

The Role of R&I Initiatives in Transformative Change Processes: The Case of EIT Climate KIC and JPI Urban Europe.

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Abstract:

R&I initiatives are particularly important in transformative change processes. This research investigates two research and innovation (R&I) initiatives that act as intermediaries in the areas of urban transition and climate change mitigation: European Institute of Technology (EIT) Climate-KIC and the Joint Programming Initiative (JPI) Urban Europe. EIT Climate KIC has a strong focus on supporting entrepreneurial activities, education and capacity development as well as building networks around thematic areas. JPI Urban Europe aims to offer room for experimentation in policy and practice to build capacity for urban transition. As such, they are both transnational R&I initiatives in Europe with a focus on funding of R&I activities and selected complementary measures for scaling and impact. By drawing on Transformative Innovation Policy literature as well as literature on intermediaries, this paper analyses and compares their strategic objectives, the networks that they develop as well as a selection of their strategic activities to better understand their role and contribution to transformative change processes.

1. Introduction

Addressing societal challenges such as climate change and sustainable development requires transformational changes in different sectors of society. The importance of research and innovation in realising such transformation is reflected in the resurging debate on “missions”. Such missions put the role of R&I and associated policy instruments in addressing persistent and wicked societal challenges to the fore (Wanzenböck, Wesseling, Frenken, Hekkert, & Weber, 2020) and point to a new role of R&I initiatives (Glennie, 2019).

Missions are not new, but their quality has fundamentally changed with direct implications for R&I. The very ambitious technology driven mission of the past (e.g. man on the moon) had a clear problem and solution frame which gave a clear objective and direction to R&I policy. Whether the goal was achieved or not was unambiguous. In contrast, the missions of today aimed at addressing “grand challenges” or “societal challenges” such as climate change or sustainable development are far more complex and wicked in nature (Wanzenböck et al., 2020). In such missions, heterogeneous resources need to be mobilised, different actors need to be involved and the perspectives on what the problem is and what a solution could look like differs considerably and may change over time in light of new insights into the nature of the challenge in question. Moreover, environmental and social conditions are not just merely the backdrop and context for achieving economic growth through innovation. Instead, environmental and social conditions take on centre stage in such missions. The vantage points shifts and the role of innovation for improving and safeguarding these conditions becomes critical. From this perspective R&I can and should achieve technological breakthroughs, new business models or advancements in basic research – but these are no longer the ultimate goals per se nor are they sufficient to resolve the aforementioned challenges. Instead, mission-orientation demands innovation policy in which the ultimate goal is to tackle grand challenges. Many of them have direct implications on the fundamental logic and functioning of societal systems that determine dominant practices.

How to bring about these deep changes in societal system through R&I is theorised under the concepts of “Transformative Innovation Policy”. It is understood as a fundamentally different but complementary concept to established innovation policy paradigms (Schot & Steinmueller, 2018) and directly related to mission oriented types of innovation policy frameworks (Wanzenböck et al., 2020). This paradigm is explicitly normative, and challenges established assumptions about the merits of innovation and the modus operandi of R&I policy making at large. Its premise is that R&I policy needs to consciously shape the direction of innovation and thereby contribute more effectively to the change of socio-technical system. To this end, missions pose challenging questions about the nature of R&I policy and about the role and activities of R&I initiatives in translating and operationalising missions. While the normative turn has arrived in innovation policy at the strategic level it is less clear what the implications for particular actors and R&I initiatives in this process are (Daimler, Hufnagl, & Warnke, 2012). If anything, the new direction in mission oriented STI policy has largely led to an under-estimation of the governance challenges of such an approach which includes the changing role and function of organisations that act as carriers of such transformative aspirations (Weber, Lamprecht, & Biegelbauer, 2019). As of now, comparatively little has changed in operational terms and in the way R&I programs are defined, designed and implemented (Ricci & Weber, 2018). These issues are critical however in “bringing missions on the ground” because R&I initiatives are well suited

to enable the coordination of such mission across a large number of stakeholders (Ricci & Weber, 2018).

Against this background, the overarching research question in this paper is:

What is the role of R&I initiatives in mission oriented, transformative change processes and to what extent is this reflected in the current activities of JPI Urban Europe and EIT Climate KIC?

Conceptually, this paper addresses the research question through a transformative innovation policy research lens. This emerging field of research helps to shine a light on the objectives and instruments of innovation policy for transformative systems change. This paper also draws on the concept of intermediation and intermediary actors to revisit the role and functions of actors who work on system innovation.

Empirically, the paper compares two R&I initiatives in Europe which both have a transformative aspiration: European Institute of Technology (EIT) Climate-KIC and the Joint Programming Initiative (JPI) Urban Europe. The paper contrasts the evolution of their visions and missions, the networks they have helped to create and four of their long-standing strategic activities. In doing so it relies on a mixed methods approach and combines a qualitative content analysis with a quantitative network analysis.

2. Literature Review:

2.1 Sustainability Transition Research

In contrast to traditional innovation research, the sustainability transition scholarship shifts the focus from product or process innovation towards a more systemic view on innovation and its role for achieving sustainable futures (Markard, Raven, & Truffer, 2012). Furthermore, it is explicitly normative in that it seeks to understand and promote processes that lead to more sustainable production and consumption practices.

The sustainability transitions community is concerned with changes in socio-technical systems. Socio-technical systems are systems in which technological elements (e.g. physical infrastructure) and social elements (e.g. governance arrangements) are deeply intertwined. The concepts highlights that both dimensions evolve together to address specific societal needs, such as mobility, sanitation or energy (de Haan et al., 2014). Importantly, socio-technical systems encompass the supply as well as the demand side in the following five dimensions (Ghosh & Schot, 2019):

1. Science and technology (i.e. design, artefacts, engineering side as well as the knowledge and research used to develop & justify technological decisions)
2. Policy and governance (i.e. policy directions, ideas, measures, mechanisms to govern)
3. Market and users (i.e. includes market size, market composition, user preferences, and projected user preferences by producers and policymakers)
4. Industry structure and strategy (i.e. includes supply-side actors and arrangements, planning for operation, financing, service provision, maintenance and other aspects of day to functioning)

5. Socio-cultural dimension (i.e. acceptance and symbolic meaning of change in society – considering gender, ability and income class aspects)

Deep changes in socio-technical systems are difficult to bring about because dominant practices are determined by the underlying rule sets in all of these dimensions. Together, they create strong path-dependencies and lock-ins (Rip & Kemp, 1998; Unruh, 2002). In addition, there are other types of path-dependencies to take into account such as those relating to long-term investments (e.g. in infrastructures with high sunk costs), organisational structures and institutional framework conditions. As a result, the historically grown linkages between social and technical system elements undergoes incremental rather than fundamental changes (Rotmans, Kemp, & Van Asselt, 2001) which is insufficient to cope with urgent sustainability challenges of today. In fact, incremental changes only tinker with existing ways of doing which optimizes existing practices to further locking-in the status quo. To conceptualise changes in these socio-technical systems, this literature uses the notion of transitions, that can be understood as the interaction between three levels: niche, regime and landscape:

