

TOWARDS A TRANSFORMATIVE INNOVATION POLICY (TIP) RESEARCH AGENDA

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Towards a Transformative Innovation Policy (TIP) research agenda

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Disclaimer: *This report is not an official document of any of the above organisations.*

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Index of Acronyms

CSR	Corporate Social Responsibility
EEA	European Environment Agency
EIT Climate-KIC	European Institute of Innovation and Technology Climate – Knowledge and Innovation Community
Eu-SPRI	European Forum for Studies of Policies for Research and Innovation
EU	European Union
Globelics	Global network for Economics of Learning, Innovation and Competence Building Systems
GMO	Genetically Modified Organisms
MLP	Multi-Level Perspective
MNC	Multi-National Corporation
NGO	Non-Governmental Organisation
PDCA	Plan-Do-Check-Act
R&D	Research & Development
SDG	Sustainable Development Goal
SPRU	Science Policy Research Unit
STI	Science, Technology & Innovation
STRN	Sustainability Transitions Research Network
TIP	Transformative Innovation Policy
TIPC	Transformative Innovation Policy Consortium
TIPRN	Transformative Innovation Policy Research Network

At a glance

Throughout 2018 and 2019, academic scholars and policymakers involved in research and practice on science, technology and innovation (STI) policy came together on several occasions to explore intersections of their perspectives around the emerging 'Transformative Innovation Policy (TIP)' theme, in the 'internetwork dialogue'. This working paper presents discussion on ten questions raised in multiple sessions and workshops, categorised under three main themes – 1) conceptualisation, 2) actors and contexts and 3) operationalisation of TIP. The aim of this paper is to present the rich quality and diversity of knowledge shared by over 100 scholars with transdisciplinary expertise, as well as policy professionals willing to contribute practical experience to the scholarly debates. A further aim of this paper is to provide a springboard for accelerating the ongoing developments in TIP research. A virtual conference in 2021 could build on these different streams of knowledge presented in the paper. The paper seeks further contributions from the new network of TIP scholars (TIPRN) in building a vibrant community of practise on TIP.

Introduction

The need to align the capacities of societies to innovate with the persistent challenges they face is increasingly recognised in research and policymaking. Transformative Innovation Policy (TIP) proposes a new approach for the role of innovation in addressing these global societal and environmental challenges, combining insights from several research domains including sustainability transitions literature and innovation studies. A workshop organised in Utrecht in February 2019 offered an important opportunity to explore the synergies and tensions between different perspectives on TIP by different research and policy communities. In November 2019, the TIPC conference in Valencia built on these initial insights to further advance towards developing a research agenda on TIP. This report summarises the high-quality and diverse input shared by researchers and practitioners at the 2019 events, on ten different themes / questions around Transformative innovative policy. This report will serve to inform the research agenda of the “Transformative Innovation Policy Research Network (TIPRN)”, which was launched at the TIPC conference in November 2019 to serve as a community of engaged scholarship and cutting-edge practice in this domain.

As a concept, TIP aims to provide enough granularity to understand systemic change, and, at the same time, to be sufficiently operationalizable that it can be used by advocates and policy makers beyond an academic context. Central to this concept is the notion of “transformation” that refers to ongoing, systemic transformations, irrespective of whether it is goal-driven or emerging in more complex ways from problem-driven initiatives and experiments. The governance of transformation processes should be a way of organizing and mobilizing a diversity of actors, practices and pathways. Transformations often encompass different scales, spaces and actor groups. There is no single or simple answer of what is

required to enable transformations, as it will depend on local political cultures and the role of STI in each context.

The TIP outlook is sceptical of assuming top-down steering or ‘strong state’ as the only immediate solution. The state, in its different forms, may play an important role in steering, guiding and facilitating transformations by managing directionality and the interests of different stakeholders. Governance can also be fragmented; what is important is how collective action is organised. A more bottom-up approach or decentralised governance can, in the right circumstances, better accommodate ongoing experiments and multiple stakeholders contributing to transformation. Transnational governance can also play an important role; however, conflict of interests and geo-political tensions can also undermine and delegitimise transnational and national efforts.

Transformation encompasses areas and activities that stand beyond the traditional scope of STI policy. However, social, technical and institutional innovations are often a central part of imaginaries for the future. STI policy may play a crucial role in articulating such imaginaries, and in managing deep uncertainties that will emerge through the transformation processes, for example, through the establishment of missions or challenge-led programmes. Deciding on the scope and role in STI policy in these efforts is always challenging. Transformations in the Global South are often as much about poverty and inequality as they are about climate change and sustainability. In that context, STI agencies and other change agents are often restricted in the role they play in the policy landscape. This presents specific challenges that a TIP approach might be able to mitigate.

In order to enable the transformations of systems and societies, STI agencies have been rethinking their role in shaping the directionality and governance of innovation processes. In this document a rich agenda for practice and research can be discerned, that could better inform these efforts and address the specific challenges that ensue.

On the one hand, STI agencies can seek to mobilise the existing repertoire of initiatives and policies combined with novel approaches to support societal experimentation. On the other, it is essential to think beyond initiating and conducting such experiments, and consider different pathways for scaling up, mainstreaming or institutionalising changes in order to have a systemic impact. Evaluation in this respect plays an essential role but should be understood as a formative process of learning and network building rather than solely about accountability. Nevertheless, building an appropriate “knowledge infrastructure” that will facilitate mapping and collecting evidence of systems transformation is essential to support long-term efforts of TIP initiatives and sustain coalitions. Creating the means for sharing learning that is already happening on the ground is essential - i.e. establishing a ‘knowledge infrastructure’ is a crucial task. Transformative Innovation Policy holds promise in addressing the grand challenges through experimentation, evaluation and new roles for the state, policy actors and STI agencies, however it requires continued transdisciplinary collaboration to impact sustainable futures.

Throughout 2018 and 2019, academic scholars and policymakers involved in research and practice on science, technology and innovation (STI) policy came together on several occasions to explore

intersections of their perspectives around the emerging 'Transformative Innovation Policy (TIP)' theme, in the 'internetwork dialogue'. The rationale for that dialogue was to facilitate debate and share knowledge among different academic communities on how STI policy can respond to contemporary social, economic, and environmental challenges. A key departure point was that the strategy and urgency with which the systemic problems must be confronted, defy conventional approaches in STI, which is customarily motivated by primarily economic arguments around competitiveness and economic growth, or scientific endeavour. The initiative was funded by the [European Forum for Studies of Policies for Research and Innovation \(Eu-SPRI Forum\)](#), and convened by members of the [Transformative Innovation Policy Consortium \(TIPC\)](#), and it involved members of the [Sustainability Transitions Research Network \(STRN\)](#) and of the [Global Network for Economics of Learning, Innovation, and Competence Building Systems \(Globelics\)](#).

Various conference sessions captured the emerging discourses of transformative innovation policy in its various forms, scoping the questions and controversies that arise in its wake. It also aimed to foster collaboration, joint work and research programmes that may address those questions and establish new directions of research and practice, together with potential funders. The dialogue culminated in the workshop organised in Utrecht in February 2019, which offered one of the first opportunities to explore the synergies and tensions between different perspectives on TIP by different research and policy communities. Later in November, dedicated sessions for group work around multiple themes around TIP helped move this dialogue forward.

Transformative Innovation Policy is emerging in response to the perceived need to align the capacities of societies to innovate with the grand challenges they face, as recognised in various levels of research and policymaking. The sustainable development goals, for example, imply the mobilisation of innovation policies in a range of areas: several SDGs allude to the need for system innovations, and for better distributing the dividends from economic activity. Despite the existence of such overarching goals, policies in different domains are often misaligned, lacking coherence between different governance levels and failing to target genuine transformation of existing practices and industries³. These issues point to a deeper misalignment between stated goals and the prevalent rationale for innovation policy and its relation to sectoral policies, which led many scholars to propose a new framing, labelled Transformative Innovation Policy or Innovation Policy for Transformative Change, which could represent an emerging paradigm.⁴

³ **EEA (2019)**, Sustainability Transitions: policy and practice, European Environmental Agency. Luxembourg: Publications office of the European Union. doi: 10.2800/641030

⁴ **Schot, J., & Steinmueller, E.** (2016). Framing innovation policy for transformative change: Innovation policy 3.0. SPRU Science Policy Research Unit, University of Sussex: Brighton, UK.

Steward, F. (2012). Transformative innovation policy to meet the challenge of climate change: sociotechnical networks aligned with consumption and end-use as new transition arenas for a low-carbon society or green economy. *Technology Analysis & Strategic Management*, 24(4), 331-343.

