# TRANSFORMING EXPERIMENTATION:

## EXPERIMENTAL POLICY ENGAGEMENTS AND THEIR TRANSFORMATIVE OUTCOMES

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# CONTENTS

# SUMMARY

This research report examines the various practices, rationales and approaches associated with policy experimentation followed by a proposal of how experimentation can apply to advancing Transformative Innovation Policy (TIP) for Transformative Change. This document integrates and builds on an earlier version that outlined different types of Experimental Policy Engagements (EPEs) but adds to that a proposed list of **Transformative Outcomes that can be used to create new EPEs or modify existing EPEs to promote more transformative change**. It is the result of a follow-up scoping exercise conducted for the Transformative Innovation Policy Consortium (TIPC) and a workshop with its members.

## EXPERIMENTAL POLICY ENGAGEMENTS

The report argues for the adoption of a specific understanding of Experimental Policy Engagements (EPEs), emphasising experimentation between policymakers and other stakeholders. The five modes of such EPEs, which help to capture the diverse practices, include: (1) policy design experiments, such as randomised control trials; (2) policy instrument and process experiments, applying new formats in established ways of policy; (3) creating experimental spaces, for example, policy labs and transition arena;  (4) supporting, connecting and evaluating societal experiments, via intermediaries, workshops and online resources; and (5) supporting experimental culture, via strategies and initiatives rewarding reflexivity and learning.

## EXPERIENCES FROM TIPC MEMBER ORGANISATIONS

Selected examples of experimental policies already undertaken in TIPC member countries (Colombia, Finland, Mexico, Norway, South Africa and Sweden) are briefly discussed in relation to the different modes. The early impression is that potentially transformative EPEs do exist but often at the margins of the activities of the member organisations. Some cultural change towards experimentation was observed through a new generation of policymakers. Overall, interesting experimental initiatives are taking place in TIPC member countries but they are only a start in the journey towards transformative innovation policy. While transformative in some aspects, they do not yet take into account the broad array of elements needed to support transformation via experimentation.

## TRANSFORMATIVE OUTCOMES

Transformations are very complex and long-term processes, where EPEs alone cannot bring out such transformation. They can, however, contribute to transformative processes and potentially shape the process underway along with other factors. This report argues that individual and a portfolio of EPEs can lever specific transformative outcomes, which connect to three processes of transformation: **successful niche building, niche expansion and embedding, and destabilisation and opening up of socio-technical regimes**. The proposed *12 transformative outcomes* under these processes include:

**Successful niche building**

**1. Shielding** – broadening and deepening

**2. Learning** – broadening and deepening

**3. Networking** – broadening and deepening

**4. Expectation dynamics** – broadening, deepening, opening up

**Niche expansion and embedding**

**5. Upscaling** – increasing user adoption

**6. Replication** – local and trans-local

**7. Circulation** – accumulating and intermediating

**8. Institutionalisation** – creating formal and informal rules

**De-stabilisation and opening-up of regimes**

**9. Destabilisation** – de-aligning/disrupting subsystems and regimes

**10. Opening up** – unlearning and deep learning of regime actors

**11. Empower niche-regime interactions**

**12. Changing perceptions of landscape pressures**

The report posits that experimentation is needed and can take place to support transformation processes of n*iche building and expansion as well as regime destabilisation and opening up*. Thus, it is needed in all stages of transformation. The specific categorisation of four transformative outcomes associated with the process of regime destabilisation and opening up outcomes (9-12) is something that has seldom been connected with experimentation.

We plan to further develop the understanding and usefulness of the transformative outcomes in concrete work with TIPC members on new and existing experimental engagements. In this work we aim to integrate the transformative outcomes into a formative evaluation method as developed and proposed by TIPC.

# 1. INTRODUCTION

The Transformative Innovation Policy Consortium (TIPC) undertakes a 5-year programme, which aims to advance policy practice, training, evaluation and research aligned with the emerging framing of innovation policy for transformative change (Frame 3)[1]. TIPC uses a notion of transformation derived from the sustainability transitions field. Being transformative means that socio-technical systems developed to deliver societal services (e.g. heat, power, mobility, food and water, healthcare) need to become more sustainable. This implies not only economic sustainability but also environmental and social sustainability, involving changes in technology and infrastructure, practices and routines, professions, organisations, and policies and institutions. The assumption is that many current systems are not sustainable, and thus need to go through a radical change. This change process can be called a transformation or a transition (we use the term 'transformation' in this document). TIPC is a learning platform in order to work on such system transformation.

Transformative innovation policy is an exploratory concept. Although it is still rather unclear how to design, implement and evaluate transformative innovation policies, Schot and Steinmueller suggest that experimentation takes a central role.[2] This is also supported by the role described for experiments in the sustainability transitions literature.[3][4] This focus can be justified by three observations.

First, transformations are long, complex, open-ended processes involving multiple stakeholders, and where visions, expectations and problem-framings ought to be reassessed on an ongoing basis and reviewed under the light of new evidence, novel technologies and practices.[5][6] These processes demand reflexivity: stakeholders discovering ways of working and being, and exploring new values and routines questioning their existing ones (deep learning). Such reflexivity arises from practical experiences that can benefit from an experimental approach.