- Regimes, represent highly stable and entrenched configurations of the underlying rules and routines which determine how things are being done in socio-technical systems (Fuenfschilling & Truffer, 2016). Regimes are described as “*coherent, highly interrelated and stable structure characterised by established products, technologies, stocks of knowledge, user practices, norms [and] regulations*” (Markard et al. 2012, p 603) which creates a logic that actors adhere to and which guides the progression of incremental change along established pathways (Markard et al. 2012).
- Niches refer to spaces in which radical innovations emerge that fundamentally challenge the status quo. They are conceptualized as a protective space (Smith & Raven, 2012) offering ‘seeding’ conditions for innovative practices in which they can develop without being subject to the selection pressure of the prevailing regime (Kemp, R.; Schot, J.; Hoogma, 1998). Their safe space allows for the building up of a social network that supports innovation (e.g. supply chains, user-producer relationships, etc.) and associated learning and sense-making processes.
- Both niches and regimes are embedded in a so called “socio-technical landscape”. The concept refers to the technical, material and social backdrop of regimes and niches. It relates to the physical world, shared cultural beliefs or symbols, political ideologies but also large-scale trends such as demographic changes or global warming. Landscapes thereby provide the “gradients of force” that make some actions easier than others (Geels, 2004). As such, they can create pressures on regimes or lead to friction and tensions. This can lead to windows of opportunity that lead to the emergence and breakthrough of niche developments (Geels & Schot, 2007).

Socio-technical transitions are conceptualised as a phenomenon that emerges through the interplay between these three elements. These pathways in which this is unfolding have been theorised in recent years (Geels et al., 2016; Geels & Schot, 2007; Werbeloff, Brown, & Loorbach, 2016). From these pathways two broad-brush dynamics can be distilled. On one hand, an important dynamic in transformational change can be summarised under the category of “bottom-up”. In transition literature, bottom-up induced change typically revolves around a socio-technical niche as the springboard for systems change. What contributes to such bottom-

up dynamics is manifold but usually associated with processes that build up a niche, protect and nurture it (Raven, Bosch, & Weterings, 2010; Smith & Raven, 2012). Processes related to this dynamic are, for example, the development of a community of supporters around a niche, learning about the niche or the development of a shared vision (Schot, Kivimaa, & Torrens, 2019). In contrast to niche-centric bottom-up dynamics more top-down regime centric dynamics can be discerned. Top-down dynamics highlight processes in which the dominant regime becomes destabilised or reconfigured directly without the influence of a niche (Turnheim & Geels, 2012). Associated with top-down dynamics are, for example, major policy changes such as phase outs, taxation or regulation (Turnheim & Geels, 2012).

The distinction between bottom up and top down dynamics are a useful heuristic for analytical purposes. These broad-brush categories enable a diagnostic approach that allows for a closer look into the underlying causes that trigger one dynamic to be more salient than the other. On such a basis recommendations on complementary measures can be made particularly when keeping in mind that transformational change requires the convergence of both dynamics (Loorbach, 2014).

2.2 Transformative Innovation Policy

Three paradigms of innovation policy can be discerned when looking at the evolution of innovation policy (Schot & Steinmueller, 2018). Two paradigms have thus far structured much of innovation policy research and practice and a third “transformative” paradigm is currently emerging. The first paradigm can be subsumed under the term “Science and technology” or the first frame of innovation policy (Schot & Steinmueller, 2018). Influenced by the importance of technological breakthrough in winning the second world war, as well as an emergence of scientific management practices (i.e Taylorism) this paradigm is characterised by a domination of science and technology driven innovation for the sake of national prowess and economic superiority (Biegelbauer & Weber, 2018). In this paradigm, innovation was seen as the means to achieve economic growth, job security or the realisation of ambitious technology missions (e.g. man on the moon).

The paradigm became institutionalised through patent laws and the establishment of dedicated R&D departments and large scale laboratories (Diercks, Larsen, & Steward, 2019). The need for innovation policy was legitimized through a requirement to fix market failures and externalities which lead to a less-than ideal innovation output, limited the ability to commercialise scientific results and hampered economic growth while reducing the ability to achieve missions (Weber & Rohracher, 2012). In this paradigm, the negative consequences and side effects of the innovation process were acknowledged but could be remedied by conducting more research and producing more innovation. This understanding rendered innovation as good per se (Schot & Steinmueller, 2018). The main actors in this paradigm are scientists who are responsible for producing knowledge, state actors for funding this process and private actors, embodied as large corporations, for turning knowledge into commercially viable products (Schot & Steinmueller, 2018).

Based on the shortcomings of this linear approach to innovation policy a new paradigm emerged which takes on an innovation systems perspective (Diercks et al., 2019). Rather than just the production of knowledge through science, the actual use of knowledge moved to the fore, and

thus the interactions between different types of actors, in a particular science and industry (Schartinger, Rammer, Fischer, & Fröhlich, 2002). Important focal points for this perspective was how a constellation of different actors and the interactions between them can strengthen the absorption of innovation in everyday practices of businesses or end-users (Diercks et al., 2019). The emphasis on learning and collaboration between heterogenous actors brought new interaction forms to the fore, the capabilities of firms to absorb knowledge and experience from others as well as entrepreneurship as a critical driver for innovative ideas (Diercks, 2018). The rationale for policy intervention was not only market failure anymore but the failure of an innovation system which limits the ability to make use of knowledge due to weak or malfunctioning links and framework conditions between government, industry and university (Weber & Rohrer, 2012).

In this paradigm, the role of government is one of creating beneficial framework conditions so that all sorts of innovation output emerges while the benefits of innovation were still framed by relatively narrow economic rationales (Diercks, 2018). As such, the innovation system paradigm has also been recognised as insufficient to address the nature and complexity of societal challenges as it is mainly directed at optimising an innovation systems for economic purposes largely neglecting other social or environmental goals (Schot & Steinmueller, 2018). The vast majority of the innovation systems literature continues to regard innovation as positive per se, even though recent contributions to the innovation systems literature have started to take matters of directionality into account (Hekkert, Janssen, Wesseling, & Negro, 2020).

Most recently, a new field of innovation policy research emerged that is concerned with the role of innovation policy for addressing grand societal challenges. The emergence of this new policy paradigm is based on the recognition that traditional assumptions, goals, instruments and governance models in research and innovation policy are ill equipped to address wicked social and environmental challenges (Schot & Steinmueller, 2018). The new innovation policy paradigm is the attempt to better align innovation policy objectives with the social and environmental challenges that prevail (Schot & Steinmueller, 2018). This policy paradigm builds on the two more established innovation policy paradigms and is understood as an additional layer, rather than a complete replacement of older innovation policy paradigms (Diercks et al., 2019). In fact, a well-functioning innovation ecosystem, in the traditional sense of well distributed roles and responsibilities across different sectors and levels of government and thematic domains is the fundament on which more ambitious strategic ambitions can be placed (Ricci & Weber, 2018).

Transformative Innovation Policy adds something to the innovation policy space that was thus far crucially missing: a normative purpose and directionality that goes beyond the general focus on competitive, economic growth and fixing market and systems failures (Weber & Rohrer, 2012). Moreover, it departs from the assumption that innovation is always good and that social and environmental negative externalities can be managed ex-post by the state. On the contrary, this paradigm postulates that innovation is not positive per-se and that it can lead to more problems than it solves by fortifying existing path-dependencies and thereby perpetuating severe social inequalities and negative environmental consequences (Schot & Kanger, 2018). Clearly, transformative innovation policy is not only about the transformation of different sectors (e.g. energy, food) but also about fundamental changes to the logic and function of knowledge and innovation systems themselves (Kuhlmann & Rip, 2018). Against this background

the following represents a selection of characteristics of transformative innovation policy that are particularly important for the purposes of this paper.