To face urgent societal challenges, this framing suggests that the rationales, instruments, indicators and governance mechanisms underpinning the STI systems must change, embracing a transformative turn. Different proposals in this direction resonate with the insights and debates from the various STI communities. For example, the sustainability transitions field has for a long time argued that persistent challenges require new understandings of the dynamics of systems change.⁵ Innovation studies scholars and sustainability experts have also explored practices and rationales for policy making that could contribute to more participative, experimental and reflexive modes of governing STI systems.⁶ The role of STI in reproducing and potentially transforming patterns of inclusion and exclusion has also been studied in depth⁷, with calls for much more attention to justice and the distributional effects of policies (as in the notion of just transitions, for example⁸).

Nevertheless, it remains a challenge to mobilise the insights of these diverse communities to devise new strategies, instruments and capacity building efforts to shape STI systems that can enable societal transformations and a fair allocation of their benefits⁹. Much of the scholarly work in this domain remains out of reach for policymakers, and vice versa. Establishing an internetwork dialogue on TIP, and a platform for transdisciplinary practice in this domain, is a bold step to meet this challenge and support that transformative turn.

Weber, K. M., & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. *Research Policy*, 41(6), 1037-1047.

⁵ **Grin, J., Rotmans, J., & Schot, J.** (2010). Transitions to sustainable development: new directions in the study of long term transformative change. Routledge. **Smith, A., Voß, J. P., & Grin, J.** (2010). Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research policy*, 39(4), 435-448.

⁶ **Borrás, S.** (2011). Policy learning and organizational capacities in innovation policies. *Science and Public Policy*, 38(9), 725-734; **Leach, M., Rockström, J., Raskin, P., Scoones, I. C., Stirling, A. C., Smith, A., ... & Folke, C.** (2012). Transforming innovation for sustainability. *Ecology and Society*, 17(2), 11; **Voss, J. P., & Kemp, R.** (2005, June). Reflexive Governance for Sustainable Development—Incorporating feedback in social problem solving. In paper for ESEE conference, Lisbon; **Kuhlmann, S., & Rip, A.** (2014). The challenge of addressing Grand Challenges. A think piece on how innovation can be driven towards the “Grand Challenges” as defined under the European Union Framework Programme Horizon, 2020; **Edler, J., & Boon, W. P.** (2018). ‘The next generation of innovation policy: Directionality and the role of demand-oriented instruments’—Introduction to the special section. *Science and Public Policy*, 45(4), 433-434;

⁷ **Perez, C.** (2013). Unleashing a golden age after the financial collapse: Drawing lessons from history. *Environmental Innovation and Societal Transitions*, 6, 9-23.

⁸ **Swilling, M. & Annecke, E.** (2012) *Just Transitions: Explorations of Sustainability in an Unfair World*, United Nations University Press, p. 448.

⁹ This issue is unevenly and underrepresented in the report. Issues of just transitions, inequalities, distributive justice, social/environmental justice, winners/losers, fair access to infrastructures and amenities need more exploration and emphasis in the research agenda.

The journey 2018-2020

The dialogue was structured to create different opportunities for debate and reflection with academics and practitioners. It was comprised of two rounds of sessions in the conferences of the different communities involved, a collaborative workshop in Utrecht, and a final conference in Valencia (See figure 1).

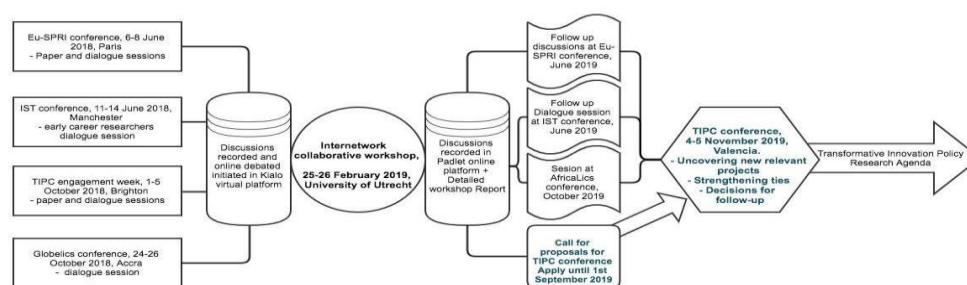


Figure 1. Path of internetnetwork collaboration until the workshop, February 2019.

The first phase aimed to activate the debate, with dialogue sessions in the conferences of each of the participating networks, and a conference track in the Eu-SPRI conference (Paris, May 2018). These sessions brought together participants from the other networks, who were asked to identify pressing questions and shared insights that could help substantiate a joint research agenda. The notes collected in each of those sessions were organised as a set of questions and controversies.

In the second phase, those inputs were then digested in the two-day Internetwork Collaborative Workshop in Utrecht in February 2019, resulting in an in-depth dialogue about a potential transformative agenda for innovation policy produced in collaboration among the STI community, policy practitioners, funders and innovation agencies. Around 30 scholars participated in this workshop (Annex I) representing research networks like the Eu-SPRI Forum, Globelics, TIPC and STRN. The group discussions followed three themes of discussing TIP:

1. How to conceptualise transformative innovation policy (TIP)? How to put it in context of emerging approaches of framing new STI policies?
2. What is the role of different actors in STI policy in Global North and Global South contexts?
3. How to design, implement and evaluate transformative innovation policy initiatives in various contexts?

On the second day, groups were formed around each of these topics and discussion continued, based on questions compiled in the reader and using [Padlet](#). The event included pitches by the representatives of the different groups (Annex II), that set the scene of the workshop showcasing the heterogeneous understanding of transformation, identifying common grounds as well as tensions regarding the conceptualisation and rationales represented in the room. The workshop also had a rich set of background papers suggested by the participants (Annex III) and circulated in advance.

The third phase consisted of a second round of events in conferences; a second substantial engagement with this topic occurred in November 2019 when a conference was organised to mobilise the community of scholars and practitioners in the emerging 'Transformative Innovation Policy' theme. It continued the ongoing dialogue between members of four research networks – the [Transformative Innovation Policy Consortium \(TIPC\)](#), [European Forum for Studies of Policies for Research and Innovation \(Eu-SPRI Forum\)](#), [Sustainability Transitions Research Network \(STRN\)](#) and [Globelics](#) (in particular Africalics) in order to understand how different actors around the globe are interpreting and enacting transformative innovation policies through research and policy actions. We welcomed more than one hundred participants in the conference, affiliated to one or multiple research networks and offered multiple highly interactive sessions and two panel discussions between European policymakers as well as research and policy funders.

The group work in Valencia was organised across ten themes, namely:

1. Conceptual Foundations of Transformative Innovation Policy
2. STI Policies for Transformative Change
3. Experimentation for Transformative Change
4. Politics and Governance of Transformative Change
5. Role of Research and Innovation Agencies for Transformative Change
6. Role of Governments and Ministries for Transformative Change
7. Role of Businesses and Entrepreneurs for Transformative Change
8. Transformative Innovation Policy in Developmental Context
9. Transformative Innovation Policy in Regional Context
10. Tools for Transformative Innovation Policy

Through an in-depth facilitated discussion on each of these themes, the groups contributed to the research challenges and opportunities on each topic. The inputs from all groups were recorded online and are available for access [here](#) on Padlet (Thanks to the note-takers in all groups).

In the closing session of the conference, it was agreed that a research agenda needs to emerge on the broad topic of transformative innovation policy. Many practitioners remarked that besides generating new knowledge, there should also be efforts in translating and sharing scholarly knowledge for capacity building among practitioners for broadening innovation policy. To this end, a new “Transformative Innovation Policy Research Network (TIPRN)” was launched at the conference. Interested individuals from the STI research and practise community and affiliates of all four research networks were invited to [join this new network](#), and support the development of the network and the research.

The research agenda

The research agenda is presented below in three sections and ten questions. The aim of what is presented under the questions is meant to be illustrative of the quality and diversity of knowledge shared by researchers and practitioners at the 2019 events rather than a comprehensive digest of discussions. The following sections showcase the insights from different perspectives of scholars from different academic backgrounds, scholars with transdisciplinary expertise as well as policy professionals willing to contribute practical experience to the scholarly debates.

Conceptual foundations of TIP

1. How to conceptualise transformative innovation policy (TIP)?

A crucial element of a research agenda on TIP should clarify: why do we need this concept and what do we want to achieve with it? The idea of transformation, for some, caters to the magnitude and the quality of change, including normative entry points.