Second, transformations have a necessarily normative character, forcing questions of what the transformation should be for, and who should carry them out.[7] Technology and policy interventions are not neutral. On the contrary they favour or disfavour specific interests, beliefs and values, and questions need to be asked about transformation for whom. Spaces need to be created to play up and play out the politics of transformation. Experimentation is vital in facilitating the design, appraisal and the enactment of alternatives and provide forms of tentative governance and deliberation about the desirability of particular pathways.[8]

Third, experimentation can be a way for creating alignment between multiple socio-technical dimensions that are required for system innovation. Discourses, consumer practices, business models and policies all co-evolve alongside with technology.[9] Experiments can be seen as tools for building niches which are an important source for socio-technical change. In other words experiments are a means for opening up new socio-technical developments, challenging existing ones and setting collective priorities towards acceptable transformation pathways[10], including the emergence of a 'compass' for guiding sustainable transformation.[11]

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[1] See www.tipconsortium.net.

[2] Schot, J. Steinmueller, W.E. 2018. Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy* 47, 1554-1567

[3] Grin, J, Rotmans, J, Schot, J, Geels, F, Loorbach, D., 2010. *Transitions to Sustainable Development*. Routledge, New York & London.

[4] Köhler, J, Geels, F, et al. 2019. An agenda for sustainability transitions research: State of the art and future directions. *Environmental Innovation and Societal Transitions.*

[5] Grin, J., Rotmans, J., Schot, J., 2010. Transitions towards sustainable development. KSI-book series part I, Routledge Publishers, UK.

[6] Leach, M., Scoones, I., Stirling, A.C., 2010. *Dynamic Sustainabilities: Technology, Environment, Social Justice.* Routledge, New York & London.

[7] Scoones, I., Leach, M., Newell, P. (Eds.), 2015. *The Politics of Green Transformations (Pathways to Sustainability).* Routledge, New York & London.

[8] Bason, C., 2017. *Leading Public Design: Discovering human-centred governance.* Policy Press, Bristol.

[9] Kivimaa, P., Hildén, M., Huitema, D., Jordan, A., Newig, J., 2017. ).  Experiments in climate governance –a systematic review of research on energy and built environment transitions. *Journal of Cleaner Production,* 169: 17-29.

[10] 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.

[11] Smith, A., 2006. Niche-based approaches to sustainable development: radical activists versus strategic managers. In: Voss, J.-P., Bauchnecht, D., Kemp, R. (Eds.), *Reflexive Governance for Sustainable Development.* Edward Elgar, Cheltenham.

Interest in experimentation is not unique to transformative innovation policy and TIPC. Arguably, societies are increasingly 'experimenting with themselves'. Experimentation is prevalent in various areas of management, public policy and environmental governance. This is evident in the prominence of lean experimentation in the start-up culture, the increase in innovation policy labs,[12][13] living labs, and the growing influence of the design discipline on processes of policymaking.[14] Policy experimentation is often aimed at assisting decision making, confirming hypotheses, and providing evidence for justifying decisions. It ranges from a more instrumental testing of new policy models to attempts to increase reflexivity and learning in governance. Policy experimentation may be used to try to avoid large-scale failures with more temporary and scale-limited exploration of policy options first. However, experimentation for transformation extends beyond a focus on supporting decision making. It is not just about developing robust methods for determining 'what works' and providing a basis for evidence-based policy, but also about structuring the transformation process and empowering actors.

Experimentation for transformative change displays a mixture of a distinct design attitude,[15] concerned with creatively exploring alternative ways of framing problems to create innovative solutions, and an 'evolutionary attitude' concerned with creating the right conditions for societal experimentation to flourish.[16] This mixture resonates well with the sustainability transitions research on Strategic Niche Management.[17][18][19] In this literature, experimentation is positioned as an instrument to construct and expand niches and to destabilise

incumbency (i.e. dominant unsustainable socio-technical practices). In other words, experiments and niches constitute each other (co-evolve), and create the right conditions for transformation, including transformative capacities.

Transformative understandings of policy experimentation do not assume that policies control or dictate transformations. On the contrary, the assumption is that transformation has started, and policymaking needs to engage with what is available. By doing that, it can in part and in connection to other factors shape the developments. However, reflexivity and experimentation in policymaking is vital, as rigid policymaking can constitute a significant barrier for the transformation underway.[20] Accordingly, experiments may be initiated by other actors, and policy-makers may become involved along the way. In this context, it would be misleading to assume that experiments are all rigidly bound when, in effect, these processes tend to be open-ended and flexible, and involve a range of policy interventions and actions by a host of actors over time.[21][22] The drawback of such a broad understanding of experiments for transformative innovation policy is that they may become elusive. However, in the context of a transformation, this may be unavoidable and even an advantage, despite the complexities involved. The very aim of experiments is to connect up with ongoing change processes and contexts, modulating them to a more sustainable direction and, thus, making the boundary between the experiment and ongoing transformations more fluid.

[12] Tonurist, P., Kattel, R., Lember, V., n.d. Discovering Innovation Labs in the Public Sector, Working Papers in Technology Governance and Economic Dynamics.

