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Policy briefing

Mission-oriented innovation systems

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ABSTRACT

Rather than merely supporting R&D and strengthening innovation systems, the focus of innovation policy is currently shifting towards addressing societal challenges by transforming socio-economic systems. A particular trend within the emerging era of transformative innovation policy is the pursuit of challenge-based innovation missions, such as achieving a 50 % circular economy by 2030. By formulating clear and ambitious societal goals, policy makers are aiming to steer the directionality and adoption of innovation. In the absence of suitable frameworks to understand and enhance the impact of missions, we introduce the notion of Mission-oriented Innovation Systems (MIS). MIS consists of networks of agents and sets of institutions that contribute to the development and diffusion of innovative solutions with the aim to define, pursue and complete a societal mission. We provide several promising research avenues, including how MIS come into existence, how they are governed and how the interactions taking place in a MIS may influence directionality and technological variety.

1. A new era of innovation policy

For many decades, the core aim of innovation policy was to fix market failures, notably by repairing private firms' underinvestment in Research and Development (R&D). From the nineties onwards, a second generation of innovation policy also strived to fix failures in national innovation systems and strengthen national innovation networks. Both policy approaches focused primarily on innovation for economic growth (Schot and Steinmueller, 2018).

We are now entering a new era of innovation policy. Policy makers promoting third generation 'transformative' innovation policy acknowledge the importance of tackling societal problems, as well as the difficulty in changing innovation direction in innovation systems marked by path dependencies (Schot and Steinmueller, 2018). Weber and Rohracher (2012) coined the term *transformation failures*, which – in addition to market and system failures – legitimize government intervention aimed at influencing the directionality of innovation systems towards addressing societal problems (Boon and Edler, 2018; Kattel and Mazzucato, 2018; Wesseling and Edquist, 2018; Wanzenböck et al., 2019).

The European Commission is one of the most visible drivers in this paradigmatic shift in innovation policy philosophy. The Horizon 2020 research and innovation program of the European Union (2014–2020) focused on taking on broad societal challenges combined with driving economic growth and industrial leadership. The forthcoming 100 billion Euro program, *Horizon Europe*, goes a step further. Influenced by the work of Mazzucato (2016), it explicitly uses the concept of 'missions' to address widely shared societal challenges. We define a societal challenge-based mission as '*an urgent strategic goal that requires transformative systems change directed towards overcoming a wicked societal problem.*' It has driven the European Commission to currently formulate missions with more

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clearly defined targets, for instance in the areas of climate change adaptation, cancer and healthy oceans. Through these missions, the EU hopes to maximize the impact of R&D and to help citizens understand why it is allocating innovation funds in the first place (EC, 2019). This modernization of innovation policy has spilled over to member states that have also started to redesign their national innovation policies. In the Netherlands, for example, various ministries have formulated ambitious missions, which now guide their own strategies as well as the directions of public-private R&D and innovation activities (Ministry of Economic Affairs and Climate, 2019). One such mission is defined as ‘The reduction of national greenhouse gas emissions by 49% by 2030, with the outlook of 95% by 2050 compared to 1990 emission levels’ [translated from Dutch] (Ibid, p.5) and breaks down this overall target per sector. As a ministry proposing a mission is also responsible for completing it on time, the new policy regime marks a fundamental shift away from innovation system policies principally driven by an economic agenda.

Using clearly defined missions to elicit directed innovation, also referred to as Mission-oriented Innovation Policy (MIP) (Mazzucato, 2016; Kattel and Mazzucato, 2018), may be regarded as a promising means to deploy transformative innovation policy. While this term is quickly picking up momentum, it is very much in line with existing notions like demand-based innovation policy (Thirtle and Ruttan, 1987) and policy-induced innovation (Lindman and Söderholm, 2016), as well as with new innovation policy frameworks such as challenge-led innovation (Raven and Walrave, 2018) and dedicated innovation systems (Pyka, 2017). Characteristic of MIP is that it does not only claim that policy should target public investments at facilitating urgent societal transformations, but it also seeks to coordinate innovation efforts by a wider range of actors through the formulation and support of a well-defined objective.

The focus on tackling actual societal challenges, rather than on pushing innovations, is precisely what makes the concept of MIP so relevant for the transitions research community. By adopting MIP, policy makers – within innovation departments and beyond – become intrinsically motivated to better understand and steer changes in socio-economic systems. Moreover, large scale innovation policy initiatives aimed at speeding up societal transitions provide a favorable opportunity for transition scholars to conduct empirical research in this area.

2. A lack of applicable frameworks

While ‘missions’ is the new buzzword in policy departments, both analysts and policy makers are struggling in their attempts to design and implement MIP. Basically, a framework is missing that can be used to map and evaluate innovation dynamics that contribute to completing a societal mission, and to consequently design appropriate intervention strategies.

For the first-generation innovation policy, the framework was clear: measure national R&D expenditures and design policies to increase investment in R&D. Second-generation innovation policy is already less straightforward, as there are many degrees of freedom in improving the various elements of innovation systems. Nonetheless, strengthening ties between actors in innovation networks emerged as a strong imperative for innovation policy. Evaluators can assess policy effects by gauging how interventions change the structure of (and behavior in) these networks.

Even though the transition community can provide many relevant insights on third generation innovation policy, a dedicated framework to design MIP is not yet developed at this stage. The well-known Multi-Level Perspective on technological transitions (Geels, 2002) may be relevant for missions tied to a generic societal function (e.g. sustainable mobility), but not when missions cover multiple societal functions (e.g. achieving a 100% circular economy) or focus on highly specific challenges (e.g. achieving long-term survival for the majority of cancer patients by 2030). Similarly, the Technological Innovation System perspective does not suffice, as it focuses on understanding change in a specific technological domain rather than progress in solving an overarching societal problem (Hekkert et al., 2007). Transitions Management is highly relevant with its concept of transition arena’s in developing empowering visions for transition pathways to tackling the mission that are shared by different front runner stakeholders (Hyysalo et al., 2019; Loorbach, 2010a, 2010b), but lacks the analytical systems perspective.

