



# **Developing a Shared Understanding of Transformative Innovation Policy**

TIPC Research Brief  
2017-01

Johan Schot, Chux Daniels, Jonas Torrens, Geraldine Bloomfield

Produced with contributions from TIPC members and SPRU TIPC Team:  
Johan Schot, Geraldine Bloomfield, Joanna Chataway,  
Laur Kanger, Cláudia Obando Rodriguez, Matias Ramirez, Sarah Schepers,  
Ed Steinmueller, Blanche Ting, Jonas Torrens

## Summary

This research brief distils and consolidates the learning from the pilot year of the Transformative Innovation Policy Consortium (TIPC). Activities in this period included country reviews, case studies in each of the five member countries, and two synthesis workshops. Together, these activities provided insight into the diverse expressions of Transformative Innovation Policy (TIP) already taking root in the Consortium member countries. By summing up and contrasting these experiences, the present document informs the development of a five-year research programme for the Consortium. It also serves for reflecting upon the ways of working and learning established by the Consortium. The pilot year demonstrates that elements of TIP are salient across different contexts, with emerging narratives about the role of STI policy in steering processes of transformative change, and instances of policy makers seeking new rationales and instruments. It also points towards the need for a reconceptualization of policy experimentation and evaluation, to realign the conceptual language of TIPC with the actual practices of policy agencies. As such, this first, exploratory year confirms the need for clarifying and experimenting with the approaches that may give further substance to the frame of Transformative Innovation Policy.

## 1. Background

Over a period of almost a year, a group of academics, policy makers and funding agencies from countries in the Global North and South have worked together in the Transformative Innovation Policy Consortium (TIPC) on an ambitious pilot programme to examine and expand on current innovation policy frames and approaches to assist in solving urgent social and economic issues. The project was instigated by researchers in Science Policy Research Unit (SPRU), at the University of Sussex, and works collaboratively with the members in a co-creation process. The long-term vision of TIPC is to give substance to a new frame for Science, Technology and Innovation (STI) policy that can help promote transformation of systems and societies. To accomplish this vision, TIPC invites its member countries to reflect upon the pressing societal challenges they face and to reexamine the role of STI policy. Mobilising empirical research, and combining it with experimentation, training, skills development, evaluation and communications, TIPC seeks to build a constituency behind transformative policies which will allow their upscaling and spread. This transdisciplinary approach has begun generating new frameworks, standards and narratives and exploring novel ways to harness mutual policy learning and foster co-creation of knowledge between researchers, policymakers and innovation funding agencies.

In this spirit, this research briefing gathers together key insights that have emerged from the work undertaken during the initial year. These include: country reviews, Transformative Innovation Learning Histories (TILH) case studies and a synthesis of this work across the member countries. It also reflects on how these insights should inform the proposed five-year programme which includes policy experimentation (see Torrens and Schot 2017), further research and new approaches for evaluation and capacity building.

## 2. Why the need for Transformative Innovation Policy?

Re-thinking innovation policy is timely. The world is in deep transition, in part due to the current unsustainable ways of providing food, energy, mobility, healthcare and water, and to the inability of traditional approaches to technological change to bring about systemic change in desirable directions (Working paper, Schot and Kanger 2016). Many funding bodies, governments and international organisations across the world *want* innovation to address these societal grand challenges, as expressed in the United Nations' Sustainable Development Goals (SDGs). From access to food and energy, rising inequality, inclusion, and climate change, it is obvious that innovation has a role to play. However, what is not clear is how to design, implement or govern challenge-led innovation policies. This gap cannot be solved by optimising current scientific and technological solutions but instead requires a re-thinking of conventional approaches to science, technology and innovation policy towards transforming socio-technical systems. TIPC exists to address this need.

To set the context for this work, it is important to recognise how it relates to the two conceptual Frames that emerged within the scholarship on Science, Technology and Innovation studies and which have dominated innovation policy making since the 1950s. Both are ill suited for directly addressing societal challenges, due to their conceptions of the links between innovation and welfare, and to their rationales for policy interventions (Schot and Steinmueller, 2016; Chataway et al., 2017a/b).

### *Frame 1: R&D and Regulation*

This frame emerged out of World War II. The conceptualisation is simple and straightforward: investments in research lead to innovation. Hence, Frame 1 has been criticised for its linearity. In this frame, policy makers are expected to intervene in situations where markets fail. Hence it is assumed that innovation policy should provide markets with incentives to produce R&D. Regulation is considered an appropriate response to problems arising from innovation, as in the case of pollution. In this frame, innovation is primarily aimed at driving economic growth which is assumed to meet societal needs indirectly.

### *Frame 2: National Systems of Innovation and Entrepreneurship*

Frame 2 emphasises the utilisation of knowledge, commercialisation, learning, interaction and linkages between various innovation actors within a system. Policy intervention is therefore thought of as a response to system failure – the inability to harness the full power of the innovation system due to weaknesses in the linkages. Absorptive capacity, firms' capabilities and entrepreneurship are considered vital elements in this frame. Innovation, as the driver of economic growth and competitiveness, is considered to always be positive. As with Frame 1, intended and unintended consequences for society or the environment of the innovation are not placed at centre stage.