[13] Williamson, B., 2015. Testing Governance: the laboratory lives & methods of policy innovation labs. Stirling: University of Stirling.

[14] Bason, C., 2017. Leading Public Design: Discovering human-centred governance. Policy Press, Bristol.

[15] Bason, C., 2017. Leading Public Design: Discovering human-centred governance. Policy Press, Bristol.

[16] Torrens, J. 2018. On Policy Experimentation: Decision, Design and Evolutionary Attitudes. Available at: http://tipconsortium.net/on-policy-experimentation-decision-design-and-evolutionary-attitudes/

[17] Kemp, R, Schot, J, Hoogma, R, 1998. Regime shifts to sustainability through processes of niche formation. The approach of strategic niche management. Technology Analysis & Strategic Management 10 (2), 175–198.

[18] Schot, J, Geels, FW., 2008. Strategic niche management and sustainable innovation journeys. Theory, findings, research agenda, and policy. Technoly Analysis & Strategic Management 20 (5), 537–554

[19] Smith, A, Raven, R, 2012. What is protective space? Reconsidering niches in transitions to sustainability. Research Policy 41 (6), 1025–1036.

[20] Kivimaa, Paula, Kern, Florian, 2016. Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. Research Policy 45 (1), 205–217.

[21] Hodson, M., Geels, F.W., Mcmeekin, A., 2017. Reconfiguring Urban Sustainability Transitions, Analysing Multiplicity. Sustainability 9, 20.

[22] Turnheim, B, Kivimaa, P, Berkhout F (eds), 2018. Innovating Climate Governance: Moving Beyond Experiments. Cambridge University Press, Cambridge.

To explore the uses and approaches to experimentation that are relevant in the context of transformative innovation policy, TIPC proposes to use the term **Experimental Policy Engagements (EPEs)**. This is to stress that individual projects, programmes and even policies can be seen as engagements with a wider ongoing transformation process of which they are part. Yet they can also be delineated. (EPEs) are defined as:

The diverse ways in which policymakers engage with processes of societal experimentation for sustainable transformation: initiating, supporting or mobilising, and evaluating such initiatives for informing decision-making, enabling processes of social learning, developing alternative pathways and enacting desirable futures.

In this definition, societal experimentation refers to practice-based and challenge-led initiatives developed to promote transformation of some sort (adapted from Sengers et al. ). This document first explores five possible EPE modes (based on Schot and Torrens 2017, with some modifications) in Section 2. It then briefly discusses selected examples how experimental policies have been undertaken in six TIPC member countries (Colombia, Finland, Mexico, Norway, South Africa and Sweden) in Section 3. This is followed by a proposition how to make these and other EPEs more transformative by creating a list of transformative outcomes based on the sustainability transitions literature in Section 4. The document concludes with the reflection of how TIPC may support the emergence of transformative EPEs, and help its members to mobilise them to the pursuit of transformative change in Section 5.

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[23] Sengers, F, Wieczorek, AJ, Raven, R, 2016. Experimenting for sustainability transitions. A systematic literature review. *Technological Forecasting & Social Change*.

# 2. FIVE MODES OF EXPERIMENTAL POLICY ENGAGEMENT

Amending an earlier version of the EPEs by Schot and Torrens, we here outline five modes of experimental activity that policymakers can conduct or support. They range from experimentation with policy instruments (mode 1: randomised control trials and mode 2: experimentation within traditional means of policy processes and instruments) to experimenting with new kind of policymaking (mode 3: creating experimental spaces and mode 4: supporting, connecting and evaluating societal experiments that are already being conducted by others), and ultimately to a broader change in governance towards an experimental culture (mode 5). While we describe all the modes, we are not making use of RCTs (mode 1) in the context of transformative innovation policy.

## 2.1 RANDOMISED CONTROL TRIALS

Early on, producing 'scientific evidence' for informing decisions about 'what really works' was a key motivation for those arguing for experimental practices. Since the early 20th century, economics and psychologists (in the case of education policy) lead the advocacy for structured attempts to experiment with policy design. Under this conception of experimentation, the crucial task was one of hypothesis testing, checking the validity of the assumptions underpinning the policy design, measuring and evaluating the outcomes of policies, and improving their effectiveness by adjusting the instruments' parameters ('calibrating instruments'). For that to be possible, the experimental procedures deployed would attempt to establish control over the context of application, isolating the effects of policy from other effects and seeking to compare groups which received the 'policy treatment'. Hence, a sophisticated methodological tradition has developed to support this form of experimentation, deriving from methodologies associated with medical trials and sustained by a renewed emphasis on 'evidence-based policy'.[24]

Accordingly, Randomised Control Trials (RCTs) have gained prominence in various fields: they require applying the intervention (treatment) to randomly selected groups and controlling other factors, and allow establishing statically sound evidence of the effects of a determinate (policy or medical) treatment. The promise of a scientifically based, systematic way of assessing policy options have led many to argue that RCTs are the 'Golden Standard' in the production of evidence-based policy, but that promise has now many critics, as it may narrow the forms of evidence and learning which are considered in policy making.[25]

It is unlikely that RCTs lead to transformative outcomes in terms of sustainability socio-technical system change. Thus, RCTs appear an unhelpful mode of EPE in the context of the transformative innovation policy. Rather, they are more attuned to improving the existing system through incremental change, albeit sometimes with huge gains in social and environmental terms. RCTs are here presented as a useful way of experimenting for optimising existing systems.