The concept of TIP is based on contributions from different academic communities, for which it is important to highlight the building blocks, and the different understandings of some **basic conceptual elements: socio-technical systems, production/consumption systems, economic sectors, institutional approaches and actor-oriented approaches**. From a socio-technical systems perspective, TIP seeks ways to phase out unsustainable systems through disruptive initiatives instead of regulatory or other conventional policy measures. It is about transitioning to new systems that are more sustainable and that address grand challenges which requires multi-scalar and deep dynamics of change. The TIP concept incorporates the notion of policy experimentation, deep multi-system change-processes (including stability and acceleration dynamics), and responsible research and innovation. In contrast to the socio-technical systems perspective, some scholars argued that it is also about finding new approaches to changing economic, industrial and technological systems through social processes such as collaboration.

Understanding **TIP as a collaborative process** also means acknowledging the role of multiple actors, intermediaries, frontrunners and incumbents, powerful and powerless actors in the co-learning and co-creation processes of policy design and evaluation. From the perspective of industrial innovation,

the framing of TIP offers a more explicit treatment of actor identity and power and further develops the need for work on needs and capabilities. It also acknowledges the diversity and simultaneity of challenges and thus the need for more holistic or mixed policies to meet specific goals.

All these aspects of conceptualising TIP point to the fact that the concept should be able to respond to two communities: practitioners and researchers. For policy makers and policy entrepreneurs, the concept should serve as a basic cognitive frame to communicate about missions and offer intervention logics. This means that the concept of TIP would have different levels of granularity and operationalizability depending on who used it and in what context. It is important to find a balance between diversity and complementarity of different approaches and entry points to understand TIP. This comment reflects the need for the TIP research community to be clear and transparent about how basic concepts, such as socio-technical systems, add value to the main research endeavour to understand system transitions and the role of policy.

Transformation is a concept with many nuances some of which were articulated in discussions on the role of STI policy for transformative change. It may refer to ongoing processes which have not been initiated intentionally (unfolding transformations) or refer to normative efforts to induce transformations (induced transformations) along particular normative directions (e.g. attempts to establish 'car free cities', 100% renewable futures and so forth). Many definitions and ways of understanding transformation were articulated along established lines of distinction, such as unit/level of analysis, societal vs disruptive, temporal vs spatial unfolding. It was agreed that transformation will require processes of change at many different levels of aggregation spanning from the individuals to the socio-technical systems to global value chains. To engage in transformation, consumers, workers, managers and engineers will need to develop new routines and competences. Transformation is far larger than what is ordinarily understood to be the content of STI policy. Given that innovation processes draw upon both science and experience-based knowledge, traditional STI-policy has shortcomings in navigating the challenges associated with societal transformation and in articulating the role of relevant social actors. TIP seeks to identify and remedy these shortcomings in order to address challenges such as equity, sustainability and democracy.

2. Why is TIP an emerging approach of framing new STI policies?

TIP differs from previous understandings of STI policy in the sense that it is highly normative in terms of defining and selecting a wider range of problems that societies want to tackle with policy. It is more pragmatic and applied than critical socio-politico-technical frameworks. It is also considered more oriented towards long term goals (eg. SDGs) and purposeful change (as opposed to system reinforcing logics, infrastructuring logics, market fluidising logics, innovation deficit logics). It enables coordination and new institutional designs for the new form of reflexive and inclusive governance. This new approach of STI policy requires more systematic conceptualisation of the actor-network-practice landscape in a much more inclusive and democratic manner. In the background of developing a strong conceptualization

for TIP, there is an ongoing and iterative reflection about the conventional role of the STI and other epistemic communities in conceptualising and enabling system transformation.

Conventional STI policy also has a high-technology bias that tends to exclude or ignore low and middle income countries' opportunities for improving social welfare and meeting needs. It is important to pay attention to innovation processes at the grassroots and openness to other forms of bottom up innovation. Many national innovation strategies are still focussed on economic growth and neglect missions like addressing climate change or natural disasters¹⁰. They acknowledged that a new strategy should be to pilot experiences in local regions together with communities.

It is acknowledged that in countries in the Global South, implementation of policies in order to create real, local impact is the core challenge that new STI policies should focus on. This implementation problem is also highlighted in the context of lagging regions in Europe such as Romania, Bulgaria, Andalucía, where industrial transitions, for instance towards sustainable energy, require a better framework for experimental STI policies and a solid shared framework for testing and the implementation of policies.

It is recognised that the role of STI policy is crucial for TIP as it provides an imaginary for the future that is built on emancipation and solidarity. Digital technology provides this scope, as long as these technologies are mobilised to challenge rather than reinforce the direction of current development. It is possible to find several examples of these transformations in the Netherlands, Sweden, South Africa and China, and here innovation agencies could play a crucial role in setting imaginaries and enabling change. Innovation agencies can also help by legitimising innovations and removing regulatory barriers. At the same time, the role of STI policy is to provide innovations with a meaning and direction, which is important in countries like Costa Rica where innovation is a goal in itself, without much reflection on objectives and societal benefits. Innovation might also create inequality with multinational firms dominating production in poor regions. Transformative STI policies need to redirect efforts to challenge existing institutional structures and to include different beneficiaries in defining problems and solutions.

The question is whether the STI community (involving researchers, policy practitioners, intermediary organisations and civil society) can start envisaging different models of innovation. Innovation agencies can create STI-led policies to shape demand, more motivated (mission specific) innovation policy, participatory objective setting and engagement with initiatives at the city level such as urban labs. In a more actor-centric approach, one objective should be to reposition actors in ways that better enable them to take the lead and create change. Relatedly, there is a need for frameworks for monitoring and analysis based on that repositioning.

Wider transformation processes are already underway although at different paces and directionalities in different societies. The principal desirable role of STI policy may be to shape the directionality, accelerate, and enable transformation. Social context is fundamental in the enactment of

¹⁰ Based on reflections from practitioners in Chile in one of the workshops

these roles. Context is also about opportunity, which allows understanding systemic problems as well as available strategies and resources. Institutional innovation and technological innovation are often complementary, innovation often entailing changes in organisational contexts and in the position of the actors in the system. This is illustrated through the examples of the health system where patients, doctors and other actors are embedded in the contexts of the institutions like health ministries, hospitals and the medical supply infrastructure. Consequently, for transformation of health care, systemic change means looking beyond just increasing the access to patient care. It is also important to distinguish what is the place for science, technology and innovation policy in relation to other sectoral policies like health or energy. What specific roles or functions does it fulfil? Innovation policy is about creating and supporting novelty, while other policies have sectoral focus to regulate and operate systems like energy or mobility. Innovation policies are often centred around knowledge and process orientation.

When working with STI agencies seeking TIP, it is important to acknowledge that implementation of STI policy for transformation often needs to happen in institutions that are themselves highly resistant to change. The room for manoeuvre is highly constrained, since civil servants are embedded in long running political and cultural institutions which favour some capabilities over others. Therefore, a central question is how to improve and diversify capabilities by understanding human agencies and initiatives within agencies with greater reflexivity instead of “cockpitism”.¹¹ In addition, STI policy has a supply side bias while transformation of socio-technical systems involves fundamental change in both supply and demand. The focus is on societal functions served by these systems, going beyond the binary of production versus consumption debate. Greater attention should be placed on the influence shaping demand and its evolution. A TIP and/or a mission-oriented approach is an essential tool for governments and policy makers to navigate STI policy for transformation.

3. What is the role of experimentation for transformative change?

Transformative innovation policy needs to be reflexive about the characteristics and process of transformation in order to facilitate the experimentation as a necessary means to achieve transformative change. Some suggested attributes of transformative experimentation are: directionality, participation, learning and managing expectations and anticipations for futures¹². Some suggested that the framing of being transformative could be borrowed from the latest definition of socio-technical experimentation - inclusive, challenge led, practise based, adaptive to uncertainty.

Some aspects to consider in order to experiment for systemic change with transformative impact on socio-technical systems are suggested as follows:

¹¹ “cockpit-ism”: the illusion that top-down steering by governments and intergovernmental organizations alone can address global problems, in **Hajer, M., Nilsson, M., Raworth, K., Bakker, P., Berkhout, F., De Boer, Y., ... & Kok, M.** (2015). Beyond cockpit-ism: Four insights to enhance the transformative potential of the sustainable development goals. *Sustainability*, 7(2), 1651-1660.

¹² Each of these attributes require further unpacking in more in depth discussion on TIP research agenda.