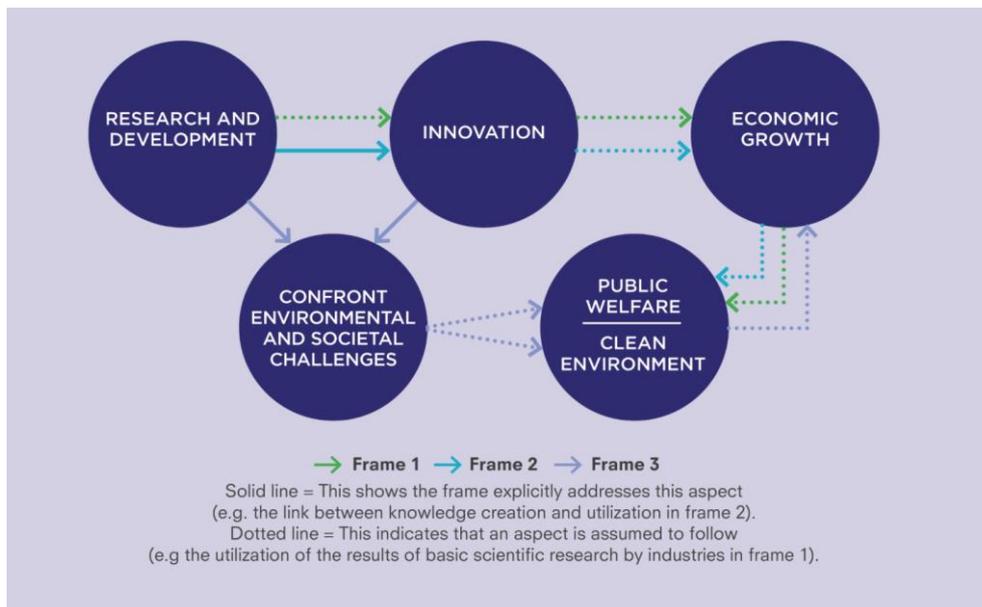
### *An emerging, third frame: Transformative Innovation Policy*

TIPC focuses on giving substance to a third frame of innovation policy (Frame 3) – that of transformative change - which argues that Frames 1 and 2 have so far proved to be ineffective in addressing some pressing social and

environmental challenges. This frame is emerging and has been discussed but needs further testing and refinement (Steward 2012; Weber and Rohracher 2012; OECD 2015; Schot and Steinmueller 2016) The primary rationale is innovation policy has to engage proactively in the transformation of the system of provision - transport, energy, healthcare, food education or finance – to ensure they meet human needs effectively and sustainably. Consequently, Frame 3 aims to harness the power of innovation in bringing transformative change at societal level by seeking to address challenges such as those embedded in the SDGs. Transformative Innovation Policy (TIP) focuses policy efforts on issues around system change, and structural transformations. This new rationale requires reconsideration of the foundation which inform the formulation, implementation and governance of innovation policies.

The figure (Figure 1) below presents a conceptual framework to explain how STI policy formulation, implementation and governance could contribute to addressing social and environmental challenges, while also targeting economic growth and development. It shows that Frames 1 and 2 innovation policies focus primarily on economic growth with the assumption that public welfare gains will follow, i.e. trickle-down effect. Distinctively, Frame 3 reverses that logic, emphasising that by addressing environmental issues and public welfare through system change, societies may enable sustainable economic growth. As such, Frame 3 incorporates the notion of directionality and sustainability pathways which may also lead to a redefinition of economic growth. It matters not only whether growth occurs, but the nature of that growth and how it redresses society's ills. Directionality includes opening up for a wide variety of pathways (Stirling 2009) as well as closing down certain options. It is about incorporating socio-technical choice and embracing innovation as a political process.

Figure 1: Conceptual Framework for Transformative Innovation Policy



Source: Chataway et al., 2017a (See also Schot and Steinmueller, 2016 for discussions on 3 Frames)

### 3. Developing mutual understanding and exploring prospects for Transformative Innovation Policy

Since this is an emerging frame, it has been important during the pilot phase to develop a shared understanding, articulation and vocabulary for Transformative Innovation Policy (TIP). SPRU researchers, together with TIPC members, co-designed a work plan that included:

1. A historical analysis of innovation policy in each country and prospects for transformative innovation (within the context of the 3 Frames of innovation policy)
2. A case study, co-constructed using the Transformative Innovation Learning Histories (TILH) methodology
3. Two participatory TIPC workshops, in Lund, Sweden, and in Bogota, Colombia, where country representatives came together to synthesise their insights and facilitate learning across the Consortium members.