## 2.2 POLICY INSTRUMENT AND POLICY PROCESS EXPERIMENTS

EPEs can take place in the form of experimenting within the confines of established forms of policy instruments and processes, initiated by national, sub-national or local government agencies. Thus, for example, an innovation funding call organised or structured in an experimental manner would fall under this mode. Examples from other sectors include experiments with public dialogues in the context of public participation in UK climate policymaking;[26] experimental research–industry collaboration in Australian urban water governance;[27] an explorative planning process and novel kind of eco- and energy requirements for an ecological and energy efficient residential area within a defined district in Denmark[28], and; policy pilots for climate risk adaptation in Indian agriculture.[29]

[24] Abhijt V. Banerjee and Esther Duflo, Poor Economics. *A Radical Rethink of the Way to Fight Global Poverty*, Public Affairs, 2011

[25] Cartwright, N., 2010. What are randomised controlled trials good for? *Philosophical Studies* 147, 59–70.

[26] Pallett, H. 2018. Understanding Public Dialogue as an Embedded Democratic Innovation in UK Climate Governance. In: B. Turnheim, P. Kivimaa, F. Berkhout (eds.), *Innovating Climate Governance: Moving Beyond Experiments*. Cambridge University Press: Cambridge, pp. 85-102.

[27] Farrelly, M., Bos, A. 2018. Broadening Experimentation through Research-Industry Collaboratives in the Australian Water Sector. In: B. Turnheim, P. Kivimaa, F. Berkhout (eds.), *Innovating Climate Governance: Moving Beyond Experiments*. Cambridge University Press: Cambridge, pp. 103-120.

[28] Holm, J., Stauning, I., Sondergård, B., 2011. Local climate mitigation and eco-efforts in housing and construction as transition places. *Environ. Policy Gov.* 21,183-198.

[29] Nair, S., Howlett, M. 2018. Policy Pilots for Climate Adaptation in Indian Agriculture. In: B. Turnheim, P. Kivimaa, F. Berkhout (eds.), *Innovating Climate Governance: Moving Beyond Experiments*. Cambridge University Press: Cambridge, pp. 166-181.

Policy instrument and policy process experiments can be differentiated from other forms of policy innovation by being set-up as temporary and/or limited in scope or scale (e.g. a sample of the broader target group or a limited geographical area).[30] This means that the outcomes of the experiments inform whether the policy engagement should be continued after the experimentation phase ends (possibly becoming a permanent part of the existing policy mix) and whether it is extended to other target groups (e.g. via replication) or scaled up.

In principle in this mode, EPEs can address many types of STI policy instruments, from subsidies to tax credits, innovation vouchers, procurement, foresight and instruments aiming at building public-private partnerships and much broader national or regional systems of innovations. EPEs could focus on individual instruments as well as on policy mixes, and may focus on the policy process including goal setting, policy preparation process, policy instrument type, instrument logic, policy implementation process, or policy evaluation.[31]

However, the potential of EPEs have not yet been extensively explored in the context of innovation policy, and many instruments are not focused on promoting environmentally and socially sustainable transformation. Some countries have developed programmes for social innovation, inclusive innovation or grassroots innovation, as well as experimenting with various forms of challenge-led research and innovation funding programmes, and responsible research and innovation programmes. In these programmes funding agencies often try to break away from standard formats of programme construction, administration, focus and/or evaluation, they experiment with delegation of agenda setting to the actors, or

becoming more pro-active organising coordination moving away from a funding and forget model to becoming a strategic actor.

## 2.3 CREATING EXPERIMENTAL SPACES

Policymakers are increasingly engaged in generating interventions which are themselves experimental, and which have explicit transformational objectives beyond the formulation of new policies. These can be platforms for new interactions or, for example, geographical or regulatory spaces where mainstream rules and restrictions do not apply. This is the case of a growing number of Urban Living Labs[32] or Fablabs and Makerspaces,[33][34] for example, where the intervention consists of setting up an experimental space, forming a constituency around it and nourishing a variety of experiments. Similarly, practitioners of transition management[35] have been developing an approach for setting up 'transition arenas', hosting groups of stakeholders with the aim of envisioning a transformation, defining key experiments needed to advance the vision and selected transition pathways, and seeking to strengthen and embed the experiments in practice to facilitate change. Transition arenas can be created or endorsed by policymakers or exist outside formal policymaking channels. In the latter case, policymakers are often important participants to these arenas – as the transition pathways generated include specific policy pathways, requiring action from public administrations.[36] Perhaps of closer interest to policymakers has been policy labs,[37] which have been tried out in multiple policy contexts, while typically not in the context of transformative change.

[30] Kivimaa, P., Hildén, M., Huitema, D., Jordan, A., Newig, J., 2017. Experiments in climate governance – A systematic review of research on energy and built environment transitions. *Journal of Cleaner Production* 169: 17-29.