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- Multi stakeholder: Engagement of a diverse range of actors is critical in a TIP approach. But in the context of a variety of experiments at different levels, how do we organise participation in different socio-technical systems? There are questions of trust and coordination in actor networks, as well as the scale of participation (long-term sustained participation in local experiments versus national level participation).
 - Vision led - With wider participation, comes a wider portfolio of expectations. How to map expectations of different actors?
 - Shared learning: Learning (1st and 2nd order) is a key component of experimentation for transformative change. How to share it across the networks is suggested to determine the transformative potential through experimentation.
 - Incorporate local and indigenous knowledge: we need to recognise the fact that transformative experiments are already taking place outside the radar of academia and public policy (grassroots initiatives)
 - Link to SDGs and to societal impacts: Whether and how the experimentation directly or indirectly helps in achieving sustainability goals and targets and what measurable impacts can be identified.
 - Characteristics of transformation: We need to pay attention to the politics of creating a democratised and decentralised system through collective processes and citizen empowerment.
 - Evaluation of the transformative potential of experimentation: The need to rethink the role and the approach of evaluation in transformative experiments through redefining frameworks and indicators, asking questions like evaluation for what and for whom? When to evaluate? What is the theory of change behind evaluation? How to capture second-order learning?
 - It was also recognised that there is a vital role for public policy in creating space for and supporting experimentation. These could be in the form of sandboxes, public procurement and policy labs.

Innovation policies can deliver on transformation when there is emerging coordination across experiments in trans-local levels. The rationale is that individual projects and initiatives (experiments) are temporary and fragile, and need to be connected up for it to be transformative¹³. It is also mentioned that the state plays the role of a convener, facilitator and enabler of transformation in some cases. We also need to be reflexive on what problems we are addressing through transformative experimentation - which could be radically different in Global North and Global South contexts. Some of these tools could be mission-oriented policies that consider different contexts, supporting localized experiments and using these results to inform upscaling, replication and mainstreaming. This is one of the biggest challenges of TIP: to think beyond the experiments themselves, how to combine the outcomes of various experiments to generate relevant policies.

¹³ **Turnheim, B., P. Kivimaa, and F. Berkhout, eds., 2018.** *Innovating Climate Governance: Moving Beyond Experiments.* Cambridge University Press.

4. How do policy and governance play an important role for transformative change?

A key issue with transformative change through building and mainstreaming niche experimentation and opening up regimes¹⁴ has been that there are complex and often conflictual political relations between niche actors and incumbents. The centrality of niches in the multi-level perspective (MLP) implies that transformative processes often involve niche processes being assimilated, co-opted or imitated by incumbents to inflect the direction of the regime's transformation. This assumption requires questioning and further research on the role of transformation involving incumbent actors, and their agency is at the core of politics and governance of transformative innovation.

In order to enable TIP, reflexive governance strategies are required. This constitutes anticipation of futures and multiple framing of future pathways through experimentation. Three levels in which this framing is envisioned for alternative futures are as follows:

1. Frame-mapping – This is about Anticipatory framings which include reflexive debates on performativity and normativity on alternative frames of expectations. This is a deliberative process that benefits from zooming-in to specific contexts and zooming-out to identify connections and inter-dependencies.
2. Frame-working – This is about opening-up to create portfolios of experiments and closing-down variety in order to concentrate investment in scaling-up experiments. There is obvious tension between these two processes, especially in the presence of formal, generalisable elements as well as informal(-local) system elements, that prevent scaling up. How to then create relationships between existing regimes and alternatives nurtured in niches, which might involve different problem perception in different scales? What is the role of policy for co-creating transition pathways, considering directionality and maintaining a balance between opening-up and closing-down?
3. Scale-up experiments – Experimentation with alternatives offers a 'flexible stability' and opens up the possibility for alternative futures. Scaling up these initiatives would mean opening the door for larger scale investments, among other implications. This can involve conflict mediation, nurturing expectations that can, over a longer period, generate momentum. This is connected to the notion of performativity of futures, an absence of which is seen as a reason for loss of momentum.

It was widely recognised that mission led policies have become a common currency in policy narratives. This reflects a renascent confidence that government can make a difference to social outcomes which is broadly consistent with transformative innovation policy perspectives. However,

¹⁴ Ghosh, B., P. Kivimaa, M. Ramirez, J. Schot, J. Torrens, 2020. Transformative outcomes: assessing and reorienting experimentation with transformative innovation policy, TIPC working paper (Accessible at: <http://www.tipconsortium.net/publication/transformative-outcomes-assessing-and-reorienting-experimentation-with-transformative-innovation-policy/>)

mission-led policies may also centralise processes of choice and ‘close down’ processes of exploration, experimentation, and learning prematurely. While it is granted that addressing many social needs is a matter of urgency, the absence of clear blueprints for a more socially and environmentally sustainable future suggests caution and avoiding a rush to judgement about the direction and means for proceeding. Mission-led policies may leave out or leave behind parts of society perceived to be of secondary importance in mission success, a tendency which risks reproducing the separation between technocratic elites and the broader society. This is part of the controversy concerning mission-led research, which is important to discuss and further unpack under the umbrella of politics and governance of transformation. Even if mission-led constructs are an influential line of thought for policymaking, continued attention to other forms of governance – e.g. catalytic, challenge-led, or bottom-up should continue to receive research attention and comparison with mission-led policy outcomes.

Understanding TIP as a mission-led participatory political process, involving a multiplicity of actors also provides justification for the formation of coalitions, networks, alliances and/or innovation partnerships for mission-oriented initiatives. These transformative coalitions and partnerships should go beyond incumbents to include additional actors from civil society, users, niche actors and so forth. These coalitions will face the challenge of embracing the dynamism of the transformative process (actors may change or diversify during the process). This process comes with challenges of managing intermediation, expectations and conflicts. It is recognised that very concrete coordination could take place in niche spaces since holistic innovation policies look at actor constellations. These constellations involve new interactions and relationships within and between communities, building new roles, all of which are emerging avenues for collaboration and networking. It is also useful to understand the importance of an actor's actions in several critical junctures of different policy stages, allowing for interaction with feedback loops. Policy makers, with adequate tools, may play a brokering role in these interactions and actor constellations.

The centrality of national policy actors differs across countries. Nations with larger state capacity often have both opportunities and challenges stemming from regional and local innovation processes. Diversity creates opportunities for experimentation and shared learning and for a plurality of initiatives. Diversity can also be accompanied by exclusion or marginalisation which constrains or introduces bias in the exercise of these opportunities. International political tensions persist despite the global nature of many social problems. These tensions are productive when they serve as a spur to accomplishment, e.g. the aspiration of the Paris Accords. They also have the potential to diminish the value of the scientific and technological commons that has been constructed through international cooperation and exchange (including the flow of people). The construction of transnational agreements and cooperation for global governance plays important roles in enlarging knowledge and in directing attention to salient global issues. Further research on the influences that foster transnationality as well as impede or destroy it is needed.

Actors and contexts for TIP

5. What role do STI agencies play in TIP?

Policy that looks promising on paper may not be transformative in implementation¹⁵. Additionally, it is often unclear what it would mean to implement specific policies, especially when different nations name and understand innovation in different ways. In some countries, innovation agencies are emerging champions of systems change and work with the meta-knowledge about transformative processes themselves, for example Vinnova and their “Norm critical innovation” strategy.¹⁶ STI agencies can play multiple roles including being strategic actors, funders and intermediaries or brokers. Crucially, for transformation to happen, they need to experiment with new types of funding and invest in new approaches of science and innovation such as strategic alliances, citizen science, learning by doing, living labs, research consortiums, interdisciplinary knowledge creation (such as combining AI research with sustainability research).

More specifically, STI agencies can be seen to have key roles in the following areas:

1. In identifying opportunities for transformative change by creating baseline or reference knowledge about societal capabilities needed for transformation and the possible pathways for reaching these futures.
2. In asking questions like, “What does a systems perspective mean for research and innovation?”, and “how do we monitor and evaluate contributions to system change?”
3. In establishing platforms for co-creation by organising fora for identifying issues of directionality which are more inclusive and deliberative than conventional consultation processes. This may involve bridging the gap between research and societal innovation by providing infrastructure to researchers to operate in living lab settings for co-creation and for making research accessible to change makers.
4. As intermediary actors, in managing the diversity of stakeholders with a view to preventing capture of agendas and narratives by single interest groups or actors and encouraging participation by those that might otherwise be overlooked (e.g. citizens, new entrant firms, or regional actors)
5. Funding and commissioning experimentation to deepen knowledge of alternatives and their prospects, which address not only the need for new knowledge but also the implications of that knowledge for transformative change (e.g. responsible research and innovation).
6. As funders, investing in evaluation beyond the summative or accountability standards to provide means for deep or second order learning (learning about what needs to be learned and retaining knowledge from experimentation) and for indicators or metrics of transformation.

¹⁵ Points to significant literatures on policy and governance failures

¹⁶ Nilsson, Å. W., & Jahnke, M. (2018). Tactics for Norm-Creative Innovation. *She Ji: The Journal of Design, Economics, and Innovation*, 4(4), 375-391.