The country reviews highlighted that elements of all three frames are present in each country, yet in differing ways. Norway, a country with an oil based economy, has been investing in a move towards a knowledge economy, and towards making science more responsible to societal demands through the approach of Responsible Research and Innovation (RRI). Sweden has been restructuring its industrial base, recognising sustainability as a business opportunity. Colombia, having experienced a prolonged and traumatic civil war, is undertaking a peace process that promises the recovery and reintegration of segments of the population excluded from development, while seeking to redress longstanding regional divisions; both present major development challenges but also opportunities for transformative innovation. Similarly, in South Africa, policy action for overcoming exclusion patterns, reminiscent from apartheid, and high rates of unemployment among the black population has spurred the search for policy approaches with a transformational potential, and experimentation with various stakeholders working together in tackling the triple challenge of poverty, unemployment and exclusion. In Finland, engagement with transformation innovation policy comes as a response to the financial crisis, aimed at opening up new growth and economic opportunities.

Not surprisingly, the partners which take part in the Consortium demonstrate willingness to reconsider the role of science, technology and innovation (STI) in addressing their pressing challenges. This is evident in the country reviews, which revealed a shared sense of urgency, an acknowledgement that current systems are not delivering adequate responses to their challenges, and that STI is under pressure to deliver not only economic development but also to contribute to societal and environmental goals. However, the reviews also highlight that whereas Frames 1 and 2 are evidently quite strong and embedded in institutional structures and in regulations, Frame 3 (TIP) remains mainly aspirational, lacking a strong narrative or a consistent set of organisational routines.

Therefore, the various country reviews all articulated the need for transformation. They also demonstrated how transformation is interpreted differently. In differing contexts, 'transformation' indicated changes in the research system; industry structures; a move to a resource economy; shifts in exclusion patterns; or the integration of the informal economy into the innovation system. Thus far, work on Transformative Innovation Policy has tended to concentrate around novel policy instruments and policy engagements. The country reviews demonstrated that member countries are focusing their efforts on a number of different instruments:

- Responsible Research and Innovation (Norway)
- Procurement (South-Africa and Finland)
- Challenge- led/Strategic R&D programmes (Sweden, Finland)
- Demand articulation with public involvement (Norway, Finland, Colombia)
- Social innovation, grassroots innovation (Colombia & South Africa)

However, the underlying theory and narrative of transformative change is still incipient. Differently from other areas of innovation policy, there is little consistency in how different countries approach transformations. The focus was not necessarily on sociotechnical system change, and the object of analysis was not necessarily a system of provision (e.g. energy system, healthcare system), as is commonly the case in the sustainability transitions literature. In part because of this lack of a shared analytical strategy and conceptual approach, it remains unclear how to understand and pursue Transformative Innovation Policy, or how to draw from experiences from other contexts to generate mutual learning. Hence, even as countries begin to explore this avenue by developing new instruments, a gap stands between narrative on and implementation of Transformative Innovation Policy.

Approaches derived from the sustainability transitions perspective could fill this gap. These approaches tend to share an understanding of the dynamics implicated in processes of systemic change, and have an expanding conceptual vocabulary to facilitate analysis. They argue for experimentation and social learning; niche development; and regime destabilisation, as well as, emphasising the need for policy mixes specifically designed to address these processes. This potential has been recognised in Finland and Sweden, including first try-outs of mapping policy instruments onto transition dynamics.

Additionally, engaging with transformation leads research funders to reassess their traditional roles and to begin embracing their emerging role as strategic change actors. In the latter, they act proactively as mobilisers and facilitators, often in domains which conventionally appertain to other ministries and stakeholders. Blurring the boundaries between policy domains and developing new attributions, adds to the complexity of their established role. It leads to questions about their mandate, and may strain their capacities. In a deeper sense, the institutional context for TIP is still missing. Despite the emphasis of previous frames on coordination between actors, many contexts still face the fragmentation in their research systems, and struggle to promote coordination between important stakeholders. Yet how to overcome this remains still unclear. An open question

is whether and how an experimental approach might help funders to develop this new role and the capacities it entails.

Finally, the country reviews revealed that current research evaluations are not suitable for transformative change. They are input and output oriented, and focus on auditing projects. There are few approaches aimed at systemic change, where increased complexity and difficulties in attribution hinder traditional approaches. Process oriented evaluation focusing on transformative change and providing input in the process itself (formative evaluation) is lacking. Experimenting with different approaches for evaluating these processes is a critical area of TIPC research that can contribute both to the practice of Transformative Innovation Policy and to the scholarship in sustainability transitions, innovation studies, and science and technology studies.

#### 4. Zooming into specific examples of TIP

In the pilot year, Transformative Innovation Learning Histories (TILH) were used to examine a portfolio of policy instruments and approaches emerging in the member countries. This allowed the Consortium to begin clarifying what makes a particular process 'transformative'.