3. Mission-oriented Innovation System (MIS)

For this reason, we propose a new systems framework that is specifically tailored to the needs of analysts and policy makers that aim to understand and intervene in the innovation dynamics related to prioritizing and solving a societal mission. We coin this the Mission-oriented Innovation System (MIS), and define it as *‘the network of agents and set of institutions that contribute to the development and diffusion of innovative solutions with the aim to define, pursue and complete a societal mission’*. In its essence, the MIS is another type of innovation system, such as the national, regional, sectoral and technological equivalents. However, it differs from the latter in how the system boundaries are delineated, how interactions in this system come about (e.g. demand pull versus supply-push) and what it ultimately produces (e.g. new technological and behavioral solutions). In the aforementioned example of missions recently introduced in the Netherlands, the MIS comprised ministry officials engaging a wide range of civil servants and representatives from science, industry and NGOs. Their possibilities to exert influence (e.g. by forming coalitions), and therefore their involvement, evolves during the process of defining the missions’ scope and ambition level.

Since a MIS emerges around problems rather than solutions, it is not clear from the outset which actors play a role in developing and diffusing innovative solutions during a mission’s runtime. Depending on which problem is prioritized and how the associated mission is formulated, actors from different public and private domains (including various sectors) might be involved in promoting and experimenting with innovations that have the potential to contribute to the collectively shared goal. Missions typically require integration of a range of technological and non-technological innovations. The Mission Zero initiative in Sweden to reduce traffic accidents, for example, led to new safety technologies in cars but also to effective infrastructural and institutional changes like 30

km/h zones (Johansson, 2009). As it evolves, a MIS will be populated by actors searching for complementarities within their own solution path while competing with actors proposing alternative routes.

A MIS can thus be seen as a temporary innovation system in which policy makers and other actors aim to coordinate innovation activities, with the objective of developing a coherent set of technological, institutional and behavioral solutions. Actors may contribute for a variety of reasons, like expected economic gains (firms), a normative stance regarding the mission (NGOs), or due to an institutional role like banks that provide capital or universities that educate students. The geographical boundaries of a MIS vary depending on the location of actors that contribute to the development and demand for innovative solutions.

4. Promising research avenues

Without understanding the innovation system dynamics resulting from the formulation, pursuit and completion of a mission, policy makers remain in the dark on how to assess and draft effective MIP. We highlight a number of issues that are worthwhile to explore.

First, there is much to say about how a MIS comes into existence and how that affects its impact. A MIS emerges when different actors engage in the formulation of a mission. Prioritizing and delineating pressing societal challenges is a complex process in which many actors can be involved. Based on interests and stakes in key technologies, industries or societal issues, different actors try to influence the mission formulation process. For example, influencing may occur either through lobbying government officials or through formal representation in deliberate agenda-setting activities. Such efforts have a direct impact on the boundaries of the innovation system, as problem framings determine what solutions are included and excluded. To manage the scope of innovation activities, it is critical to know how policy makers can organize mission formulation processes.

A second topic relates to the effect of strong directionality. In an ideal case, a MIS is likely to be characterized by constant urgency and directionality through ambitious targets, continuous monitoring and assessment of milestones. Mission statements often claim that societal problems need to be solved in a clearly specified timeframe. This is contrary to what TIS studies would suggest. They report many cases of emerging innovations where periods of high expectations and shared urgency are alternated with periods of low urgency and lack of policy attention (Negro et al., 2012; Meijer et al., 2006). Studying MIS allows for insight into the impact of strong directionality on the pace of transitions and innovation.

Third, strong guidance may also affect the level of technological variety in an innovation system. When quick results are driving the innovation process, potential winners may be picked in early phases, which reduces technological variety. It is important to shed light on the consequences of these types of dynamics. The selection and integration of possible solutions is likely to be a very politically and normatively laden process in which different actors try to lead the innovation system's focus into the direction that they favor. Frameworks like strategic action fields (Fligstein and McAdam, 2011) and the advocacy coalitions framework (Sabatier, 2011) help scholars to study these policy steering processes. This would provide a more critical insight into the normativity underlying the directionality that is aimed for in transitions and for which TIS and MLP are often critiqued (Elzen et al., 2011; Bening et al., 2015).

A final topic that we introduce here is the role of the government in shaping a MIS and coordinating a mission. The complexity resulting from directionality, high urgency and a specified time path in combination with different sets of interrelated technological and institutional/behavioral solutions is likely to require a broad mix of policy instruments, governance and coordination mechanisms. This exacerbates the importance of policy coordination to safeguard a policy mix's consistency, coherence and comprehensiveness (Howlett and Rayner, 2008; Rogge and Reichardt, 2016). Moreover, it is likely to require a much stronger role of the nation state, and more advanced policy capabilities, than is the case in other innovation systems frameworks.

5. Conclusion

It is important to think twice when proposing a new framework. Do we actually need it? Would it not be sufficient to stick with the concepts that we know well? We argue that this is not the case since, when a societal mission is formulated, a specific type of innovation system will form that has very specific characteristics and dynamics. It is important to understand these well in order to be able to more effectively intervene. A dedicated framework therefore helps to facilitate interaction between academics and to transfer this knowledge to policy makers and other strategic actors. The current MIP initiatives provide a great opportunity for transition researchers to empirically study emerging mission-oriented innovation systems and draw lessons to improve the design of these initiatives and their overarching strategies.

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