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7. Assisting in the circulation of knowledge and with the processes of embedding, implementing, scaling and reproducing knowledge.

Collectively, these areas suggest an enhanced role of STI agencies in the governance of the loci, rate and direction of science, technology and innovation. The mission orientation for these agencies impels proactiveness in shaping directionalities.

Each of these areas challenge existing processes and ways of working in STI agencies to enlarge and enhance capabilities. Many of these areas also challenge the position of STI agencies (alongside other change agents) by implying a wider scope of action in which other governmental ministries and agencies are also implicated. This suggests the need for research on orchestration, coordination and policy analysis and an overarching 'knowledge infrastructure' which is sensitive to the social and political realities of different contexts. The research foundations for tackling these challenges are underdeveloped.

The SDGs have many implications for STI policy and, as part of the articulation and circulation of knowledge, STI policy organisations have an important role for identifying where and how STI may contribute to meeting each of the SDGs. However, it is also the case that the SDGs often involve a scope of action beyond the remit of STI agencies, and require the co-participation and cooperation with other parts of government, the political process, and the social discourse more generally. The SDGs cannot be relegated to STI agencies nor can they be ignored by these agencies. From a practitioners' perspective, representatives from Vinnova, Sweden, articulated their efforts to contribute to SDGs, through focussing on socio-technical systems change as well as economic competitiveness and characterising themselves as problem owners and change makers. As an innovation hub in the EU (European Union), they prioritised achieving SDGs and are taking a mission-oriented approach to address each of the challenges in policy labs. What they want to improve are 'roadmaps,' and active learning which would enable a real understanding of obstacles and potential of transformations.

Transformative innovation policy should not ignore science (diverse forms of it) nor place all the bets on scientific expert knowledge that is assumed to be able to accomplish transformative social aims. Although some would contest whether 'blue sky' research is a valid concept given the social influences within the scientific community that guide trajectories and agendas, others would highlight the uncertainty and elements of surprise that accompany research, some of which produce entirely unexpected and 'off-agenda' outcomes. In turn, some of these outcomes prove to have useful practical application either sooner or later.

6. What role do governments and ministries play in TIP?

The role of governments is closely linked with the governance and politics of TIP. With transformative change affecting actors along the entire value chain, from innovation to production to consumption, there is a clear rationale for early involvement of those concerned in the shaping of strategic

visions. A primary role of the state¹⁷ is in organizing the policy-preparing and policy-shaping process in such a way that actors can develop coherent strategies of change. Governance is then the process of organizing this collective change process, by providing space for multiple stakeholders to meet, exchange ideas and negotiate. This process however is said to depend on the political culture of a nation, closely connected to whether bottom-up or top-down approaches prevail in the specific setting. It is also argued that the mix of experts from different backgrounds – public policy experts, statisticians, psychologists, engineers, economists and other social scientists can make progress difficult to achieve.

Transition literature assigns very specific tasks to the government – regulation, standard and norm-setting, strategic direction and visions, political legitimation. Governments are more associated with continuing the existing logics as opposed to facilitating innovation for new logics. In public administration theories, governments are central actors who legitimise their action through evidence-based policymaking¹⁸. However, this literature on public administration rarely addresses ideas like transition and innovation. In this regard, missions are thought to be easier to understand and implement, while the transformative innovation policy approach appears more difficult. However, for some practitioners, a focus on TIP meant reflecting on the ineffectiveness of their previous methods, directing them to work on changing perspectives and to establish means for continuous monitoring and evaluation. They argue that for transformation, strong evaluation is needed on what actions were taken and what was the outcome with a focus on process.

The state has several important roles to play in the process of transformation. Re-organising markets in the face of major technological or societally driven transformations requires a guiding force to enable and accelerate this re-organisation and reconfiguration process in order to help overcome path-dependencies and reduce uncertainty for the private, public and third sector agents. The state can take on either a more or a less active role in this process, from a proactive change agent to an enabler and facilitator of change. This balance depends on the ability of actors and stakeholders to self-organise as well as the psychology of actors - how they see themselves as system-insiders and thereby perceive the impact of change in these systems on their own work practice and career.

To leave it to the market to overcome the uncertainty and to reshuffle relationships might slow down both innovation and its contribution to transformation. One way to overcome potential problems and to compensate for the high degree of uncertainty during the transformation process is for governments to engage in ‘mission-oriented’ policy where the state engages in a combination of public policies and in promoting a common vision indicating the direction of change.

Transformative change is about normative issues as well. Setting direction requires more room for discretion about understanding "things that really matter." The state, through organizing appropriate

¹⁷ State is often associated with governments and ministries. However state actors may also vary - notably given the decentralisation and increasing autonomy of territorial state actors (regional, urban) regarding specific functions and responsibilities (water, energy, food).

¹⁸ There are calls to look beyond this paradigm.

governance processes, is the agent responsible for addressing matters of directionality of change in line with the constitutional (in our contexts mainly democratic) principles of statehood. However, it was pointed out that increased focus in one direction, such as inclusivity and local community empowerment, can reinforce the practice of picking “winners”. Does this bias overlook the issue of how to deal with the losers of transformations? A balanced view is therefore that an important role for the state is also to handle tensions and conflicts between the powerful and the powerless.

Significant discussion involved attempting to understand what type of state is needed for TIP, whether there is a specific type of state or if there were elements of the state that should be tailored to different contexts. Some parameters were mentioned that could help define a “strong” state (in the sense of being able to steer processes of transformation, not as an authoritarian state):

- To be able to regulate
- Capability to generate shared vision
- Flexibility and devolvement in the allocation of budgets
- Citizen’s representation
- Tolerance of the ‘other’
- Scoring high in Democracy index
- Developmental State

For some countries in the Global South, state leadership is paramount for setting long term goals and providing leadership in attempting to achieve them. Representatives of ministries from African countries argued that in their context, the government's role is to create infrastructures like schools and to make this infrastructure functional, while education as a service can rely more deeply on community-led initiatives. The importance of ministries in facilitating provision of technology and infrastructure and other kinds of support mechanism was repeatedly acknowledged. It was also argued that another role of government in these contexts is more distributive – to coordinate between institutions to increase social capacity for development in poorer regions. A key question raised by a researcher was: “How can governments across Africa on top of other challenges understand and navigate, even exploit opportunities of 4IR, and avoid the problems, such as social injustice, achieving SDGs etc.”

A key issue discussed in the context of ministerial support for transformative change is the mechanisms through which the state can ensure that the new policy rationales and frameworks align with existing public policy. It is argued, for purposes of accountability, that the state should be more explicit and vocal about why it is favouring some experiments over others and why it is not following up on a certain experiment. Moreover, whilst the state may be less suited to initiating experimentation in some contexts, it may consider connecting, assisting and enabling experimentation. Whether the role of state is strong or weak is also context specific, accounting for corruption and socio-economic problems. It is important for governments to envision a new type of public policy using the TIP approach to support STI policy to more effectively respond to sustainability and developmental challenges.

A perceived risk in the leadership role of the state is that the state may not be strong enough or may not have the instruments to prevent capture of the methods and objectives of public policymaking by particular interest groups, who could be less inclusive and more invested in the current system. Furthermore, even within the public institutions, actors may be confined to rigid jobs and not given a remit to think holistically about the overarching goal of systemic change. In such circumstances, it is argued that immense political and administrative will are required to change organisational structures and practises to pursue the notion of transformative change.

7. What role do businesses and private entrepreneurs play in TIP?

Innovation is an uncertain process. At an early stage of the innovation process there is technological uncertainty related to the fact that enterprises cannot know in advance about the best technological solutions. There is market uncertainty throughout the innovation process. Private enterprises have their own strategies to cope with technological and market uncertainty. However, it is important to build connections among the different actors to navigate these uncertainties.

The theoretical core of the innovation systems and transitions approach is interactive learning among networks of actors. Since innovation is an uncertain process, actors will try to reduce uncertainty by building lasting and stable market relationships. It was proposed during this discussion that innovation thrives in 'organized markets' that are able to utilise knowledge about market characteristics to address uncertainty. The strength of the organised markets however becomes a major weakness when there is a shift in technological paradigm. In other words, shifts in technological paradigm sometimes disrupt established relationships. This can be a desirable outcome from the perspective of transformation. It is proposed that transformations require a fundamental reshuffling of markets with established relationships, which might mean old user-producer relationships are destabilised and new ones built in the process. More commonly, the relationship breaks up because one party or the other is no longer interested in maintaining the relationship. A user encounters a better product for their purposes and changes their relationship to the supplier of that product. A producer discovers a more lucrative set of customers and focuses attention on them, neglecting their established customers. Much of this reshuffling can be mediated by digital technologies and the application of data and platforms, which brings opportunities for renewed market relationships between different categories of users and suppliers. This also however means increased digital divides and inequalities arising from biases embedded in application of AI technologies. An implication of the new era of transformation process through technological innovation is therefore the drastic increase in uncertainties and technology led inequality.

