Innovation Are Models, or What Work Is Being Done in Calling Them Models?', *Social Studies of Science*, 45: 570–96.
- Grantham, A. (2001) 'How Networks Explain Unintended Policy Implementation Outcomes: The Case of UK Rail Privatization', *Public Administration*, 79: 851–70.
- Hekkert, M. P., Janssen, M., Wesseling, J. H., et al. (2020) 'Mission-Oriented Innovation Systems', *Environmental Innovation and Societal Transitions*, 34: 76–9.
- Hekkert, M. P., Suurs, R. A., Negro, S. O., et al. (2007) 'Functions of innovation systems: A new approach for analysing technological change', *Technological forecasting and social change*, 74: 413–32.

- Hendriks, C. M. (2009) 'Policy Design without Democracy? Making Democratic Sense of Transition Management', *Policy Sciences*, 42: 341–68.
- Howlett, M. (2009) 'Governance Modes, Policy Regimes and Operational Plans: A Multi-Level Nested Model of Policy Instrument Choice and Policy Design', *Policy Sciences*, 42: 73–89.
- Huvila, I. (2011) 'The Politics of Boundary Objects: Hegemonic Interventions and the Making of a Document', *Journal of the American Society for Information Science and Technology*, 62: 2528–39.
- Janssen, M. (2020) *Post-Commencement Analysis of the Dutch "Mission-Oriented Topsector and Innovation Policy" Strategy*. Mission-Oriented Innovation Policy Observatory. Utrecht University.
- Janssen, M., Bergek, A., and Wesseling, J. (2022) 'Evaluating Systemic Innovation and Transition Programmes: Towards a Culture of Learning', *PLOS Sustainability and Transformation*, 1: e0000008.
- Janssen, M., Torrens, J. C. L., Wesseling, J., et al. (2021) 'The Promises and Premises of Mission-Oriented Innovation Policy: A Reflection and Ways Forward', *Science and Public Policy*, 48: 438–44.
- JIIP (2018) 'Mission-Oriented Research and Innovation: Inventory and Characterisation of Initiatives'. Final report. Brussels: Joint Institute for Innovation Research, European Commission.
- Jørgensen, M. S. and Andersen, B. H. (2012) 'The Controversies over Bioenergy in Denmark: "Bio" Is Not the Same as "Sustainable"', *Environmental Engineering & Management Journal*, 11: 2101–19.
- Kertcher, Z. and Coslor, E. (2020) 'Boundary Objects and the Technical Culture Divide: Successful Practices for Voluntary Innovation Teams Crossing Scientific and Professional Fields', *Journal of Management Inquiry*, 29: 76–91.
- Kimble, C., Grenier, C., and Goglio-Primard, K. (2010) 'Innovation and Knowledge Sharing across Professional Boundaries: Political Interplay between Boundary Objects and Brokers', *International Journal of Information Management*, 30: 437–44.
- Klerkx, L. and Begemann, S. (2020) 'Supporting Food Systems Transformation: The What, Why, Who, Where and How of Mission-Oriented Agricultural Innovation Systems', *Agricultural Systems*, 184: 102901.
- Klerkx, L. and Leeuwis, C. (2008) 'Delegation of Authority in Research Funding to Networks: Experiences with a Multiple Goal Boundary Organization', *Science and Public Policy*, 35: 183–96.
- Klerkx, L., van Bommel, S., Bos, B., et al. (2012) 'Design Process Outputs as Boundary Objects in Agricultural Innovation Projects: Functions and Limitations', *Agricultural Systems*, 113: 39–49.
- Kroll, H. (2019) 'How to Evaluate Innovation Strategies with A Transformative Ambition? A Proposal for a Structured, Process-Based Approach', *Science and Public Policy*, 46: 635–47.
- Kuhlmann, S. and Rip, A. (2018) 'Next-Generation Innovation Policy and Grand Challenges', *Science and Public Policy*, 45: 448–54.
- Lamy, P., Brudermueller, M., Ferguson, M., et al. (2017) *LAB-FAB-APP: Investing in the European Future We Want*, Luxembourg: European Commission.
- Larrue, P. (2021a) 'The Design and Implementation of Mission-Oriented Innovation Policies: A New Systemic Policy Approach to Address Societal Challenges', OECD Science, Technology and Industry Policy Papers, No. 100, Paris: OECD.
- (2021b) 'Mission-Oriented Innovation Policy in Norway: Challenges, Opportunities and Future Options', OECD Science, Technology and Industry Policy Papers, No. 104, Paris: OECD.