2.2.1 Coordination and alignment

Coordination and alignment is an important aspect for realising transformative ambitions through innovation policy. On one hand it is about achieving alignment in national and supra national R&I programs and projects to tackle societal challenges more effectively. This means to foster the alignment of national research programs, priorities and activities around a common vision and shared agenda (e.g. missions). This includes top-down alignment at the financial and strategic level as well as bottom up through cooperation at the project level. More specifically, alignment in R&I can be achieved through joint foresight and mapping, joint evaluation of R&I projects and programs or the mutual use of R&I infrastructure (Meyer, Dinges, & Wang, 2017).

On the other hand, it is about alignment between policy areas because system transformation requires directionality and strategic orientation in different socio-technical systems which cannot be relegated to R&I policy alone (Kuittinen H., Polt W., & Weber M., 2018). R&I policy can act a critical linchpin in this regard, as it can induce directionality in sectoral or industrial policy more generally and thereby induce alignment among various public policy areas. After all, where transformation should be achieved is closely linked to specific sectors (e.g. agriculture, energy, etc.) and therefore necessitates changes in sectoral policy as well (Weber et al., 2019). Moreover, system transformation calls for fundamental changes to the cultural and cognitive elements which are cutting across a range of public policy domains (e.g. education, social services, etc.). Taken together, this opens a myriad of interfaces between different sectors and government levels in which innovation policy can become the lever for strategic direction. Seen this way, transformational innovation policy is then also about achieving a more collective reorientation of the different instruments and frameworks across a range of policy domains that are important for the uptake and diffusion of alternative practices (Kuittinen H. et al., 2018).

2.2.2 Experimentation

Experimentation takes on a central role in transformative innovation policy (Schot & Steinmueller, 2018). On one hand transformative innovation policy is about legitimising experimentation as a deliberate strategy for dealing with uncertainties, for setting important corridors for experimentation into desired directions and for facilitating a culture of learning by doing (Schot et al., 2019). On the other hand, transformative innovation policy understands itself as the unit for experimentation and to experiment with policies and the policy making process itself. This can take on different forms. For example, by experimenting with new combinations of R&I policy instruments and processes or by creating experimental policy spaces with transformative ambitions (Schot et al., 2019). New interaction forms which create a level playing field for exchanges between actors through Living Labs or Policy Labs have become an relatively widely used format in this regard (Voytenko, McCormick, Evans, & Schliwa, 2016). Another option is to tinker with established legal and bureaucratic frameworks with the objective of improving their flexibility and to accommodate for the application of innovation in real world settings (e.g. regulatory sandboxes). Policy experimentation for transformation can also mean, to test temporary actor constellations for a short while when they momentarily provide a beneficial constellation for achieving shared objectives (Kuhlmann & Rip 2018). It is important to note however, that policy experimentation has received far more attention when it comes to

bottom up dynamics related to niche building and development. Schot and Steinmueller (2018) however remind us that the next generation of innovation policy is also about engaging with top down dynamics associated with the destabilisation of entrenched practices and locked-in socio technical regimes. Similar to the points made above, this means to view innovation policy in a more holistic way that transcends more traditional concepts of innovation policy and domains associated with it.

2.2.3 Stakeholder Mobilisation

The two characteristics outlined above already hint to the need of mobilising and coordinating an even wider range of stakeholders. This governance aspect needs to deal with uncertainties and a constant need for learning and adaptation in the face of emerging developments over long time horizons. On the other hand, such stakeholder mobilisation needs to deal with higher complexities that emerge from new interfaces between policy domains and the higher number of stakeholders associated with them. Furthermore, Kuhlman & Rip 2018 highlight the concept of “orchestration” as an important aspect in the organisation of transformative innovation policy. It is understood as a type of mutual coordination between different elements (actors, instruments, resource flows) in an innovation system. In contrast to the traditional emphasis on centralised control, orchestration points to the importance of mutual actions and interactions as the basis of pro-active adjustments by a range of different actors or by dedicated intermediaries (Kuhlmann & Rip, 2018).

Against this background, the concept of tentative governance (Kuhlmann, Stegmaier, & Konrad, 2019) was developed and draws on previous governance concepts such as "adaptive governance" (Olsson et al., 2006) or "experimentalist governance" (Sabel & Zeitlin, 2012) and embeds them in a broader framework. The tentative governance approach stresses that the various uncertainties should be dealt with in early stages of development by means of deliberative processes characterised by explorative strategies. Experimental approaches, flexibility and learning are emphasized as important elements of a tentative governance approach which provides a framework for nudging an open process into a desired direction (Kuhlmann et al., 2019). Furthermore, tentative governance is explicitly contrasted with definitive governance, which emphasizes the goal-oriented nature and controllability of transformation processes. Rather than working from a grand governance masterplan the formulation of transformative objectives should be coupled with temporary arrangement for stakeholders to work together towards achieving these objectives. However, Kuhlmann and colleagues (2019) also point to the need to combine tentative with more definite forms of governance to balance the need for certainty with the need for responsiveness.

We formulate the following hypothesis based on the notions of the transformative innovation policy literature cited above:

H1: R&I initiatives with a transformative agenda are working on system innovation by utilizing a combination of bottom up and top down transformative innovation policy approaches that emphasise alignment, stakeholder mobilisation and experimentation.

2.3 Intermediaries

Research on intermediaries in sustainability transitions is diverse and they have been conceptualized in a variety of ways (Kivimaa, Boon, Hyysalo, & Klerkx, 2019). Terminology such as “hybrid actors” (Elzen, van Mierlo, & Leeuwis, 2012), “boundary spanners” (Brodnik & Brown, 2017) or “middle actors” (Parag & Janda, 2014) have been used to describe intermediary roles and activities. Intermediaries come in different organizational forms, such as NGOs, government agencies or private public partnerships, predicated on the specific pursuit of different priorities and intended outcomes. Intermediaries operate at a variety of scales and sectors in societal systems spanning the very local to the trans-national. Similarly, their work goes over different time scales ranging from sometimes short project-based initiatives to comprehensive programmatic work (Hodson & Marvin, 2010).

A point of convergence however is that they are described as important and active agents of change (Fischer & Newig, 2016; Hodson & Marvin, 2010; Kivimaa, Hyysalo, et al., 2019). They are particularly important in transformative change processes because of their multi-actor and multi-scale nature which requires strong intermediary action (Fischer & Newig, 2016) particularly around processes of niche development and support (Geels & Deuten, 2006). Another point of convergence in the transitions literature is that intermediaries engage in supporting radical innovation on a project level while challenging and opening up opportunities in dominant configurations at the regime level (Kivimaa et al., 2019).

In light of the diversity of research on intermediaries in socio-technical transitions Kivimaa and colleagues (2019) put forward a definition of intermediaries in socio-technical change processes: Intermediaries are: *“actors and platforms that positively influence sustainability transition processes by linking actors and activities and their related skills and resources or by connecting transition visions and demand of networks of actors with existing regimes in order to create momentum for socio-technical system change, to create new collaborations within and across niche technologies, ideas and markets, and to disrupt dominant unsustainable socio-technical configurations”*.