Positionality of business and entrepreneurship in relation to transformative change raises questions of identity and purpose. It was asked whether the incumbent industries and lobbying EU institutions are the ones who are the most powerful actors at the moment. If so, what does that imply for global transformation potential? Furthermore, the purpose and representation of global third sector

organisations also demand a discussion. Several considerations are relevant in understanding the role of businesses in TIP:

- **The way incumbent firms operate** - Are incumbents investing in the long-term strategy of transformation or are they just using the terminology of transformation for public relations, with an underlying business as usual motivation?
- **The way platform economy operates** – This is often about winner takes all with one or two big companies controlling the interface. The EU has taken the view that this economy monopolised by Uber, Airbnb and Facebook needs to be regulated in advance and work in tandem with innovation policy. Scholars with this view seek to unpack the rationales for investments in digital platforms today and raised the question of how to decentralise the power away from few dominating firms.
- **The way NGOs (Non-Governmental Organisations) influence** – It was raised during the discussion that there are unintended consequences of Greenpeace’s opposition to Monsanto resulting in the concentration of food production and market control by big companies. Such unintended consequences could create centres of power. However, this view was contested by others, noting that Monsanto’s opposition to GMO (Genetically Modified Organisms) might have very little influence on concentration of the food production. Is there a better example illustrating the influence of NGOs and international organisations in transforming businesses?
- **The way multinational corporations (MNCs) operate** – It was also suggested that MNCs prefer high regulatory entry barriers which keep out the smaller innovators, firms from the developing world, SMEs etc. This way power and control become more centralised. This view implies a call for more decentralisation of market powers and empowerment of small businesses as a process of transformation.
- **The way grassroots based, bottom of the pyramid entrepreneurs are perceived** - They hardly qualify as worthy of attention in public policymaking and yet may contribute to untold stories of transformation at local levels.

It was argued that in order to successfully implement TIP, we need good dynamic theories of institutional organisation and evolution of firms and businesses. “How do institutions evolve over time as a dynamic process and power?” can be considered a central research question. Furthermore, the focus on CSR (Corporate Social Responsibility) needs to shift from utilising available indicators, data and narratives to creating new measures, indicators and transformative narratives. The configuration of actors is also a useful indicator of how the market will evolve, who is designing missions, whose agency lies behind mission definitions, who dominates and who loses out. Therefore, we need to invest in research that helps mapping and identifying actors, their positionality, the degree of distance and closeness, conflict, not just at the local level but at the global level. Another aspect of research in TIP should be on how finance and the sources of funding must change and are perhaps already changing in response to persistent challenges that are motives for fundamental social and economic transformations.

8. What is the role of TIP in the Global South?

There are specific challenges for transformative change in the context of the Global South, what we called developmental context. In order to dive into these context-specific challenges, scholars wanted to understand what a developmental context might mean. It was later agreed that “what works in other contexts does not necessarily work in developing contexts. We need to appreciate the local reality”. They point to literature which focuses on these contexts like transitions in developing context, catch-up theories, grassroots innovation literature. A key message has been to unpack these theories and understand the relevance of these approaches for studying transformation.

Discussing the context specific issues, it was shared that in contexts such as Africa and Latin America, agencies in charge of innovation and STI policy are far less influential in policy making, limiting their capacity to determine policies that might influence innovation beyond the explicit scope of STI, such as environmental or educational policies. This is in contrast to contexts where innovation is broadly understood by many actors and implicated in a wide range of policies. So, a key question raised in the groups are whether TIP in the Global South will be dominated by top-down policies or bottom-up initiatives? Moreover, in many cases there is a lack of coordination or orchestration between science, technology and innovation policies. This means, even at the top, each group of experts largely focus and control policy agendas that serve themselves and not the entire system.

In contrast to top-down policy dependence, scholars discussing this topic were more interested in understanding the role of local level experimentation as bottom up initiatives where co-production of knowledge happens organically among the actors involved. However, there are a few issues with this approach. First, it is often unclear what are the values of this co-production process and who gains from it. Second, lots of experimentation are premised on institutions / policy support that does not exist in developmental contexts. Third, there is an issue of temporality as the present and future roles of actors may change with institutional and policy changes, creating additional challenges. But there are ample opportunities and many reasons why experimentation is vital in these contexts and why co-learning processes need to be supported. Using examples from India, Brazil and other countries, scholars argued that knowledge circulates from one context to another and this is key to systemic transformation.

A key point of discussion has been capability building and learning for transformation. Key questions raised in this regard are: How can we transform the capabilities at the local level? How transferrable are the learning processes? It is worth understanding the origins and transferability of capacities. This should be central in policy design for addressing social issues and to do this we need ‘champions’ either in the public or the private sector. These champions may also need capacity building among themselves, but they will be in a position to lead and guide transformations in local policy or even at project level.

There were also discussions on the scale in which this transformative change might happen. Scaling up is a common theory in niche management literature, where experiments are expected to scale up and diffuse in wider contexts. However, it was argued that increasing scales may not be the obvious

path to achieve SDGs (global agenda) in specific cities (local context). What is more important is to define boundaries and increase capability on a relatively smaller scale, instead of going for features required by large scale such as standardisation that might be co-opted by incumbent market actors (e.g. smart city developments). Another approach is to connect and learn from inter-local practises, and the role of policy is not to scale up experiments, but rather to set up platforms for learning and replication of transformative innovation across different contexts. Some scholars point to the importance of multi-level governance mechanisms to mitigate the issues. The notion of catch-up is also discussed in this context, where emphasis is on developing technological leadership in local contexts which creates new market opportunities.

It is also observed that incumbents are an inescapable feature in many developing economy contexts because of the weakness of new firm formation and concentrations of talent in incumbent organisations. This suggests the need for ideas and research about working with incumbents to achieve transformational outcomes. In many cases, transformative directions are outside the interests or control of incumbent actors, yet they share an interest in developing more environmentally sustainable practices. In this regard, social innovation and empowering local projects can play an important role in connecting incumbents with new actors.

The relevance of mission-oriented policy in developmental contexts was also discussed. It was pointed out that health, education and digitalisation are extremely important areas of transformation. However, the risk with missions is that it makes transformation prescriptive. To conduct mission-oriented experimentation and evaluation of long-term projects organised to elicit impacts on societal challenges, learning, and adaptation is expensive. Funding and budget are critical issues in some countries, where STI funding has been diminishing in recent years. On one hand, there is lack of funds, resources but on the other hand policy makers are not trusted in the community due to a history of corruption. Furthermore, societies often need legitimacy and support from the governments to do things organically and bottom up. This led to people working together, creating direct networks when the state cannot deliver or keep up policy coordination cost to a minimum. This points to the fact that a process-oriented approach to transformation is essential.

9. How to do TIP in various diverse regional contexts, in coordination with regional policies?

In this theme, cities feature as potential transformative innovation hubs. This emphasis stems from the fact that local problems need to be solved locally, using local capacity. Scholars imagine cities as evolving organisms where change can be problematised by a different understanding of transitions concepts like niches and regimes. Focussing on niche theory, scholars asked whether the spatiality of niches matter in the quality of learning and networking. Which region/ context can you learn or not from? What is the learning strategy from this? Currently, cities are still not seen as an important level at which

innovation happens, since there is major focus on national and local systemic levels. It is also the place where power imbalances exist and multinationals define the pathway for transformation.

Organisations like EEA (European Environment Agency) and EIT Climate-KIC (European Institute of Innovation and Technology Climate – Knowledge and Innovation Community) are prominent in their work in regions and cities. Practitioners in these organisations suggested that the bulk of implementation is done at the local level. Urban transformations and finance are two cross-cutting themes that EEA are investing resources in, looking to build strategic partnerships for building a knowledge system in support of systemic change. A question is what can regions and cities do in transition processes? More importantly, what do regions and cities want to do in order to enable transformation processes?

In discussing the role of regional policy, it is important to understand the connection between regional and national innovation teams and policies. How national strategies and knowledge management systems align and coordinate with regional policies was argued to be an important area of future research within this theme. Key questions are: What is the role of local government in national governance? How much power is there in regional governments? Using examples from Brazil where efforts to combine local demands in national level strategy is studied, it is said that learning from heterogenous local innovation systems and cooperation between the actors helped to improve the overall system. Evidence from Baltic regions suggest that different EU policies have varying impact on different local regions, resulting into heterogenous and uneven development of regions due to diversity in the effectiveness of learning. How do we learn from territorial diversity? How to measure the scale of unevenness in these regions?

