The role of directionality and its challenges for the acceleration of sustainability transitions by intermediaries

DANIEL HIRSCHMANN\textsuperscript{a}, DANIEL FESER\textsuperscript{a}, SIMON J. WINKLER-PORTMANN\textsuperscript{b}

\textsuperscript{a} Chair of Economic Policy and SME Research, Goettingen, Germany
\textsuperscript{b} University of Applied Sciences / Society for Institutional Research - sofia, Darmstadt, Germany

Taking into account the diversity and fragility of sustainability transitions and their pathways, intermediaries contribute to the acceleration and steering of sustainability transitions by fulfilling multiple facilitating roles (Kivimaa 2014; Smink et al. 2015; Kanda et al. 2018; Kivimaa et al. 2020). Policy makers have already started to design innovation policies with explicit focus on sustainability transitions and in turn, are facing directionality challenges (Grillitsch et al. 2019; Köhler et al. 2019). Moreover, research on intermediaries governing transitions has advanced and directionality has been recognized as a challenge for transition intermediaries (Kivimaa et al. 2020). However, empirical evidence remains rare on how the agenda setting of innovation policies regarding sustainability affects intermediaries in overcoming directionality challenges and in their contribution to the acceleration of transitions, particularly when it comes to academic knowledge transfer.

By empirically analyzing the characteristics of transition intermediaries explicitly focused on accelerating sustainability transitions and their activities, this paper addresses the following research questions: How does an explicit normative focus on sustainability transitions affect the roles and activities of intermediaries in innovation policies and the approaches to overcome directionality challenges related to actors, networks and institutions?

For this analysis, the paper draws on the framework for directionality challenges established by Grillitsch et al. (2019) that relates the occurring challenges to the three generic features of innovation systems: actors, networks and institutions. We further combined it with the roles and activities and the typology of transition intermediaries synthesized by Kivimaa (2014) and Kivimaa et al. (2019) and supplemented by Vihemäki et al. (2020). With the derived framework the paper analyzes (I) how the challenges related to directionality that occur in regional innovation policies with an explicit focus on sustainability transitions affect intermediary roles and activities, (II) which activities are affected and (III) how intermediaries address those directionality challenges.

This paper uses a case study methodology (Yin 2018) to gain in-depth insights into activities of intermediaries related to directionality. We conducted a comparative analysis of four cases in German regions to clarify the impact of an explicit sustainability focus on intermediaries. Conducting 63 semi-structured interviews, we asked theoretically informed questions centered on the activities of intermediaries, their organizational structures, and their contribution to sustainability transitions.

Based on an evaluation that is currently ongoing, we find activities and roles of intermediaries that are affected when innovation policies focus on sustainability transitions. Our assessment indicates impacts on all of the three generic features of an innovation system: actors, networks and institutions.
Referring to the actors’ interest and capability feature of an innovation system, the data indicates that intermediary roles and activities are affected by directionality induced by the explicit focus on sustainability transitions. The normative focus increases communication efforts and adds extra complexity to the persuasion of potential actors, as the complexity of sustainability transitions and reservations raises initial entry barriers and as individual incentives to participate in the policy are more difficult to explain. Therefore, traditional transfer instruments need to be adjusted and advanced to meet transition requirements. The interviewed intermediaries initially enable groups of relevant actors to develop a common understanding of problems instead of imposing solutions. Additionally, they closely moderate transition processes and not just initiate change. Intermediaries therefore need to adjust and advance their communication, persuasion and moderation skills to overcome challenges related to directionality.

The strategic decision of intermediaries about the directionality shapes the structure of networks in regional innovation systems. The interviews indicate that intermediaries with a more explicit focus on sustainability transitions select new project partners according to their impact on sustainability in future cooperation, have broader diversity in addressing new actor groups like cooperation with NGOs, schools and environmental parks whereas intermediaries with less explicit focus concentrate on businesses. Moreover, intermediaries with explicit focus benefit from regional availability of experienced cooperation partners and the building up of network capacities over a long period of time. We also find learning and exploration in networks playing a different role according to their directionality focus.

Transition intermediaries in regional innovation systems focus on sustainability transitions often experience institutions as impediments as they reinforce the current unsustainable development path. Our analysis suggests that intermediaries in these regions address institutions more directly in their activities than other regions, performing different roles.
Publication bibliography


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About the Authors

Daniel Hirschmann
Born in 1989 in Helmstedt. Studied economics and economic and social history at the University of Göttingen. Since October 2019, he works as a PhD candidate and research associate at the Chair of Economic Policy and SME Research at the University of Göttingen. His research focusses on innovation and sustainability economics, role of knowledge transfer in the regional transformation process.

Daniel Feser
Born in 1987 in Dachau. Studied technical economics and economic and social history at the University of Göttingen. Dissertation on the role of knowledge-intensive service providers and energy consultants in the innovation process. Postdoctorate Researcher at the Chair of Economic Policy and SME Research, University of Göttingen since October 2019. His current research interests are innovation and sustainability economics as well as the role of knowledge transfer in regional transformation process.