##### **Box: Transformative Innovation Learning Histories (TILH)**

The objective was to understand how the respective innovation happened, identify its transformative elements, record and reflect the experience, then develop insights and ideas for future research and TIP experimentation. For that, the Innovation Histories method was adapted (Douthwaite and Ashby, 2005; Hargreaves, 2012). This method is useful for both research and policy reflection, and is particularly suitable for processes of co-creation. It involves:

1) Gathering multiple personal accounts and documentation of a transformative innovation process and the role of policy in developing it, including:

- a review of relevant academic literature and policy documents
- participatory, stakeholder workshops
- smaller group discussions
- one to one engagements

2) Jointly constructing (SPRU researchers and local country teams) written accounts and a timeline of the innovation and actor networks

The following questions guided the case study work:

- What were the most important events or themes relating to the development of this transformative innovation?
- Why was the event/relationship important?
- Was this project or innovation policy engagement 'transformative', and if yes, in what sense? Who was involved in the innovation, why were they involved, and how did they contribute/participate?
- What were the results?

- What was the role of policy (positive, negative or neutral) in shaping the transformative elements of the project?
- Were there specific combinations of policies (policy mixes) that contributed to this project being 'transformative', if yes, why?

The output presents multiple voices in a narrative format that synthesises empirical data, quotes from participants, researcher reflections, and theoretical insights that helped to uncover the transformative impact of the respective innovation policies and initiatives.

The insights from these TILHs help to develop a mutual understanding of Transformative Innovation Policy, illustrating its characteristics with concrete examples. For that, the TIPC team developed a set of indicative criteria aimed at recognising policy with a transformative potential that is aligned with the Frame 3 approach. The criterion contains six key elements:



In the Lund workshop (March 2017), a TILH case from each of the member country was identified because it demonstrated the potential to contain most of these elements. This led to the selection of the following cases:

- Colombia - Transformative Innovation Policy in/for Specialty Coffees
- Finland: The Emergence and Consolidation of Mobility-as-a-Service

- Norway: Transformative Developments in Research Funding: The Case of Responsible Research and Innovation
- South Africa: Cofimvaba Technology for Rural Education and Development: A multi-year pilot transformative innovation policy intervention
- Sweden: - Challenge-Driven Innovation: New Avenue for Transformative Policy at VINNOVA

The analysis of the resulting TILHs (summary in APPENDIX) examined to what extent these elements were present, and identified challenges shared across multiple countries.

## 5. Zooming out - synthesised insights from the TILH case studies

Undoubtedly, context matters for Transformative Innovation Policy. However, while some of the findings and key insights are context/country specific, others show commonalities in all or most of the countries. Considering these commonalities, we may begin to discern generalisable lessons and caveats that are salient in other contexts. After all, Frame 3 is not a strict prescription for a policy, but rather a lens for understanding and reconceptualising challenges and policy responses.

Each TILH demonstrated the complexity of attempts to enable transformative change. Rather than recounting the impacts of a policy intervention or the effect of a single policy instrument, each case tells a story of a proactive policy 'engagement', requiring the mobilisation of a variety of actors, the creation of networks, and engendering a process of social learning. These policy engagements span many years and took place amidst contexts comprising of a multiplicity of interests. As such, policy actors had to seek the articulation and alignment of expectations, and faced difficulties for nourishing long-lasting relationships of trust with various stakeholders while addressing their objections and uncertainty.

Building networks played a central role in sustaining these processes overtime. Often, these networks had to bridge between local, national and international arenas, from which they drew support and resources. Hence, intermediation and conflict management appeared as a crucial activity. As such, the accounts don't conform to static notions of top-down or bottom-up changes - combining both in different periods is crucial.

Accordingly, the cases also show that agencies placed less emphasis on simply designing policy instruments, and put a lot of effort into building working relationships with the relevant stakeholders. The challenges faced in each of the cases were: being subject to policies from various departments, and forming implicit policy mixes that were of importance. In many cases, to attempt transformation, STI policies had to proactively engage other areas of policy making, along with the users and stakeholders of those policies. This is often fraught with tensions and power struggles. Developing the capacity to analyse and steer policy mixes is therefore a central concern of TIPC.

The TILHs recount initiatives that began with an aspiration and general vision of how to tackle the challenges at hand. The timelines of the different cases revealed a stepwise clarification, substantiation and experimentation which allowed for the emergence of a shared direction of travel, and the recruitment of a constituency committed to the changes. The TILH narratives do not suggest a clear blueprint that can then be implemented and scaled, nor of a series of well-planned interventions. Instead, experimentation played various roles in the TILHs, beyond what is normally referred to as 'policy experimentation'. Here, it was thought of as a way of informing and justifying the design of policy instruments. In most cases, experimentation was understood as a means for transformative change, allowing for alternatives approaches, practices and products to emerge protected from traditional power structures, organisational imperatives and inadequate institutional arrangements. Both the Colombian and Finnish cases show that experimentation was not necessarily being initiated by policy makers.

Instead, it was policy actors attempting to structure participation, collaboration and joint-work, which then slowly sediment into novel institutions and governance arrangements. This tentative, experimental form of governing is aligned with the notion of Experimental Governance (see Torrens and Schot 2017). Advancing the understanding of this kind of engagement, and how it plays out in different contexts is one of the important contributions of the upcoming TIPC 5-year programme.