The discussion on regional transformation ranges from cities to EU level policy dynamics. Governance can be fragmented or multi-level - e.g. networks of cities. For regional transformations, what is important is collective action and transnational forms of governance. Emergence of circular economy, carbon neutrality, and EU's policy of territorial specificity were mentioned within the theme of regional transformation potential. Major discussions have been in understanding how do we learn from each other? What narratives can we develop if sustainability is not yet an issue. What kind of capacities are needed?

It is agreed that some degree of coordination is desirable between regional and local governments, especially in the case of cities that can benefit from a (horizontal) circulation of knowledge and resources. However, coordination within a local or national context may not always be a desirable thing in the context of change. In these contexts, we need to stress the value of experimentation and emerging coordination through working together on the ground. We need place-based experimentation since issues like climate change require coordination at global and trans-local level alongside a lot of local level experimentation.

TIP has ambitious goals such as addressing societal challenges, related mainly with equity and sustainability challenges, through socio-technical system(s) transformation. It considers a variety of functional policy domains that transcend STI. It should be thought of as a complement rather than replacement of traditional innovation policy (R&D (Research & Development) support and innovation

system support). Since 2015 there has been more work on solutions-oriented innovations and a shift in discourse towards more system transitions research. It was suggested that a clearer understanding of systemic challenges and the need for transformation is important.

Operationalizing TIP through design and evaluation

10. What tools are necessary for designing, implementing and evaluating transformative innovation policy?

When thinking of the implementation of TIP processes, it is necessary to specify a number of dimensions: who is doing transformative innovation, what, why, how, when, where, whose agenda, which innovations/sectors/developmental stage and at which level (experiment/projects/whole systems); who to target – upstream actors (firms, universities) and downstream actors (civil society actors, cities, communities, users, trade unions, etc). It was observed that normally, TIP is interpreted to start at a very small scale at niche level, not attempting to tackle things at inter-ministerial level. In contrast, many “Systems of Innovation” frameworks approach change coming from the top, designing policies at inter-ministerial level. These different scholarships seem to have different tools to address different problems at different levels. Therefore, the key question seemed to be not the selection of tools and frameworks for evaluation, but the appropriate operationalisation of tools. How the process is being run and deployed seemed to be at the core of this discussion. It was further explained that if the focus is on transforming governance, the problem is not the tools themselves, but the processes needed to deploy these tools. Such process should be guided by principles such as the needs to address a specific set of challenges. It needs to find a balance between multiple objectives, for example, between environmental sustainability and social equity.

Another starting point in the design and implementation of TIP is to define what kind of leadership is required. Such leadership should allow to set priorities, locate policies, and identify the role of different actors including different parts of the state, at different scales (national, local, city etc). It will also facilitate participatory processes through navigating existing power asymmetries. Leadership, be it organised by the state or some other agent, should provide directionality but at the same time be flexible. This could be achieved by a central coordinating organ like a council or innovation agency that may be set up with representation of interested stakeholders.

Scholars discussed the applicability of the “PDCA” framework: Plan, Do, Check, Act in policy making processes. It was argued that even though this framework focuses on meta-planning and continuous improvement in the development of processes and products (tools), and understanding what your customer needs are, it is still a linear and top-down model of policy making. Therefore, new frameworks for TIP are required, which allow policy processes to be non-linear and participatory. In order to create them, we should define their scope (project, program, policy) and approach them from a challenge perspective: define the challenge to be addressed, analyse existing opportunities, and define capabilities required to do so. Other frameworks suggested in the group were:

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- “Double diamond” which brings a design perspective to help navigate the messiness of engaging with different stakeholders for addressing complex issues. Learning by doing implies creating and changing design as you go.
 - EIT Climate – KIC representatives stressed the importance of ‘framing’ which allows adapting to the context beyond a tool and to be able to extract something meaningful from the process.
 - “Simulations” which allows the modelling of complexities. Modelling exploring mindsets (referring to conceptual mapping), connecting pathways to impact, policy options with outcomes. Simulation can be used at any level of abstraction, for example defining areas of funding for innovation activities. It can be a live and dynamic process, continuously re-evaluating situations.
 - Visualisation that transforms information sharing and retention capacities. Lots of information harvested can simply be visualized using network maps. These are also powerful for communication and knowledge management.
 - Future-oriented methodologies such as foresight are crucial for developing a structured approach to transformation, through careful consideration of future orientation that is already embedded in the policy processes.

It was stated that the problem is not the availability of tools, but the selection, adaption and combination of those that are most suited for implementing TIP. Instruments for TIP should seek to be able to inform and provide feedback to the policy process. There are at least two aspects to the way that TIP informs policy processes. The first one is about strengthening participatory policy processes that can enhance the uptake of different types of knowledge as well as support for capabilities building. A key question here is how are stakeholders analysed and selected? There is a need for legitimacy and design of the governance system on the basis of directionality criterion. Inter-ministerial platforms and spaces are indicated as growing in use. In Japan, high-level executive levels provide funding to those willing to participate in those types of spaces. The second one is how to organise the evidence that has been gathered through participatory policy processes. Especially, who will be responsible for policy failure? This will necessarily imply rethinking power, decision making and how to address formalized processes. Who makes the decisions on the types of knowledge and evidence that inform TIP and will shape its outcomes.

Learning is not going to happen by itself. Therefore, basic research, co-learning, is crucial. Being able to communicate what is seen, storytelling and visualisation of the processes are also shared as vital tools. Discussions on practical tools of communication and teamwork also ended up in concerns about privacy policies and possibilities of data leaks in online software. In developing a shared narrative and pathways towards transformation, there should be room for the narratives of both winners and losers. It should also address the need to take risks in the policy process, seeing it as a relational process rather than one about problems and solutions. These choices will create tensions that have to be actively considered.

It was agreed that TIP requires radical changes in evaluation, in the processes used to conduct evaluation and the kind of changes and, consequently, indicators, we aim to observe. Traditional

approaches to evaluation assume a linear logic in defining measurable goals as the basis for assessing performance. By simplifying reality, conventional evaluation approaches have been identified as inadequate for capturing change in complex issues, which may involve uncertain and often unpredictable interactions between different people and events, or where interests diverge or conflict. Similarly, conventional approaches to evaluation are seen as a tool for accountability, which may deter the recognition of transformation or the fostering of second-order learning (i.e. the introduction of reflexivity to evaluation practice).

We envisage several potential relevant areas of research and practice in the TIP evaluation domain: (i) developing dynamic evaluation tools to monitor and reflect on unfolding transformations; (ii) adopting a formative approach to evaluation, aimed at improving the design and implementation of an intervention and at supporting organisational capability building; and (iii) engaging in participatory processes through evaluation in order to generate open debate, confront conflicts of power and interest, as well as foster second-order learning.

In building these evaluation tools, some key elements should be considered:

- How to design an evaluation to address inequalities/equity issues and enhance participation? Such an approach should consider diverse interests and expectations and seek to be inclusive.
- How to evaluate short and midterm gains without losing focus on the ultimate goal, the transformation of the socio-technical system, and how to use those observed changes to refine TIP theory?
- The unit of evaluation: project, programme or policy and at local, national or supra-national level
- Evaluation should be considered a formative stage and as a learning process that measures outcomes; it should promote steering in terms of collective action and network formation. Strong networks and partnerships, based on mutual learning processes can support long term funding, guarantee uptake, etc. The generation of evidence is the catalyst for upscaling, which together with a broad base of engagement, can create the required legitimacy for TIP initiatives.
- All stakeholders participating in the evaluation should gain some capabilities on evaluation, as it will allow them to actively participate in it. This also includes a shift from competition and success, to learning and acceptance of failure as part of the cycle of policy intervention.

Socio-technical systems have diverse dimensions that need to be transformed (technologies, industry, regulations, knowledge, routines), but some of these transformations will only be seen in the long term, therefore it is necessary to have proxies. These proxies can be specific understandings of changes (outcomes) in elements of a transformation, such as learning, expectations, networks, niches, regimes, etc.; but it is necessary to test their adequacy as proxy measures for transformation. System change indicators such as SDGs also necessitate to be explicit about directionality. For the development of solid indicators, access to good qualitative and quantitative data is one of the biggest challenges. It may be useful to explore the possibilities enabled by large-scale web data for this purpose.

Measuring transformative innovation presents its own set of challenges. Normative approaches tend to think about indicators that measure growth and which are process oriented. These indicators tend to measure knowledge change. However, we need data at micro level as well as qualitative indicators that measure non-technical change. As with any complex system, there is a potential problem with causal attribution or 'impact assessment', since proving that transformation results from a specific policy intervention can be difficult.