It is important to highlight however that intermediaries play different roles at different stages of the transformative change processes (Kivimaa, Hyysalo, et al., 2019). While more bilateral mediating roles are salient in early stages, multi-actor and cross-scale intermediation becomes more important in later stages. It follows, that the activities of intermediaries are developing throughout this trajectory as well. For example, intermediary activities develop from providing information about niche activities in early stages of a change process to the strategic lobbying of policy makers at later stages (Kivimaa et al., 2019). Regardless of the stage however, the importance of their activities is highlighted during niche construction (Geels & Deuten, 2006), niche expansion & embedding (Kanger & Schot, 2016) as well as destabilisation and opening up of regimes (Moss, 2009).

Kivimaa et al. (2019) distinguishes between five categories of intermediaries. These are: a) niche intermediaries, b) regime-based transition intermediaries, c) user intermediaries, d) process intermediaries and e) systemic intermediaries. Based on the specific roles and functions of each

of these intermediaries, they can play a significant role in one or more processes of transformative change.

For example, grassroots organisations like local energy networks act as niche intermediaries and help in niche construction processes through building expectations, broadening networks and generating second order learning. User intermediaries are actors who facilitate new user practices and enables users to articulate new demand, thereby creating new market for the niche innovations. They mainly work for niche building, even though they might help in acceleration and embedding of niches as well. Like user intermediaries, process intermediaries also facilitate niche acceleration through aligning the innovations with regime priorities. These intermediary actors may be architects, planners or consultants who manage the process of negotiation, translation and diffusion of innovative solutions (Kivimaa et al., 2019). Other regime based organisations may also act as regime-based intermediary which supports reorientation of the regime towards more sustainable directions. An example of this regime-based intermediary is the Sustainable Buildings Task Force which supports more energy efficient and sustainable housing system in the UK. Smink et al. (2015) presents boundary shakers as actors within organisations, whose “*practices involve: finding out the agendas and issues of others; convincing people of the merits of the initiative by framing the initiative to be fit with their agendas; stage management such as using experts to reinforce particular points; aligning measurement systems with the change initiative; and lobbying for help from more senior managers*”. These are typical functions of regime based intermediaries working towards unlocking path dependencies.

Kivimaa et al. (2018) describe systemic intermediaries as those actors who act towards a broad transition agenda and make a system level impact. An example of such a systemic intermediary are government affiliated organizations like Sitra which intermediates between the regime and niche by opening up the regime to new markets and actors. Based on these examples, we suggest that systemic intermediaries play more prominent roles in the process of opening up of the regimes and unlocking path dependencies.

We formulate the following hypothesis based on the notions in the intermediaries’ literature cited above:

H2: R&I initiatives with a transformative agenda are intermediating between actors in different socio-technical systems.

3. Methodology

To answer this paper's research, question an in-depth case study of EIT Climate-KIC as well as JPI Urban Europe was conducted combining two different but complementary methodological approaches: 1) a qualitative approach that utilised a content analysis and 2) a quantitative approach that utilised a network analysis. This mixed methods approach helps to identify the networks that both organisations are creating as well as an in-depth analysis of their strategic activities. Before we introduce both approaches, we first discuss the case-studies themselves:

3.1 Climate KIC

The inception of Climate KIC needs to be understood in the context of the EIT, the European Institute for Innovation and Technology. The EIT was launched in 2008 by the European Commission and is a dedicated innovation organisation for the pursuit of the European Union's innovation strategy. The organisational structure resembles a network organisation with a small headquarter in Budapest responsible for establishing different KICs which should carry out work independently in initially three priority areas (Energy, ICT, Climate). The KICs were set up as the operational units through which the EIT undertakes its activities (EIT, 2012).

In 2009, the 1st call for KICs was launched. Their overarching aim was to *address societal challenges via innovation in the knowledge-triangle*" (EP, 2013). EIT Climate-KIC is a particularly interesting case because it has been different from the other KICs since its inception. For once, because it defined its purpose and mandate much broader than the other KICs which were mainly focused on strengthening Europe's economic competitiveness. In contrast, EIT Climate-KIC positioned itself as a cross-sectoral initiative that goes beyond matters of innovation policy in a strictly economic sense (Diercks, 2018). Equally interesting was EIT Climate-KIC's strategic aim which was to achieve system transformation through innovation. The ways to achieve this was by being an incubator for climate technologies, products and services on the one hand and through being a place-based innovation and implementation facilitator on the other (Diercks, 2018).

Today, Climate KIC is Europe's largest public-private innovation partnership focused on climate change. It is active in 24 countries and has 28 offices established across Europe. It is an independent legal entity with a CEO that runs its operations, and who, together with the Executive Board, is responsible for the coordination of the CKIC strategy and business plan. As such, Climate KIC can define its own activities in a yearly business plan in order to respond to new challenges. While resembling features of a business organization, CKIC is also a trust-based network of different partners that come together under the CKIC umbrella. Overall, CKIC is a business-oriented entity but it does not own the resources with which it operates (EIT, 2012).

3.2 Joint Programming Initiative (JPI) Urban Europe

JPI Urban Europe was established in 2010 as an initiative driven by EU Member States to address the urban challenges with the ambition to develop a European research and innovation hub on urban matters and create European solutions by means of coordinated research. Its objective is to develop knowledge, tools and dialogue platforms for urban transition. The main activities of the JPI Urban Europe are to connect public authorities, civil society, scientists, innovators,

business and industry and involve national coordination and alignment, co-creation and capacity building at the AGORA Stakeholder Dialogues, strategic partnerships, Joint investments in urban R&I, urban living labs and experimental approaches and project portfolio management. In addition, it engages in reflexive activities such as strategic synthesis and monitoring and evaluation. In 2020, JPI Urban Europe engages 20 countries in Europe.

Joint Programming is a process which was launched by the European Commission in 2008 and designed for the implementation of the European Research Area (ERA). The process focused on reducing fragmentation in research and strengthening research and innovation projects by voluntary cooperation among European partners and align their national interests. A Strategic Research and Innovation Agenda (SRIA) was developed to identify and agree on research priorities and define joint implementation measures.

Since 2012, JPI Urban Europe has launched annual calls addressing specific areas and priorities in the SRIA, until today more than 80 projects have been funded and 90 Mill EUR public R&I funding granted. In 2020, approximately 450 project partners are involved in projects funded by JPI Urban Europe calls. Partners include universities, research organisations, city administrations, business and non-profit organisations.

3.3 Content Analysis

Content analysis was conducted of strategic documents of EIT Climate-KIC and JPI Urban Europe (e.g. business plans, strategies) published between 2012-2019, to investigate EIT Climate-KIC's and JPI Urban Europe's evolution over time. To better understand the role of CKIC and JPI Urban Europe in transformative system change this was supplemented through a content analysis of documents related to two long standing programmes of EIT Climate-KIC ("Pioneers" and "Climathon") and JPI Urban Europe ("Joint Calls" and "AGORA Stakeholder Dialogues"). The documents were very diverse, ranging from business and annual plans, to strategy documents and program evaluations. This was done with a transformative innovation policy lens combined with a bottom-up / top-down perspective to assess if one pathway of change is more salient than the other or if a balance between bottom up and top down change dynamics are represented.

3.4 Network Analysis

Furthermore, a network analysis was performed to visualise and analyse the network structure of funded projects, their key actors, the diversity of actors and their structural differences. Data was obtained by using a database of projects funded by EIT Climate-KIC during the period 2016-2018 and the JPI Urban Europe Joint Call Project Database which covers the period from 2012 - 2018. The analysis builds on prior research on the network structure and clusters in CKIC and JPI Urban Europe (Heller-Schuh et al., 2015; Kalcik & Meyer, 2019).