In this sense, the TILHs do not conform to a neat progression from experiments to scaling up. Rather they offer a continuum of experimental policy engagements contributing to different forms of learning at different stages. Cases differed in how marked and formalised those stages were, and how the learning was instigated. In many of the cases, crucial changes took place at the level of roles and identities of different actors (including funders); organisational routines; and the emergence of a new framing of problems. Researchers and practitioners should thus be attentive to signs of actors revisiting their assumptions; negotiating expectations; forging new commitments; dealing with conflict; and developing viable new routines and rules. These different aspects may all be indicators of second order learning, which current scholarship on Strategic Niche Management and sustainability transitions identifies as crucial for transformations (Grin et al., 2010). Monitoring such aspects could be central to new approaches for TIP evaluation.

As highlighted around 'transformation', each case too differed in how Transformative Innovation Policy was interpreted. On the one hand, the Swedish and Norwegian cases account for processes initiated by the respective funding agencies and were aimed at the STI system itself, changing the goals of projects (towards Challenge-led innovation and towards Responsible Research & Innovation). These cases highlight the potential for tensions within the existing STI system, given that new funding policy and guidelines may alter the established relationship between funders and their stakeholders. On the other, the Colombian and Finnish cases describe a process of policy engagement with potential socio-technical transitions, where STI policy actors and other stakeholders seek to develop the means for enacting two seemingly desirable futures ( respectively, more qualitative and sustainable coffee production based on speciality coffees, and more efficient and sustainable smart mobility). These cases show that experimental policy actors ought to engage with a broad set of actors, and in some contexts, proactively build protective spaces for experimentation. Distinctively, the South African case discussed an attempt for assembling an integrative policy response to issues of rural development. It is illustrative of the fact that systemic change often requires a convergence between multiple strands of experimentation that aims to assemble an alternative system for the provision of services. This variety suggests the possibility of structuring future comparisons considering processes operating at a similar level, be it at the STI system, a sociotechnical system, or integrated policy intervention level. The challenges faced in each arena are likely to differ.

Juxtaposing these cases demonstrates that the capacities for TIP differ significantly from those developed in Frames 1 and 2. Different notions of leadership, intermediation and experimentation place strong demands on the capacities of funding agencies. Moreover, the cases also indicate the strong coupling between the STI system and the sociotechnical systems with which it interacts, and then how the quest for enabling transitions

might impinge on the organisational structures of the STI system. Investigating how to build these capacities, and how to leverage this coupling should be a central task of the TIPC.

## 6. Conclusions and next steps

The country reviews, the TILHs and the discussions within the Consortium confirmed the hypothesis that Frame 3 is beginning to emerge in various contexts. In the policy arena, however, a strong overall narrative that would justify and legitimise more investment in a TIP is lacking. The indicative criterion proposed is an important initial step towards recognising policies with a potential for transformation. However, clarifying the rationale for TIP, and recognising when a challenge is intractable to Frame 1 and Frame 2 policies and when it demands a transformative approach is still difficult.

As with Frames 1 and 2, a starting point for such a TIP narrative could be the notion of failure. Frame 1 policies are seen as responses to market failure arguments (or even the need to shape early markets), and Frame 2 policies are thought of as responses to the system failure rationale. Frame 3 should consider other forms of failure which hinder systemic change. For that, Weber and Rohracher (2012) have proposed that policies for transformative change begin with the recognition of four types of failure: directionality, policy coordination, demand-articulation and reflexivity. This is a useful framework and overlaps substantially with criteria for transformative innovation developed in the pilot (and illustrated previously). Building on that, the coming research programme should try to elucidate the following questions:

- How can these failures be identified and assessed?
- What are the characteristics of policy instruments, engagements and mixes which provide suitable responses to these failures?
- What forms of experimentation are necessary for assembling appropriate responses for the challenges?

The need for new policy instruments and for more policy experimentation is recognised in all countries. Experimentation is perceived as a suitable response given the complexity of the challenges and the uncertainty about solutions. It can provide a temporary cognitive and research space for trying out new ideas and policy learning to generate understanding and knowledge. However, as the analysis of the TILHs shows, current experimentation taking place in member countries goes well beyond designing and testing of instruments. To understand this broader scope, it is important to start mapping out different modes of experimental policy engagements. As this is a key area for development within the TIPC 5-year programme, a supporting research brief on experimentation has been produced to explore this crucial area (Torrens and Schot 2017). Learning how to better conduct experiments, how to concretise their lessons, and how to move beyond the experiments are all areas to which TIPC research may contribute.