Simon Winkler-Portmann
Born 1992 in Marburg an der Lahn, Germany. Studied Energy Management (B.Sc.) at Darmstadt University of Applied Sciences and Namibia University of Science and Technology and M.Sc. Risk Assessment and Sustainability Management at Darmstadt University of Applied Sciences. Since September 2019, he is a research associate of the Society for Institutional Analysis at the Darmstadt University of Applied Sciences. His research currently focusses on the role of governance experiments and of regional innovation policies in accelerating sustainability transitions.
The role of boundary infrastructure in assembling the governance of directionality in mission-oriented policy: insights from Dutch agricultural mission policy

**Author:** Stephanie Begemann  
Laurens Klerkx  
University of Wageningen  
Knowledge, Technology and Innovation Group

The renewed focus on ‘mission-oriented routes of directionality’ in policy agendas as new era of innovation policy has sparked attention to the what, why, who, where and how of missions-oriented policy (MIP) (Mazzucato, Kattel, and Ryan-Collins 2020; Hekkert et al. 2020; Klerkx and Begemann 2020; Wanzenböck et al. 2020). A major challenge involves how to deal with a plurality of perspectives, often contradictory, and how to coordinate and make them collaborate for the purpose of new research networks and research agendas (Diercks, Larsen, and Steward 2019; Kuhlmann and Rip 2018). MIP involves as such a dual task: on the one hand, it needs to be directive and exclusive to coordinate different actor groups, while on the other hand, it needs to be flexible to gain legitimacy and to get moulded in different problem-solution spaces. Although critiques and theoretical reflections on MIP framework design are emerging from transition literature (Hekkert et al. 2020; Janssen et al. 2020; Wittmann et al. 2020) methodologies to explore how a national MIP framework equips itself to deal with the governance of directionality, and how this translates in pathways of institutional change are limited (Hekkert et al. 2020).

Some transition scholars have recently discussed the value of boundary work, which involves the constructive effort to bind and coordinate diverse groups around an issue of concern (Bowker and Star 1999). Particular elements of boundary work include the role of boundary objects (Klerkx et al. 2012; Franco-Torres, Rogers, and Ugarelli 2020), boundary organizations (Lemos, Kirchhoff, and Ramprasad 2012; Kirchhoff, Lemos, and Engle 2013), and boundary spanners (Safford et al. 2017; Goodrich et al. 2020), which are used to examine how these single elements bind and coordinate people and institutions around transitions challenge. Porto Vilas Boas Souza (2020) has combined these elements in the concept
of ‘boundary infrastructure’ to examine the reciprocal influence between boundary infrastructure and transformations in the Brazilian pig industry. A key assumption is that boundary elements bind diverse agri-food agents to tackle specific sector demands, and that boundary elements moreover work together and reinforce each other. In another study on the governance of directionality, Pel, Raven, and van Est (2020, 11) discuss the matter of ‘synchronizing governance’ activities at the public-private border, which involves sustained efforts of coordination between institutionally diverse actors while keeping the ongoing system innovation process on a desirable course. The concept of synchronization in this context relates closely to that of ‘assemblage’, a concept used by science and technology scholars to study the ordering of heterogeneous entities so that they work together for a certain time (Müller 2016, 28). The concept of assemblage concerns itself moreover with dimensions of the power of politics: why orders emerge in particular ways, how they hold together, how they reach across or mould networks of actors, and how these networks fall apart (Müller 2016).

In this paper, we build on previous literature by conceptualizing MIP in a socio-technical setting as boundary infrastructure, and unravel through the lens of synchronizing governance/assemblage theory how boundary infrastructure elements synchronize institutions and actors in a socio-technical setting around missions, and how this translates in mission directionality (see Figure 1). Using mission-oriented innovation policy in the Dutch agricultural socio-technical setting as a case study, we unpack the boundary elements that define the circular mission, and examine how these boundary elements assemble diverse stakeholder worlds around the circular mission. Findings reveal that although some of the interactions between the boundary elements and the Dutch agricultural socio-technical setting translate in new actor constellations, other boundary elements and their interactions and networks support the continuation of old configurations and their path dependencies. For example, when the Dutch Minister of Agriculture presented her vision on circular agriculture in 2019, this assembled the Dutch Ministry of Land, Nature and Food, research services, universities, industries and producers around the Dutch Minister as boundary spanner and the vision and boundary element. However, the Knowledge, Technology and Innovation agenda (KIA) as boundary object on the theme Land, Water and Food, which includes the vision on circular agriculture as one of its six mission, fails to act as boundary object
in aligning industries and producer groups, as they are not engaged in building KIA strategies. In this way, the KIA loses its legitimacy as it unfolds, affecting its coordinating potential and the directionality of the mission. We argue as such that by conceptualizing mission-oriented innovation policy in a national context as boundary infrastructure and by studying how its boundary elements assemble diverse actors around its missions, this can support reflexive governance on the governance of directionality, and how this loops back on institutional change.