Collaboration patterns in the in JPI Urban Europe Joint Calls and the EIT Climate KIC project portfolio are approached from the perspective of Network Science. From the two datasets, bipartite network maps were constructed (i.e. a network where projects and project partners represent two different types of nodes). The network was then projected to the partner-partner levels to inspect the structure of collaboration. In the network, project partners constitute nodes

in the network which are interlinked via edges, indicating a linking between projects partners when they jointly participate in projects.

Because R&I projects are intended to foster cooperation among researchers across Europe, analysing interlinkages between countries is fruitful to gain insight into the structure and dynamics of trans-national relationship. To this end, country and actor group networks are visualized and analysed. We visualize and analyse country and actor type networks to identify and characterize the core of the networks, clusters of projects, the spatial distribution of cross-country networks and collaboration patterns between groups of actors.

4. Results of EIT Climate KIC

4.1 Strategy of Climate KIC

When Climate-KIC was launched by the European Institute for Innovation and Technology in 2010, its strategic vision shows a close alignment with concepts of sustainability transition thinking and their emphasis on the systemic and multifaceted change process. EIT Climate-KIC's approach was based on the knowledge pyramid, working with research, education, business and public bodies, and a strong focus on regions that distinguished it from other KICs. In its early stages, EIT Climate-KIC's business orientation was less pronounced than in other KICs (Diercks, 2018) with a stronger focus on system transformation and a regional approach.

Subsequently, this transformative vision became narrower as it started to emphasise entrepreneurship, technical innovation and business acceleration as the main mechanisms for change. These mechanisms were seen to be largely in the hands of EIT Climate-KIC partners and the wider EIT Climate-KIC community. EIT Climate-KIC understood its role as an organisation that promotes capacity-building and funding to entrepreneurs. This understanding and vision placed a premium on entrepreneurial agency and technological innovation as key levers for addressing climate change. At that time EIT Climate-KIC started to systematise and coordinate its activities through a 'portfolio approach' and thematic programmes which were structured along 12 thematic impact goals.

In recent years, the aspiration of delivering on transformational change has returned and widened within the organisation. The current vision is based on the idea of "collective agency" for delivering system transformations through the "orchestration" of community of experiments. EIT Climate-KIC emphasises its own role as a "keystone actor" that offers platforms, creates shared ecosystem, aligns goals and objectives, and breaks the silos between organisations who work on addressing climate change. From a transitions perspective, EIT Climate-KIC mediates between existing niches and nurtures the emergence of new actors and practices by making use of a broad portfolio of instruments (e.g. Deep Demonstration Projects). This shows that EIT Climate-KIC has broadened its understanding of agency again and is taking a more proactive and systemic stance in facilitating, steering and mobilising transformative processes and outcomes at a systems level. EIT Climate-KIC recently defined itself as an *"orchestrated innovation ecosystem that connects 'demand' and 'supply' in catalysing transformational systemic change, one that brings together public and private actors – businesses and states, individuals and cities"* (EIT Climate KIC, 2018).

4.2 Pioneers into Practice

Pioneers into Practice is a structured placement program for professionals which has been operating since 2010. After a first period evaluation (2013-2014), the programme was revised in 2015 and a new edition started in 2016. Pioneers is centrally coordinated by the EIT Climate-KIC Team but delivered by its Partners in twenty European locations. Since its creation, Pioneers involved over 1500 participants, with an average of around 200 professionals per year, and 300-400 placement opportunities in corresponding host organisations.

Pioneers into Practice is a placement program for sustainability entrepreneurs, aiming to change the day-to-day practices of climate professionals with current responsibilities in business, government and research. There is high diversity in terms of age, gender, employment background and host organisation by sector. The placement programs consists of 5-6 weeks of work at local level for professionals (from industry, small companies, universities, research institutes, local councils as well as non-profit and public organisations) and then 6 weeks of mobility in a different country and on a different project, over the course of seven months (usually from May to November), mixing e-learning, workshops and practical application at the host organisation. As such it can be considered as a structured bottom up approach to bringing different actors together and as the basis for knowledge exchange and the springboard for new ideas. To this end, Pioneers also follows an experimentalist approach in that it strongly enables learning by doing and the exchange of tacit knowledge between individuals from different organisations. It does so in a targeted way by addressing actors in a strategic locus of the network to stimulate learning and capacity building amongst key actors on thematic areas. More than half of the participants (57%) regard the programme as having a significant impact on developing new knowledge and competences. Due to the combination with more formal learning events (online trainings and workshops) facilitated by Climate KIC, Pioneers is also able to develop more abstract forms of transformative knowledge and to instil the vision of CKIC amongst participants. Forty-six percent (46%) of participants report that Pioneers has had a significant impact on developing a better understanding of low carbon transition thinking (de Ruiter & Ligtoet, 2019).

Another important function of Pioneers is to develop new networks amongst individuals from different parts of the innovation ecosystem. While providing a structured program for these new connections, Pioneers relies on the initiatives of the participating individuals to establish and nurture potential new configurations of self-organised innovation activities that can emerge out of the placements. As such, Pioneers helps to create *“innovation networks of climate change organisations and professionals at a grassroots level”* by *“equipping participants with the skills, connections and experience to lead multidisciplinary innovation initiatives in their local ecosystems and to link their own ecosystems to those of different cities/regions/countries”* (de Ruiter & Ligtoet, 2019).

4.3 Climathon

Climathon is an annual event that follows a hackathon format. It takes place the same day for all the cities involved around the globe. The Climathon evolved since its beginning in 2013 as a small event that took place in a few cities to a large event that is now reaching many major cities of the world with a strong presence on media and social media. An important milestone was the securement of the European Covenant of Mayors as a supporting partner for the Climathon in

2018 that permitted to invite all the municipalities from their community. In 2018, the Climathon took place in 113 cities, 46 countries, and across six continents and involved over 5000 participants. Supported through social media the Climathon reaches 156 million potential viewers across the world. Today, the Climathon is a consolidated brand within EIT Climate-KIC and is an element of its communication strategy.

The Climathon has a dual function. On one hand it is a classic idea generation program in the form of a hackathon. During the 24-hour hackathon entrepreneurs, students, developers, and others get together to work on climate challenges their city is facing to create innovative solutions for problem owners. Problem owners are usually private or public organisations who help fund the Climathon in a city. As such, problem owners have a significant influence on the thematic challenges that define the search for a solution during the hackathon. The solutions developed during the 24 hours can be taken forward and implemented by the problem owners. To this end, problem owners take on an important role as incubating partners who take the generated ideas and implement them or integrate them in their operations when suitable. The Climathon has a very flexible format for the development and articulation of ideas because it is sensitive to the local context through the specific needs of challenge owners. The Climathon provides a temporary space to generate dialogue, develop new ideas and build new relationships between actors from different sectors around these challenges and the topic of a low carbon economy more generally. To allow for cross city exchange and self-organised learning the Climathon also connects cities who work in similar challenges. This supports knowledge sharing and learning amongst participant about common problems. These learning opportunities for participants are maintained throughout the year as each regional CKIC office is working on involving more cities and to keep connection between them so that knowledge transfer is facilitated. In 2018 participants in the Climathon developed 395 solutions addressing 196 challenges across the world.