[31] Nair, S., Howlett, M., 2018. Policy pilots for climate adaptation in Indian Agriculture: A qualitative comparative analysis. In B Turnheim, P Kivimaa, F Berkhout (eds.) *Innovating Climate Governance: Moving Beyond Experiments*, pp. 145-165.

[32] Voytenko, Y., Mccormick, K., Evans, J., Schliwa, G., 2016. Urban living labs for sustainability and low carbon cities in Europe : towards a research agenda. *Journal of Cleaner Production* 123, 45–54.

[33] Braybrooke, K, Smith, A, 2018. Liberatory technologies for whom? Exploring a new generation of makerspaces defined by institutional encounters. *Journal of Peer Production*, 12 1, 1-13.

[34] Smith, A 2017. Innovación social, democracia y makerspaces. Revists Española del Tercer Sector (36), 49-74.

[35] Kemp, R., Loorbach, D., Rotmans, J., 2007. Transition management as a model for managing processes of co-evolution towards sustainable development. *International Journal of Sustainable Development & World Ecology* 14, 78–91.

[36] Hyysalo S, Lukkarinen J, et al. 2019. Developing policy pathways for sustainability transitions: transition arena adaptation to mid-range planning in Finnish energy policy. *Sustainability*, 11: 603.

[37] Kimbell, L, 2015. *Applying Design Approaches to Policy Making: Discovering Policy Lab*. University of Brighton. 82pp. Report from AHRC design research fellowship in Cabinet Office.

The creation of experimental spaces appears to be of increasing interest to innovation policymakers, and those in other, sector-oriented domains to support innovative developments. They are not intended to replace traditional forms of policy but co-exist and create new processes to better involve a range of actors in policy development. A challenge for TIPC is to explicitly generate interest to use and create these spaces to support transformation, rather than more incremental policy aspirations.

## 2.4 SUPPORTING, CONNECTING AND REVIEWING SOCIETAL EXPERIMENTS

In addition to or instead of setting up spaces for initiating new experiments, policymakers can also focus on supporting already existing (often bottom-up) entrepreneurial experimentation, and grassroots initiatives. A key EPE, therefore, consists of efforts to support existing experiments brought about by other actors, and intermediaries who help to articulate such initiatives.[38][39] Such an effort may also entail measuring or evaluating unfolding transformation and identifying specific needs to establish new or support existing intermediaries[40] – that are important in aggregating learning and knowledge from a larger portfolio of experiments.[41] Various governments and local authorities are seeking to develop platforms which support specific experiments and provide different degrees of intermediation for the concertation of multiple experiments.

To inform these activities, policymakers can make recourse to Strategic Niche Management (SNM)[42], an approach that emerged in the late 1990s. This approach diagnoses that radical technologies and practices are often confronted with unfavourable conditions, as they are ill-adapted to existing markets, user expectations and regulations, industry composition and infrastructures. Moreover, to become functional and competitive, the proponents of such innovations need to learn how to develop viable new socio-technical configurations, for which experimentation plays a critical role. To be able to develop, they necessitate protective spaces or niches, where experimentation and learning can occur.[43] Policymakers can create such spaces, for example, by creating arenas and platforms supported by new knowledge and advisory resources or exceptional conditions to normal rules.

SNM demonstrates that policymakers can take a proactive role in identifying emerging socio-technical configurations and supporting experimentation. The approach has a wealth of information about the processes implicated in niche formation,[44] and about the role of intermediation,[45] which also inform the Transition Management[46] approach. This differs from programme-based innovation policy in that support for experimentation does not only happen via formal research and innovation programmes and is not limited to projects funded by innovation agencies. Rather, new models are created alongside, which create spaces to engage a range of experimentation addressing a particular topic irrespective of their funding source or initiator.

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[38] van Lente, H., Hekkert, M., Smits, R., van Waveren, B., 2003. Roles of Systemic Intermediaries in Transition Processes. *International Journal of Innovation Management* 7, 247–279.

[39] Kivimaa, P., 2014. Government-affiliated intermediary organisations as actors in system-level transitions. *Research Policy* 43, 1370–1380.

[40] Kivimaa, P., Boon, W., Hyysalo, S., Klerkx, L. 2019. Towards a typology of intermediaries in sustainability transitions: a systematic review and a research agenda. *Research Policy*, 48(4), 1062-1075.

[41] Geels, F., Deuten, J., 2006. Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete. *Science and Public Policy* 33, 265–275.

[42] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. *Technology Analysis & Strategic Management* 20, 537–554.

[43] Smith, A, Raven, R, 2012. What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy* 41 (6), 1025–1036.

[44] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Technology Analysis & Strategic Management 20, 537–554

[45] Kivimaa, P., 2014. Government-affiliated intermediary organisations as actors in system-level transitions. *Research Policy* 43, 1370–1380.

[46] Rotmans, Jan, Kemp, René, Asselt, Marjolein, van, 2001. More evolution than revolution. Transition management in public policy. Foresight 3 (1), 15–31.