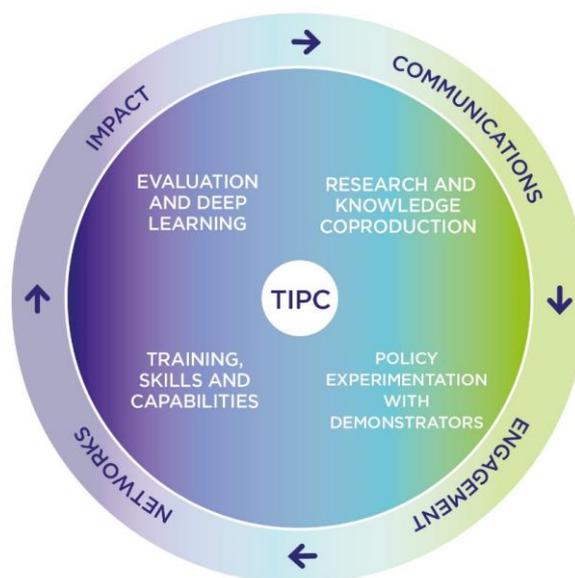
The ambition of transformative policy is not limited to STI policies, as the challenges ahead do not respect departmental boundaries. The exploratory year shows that transformative change means that STI policies will need, eventually, to evolve into a joined-up governance approach since it will involve, among others, social

policy, tax policy, energy policy and healthcare policies. TIPC should therefore focus on analysing policy mixes, not only within innovation policy itself, where the Frame 1, 2 and 3 approaches need to be combined, but also beyond innovation policy.

However, transformative change is not just policy led, it needs to be carried by a host of actors who support and advocate the change for their own ends. Policies can help to encourage, and stretch ongoing change processes towards transformative change, but they cannot be the engine which keeps the change process going. The case studies show that change is created by people – by changes in their identity, expectations, practices and routines. The issue of leadership and capacity building is hence unavoidable. It is important that the 5-year programme activities contribute to building capacity, skills and training, and to supporting its stakeholders in their engagements, their reflexive process and their deep, ‘second-loop’ learning.

The exploratory year also demonstrates that evaluation practices, metrics and ways of assessing ongoing transformations, require further development. Innovation policy is saturated with indicators based on Frame 1 (R&D statistics, patents) and Frame 2 (interactions, links, spin-offs) which have shaped the notions of what constitutes best practice. Exploring approaches that emphasise learning over auditing, and which move past quantitative indicators based on linear conceptions of innovation is crucial. Moreover, novel approaches to monitoring evaluation will have to be developed to support experimental policy engagements (Torrens and Schot 2017). For these reasons, evaluation is one of the four fundamental components of the TIPC 5-year programme.

TIPC’s long term vision is to see widespread adoption of new TIPs and practices across the globe. This vision is underpinned by mutual policy learning and the co-creation of knowledge between research and policy. As discussed, based on this vision and the results of the pilot phase, the current TIPC founding members are working to establish a 5-year programme. Its main components are illustrated below and are explicated in the TIPC 5-Year Programme Proposal.



Following this intense and rewarding first year, TIPC has a clear direction. It is by committing to this shared understanding, vision and need to build on the insights discussed in this research brief that the next chapter in the TIPC story can commence.

## 7. Acknowledgements

A wealth of contributions from the members of the SPRU TIPC Team, local research groups and workshop participants made this document possible. Their participation in the pilot year was crucial for TIPC's success and exemplified the spirit of collaboration and mutual learning that gives vitality to the Consortium. For that, and for their insights, the authors of this brief are deeply thankful.

## References

- Douthwaite, B., Ashby, J., 2005. Innovation Histories: A method from learning from experience. ILAC Brief 5 p. 4. Available at: <http://hdl.handle.net/10568/70176>
- Chataway et al. 2017. Developing and enacting transformative innovation policy: a comparative study [Online]. Paper presented at the International Sustainability Transitions 2017. Available at: <http://www.transformative-innovation-policy.net/papers/developing-and-enacting-transformative-innovation-policy/>
- Grin, J., Rotmans, J., Schot, J., 2010. Transitions towards sustainable development: New Directions in the Study of Long Term Transformative Change. Routledge Studies in Sustainability Transitions I, London: Routledge Publishers.
- Hargreaves, T. (2012b). Bristol Green Doors: An Innovation History [Online]. November 2012. Available at: <https://grassrootsinnovations.org/2012/11/26/bristol-green-doors-an-innovation-history/>
- OECD 2015. System Innovation: Synthesis Report [Online]. Paris: Organisation for Economic Co-Operation and Development. Available at: [https://www.innovationpolicyplatform.org/sites/default/files/general/SYSTEMINNOVATION\\_FINALREPORT.pdf](https://www.innovationpolicyplatform.org/sites/default/files/general/SYSTEMINNOVATION_FINALREPORT.pdf)
- Schot, J. and Kanger, L. 2016. Deep Transitions: Emergence, Acceleration, Stabilization and Directionality SPRU Working Paper Series 2016-15, Brighton: SPRU.
- Schot, J., and Steinmueller, E. W. 2016. Framing Innovation Policy for Transformative Change: Innovation Policy 3.0 [Online]. Working paper. Available at: [http://www.johanschot.com/wordpress/wpcontent/uploads/2016/09/SchotSteinmueller\\_FramingsWorkingPaperVersionUpdated2018.10.16-Newcopy.pdf](http://www.johanschot.com/wordpress/wpcontent/uploads/2016/09/SchotSteinmueller_FramingsWorkingPaperVersionUpdated2018.10.16-Newcopy.pdf).

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), pp.331-343.