5. Results of JPI Urban Europe

5.1 Strategy of JPI Urban Europe

Through coordination of national research, technological development and innovation funds, JPI Urban Europe aims to enhance capacities and knowledge in sustainable urban transitions, reduce the fragmentation in the funding and delivery of R&I, policy formulation and implementation, as well as increase the visibility of urban science. The initiative's strategy follows the overall principle to support alignment and coordination of regional, national and European R&I in the field of urban development.

As a transnational R&I programming initiative of 20 European countries, JPI Urban Europe follows a Strategic Research and Innovation Agenda (SRIA) which provides the basis for the main activities and decisions of the JPI Urban Europe. The first SRIA was implemented from 2015 to 2020 and the SRIA 2.0 sets the main objectives from 2020 until 2026.

SRIA 1.0 followed a challenge focussed approach and positions JPI UE as an enabler in a complex system of urban sustainability research, policy and practice. While the SRIA 1.0 highlighted priority areas towards sustainable and liveable cities, SRIA 2.0 does not focus on particular transition pathways but embraces a plurality of goals and contexts which may be in conflict - exemplified by the reference to urban dilemmas. The dilemmas in the SRIA 2.0 point to the need for integrating European, national and regional strategies and policies which the JPI aims to broker by creating knowledge and exchange interfaces. The SRIA 2.0 thus aims to consider the diversity of urban and regional research and innovation needs across Europe and open the door for small and less RTDI intensive countries.

The SRIA 2.0 was developed in a co-creative process involving all participating R&I ministries and funding agencies from the 20 European countries, research organisations, city administration, urban business and civil society organisations (JPI Urban Europe, 2019). This took approximately 1-year and included the following methods to involve, co-create and empower the relevant stakeholders mentioned above: open consultation, stakeholder dialogue, national consultations in member states. Finally, the SRIA 2.0 was approved by all participating JPI Urban Europe Countries and commitment to its implementation was given through the annual budgets by the JPI UE members. Multiple instruments to implement the SRIA 2.0 focus on the coordination of national R&I Programmes on urban transition and develop transnational joint calls and the connection between urban stakeholder types to match the priorities of urban practitioners (e.g. AGORA Stakeholder Dialogues).

For the future, JPI Urban Europe aims to merge into the Driving Urban Transition partnership together with the R&I programme on Positive Energy Districts and Neighbourhoods building a network of networks (JPI Urban Europe, 2020). The new partnership is sought to establish stronger networks and higher impact by broadening activities towards replication, communication, and upscaling.

5.2 Joint Calls

The most important instrument to implement the SRIA of JPI Urban Europe is transnational joint calls following a multi-annual call agenda. The Joint Calls follow a challenge-drive approach. One

of the main features is the focus on urban living labs which provide an arena for experimentation, testing and co-creation and engagement.

A multi-annual call agenda takes an integrated view on urban development with the ambition of fostering cross-fertilisation of the thematic priorities but at the same time to have clearly defined and focused call topics. Based on the call agenda, call topics are defined with consideration to results already achieved from earlier calls, the latest scientific developments, external cooperation opportunities and newly identified research needs. For different calls, tuned to the call topics and aims, specific participation conditions and criteria might apply. The Joint Calls, thus, provide a means for aligning research effort across countries and disciplines.

Since 2012, JPI Urban Europe has launched annual calls addressing specific thematic priorities in the SRIAs and fund R&I projects in the area of urban transition. 84 projects have been funded and 90 Million EUR granted. 33 of the projects engaged in one or more Urban Living Labs as part of their transdisciplinary research and several projects explicitly focussed on the implementation of living labs by providing guidelines and contributing to the literature. 41 R&I Funding Agencies from 30 countries actively supported the JPI Urban Europe Joint Calls. Approximately 450 project partners across Europe and beyond are involved in projects funded by JPI Urban Europe Joint Calls. Partners include universities, research organisations, city administrations, business and non-profit organisations.

By means of the Joint Calls, JPI Urban Europe aims to spur transnational R&D collaboration, offer stakeholders room for experimentation, capacity building for urban transition and establish a network of practitioners fostering co-learning and replication. The transnational programme is oriented towards shaping an environment to create new transition pathways that correspond to the cities' strategies and priorities. The format for the Joint Calls varies between large EU-cofunded calls and small, agile "innovation action" type calls which provide funds for experimentation and exploration.

5.3 AGORA Stakeholder Dialogues

The JPI Urban Europe AGORA Stakeholder Dialogues, is a format designed to engage urban administration, business, societal actors and researchers with the aim to exchange research needs, discuss research results and promote good practice and reflect future R&I priorities and strategies. Events of different sizes and formats are organized regularly, from thematic workshops to elaborate recommendations for future calls or pressing urban issues up to a symposium series to continuously drive the discussion on urban transition and policy conferences with high visibility in Brussels.

The AGORA aims to translate knowledge between different stakeholder communities and bring them together for mutual learning. On the one hand the stakeholder communities represent urban communities of practice (e.g. urban research, citizen organizations, city authorities, business, public utility providers) and on the other hand they are policy communities of practice (e.g. R&I policy makers and programmers and urban policy makers).

JPI Urban Europe has developed the AGORA Stakeholder Dialogues as an instrument to translate scientific knowledge for urban stakeholders, articulate opinions and demand of cities and other urban stakeholders to the R&I community and support learning processes of new urban stakeholder communities. An analysis of the participation of stakeholders in the respective

events for the urban and policy communities reveals that JPI Urban Europe has reached out to a wide community.

The majority of participants are affiliated with universities or research organisations, followed by funding agencies. 133 Cities have participated in events organized by the JPI Urban Europe between 2014-6/2018. 9% out of a total of 1281 participants over all events have been from cities (city authorities, city agencies, regions, networks of cities within a region). Two AGORA events took place from 2017-06/2018 having cities as main target group. The analysis in Fig. 1 reveals that the AGORA events successfully approach a variety of stakeholders.

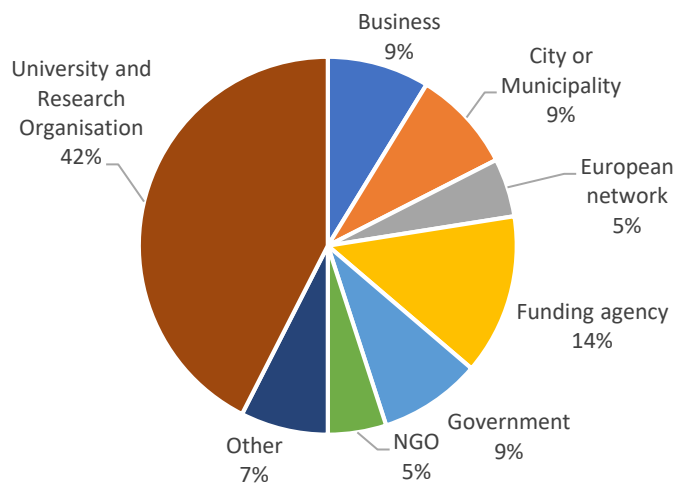


Fig. 1 Proportion of stakeholder types at AGORA events

6. Networks of EIT Climate KIC and JPI Urban Europe

The network structures of JPI Urban Europe's Joint Calls and the EIT Climate KIC project portfolio highlight some of the initiatives' main differences in approaching transformative change from an R&I perspective. In this section, JPI Urban Europe and EIT Climate KIC are compared in terms of their network structure. More specifically, we compare the collaboration patterns among the JPI Urban Europe Joint Calls funded partners and among the EIT Climate KIC project portfolio. In this analysis we focus on the projection of the bipartite network onto a project partner network to better understand the community structure behind the collection of organisations.