## 2.5 EXPERIMENTAL GOVERNANCE CULTURE

Finally, many have noticed the emergence of experimental governance culture[47], suitable for governing areas which involve substantial uncertainty and 'wicked' problems. This mode of engagement is presented here as deliberate strategies or activities to promote an experimental governance culture. The examples that exist so far have often occurred as responses to issues associated with disruptive technologies and rapidly evolving markets, as with the case of digital technologies, but is particularly salient in efforts for tackling climate change, and other complex societal challenges.[48] [49] For example, climate change is associated with substantial uncertainty; there is a multiplicity of alternatives for responding to the challenges of mitigation and adaptation, with different implications and beneficiaries. Uncertainty may overwhelm conventional planning strategies or management approaches, which rely on notions of risk management to address uncertainty.

Hence, emerging governance approaches, such as reflexive[50] and adaptive governance place experimentation as a central means for governing and not just as a useful tool for policy design. This fifth mode of experimental policy engagement may provide the learning required for the emergence of a new culture of governance that embraces and relies on experimentation. Such a culture may differ from traditional governance mechanisms by emphasising stakeholder interaction, learning, and search for alternative solutions, uncertainty and low hierarchy, not just on a temporary basis but as a structural feature.[51]

Thus, experimental governance may entail some structure. It can include (1) open-ended goals set by a central administrative body, coupled with metrics to measure progress in a manner that is open to a range of stakeholders; (2) decentralised implementation allowing actors freedom to choose the way in which the open-ended goals are pursued; and (3) specific formative monitoring and reporting mechanisms.[52] Experimental governance is about changing culture and practices within innovation policy agencies and across public administrations.

[47] Sabel, C., Zeitlin, J., 2012. Experimentalist governance. In: Levi-Faur, D. (Ed.), The Oxford Handbook of Governance. Oxford University Press, Oxford, pp. 169-186.

[48] Hoffman, M.J., 2011. *Climate Governance at the Crossroads: Experimenting with a Global Response*. Oxford University Press, New York.

[49] Laakso, S, Berg, A, Annala, M, 2017. Dynamics of experimental governance: A meta-study of functions and uses of climate governance experiments. *Journal of Cleaner Production* 169, 8-16.

[50] Voss, Jan-Peter, Dierk Bauknecht, and René Kemp (eds.). 2006. *Reflexive Governance for Sustainable Development*. Cheltenham: Edward Elgar.

[51] Antikainen, R., Alhola, K., Kangas, H-L., Stenvall, J., Leponiemi, U., Pekkola, E., Rannisto, P-H., Poskela, J. 2018. *Kunnianhimoa ja pitkajanteisyytta kokeilukulttuurin kehittamiseen* [Ambition and perseverance for developing experimental culture]. Policy Brief 34/2018, Prime Minister's Office, Helsinki.

[52] Van Asselt, H., Huitema, D., Jordan, A., 2018. Global Climate Governance After Paris: Setting the State for Experimentation. In B Turnheim, P Kivimaa, F Berkhout (eds.) *Innovating Climate Governance: Moving Beyond Experiments*, pp. 27-46.

## 2.6 SUMMARY OF EPES

Summing up, table 1 compares the five modes of experimental engagements. There are clear overlaps and complementarities between the different modes. To address an issue, policy-makers may make recourse to various engagements at different times. TIPC may want to work on all modes, except perhaps RCTs. It can work towards developing its members' capacity for employing the whole pallet of engagements.

| MODES OF EXPERIMENTAL POLICY ENGAGEMENT | MODE 1: POLICY DESIGN EXPERIMENTS | MODE 2: POLICY INSTRUMENT AND POLICY PROCESS EXPERIMENTS | MODE 3: CREATING EXPERIMENTAL SPACES | MODE 4: SUPPORTING, CONNECTING AND EVALUATING SOCIETAL EXPERIMENTS | MODE 5: EXPERIMENTAL GOVERNANCE CULTURE |
|---|---|---|---|---|---|
| Role of experimentation in policy | Assists in the formulation, calibration and justification of policy instruments | Setting up of specific experimental policy interventions in the form of new policy instruments or policy processes tried out temporally or in a small scale. | Creates dedicated environments and a constituency for experimentation, where the normal conditions (e.g. regarding permits, taxation) are relaxed. | Articulates existing experiments carried out by multiple actors, facilitates learning from and between experiments, and supports the development of networks. | Creates flexible and proactive governance arrangements, including open-ended goals, allowing decentralised and experimental interventions by multiple actors. |
| Actors involved | Policymakers, and recipients of the policy treatment | Policymakers and policy analysts, stakeholders involved in the experiments | Lead users, entrepreneurs, technology advocates, designers, civil society actors, policymakers | Networks implicated in experiments, intermediaries and policymakers | As others, but with the aim of broadening participation to actors normally excluded from policy process |
| Approaches | Randomised Control Trial, Behavioural Experiments | Experimenting with new formats in established policy instruments/ processes (programmes, subsidies, regulation) | Urban Living Labs, policy labs, walk-shops, transition arenas | Intermediary organisations and platforms, workshops, online resources | Strategies and initiatives to promote experimental culture; rewarding reflexivity and learning |

# 3. EXAMPLES OF EXPERIMENTAL POLICY ENGAGEMENTS IN TIPC MEMBER COUNTRIES

The sections below provide short examples of some approaches to experimentation and EPEs in TIPC member organisations. These can be described as early impressions based on one interview per member organisation and a half day workshop in the TIPC engagement week in September 2018 (Appendix 1). The interviewees made a choice regarding what examples were brought forward and we supported these with literature where available. While we cannot provide an overview of experimentation or EPEs connected to TIPC in member countries, we can obtain insights into some of the approaches the member organisations have taken towards experimentation for transformative change, and the issues encountered.