Stirling, A., 2009. Direction, distribution and diversity! Pluralising progress in innovation, sustainability and development. STEPS Working Paper 32, Brighton: STEPS Centre

Torrens, J., Schot, J. 2017. The roles of experimentation Transformative Innovation Policy, Transformative Innovation Policy Consortium, Research Brief no. 2017-02, Brighton: SPRU.

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, 1037–1047. doi:10.1016/j.respol.2011.10.015

## APPENDIX

Country Case study:	Key Insights
<p>Colombia - Transformative Innovation Policy in/for Specialty Coffees:</p> <p>Examined the development of speciality coffee in Colombia, focusing on the Huila department, region which is a leader in this area. The case discussed whether a transition to speciality coffee is occurring, and examined how policy makers engaged with this transition, and to what extent their policies had a transformative potential.</p>	<p>The shift to speciality coffee marks an industry transition altering industry practices, norms and routines, the benefits of which remain limited to a subset of the farmers.</p> <p>New opportunities exist for a more sustainable and inclusive coffee sector. Minor changes are taking place in a piecemeal fashion. More radical change in relationships between producers and other value chain actors, including research and innovation institutions, will require broader systemic support by policymakers.</p> <p>Although there is no evidence of a strategic STI policy targeted at speciality coffee, there are indications of bottom-up led change, which has transformative elements, in addition to policy experiments with transformative features.</p> <p>Policy can learn from bottom-up initiatives, while remaining open towards international experience (e.g. certification and production techniques).</p> <p>Policy actors have developed preparedness and capacity to act timely in facing up to external shocks, as in the case of</p>

	<p>coffee plagues. These situations may greatly accelerate change.</p> <p>The advent of speciality coffee brings about second order learning - e.g., changing farmers' perceptions of themselves, what they produce, how they produce, their role and possibilities for experimentation – with a deeper transformation potential than it would be expected from a seemingly product innovation.</p>
<p>Finland - The Emergence and Consolidation of Mobility-as-a-Service:</p> <p>Focused on the emergence and consolidation of a novel approach to transport, called Mobility-as-a-Service (MaaS), and the policies underlying and influencing this development. The MaaS aim is to provide travellers with door-to-door easy access to services, with a single payment and ticket. To achieve this, different modes of transport (private cars, mass transit and on-demand services) must work seamlessly together. By aiming to increase the usage of existing vehicle capacity and reducing individual vehicle ownership, MaaS is one of the most recent innovative attempts in Finland to change the transport system.</p>	<p>MaaS emerged from the interaction of top-down and bottom-up initiatives where a system-oriented approach at the ministry level fused with entrepreneurial initiatives. This involved a broad concertation between actors, a pattern that is uncommon in the transitions studies literature and which requires further research.</p> <p>The overall evolution of MaaS involved multiple rounds of iterations between public and private sector stakeholders, each taking a temporary informal lead in the process while adding new elements to MaaS. This highlights the importance of forums as spaces for articulating expectations and aligning visions.</p> <p>The case exemplified the need for a portfolio approach for socio-technical experiments, paired with enabling changes to regulation and organisational changes for embedding the new routines into the mobility system and STI system.</p> <p>The coupling of multiple policy initiatives by different policy actors was crucial in enabling a broader approach to transport, facilitating market formation for MaaS and removing system barriers hindering its development.</p> <p>The acceleration of mobility transition in Finland demands attention to the issue of coordinating the development of different niches and to the threat that niches end up reinforcing the existing regime rather than transforming it.</p>

	<p>The system level impact of the experiments is not evident at first.</p> <p>TIP evaluation approaches should distinguish more clearly between transformative process (policy) from transformative outcome (impact).</p> <p>There are potential tensions between Frame 3 policies and the legacies of previous frames, given the prioritisation of competitiveness and productivity in Frames 1 and 2.</p>
--	---

<p>Norway - Transformative Developments in Research Funding: The Case of Responsible Research and Innovation:</p> <p>Examines Norwegian developments of Responsible Research and Innovation (RRI). Through a process of experimentation and consultation largely directed and governed by Research Council Norway (RCN), Norwegian RRI responds to: the dissatisfaction among researchers and policymakers with traditional approaches to research funding and governance; the inability of science and innovation policy to adequately address social needs; to the lack of clarity on the directionality and (intended) goals of innovation; and to challenges around the evaluation of STI outcomes. In summary, there was the realization that STI policy is not delivering on its promise, but rather it is implicated in producing problems; hence the need for a systems change. RRI is an attempt to fill this need.</p>	<p>Development of RRI involved successive round of iterations by which the framework gradually becomes fleshed out in increasing detail, from basic S&amp;T activities to experimentation.</p> <p>It is an example of the complex process of articulating expectation and recruiting actors to a new practice, with proactive engagement from the Research Council. This points at the role of funding agency as a change agent setting, in motion an interactive process of experimentation and learning.</p> <p>RRI demonstrates the importance of a willingness to reconsider the role of innovation itself and the possibility for reframing it in diverse, context specific ways that align with Frame 3 thinking.</p> <p>RRI is characterised by a number of tensions, including: conflict vs consensus with stakeholders; avoiding “capture” by powerful interests groups; deciding on underpinning philosophy and ethics; challenging of inclusion/exclusion; and sustainability.</p> <p>Currently the future of RRI approach is uncertain as it faces substantial questions, for example, to what extent is it making a difference to the outcomes and what counts as an outcome?</p> <p>As with other Frame 3 Transformative Innovation Policy approaches, there is uncertainty on how to recognize “good RRI”; how to evaluate it; and to what extent could such evaluations can be standardised?</p> <p>Also there are tensions between, for example, (a) keeping RRI (too) open, which might lead to continuing problems of translating it to practice; or having it closed, thereby inhibiting mutual learning; (b) promoting/adopting a (too) standardized approach which might improve evaluation prospects but lead</p>
--	--