- Latour, B. (1987) *Science in Action*. Cambridge: Harvard University Press.
- Loorbach, D. (2010) 'Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework', *Governance*, 23: 161–83.
- Loorbach, D., Frantzeskaki, N., and Avelino, F. (2017) 'Sustainability Transitions Research: Transforming Science and Practice for Societal Change', *Annual Review of Environment and Resources*, 42: 599–626.
- Matland, R. E. (1995) 'Synthesizing the Implementation Literature: The Ambiguity-Conflict Model of Policy Implementation', *Journal of Public Administration Research and Theory*, 5: 145–74.
- Mazzucato, M. (2015) 'Building the Entrepreneurial State: A New Framework for Envisioning and Evaluating a Mission-Oriented Public Sector', Levy Economics Institute of Bard College Working Paper No. 824. Levy Economics Institute.
- (2016) 'From Market Fixing to Market-Creating: A New Framework for Innovation Policy', *Industry and Innovation*, 23: 140–56.
- (2018) 'Mission-Oriented Innovation Policies: Challenges and Opportunities', *Industrial and Corporate Change*, 27: 803–15.
- (2019) 'Governing Missions in the European Union', Brussels: European Commission.
- Mazzucato, M. and Penna, C., eds (2015a) *Mission-Oriented Finance for Innovation: New Ideas for Investment-Led Growth*. London: Policy Network/Rowman & Littlefield.
- Mazzucato, M. and Penna, C. (2015b) 'The Rise of Mission-Oriented State Investment Banks: The Cases of Germany's KfW and Brazil's BNDES', SPRU Working Paper Series, 2015-26. University of Sussex, UK.
- McCann, P. and Soete, L. (2020) 'Place-Based Innovation for Sustainability', No. JRC121271, Joint Research Centre.
- Miedzinski, M., Mazzucato, M., and Ekins, P. (2019) 'A framework for mission-oriented innovation policy roadmapping for the SDGs: The case of plastic-free oceans', Working Paper Series (IIPP WP 2019-03). UCL Institute for Innovation and Public Purpose.
- Naczynski, C. (2021) *Austrian Governance on EU Missions. Opportunities and Challenges, Presentation at a Workshop on "Co-creating Structures and Governance for Missions at EU, Country and Regional Levels"* (published online 28 April 2021) <https://ec.europa.eu/info/events/eu-missions-how-make-them-deliver-2021-apr-28_en> accessed 1 Oct 2021.
- Nicolini, D., Mengis, J., and Swan, J. (2012) 'Understanding the Role of Objects in Cross-disciplinary Collaboration', *Organization Science*, 23: 612–29.
- Pfotenhauer, S. M. and Juhl, J. (2017) 'Innovation and the Political State: Beyond the Myth of Technologies and Markets', in Godin B. and D. Vinck (eds) *Critical Studies of Innovation*, pp. 68–94. Edward Elgar.
- Pianta, M., Lucchese, M., and Nascia, L. (2020) 'The Policy Space for a Novel Industrial Policy in Europe', *Industrial and Corporate Change*, 29: 779–95.
- RISE (2018) *Mission-Oriented Research and Innovation Policy: A RISE Perspective*. Brussels: European Commission.
- Rivoli, P. and Waddock, S. (2011) "'First They Ignore You...": The Time-Context Dynamic and Corporate Responsibility', *California Management Review*, 53: 87–104.
- Rodrik, D. (2008) 'Industrial Policy for the Twenty-First Century', Harvard University John F. Kennedy School of Government - Faculty Research Working Papers Series, SSRN 617544.
- Sabatier, P. A. and Jenkins-Smith, H. C. (1993) 'The Advocacy Coalition Framework: Assessment, Revisions, and Implications for Scholars and Practitioners', in P. A. Sabatier and H. C. Jenkins-Smith (eds) *Policy Change and Learning: An Advocacy Coalition Approach*, pp. 211–36. Boulder: Westview.
- (1999) 'The Advocacy Coalition Framework: An Assessment', in Paul A. Sabatier (ed.) *Theories of the Policy Process*, pp. 117–66. Boulder: Westview.
- Schot, J. and Steinmueller, W. E. (2018) 'Three Frames for Innovation Policy: R&D, Systems of Innovation and Transformative Change', *Research Policy*, 47: 1554–67.
- Sharif, N. (2006) 'Emergence and Development of the National Innovation Systems Concept', *Research Policy*, 35: 745–66.