## 3.1 EXPERIMENTAL CULTURE, SPACES AND SUPPORT FOR EXPERIMENTS IN FINLAND

The discussion with Business Finland was conducted in the presence of a representative of the experimental team at the Prime Minister's Office. As the discussion mainly focused on the activities coordinated by the PMO, insights were not generated specifically on Business Finland's experimental activities, although innovation vouchers were mentioned. However, the innovation case history on sustainable mobility conducted in TIPC[53] showed how Business Finland is capable of initiating more experimental activities and support for niche processes beyond its standard activities.

The Finnish government adopted a specific aim for advancing *experimental governance culture* in the government programme of 2015. The implementation was supported by setting up a team for experimentation in the PMO, undertaking tasks, such as support to small experiments (both financially and through digital tools), facilitating the *democracy* aspect in experiments, and aiming for better public services. The funding rounds have focused on three themes: circular economy, artificial intelligence, and digital support for social and health care

personnel. The calls aimed to avoid heavy administrative procedures and commitment to predefined outcomes (allowing exploration and risk to fail), thus, emphasising novelty value and the team involved as main evaluation criteria. There was also an aim to experiment directly in the policy level, e.g. through the basic income and freedom to choose public health care provider *policy instrument experiments*. *Learning* has been facilitated by presentations and training regarding how to build up experimental settings, in particular in the agencies working under the supervision of ministries. All the issues have not yet been resolved, e.g. how to increase the courage of civil servants in making decisions favouring experimentation (especially in across administrative domains) and how differing treatment of policy target actors is legally dealt with. As the initiative is fairly recent, time will tell to what degree learning for policy formulation and cultural change is achieved in practice.[54]

Environmental or social sustainability have not been core drivers of experimental culture in Finland but some aspects have connected to it, e.g., through the focus on experimental activity on circular economy or basic income. Overall we would like to conclude that experimentation could become more systematically connected to transformation; such a focus is largely missing.

Preceding the PMO activity, experimentation has occurred through *experimental spaces*, typically city-level (e.g. the Smart Kalasatama district in Helsinki), and *supporting, connecting and evaluating experiments* (e.g. the Carbon Neutral Municipalities Network, HINKU). Smart Kalasatama (2009-ongoing) was selected as a national pilot project and functions as an "experimental innovation platform to co-create smart urban infrastructure and services in close co-operation with residents, city officials and other stakeholders... within the new Kalasatama district of Helsinki".[55] An important role has been carried out by an innovation intermediary, Forum Virium owned by the City of Helsinki, that has: expanded the scope of experimenting from business

[53] http://www.tipconsortium.net/about/
[54] Kemp, R, Schot, J, Hoogma, R, 1998. Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. Technology Analysis & Strategic management 10, 175-198.
[55] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Technology Analysis & Strategic management 20, 537-554.

models and technology development to smart living and co-development of services (open data, transport, sharing economy); encouraged resident participation and new actor-networks between incumbent businesses SMEs and other actors (disrupting established business alliances and creating a Developers Club); and transferring learning from international initiatives.[56]

The Carbon Neutral Municipalities HINKU network has expanded from 5 small municipalities in 2008 to over 30 smaller and larger ones in 2017. The goal is to reduce CO2 emissions by 80% by 2030 and to get municipal officials and politicians committed to change. The network is self-organising but the Finnish Environment Institute (SYKE, government research organisation) has been instrumental in supporting and intermediating the process between the municipalities and transferring learning. On the ground several bottom-up experimental projects have been carried out involving local inhabitants and businesses, particularly in the cleantech area. The joint purchase of solar panels experiment has been the most visible example of replication within the network.[57]

## 3.2 EXPERIMENTAL SPACES IN SOUTH AFRICA

Living Labs in South Africa have been used to advance open innovation, especially in rural communities, since the 1990s. They have been defined as "multi-partner, multi-component and multi-disciplinary efforts to address community problems through the use of technology", addressing emerging economies, community wellbeing, education and social media by forming platforms or ecosystems for co-creation.[58] In effect, different living labs comprise different types of experiments due to a range of ownership models, purposes and working formats. They share a focus through the development, prototyping and use of ICT-related products and services.

The LLiSA Network, hosted by the Council for Scientific and Industrial Research (CSIR) a research and development organisation responsible to the Minister of Science and Technology, advances the setting up of living labs in South Africa and facilitates national and international collaboration to enable learning through shared experiences, challenges and best practice.[59] The Department of Science and Technology (DST) has also been involved for about 5 years, and sees living labs good initiatives to 'wicked problems' when other policies are ineffective; but the DST's activities are constrained by the nature of government departments.[60] In living labs' co-creative processes "[p]rimary goals and objectives are established through engagement with all key stakeholders. This process is strengthened by the creation of an institutional memory through the establishment of a sense of community-owned challenges, and identification of good practices through the development of evaluation tools, training modules and databases of stakeholders, and clarifying Intellectual Property Right (IP) issues."[61] For example, a living lab for mobile learning reported as success factors – a commonly owned vision, strong leadership, and self-sustaining format.