Conclusions and next steps

This research agenda seeks to illustrate the explorative and contested nature of the discussion and a preliminary indication of the learning within the newly emerging TIPRN. The events provided opportunities for constructive dialogue and the generation of good ideas. The ideas generated under each theme inevitably overlap. For instance, the notion of mission orientation appears in almost every discussion group, and especially in contexts of TIP conceptualisation, the roles of government, new STI policies, experimentation and evaluation. Similarly, many aspects of politics are implicit in inputs from groups discussing the role of different actors – STI agencies, private entrepreneurs and ministries. This document presents issues, challenges and opportunities for a constructive research agenda on TIP.

Future work on this research agenda should be on developing each of these areas of TIP research in greater depth and combining existing research knowledge and results in a much more collaborative writing process. This means working with a more diverse network of scholars and policy actors to build on the inputs in this document and co-produce a distinctive knowledge infrastructure around TIP. This endeavour will be successful if the new network of TIP scholars (TIPRN) come forward, supporting and mobilizing more people for building a vibrant community of people and practice on TIP. A virtual conference in 2021 is being planned and will be a step towards this ambition.

Annex I List of participating organisations in internetworks workshop, Utrecht, February 2019.

1. Aalborg University
2. Addis Ababa University
3. African Centre for Technology Studies
4. Austrian Institute of Technology
5. Austrian Research Promotion Agency
6. Business Finland
7. Centre for Frugal Innovation, TU Delft
8. CIRCLE
9. EIT Climate – KIC
10. CNR-IRCRES
11. CSIC, Ingenio
12. DST, South Africa
13. Eindhoven University
14. European Commission
15. European Environment Agency
16. Federal University of Rio de Janeiro
17. INRA/IFRIS
18. ISI Fraunhofer
19. NRF, South Africa
20. Rathenau
21. Research Council Norway
22. SPRU
23. UAM
24. Universidad Nacional, Costa Rica
25. Université Paris-Est Marne-la-Vallée
26. University of Johannesburg
27. Utrecht University
28. Vinnova, Sweden
29. Westminster University, UK

Annex II Summary of the pitches to the Utrecht Workshop

Matthias Weber spoke on behalf of the Eu-SPRI community, highlighting that elements of transformative innovation policy were already emerging in that community through greater focus on system innovation and a shift toward more normative STI policy. He clarified that transformations can be driven by both societal challenges (unclear problems) and by disruptive innovation (unclear solutions). This lack of clarity results from uncertainties, complexity of interactions between demand and supply side actors, conflicting interests and differences in capabilities.

Lea Fuenfschilling, from the STRN community, emphasized that research and policy communities need to keep each other up to date on not just understanding, but also enacting transition processes. She suggested that instead of policy advice, it is important to engage in policy dialogues in order to gain trust and understand interests, struggles and concerns and that this would help academics to sharpen capacities to engage in TIP. She also mentioned that teaching transitions at the undergraduate as well as postgraduate level is important for shaping the future.

Erika Kraemer-Mbula, speaking as a member of the Globelics community, started off saying that at the heart of the challenge is addressing climate change while at the same time creating new systems of production and consumption that lift millions out of poverty. It is important to create innovation systems that are relevant for inclusive and sustainable development in resource-constrained contexts. In her view, the emerging challenges are to connect innovation policy with other type of policies; recognise the role of globalisation and to try out new forms of governance; to understand new relationships and impacts of emerging technologies and to facilitate interactive and collective learning processes within and across businesses and communities.

Johan Schot spoke on behalf of TIPC as a platform of innovation agencies and research councils, coordinated by SPRU and Utrecht University. That consortium has the aim to develop the narrative of TIPC within countries, build demonstrations, change evaluation techniques and to build capacities to bridge various innovative efforts and to transform existing systems of innovation. He argued that STI has been a separate silo in different governments which needs better integration with sectoral or system specific policies and infrastructure. STI policy also needs to be better tailored to address societal challenges of inclusivity, poverty and justice. He stressed the need for directionality: TIP is not just about steering, but also about innovation processes recognising that they represent particular directionalities. In the end, this is a new development model which requires more work than extending existing innovation frameworks. What needs to be transformed and how - are the key questions we need to focus on.

In the discussion that followed these brief pitches, it was suggested that a sectoral approach could be a useful way of understanding systems of innovation processes. This was contested with the response that focussing on sectors of production and separating out consumption is problematic and might be barrier for transformation. It was suggested that the understanding about sectors from the supply side is part of what needs to be transformed. The premise is that transformations are ongoing and require more attention in understanding the processes (demonstrated with the example of the emergence of online

platforms). It is further suggested that knowledge from research on specific systems like agriculture requires mobilising communication for effective STI policy. Concerns were also raised about researcher's positionality as *de facto* incumbents in policy processes, therefore appreciating the role of different actors as a challenge in itself for TIP. Finally, questions are raised on who TIP is for and how STI fits different national and regional policy contexts. These initial questions reverberated in the discussions that followed.

Annex III Background papers (submitted by participants prior to the workshop, February 2019)

Papers	Submitted by
Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. <i>Research Policy</i> , 47(9), 1554-1567. https://www.sciencedirect.com/science/article/pii/S0048733318301987	Johan Schot
Wanzenböck, I., Wesseling, J., Frenken, K., Hekkert, M., Weber, M. (2019). A framework for mission-oriented innovation policy: Alternative pathways through the problem-solution space. <i>SocArXiv</i> . February 14. https://osf.io/preprints/socarxiv/njahp/	Koen Frenken & Matthias Weber
Ghosh, B., & Schot, J. (2019). Towards a novel regime change framework: Studying mobility transitions in public transport regimes in an Indian megacity. <i>Energy Research & Social Science</i> , 51, 82-95. https://www.sciencedirect.com/science/article/pii/S2214629618304547	Bipashyee Ghosh
Boon, W., Edler, J. (2018). Demand, challenges, and innovation. Making sense of new trends in innovation policy. <i>Science and Public Policy</i> , 45(4), 435-447. https://academic.oup.com/spp/article/45/4/435/4915393	Wouter Boon and Jakob Edler
Vivas Lalinde, I., Matti, C., Panny, J., & Juan Agulló, B. (2018). Innovation platforms fostering low-carbon economy resource mobilisation: A community of practice approach for knowledge triangle integration in EU peripheral regions. <i>World Journal of Science, Technology and Sustainable Development</i> . https://doi.org/10.1108/WJSTSD-04-2018-0032	Cristian Matti
De Vicente Lopez, J., & Matti, C. (2016). Visual toolbox for system innovation. A resource book for practitioner to map, analyse and facilitate sustainability transitions. ISBN: 978-2-9601874-0-3 Brussels: Transitions Hub, EIT Climate-KIC. https://eitclimatekic-my.sharepoint.com/:b:/g/personal/cristian_matti_climate-kic_org/EZ5Ik3YhyPFBuzHYQBIAVbgBtDbGLBVHi1xhzfVfdJhRsQ?e=JodHmv	Cristian Matti
Diercks, G., Larsen, H., & Steward, F. (2019). Transformative Innovation policy: Addressing variety in an emerging policy Paradigm. <i>Research Policy</i> 48, 880-894. https://www.sciencedirect.com/science/article/pii/S0048733318302683	Fred Steward

Lundvall, Bengt-Åke, (2019) Transformational Innovation Policy – reflections from an Innovation system perspective. Unpublished	Bengt-Åke Lundvall
Weber, M. K., & Truffer, B., (2017). Moving innovation systems research to the next level: towards an integrative agenda. Oxford Review of Economic Policy, 33(1), 101-121. https://academic.oup.com/oxrep/article/33/1/101/2972713	Matthias Weber
Ramstad, E., (2009). Expanding innovation system and policy: an organizational perspective. Policy Studies, 30(5), 533-553. https://www.tandfonline.com/doi/full/10.1080/01442870903208551?scroll=top&needAccess=true	Elise Ramstad
Ramstad, E., (2009). Developmental evaluation framework for innovation and learning networks: Integration of the structure, process and outcomes. Journal of Workplace Learning, 21(3), 181-197. https://www.emeraldinsight.com/doi/abs/10.1108/13665620910943924	Elise Ramstad
EEA, (2019), Sustainability transitions: policy and practice. Report to be published in September 2019	Bruno Turnheim and Mike Asquith
Köhler, J., Geels, F. W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., ... & Fünfschilling, L. (2019). An agenda for sustainability transitions research: state of the art and future directions. Environmental Innovation and Societal Transitions. https://www.sciencedirect.com/science/article/pii/S2210422418303332	Bruno Turnheim