- Smith, A. and Stirling, A. (2007) 'Moving Outside or Inside? Objectification and Reflexivity in the Governance of Socio-technical Systems', *Journal of Environmental Policy & Planning*, 9: 351–73.
- Soete, L. and Arundel, A. (1993) 'An integrated approach to European innovation and technology diffusion policy: a Maastricht memorandum', *Commission of the European Communities*, Luxembourg: SPRINT Programme.

- Star, S. and Bowker, G. (2006) 'How to Infrastructure', in L. Lievrouw and S. Livingstone (eds) *Handbook of New Media: Social Shaping and Social Consequences of ICTs*, pp. 230–47. London: Sage.
- Star, S. L. and Griesemer, J. R. (1989) 'Institutional Ecology, "Translations" and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39', *Social Studies of Science*, 19: 387–420.
- Steward, F. (2012) 'Transformative Innovation Policy to Meet the Challenge of Climate Change: Sociotechnical Networks Aligned with Consumption and End-Use as New Transition Arenas for a Low-Carbon Society or Green Economy', *Technology Analysis & Strategic Management*, 24: 331–43.
- Stirling, A. (2008) "'Opening Up" and "Closing Down" Power, Participation, and Pluralism in the Social Appraisal of Technology', *Science, Technology & Human Values*, 33: 262–94.
- Stout, M. (2013) 'Delivering an MPA Emphasis in Local Governance and Community Development through Service Learning and Action Research', *Journal of Public Affairs Education*, 19: 217–38.
- Tombari, H. A. (1984) *Business and Society: Strategies for the Environment and Public Policy*. Hinsdale: Dryden Press.
- Torfiing, J. and Triantafillou, P., eds (2016) *Enhancing Public Innovation by Transforming Public Governance*. Cambridge University Press.
- True, J. L., Jones, B. D., and Baumgartner, F. R. (1999) 'Punctuated Equilibrium Theory: Explaining Stability and Change in American Policymaking', in Paul A. Sabatier (ed.) *Theories of the Policy Process*, pp. 97–115. Routledge.
- Turnheim, B., Berkhout, F., Geels, F., et al. (2015) 'Evaluating Sustainability Transitions Pathways: Bridging Analytical Approaches to Address Governance Challenges', *Global Environmental Change*, 35: 239–53.
- UCL MOISS - Commission for Mission-Oriented Innovation and Industrial Strategy. (2019) 'A Mission-Oriented UK Industrial Strategy', UCL Institute for Innovation and Public Purpose Policy Report, IIPP WP 2019-04 <<https://www.ucl.ac.uk/bartlett/public-purpose/>> accessed 1 Oct 2021.
- Van Reenen, J. (2020) 'Innovation Policies to Boost Productivity', The Hamilton Project, Washington: Brookings Institution <https://www.brookings.edu/wp-content/uploads/2020/06/JVR_PP_LO_6_15_FINAL.pdf> accessed 1 Oct 2021.
- Vilas-Boas, J., Klerkx, L., and Lie, R. (2022) 'Connecting Science, Policy, and Practice in Agri-food System Transformation: The Role of Boundary Infrastructures in the Evolution of Brazilian Pig Production', *Journal of Rural Studies*, 89: 171–85.
- Wanzenböck, I., Wesseling, J. H., Frenken, K., et al. (2020) 'A Framework for Mission-Oriented Innovation Policy: Alternative Pathways through the Problem-Solution Space', *Science and Public Policy*, 47: 474–89.
- Weber, M., Andreescu, L., Cuhls, K., et al. (2018) 'Transitions on the Horizon: Perspectives for the European Union's Future Research and Innovation Policies', Final Report of Project BOHEMIA (Beyond the Horizon. Foresight in Support of the EU's Future Policies on Research and Innovation), Brussels: European Commission.
- Weber, K. M. and Rohracher, H. (2012) 'Legitimizing Research, Technology and Innovation Policies for Transformative Change: Combining Insights from Innovation Systems and Multi-level Perspective in a Comprehensive Failures Framework', *Research Policy*, 41: 1037–47.
- Wesseling, J. and Meijerhof, N. (2021) 'Development and Application of a Mission-Oriented Innovation Systems (MIS) Approach', MIPO Working Paper. published at SocArXiv (29 June 2021).
- Wittmann, F., Hufnagl, M., Lindner, R., et al. (2021) 'Governing Varieties of Mission-Oriented Innovation Policies: A New Typology', *Science and Public Policy*, 48: 727–38.
- Yin, R. K. (2009) *Case Study Research and Applications: Design and Methods*. Sage Publications.