Fig. 2 visualises the network of the EIT Climate KIC project partners. The nodes represent project partners which are coloured by their institutional type and sized by the number of projects in which they are involved, while edges show collaborations in projects. The picture shows a closely connected graph with higher education and research institutions at the center. Beyond this large

main component, 30 other project partners are not included as they do not have ties to any other partner (i.e. projects with a single actor).

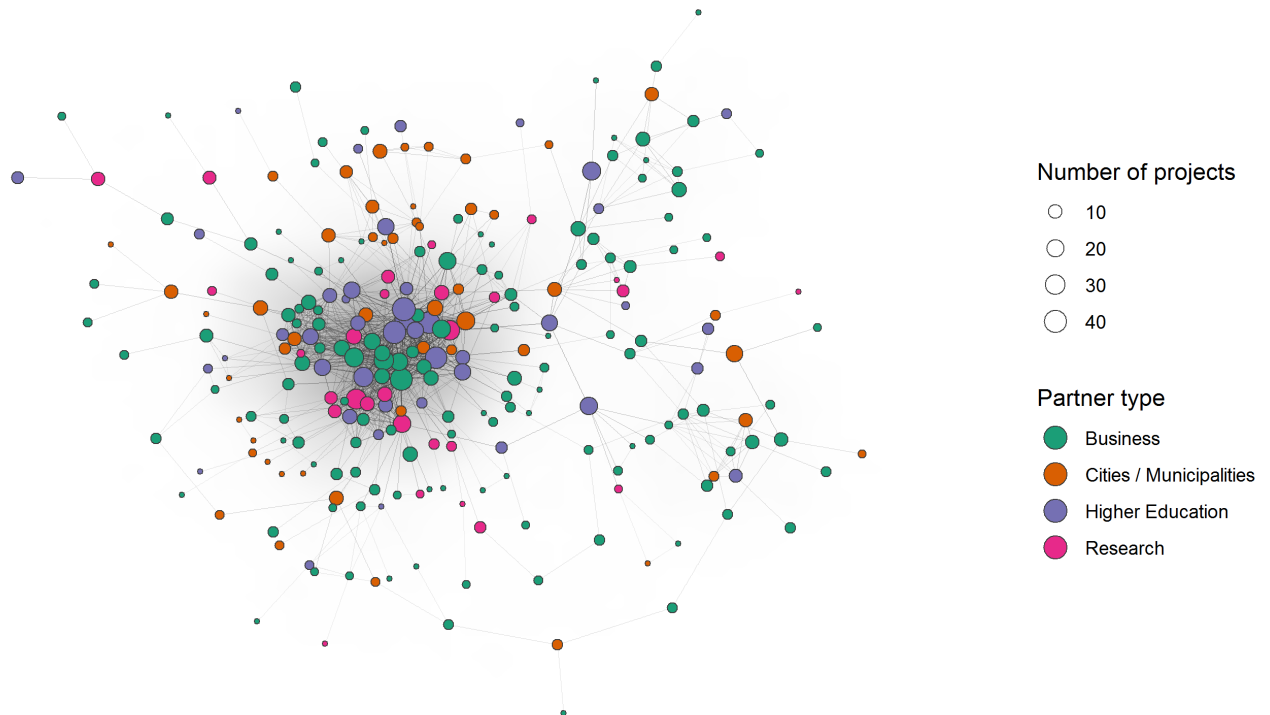


Fig. 2: Backbone network of EIT Climate KIC projects. Partners are connected if they participated in the same EIT Climate KIC project. Colour shows the partner type, while the node size shows the number of projects in which a partner was involved. The network layout is calculated only for a sparsified network including the most embedded edges (Nocaj et al., 2015)

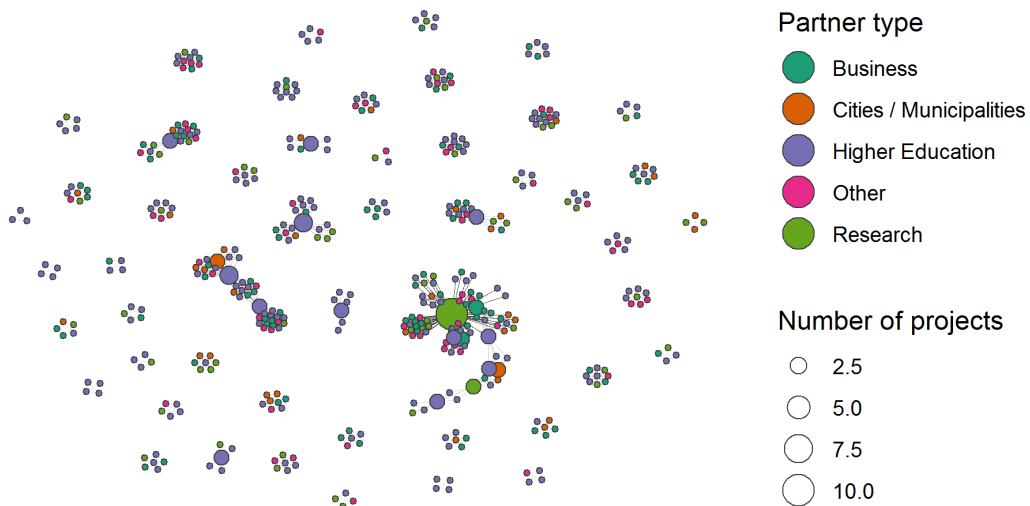


Figure 3: Backbone network of JPI Urban Europe projects. Partners are connected if they participated in the same Joint Call project. Colour shows the partner type, while the node size shows the number of projects in which a partner was involved.

Figure 3 shows the same nodes and edges for the JPI Urban Europe Joint Call projects. The structure of the network is fundamentally different with a cluster for each project but few interlinkages across projects. Only a small number of organisations participated in more than

one project tying several project clusters together. With two cities as exceptions, the linking organisations are either higher education or other research institutions.

The descriptive graph statistics in Table 1 further highlight the main differences between the two initiatives. JPI Urban Europe funds fewer but larger projects and has reached more organisation than EIT Climate KIC; albeit in a longer time-frame. The graph characteristics confirm the visual representation of the network structure which indicates that the Climate KIC project ecosystem is more tightly connected. A project partner in the Climate KIC is connected, on average, to 17 other partners compared to 8 for JPI Urban Europe partners. 12% of all possible connections between CKIC partners are covered in the projects which again highlights the close community.

The largest difference between the networks is, however, regards distribution of components. That is the number of groups in the network without a connection to other partners. In JPI Urban Europe many projects represent their own component. Project partners collaborate within the project, but do not collaborate with any other JPI Urban Europe partners. In EIT Climate KIC's project portfolio, almost all project partners are connected to each other as the largest component covers 90% of all partners.

Finally, we inspect homophily in the two networks. That is the propensity of similar nodes to connect together. The assortativity coefficient measures the proportion of edges connecting nodes with similar characteristics. Regarding assortativity among partner types (university, city, business, research), CKIC and JPI Urban Europe exhibit similar low homophily. This indicates higher diversity in the connections of the network and is likely a result of requirements in the projects to form consortia including multiple organisational types. Regarding assortativity among similar countries, the CKIC partners have a lower propensity to match up with partners from the same country.