	<p>to RRI as yet another box-ticking exercise, as opposed to tailoring the approach to specific needs, adding complexity to the evaluation; c) lastly, RRI requirements in project-writing might lead to the emergence of “RRI experts”, an outcome contrary to the original aim of RRI: to help improve researchers ability to reflect on their activities.</p>
<p>South Africa - Cofimvaba Technology for Rural Education and Development:</p> <p>This was a multi-year pilot Transformative Innovation Policy intervention. Tech4RED was located at Cofimvaba community in the Eastern Cape, one of the least developed regions of the country. The key actors started by asking one main question: what can we do to “fix” education, alleviate poverty, and bring development to the Eastern Cape area of South Africa? Against this backdrop, the project was conceptualised as a socio-economic development for rural education that contributed to improvements in teaching and learning, material and human conditions. Underpinned by technology, Tech4RED focused on six thematic areas: Information and Communication Technology (ICT), nutrition, health, sanitation, energy, and science communication.</p>	<p>Tech4RED was an example of an integrative policy engagement, that demonstrates the need and difficulties in assembling a viable alternative socio-technical configuration from multiple experiments.</p> <p>Ensuring the long-term sustainability of these engagements is a major challenge. This involves both funds to continue the TIP on a long-term basis, and consideration of how to ensure that the outcomes of such engagement have a lasting impact.</p> <p>A lead actor (champion or stakeholder group) is essential for carrying out one such engagement. A change of role, an exit or reduced commitment by such a key actor could be detrimental to the TIP. Clarifying the role of different stakeholders and aligning expectation is a critical success factor.</p> <p>Engagements based on a strong top-down approach, with weak/passive actors, or which treat partners as beneficiaries, are prone to failure.</p> <p>Capacity-building to empower (e.g. by training, supervision and support) and strengthen weaker actors and beneficiaries is critical to TIP success; otherwise, there is high risk of failure and the potential for weak actors to regress to old habits, routines and practices therefore maintaining the current system.</p> <p>It is vital that TIPs are designed to be flexible and adaptive to change, including of political nature.</p>

	<p>Constant monitoring and evaluation (M&amp;E) throughout the implementation, with reflexive feedback loops to policymakers and stakeholders is essential to ensure learning and the achievement of crucial outcomes. Consolidating and institutionalising lessons from experimentation and M&amp;E is critical but very challenging.</p>
--	--

<p>Sweden - Challenge-Driven Innovation: New Avenue for Transformative Policy at VINNOVA</p> <p>The CDI program, established in 2011, aimed to redirect funding towards projects that develop sustainable solutions to tackle current societal challenges. These challenges require innovative solutions that challenge the boundaries of traditional research fields and 'silo-thinking'. Instead, cross-sectoral cooperation between a range of public and private stakeholders are promoted, and emphasis is put on a more holistic approach to innovation, that also include social and organizational aspects.</p>	<p>Leadership is crucial in securing top management commitment; and organisational structure matters in designing and managing a cross-sectoral, CDI innovative funding scheme.</p> <p>Relatedly, consultation and collaboration are essential for getting inputs, such as expertise and support, from the broader ecosystem.</p> <p>Bottom-up approaches also need guidance as it may be difficult for many actors to understand what is expected in a completely open and unguided program. Flexibility in design and implementation is important.</p> <p>Reframing the innovation as challenge-driven meant that challenges themselves were also reframed, not as problems awaiting a solution, but as openings for renewal and transformation.</p> <p>Context matters; one size does not fit all. It is important to acknowledge sectoral and institutional project settings when designing funding schemes. Transformative innovations face very different barriers depending on where they are developed, e.g. due to specific industrial standards and regulations.</p> <p>Continuous reflection, evaluation and revision are key to success of new transformative programs and TIP, and require dedicated resources. Experimenting with evaluation itself might be necessary to develop approaches fit for a Frame 3 purpose. As an example, CDI used a staged grant design for ensuring the gradual strengthening of cooperation and agency of the grantees and revision of the instrument.</p> <p>Sustainability transitions require policy mixes – no one single instrument will be sufficient to address all challenges in a sector. Instead, coordination between different instruments may stimulate and foster various activities that enable system</p>
---	---

	transformation. These policy mixes ought to encompass support for exploration, collaboration and enactment of alternatives.
--	---