National socio-material context

![Mission-oriented policy directionalities](image_url)

Fig.1. Assemblage of directionality in a national context through the synchronizing efforts of boundary infrastructure elements

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EXPLORING DIRECTIONALITY PATTERNS IN MISSION-ORIENTED INNOVATION SYSTEMS: EVIDENCE FROM TWITTER DATA ON SYSTEMIC INTERMEDIARIES

Authors: Babajide Owoyele1*3, Arash Hajikhani2

1: Deep Data Lab, Hasso Plattner Institute, Campus Griebnitzsee, Universität Potsdam, Prof.-Dr.-Helmert-Straße 2 - 3 | 14482 Potsdam; (babajide.owoyele@hpi.de)
2: VTT Technical Research Centre of Finland, P.O. Box 1000, FI-02044, Finland; (arash.hajikhani@vtt.fi)
3. Dutch Research Institute For Transitions, Erasmus University Rotterdam, Netherlands

*Correspondence: babajide.owoyele@hpi.de

ABSTRACT

Our study explores leveraging digital trace data (e.g. social media) in mapping directionality patterns of systemic intermediaries who engage other actors in Mission-oriented Innovation Policy (M.I.P.) (Wanzenböck et al. 2020). Rather than starting with a theory-driven approach, we take a data-driven computational social science approach (Maass et al. 2018) to study emergent patterns of directionality of systemic intermediaries in Mission-oriented Innovation Systems (M.I.S.) using Twitter data.

We contribute methodologically to ongoing research on mission directionality (Hekkert et al. 2020; Jütting 2020), systemic intermediaries (Kanda et al. 2020) in transition studies and innovation systems literature. Systemic intermediaries mediate innovation systems, formulate missions, mobilizing actors and resources to pursue transformative innovation outcomes (Van Lente 2011; Kivimaa et al. 2019). These mediating actors align new and existing (formal and informal) institutional structures through “directionality”, influencing “existing system components to legitimize, develop, diffuse and adopt the mission’s solutions” (Hekkert et al. 2020). They are actors who leverage digital media, e.g. websites, Twitter for communicating directionality through values, vision and mission statements (Powell et al. 2016). Without understanding the directionality of an innovation system and its actors, the formulation, pursuit and completion of a mission to solve grand challenges in health, energy, or climate change may not be well facilitated, especially when it comes to connecting top-down and bottom-up initiatives and mission experiments (Mazzucato 2018; Rabadjieva and Terstriep 2021). Directionality is crucial as it guides aligning “who” is involved (or not) in governing and steering transformative innovation in a specific direction and “how” this steering is performed.

Although (Mazzucato 2018) suggest that “socio-technical systems change has a directionality embedded in it, actors need to become aware of this”, empirical work on what characterizes directionality patterns is still uncharted territory. Failure patterns in long term horizons (Weber and Rohracher 2012) and problem-solution patterns (Janssen et al. 2020)
are entry points. In the era of big data and computational social science methods, social media data is useful in systematically exploring **directionality patterns of actors such as systemic intermediaries in mission-oriented innovation systems**.

So far, empirical work on what characterizes actor directionality is still very much uncharted territory and lacks metrics. Directionality is a multi-actor multi-level M.I.S. phenomenon with potential analysis units such as actors, values, orientations, missions, strategies, events, activities, policies, projects (Lindner et al. 2016). Using a multi-case study approach, our current work leverages text mining of tweets to characterize the (E.I.T.) European Institution of Innovation and Technology’s directionality patterns. The E.I.T. is a systemic intermediary focusing on seven distinct missions.

**Preliminary Analysis of Text Mining Twitter Data**

With longitudinal Twitter data, we take the opportunity to move beyond small-n cases and interview approach to study these mission-guided entities in real-time. Following a digital methods paradigm (Rogers 2013), a preliminary exploratory data analysis of 263,309 tweets show that social media text can be mined to reveal mission directionality patterns (actors, actions and strategies).

However the approach needs to be augmented with other socio-semantic data sources (Basov et al. 2020). In future work, we want to integrate more “directionality text” from news articles, hyperlinks crawl data to provide a holistic picture of directionality in M.I.S. Our longer-term agenda is to build a digital observatory for mission-oriented innovation systems.

![Figure 1: Sustainability concept count, retweet count, and like count.](image)
**Figure 2** Sum of Retweet counts and Like counts over time.

- E.I.T. Digital Concepts: data, transformation, artificial, big data, intelligence, platform, smart
- E.I.T. Food Concepts: resilience, vertical farming, food technology, vertical farm, urban agriculture, food waste, food innovation, modern agriculture, agri-food, rooftop farming, organic

**Figure 3** E.I.T. directionality concepts construction
Next Steps

We will integrate website hyperlinks, news articles and Twitter data for a more robust characterization of directionality patterns in Mission-Oriented Innovation Systems.

Publication bibliography