Table 1: General characteristics and network statistics of the JPI Urban Europe and EIT Climate KIC project partner network

Descriptives	Measure	JPI Urban Europe	EIT Climate KIC
General characteristics	Period	2012 - 2018	2016 - 2018
	Number of projects	73	807
	Number of partners (distinct)	465	290
	Number of countries	29	30
	Average number of partners per project	6.75	2.51
	Median number of partners per project	6	1
Graph characteristics	Diameter	6	6
	Average degree	7.64	17
	Density	0.033	0.118
	Components	50	31
	Largest component	82	260
	Assortativity among similar type	0.026	0.029
	Assortativity among similar country	0.141	0.08

deep demonstration project. While currently in the early stages, these portfolio projects will put stronger emphasis on the development of temporally limited de-facto governance arrangements around more specific, and regionally defined, challenges (Matti, 2019). This finding suggests that the strategic direction and ambition of Climate KIC as well as its operationalisation is congruent with concepts of intermediation from a transformative innovation policy perspective as outlined above.

In contrast to this finding, the analysis of Pioneers and Climathon reveals that these programs only partially reflect some of the principles of transformative innovation policy. Both programs are predominately supportive of bottom up change dynamics from a transformative innovation policy perspective. With regards to "stakeholder mobilisation" the Climathon and Pioneers respectively rely on the rather autonomous emergence of connections between actors in niches, be it around specific ideas or solutions (i.e. Climathon) or vocational background (i.e. Pioneers). This suggests that while more deliberate and tentative forms of stakeholder mobilisation are part of the newly emerging Deep Demonstration portfolio approach, at present Climathon and Pioneers are predominately fostering a rather self-organised and ad-hoc formation of actor networks.

A similar pattern can be observed when it comes to the other two elements of transformative innovation policy: Experimentation and alignment. Also here, Climathon and Pioneers are predominantly stimulating bottom up change dynamics associated with the development and nurturing of niches. This is most clearly exemplified by the Climathon which is very supportive of idea generation around sustainability challenges. At the Climathon, the notion of experimentation becomes substantiated through the development of social or technical solutions for a particular "challenge host" - usually an organisations or local government body who supports the event and who can choose whether or not to take these ideas further. While CKIC sets an important impetus for the development of new niches through these programs, experimentation is confined and limited to the grassroots level.

7.2 Discussing JPI Urban Europe

The network analysis of the JPI Urban Europe shows few connections between project partners of different projects and organisations who mostly participated in a Joint Call for the first time. The separate cluster structure hints at an open network that is able to mobilise new actors in government, research and civil society to engage in research projects on urban transitions. One of the main drivers for the fragmented network structure is the wide range of topics that the challenge driven calls are addressing. This attracts researchers and practitioners from different fields but makes it hard to receive follow-up funding even after a successful pilot. While the challenge-driven calls and transdisciplinary project can support the build-up of local niches particularly at the urban level, the relatively weak connections between organisations in different projects might not be conducive to processes of niche growth, upscaling or replication as this would require stronger and more sustainable social ties between actors and projects. To address this, JPU UE has implemented multiple accompanying measures to foster collaboration between project stakeholders in order to support innovation and the associated learning and sense-making processes. Most notably, this comes in the form of in-kind support and network building activities which points to other important aspect of R&I related intermediation activities by JPI UE.

Importantly, JPI UEs intermediation activities are framed by a vision and mission that provides a transformative direction to its activities. More specifically, JPI UEs strategic intent is to support urban transitions by supporting knowledge creation, setting common priorities, aligning R&I instruments, moderation of science-policy processes and the support of transnational collaboration as well as local capacity building. The analysis of two of its strategic activities (AGORA and Joint calls) reveals that the operationalisation of this strategic direction follows a combination of top-down and bottom up approaches.

Regarding experimentation, JPI UE uses innovative funding formats for pilot as well as demonstration projects and supports the establishment of urban living labs as a dedicated experimentation space in a real-world context. Next to these more bottom-up and niche centric support activities, JPI UE also enables experimentation in the governance as well as operational aspects of national R&I activities. In this regard, JPI UE provides a framework for national R&I funding agencies to test new collaborations and to try new and temporary approaches. For many funding agencies, such experimentation on the international level is easier than on the national level and JPI UE is able to create a space for such experimentation outside the national R&I policy frameworks. These opportunities often endure shifting national priorities after, for examples, elections and subsequent changes in government.

Moreover, the SRIA process induced coordinating and alignment in R&I related activities of industry sectors and public policy areas among its members. On one hand, this was facilitated at the level of the challenge owners (cities) where JPI engages in a continuous dialogue with cities to learn about their challenges and coordinate their research requirements. On the other hand, the SRIA process involved other R&I stakeholders which were involved in the formulation of shared dilemmas that became strategic priority areas in JPI UEs strategy. As such, the co-development of shared dilemmas also supported the alignment of different element of national R&I policy in relation to urban issues. The commitment to these challenges by its members is exemplified by the provision of national R&I budgets that address these challenges as well as a joint learning process on programme design and implementation.

8. Conclusions

To come back to our research question and hypothesis the two empirical examples show that EIT Climate KIC and JPI Urban Europe are two R&I initiatives who are well positioned to take a leading role in mission oriented R&I policy. Their strategic direction, the networks that they have developed as well as some aspects of their activities are supporting the systemic changes that missions demand. In further operationalising missions however, both initiatives need to take a more active stance by further going beyond their traditional role associated with funding research or innovation projects. This new role requires intermediating properties to enable the concerted action in an innovation system with an explicit transformative agenda as well as transformative innovation policy approaches.

In practice this will require moving beyond the current focus on R&I funding to nurture niches and networks. While these aspects are particularly important in the pre-development and take-off phase of system transformation, activities associated with the acceleration of system changes should become stringer. In order to stimulate this acceleration and a wider uptake of novel solutions (technological as well as non-technological), it will be necessary for both initiatives to mobilize also demand-side forces and policies (e.g. by including public procurers

and regulators in their projects and programs). In a similar vein, both initiatives need to enter into a strategic dialogue about necessary changes in institutional framework conditions not only in support of novel solutions but also for a destabilisation of regimes in different socio-technical systems.

Besides this general suggestions, applicable to both initiatives, there are also differences in terms of where they could place an emphasis in their future development. While JPI Urban Europe addresses selected regime elements through enabling R&I policy experimentation at national level, EIT Climate KIC is mainly relying on community-driven and niche-centric activities. A stronger involvement of regime actors would raise the visibility of the networks that CKIC creates and help to create important interactions between niche and regime actors. The move towards creating new de-facto governance arrangements by developing long term engagements with regime actors as challenge owners in deep demonstrations projects is a noteworthy change of approach in this regard.

JPI UE is in an early stage of development which suggests that its community will grow more interconnected over time. This is an important opportunity to induce some alignment and strategic steering across the clusters of networks that it currently creates. While local, self-organised actor networks around particular niches are beneficial, a stronger use of network support measures (e.g. through communication platforms or networking events) could help to strike an important balance between steering and self-organisations of stakeholder networks. This does not necessarily mean that JPI UE has to do this by itself. Instead, interfaces with other organisations can be created to provide the spaces to experiment with different kinds of support mechanisms between different stakeholders in innovation systems.

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