From a transformation perspective the aims of SA living labs regarding community empowerment, capacity building and breaking lock-ins are important. They also allow a higher risk of failure to experimental initiatives than more traditional policies.[62]

## 3.3 COLOMBIA – EXPERIMENTATION THROUGH CHALLENGE-LED CALLS

The Green Book policy document (Libro Verde 2030), developed in cooperation between Colciencias – Department of Science, Technology and Innovation, TIPC and University of Sussex, as a step towards *experimental governance culture in Colombia*. Libro Verde outlines

[56] Ibid.
[57] Ibid. Lukkarinen et al. 2017. An intermediary approach to technological innovation systems (TIS)—The case of the cleantech sector in Finland. Environmental Innovation and Societal Transitions 26: 136-146.
[58] Coetzee, H, du Toit, I-M, Herselman M. 2012. Living Labs in South Africa: An analysis based on five case studies. *The Electronic Journal for Virtual Organizations and Networks*, Vol 14.
[59] Callaghan, R, Herselman, M. 2015. Applying a Living Lab methodology to support innovation in education at a university in South Africa. *TD The Journal for Transdisciplinary Research in Southern Africa*, 11(1):21-38.
[60] Interview with Imraan Patel, DSE, September 2018.
[61] Callaghan et al. 2015, p. 25.
[62] Interview with Imran Pateel, DSE, 21.9.2018.

steps for creating an innovation system that is inclusive, open and experimental, and aims to address and provide alternative ways to deal with societal challenges – it moves policy makers to positions of facilitators for innovation processes.[63]

Prior to that challenge-led grants have been the main EPE in innovation policy, a *policy instrument and process experiment*. There has been no formal approach to experimentation in Colciencias but they have been supported by a new generation of policymakers, and challenge-led grants have created spaces for experimentation through their differing perspective on the role of STI in transformation compared to traditional calls. For example, one of the grants has a call for proposals for peace and sustainable communities, addressing the needs of communities (e.g. water, energy) in areas of conflict and involving actors to co-creation from a previously isolated community. The programme associates with the broader challenge of peace building in Colombia, but at present mechanisms are not in place for learning and contributing to the wider challenge. The evaluation and learning activities are undefined and non-formalised from this call.[64]

Some scope for EPEs are also provided through internal workshops at Colciencias for design and monitoring (Talleres de diseño y segimiento), while a lot of what can be described as experimental happens 'by necessity', when civil servants and policymakers seek to circumvent the scarcity of funds or the challenges specific to Colombia, for which there are no self-evident solutions in STI policy (e.g. defusing conflict, reintegrating ex-combatants). These co-exist with a strong divide between experimental activities and the traditional role of the agency, i.e. implementing conventional programmes.[65] Thus, there is a need for discussing and thinking about how to more systematically integrate the idea of transformative EPEs in Colciencias, and what kind of support structures are needed to better support a culture of experimentation.

## 3.4 CHALLENGE-ORIENTED CALLS FOR EXPERIMENTATION IN MEXICO

There is no formal approach to experimentation in the National Council of Science and Technology, CONACYT. The organisation works primarily through calls for proposals, and they have been experimenting tacitly with different approaches for more challenge-oriented calls with flexibility to design bespoke calls for specific challenges. There is a great deal of experimentation in Mexico; the main strategic programme of the new CONACYT administration is called PRONACES, and is like a Grand Challenge programme addressing critical issues of migration, water pollution and violence.

The setup of the programmes, that only constitute a small part of CONACYT's overall programme portfolio, tends to be top-down challenge formulation. However, successful proposals are encouraged to spend the early phases of the project fleshing out the problem. The programmes allow for more room for stakeholders to implement projects which are more responsive to the learning process, rather than too constrained by deliverables (unlike traditional programmes that require specific outputs and include checks that they have been delivered).[66]

An example is the Mixed Funds FOMIX programme that is not constrained by traditional institutional arrangements and brings together different actors for collective learning. The programme allows for a two-step approach, in that the members of the state government, civil society, or researchers express ideas that CONACYT then works with to better understand the problem (challenge). The group conducting the project has to present a diagnostic of the problem to an international consulting group and get feedback, before they begin to implement research and innovation. The programme is framed differently in different regions of the country.[67]

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[63] www.tipconsortium.net
[64] Interview with Maria Isabel Velez Agudelo and Diego Andres Chavarro 6.9.2018.
[65] Interview with with Maria Isabel Velex Agudelo and Diego Andres Chavarro 6.9.2018.
[66] Callaghan et al. 2015, p. 25. Interview with Emilio Martinez de Velasco Aguirre & Teresa de Leon Zamora, Conacyt, Mexico 3.9.2018
[67] Emilio Martinez de Velasco Aguirre & Teresa de Leon Zamora, Conacyt, Mexico 3.9.2018

## 3.5 RESPONSIBLE RESEARCH AND INNOVATION IN NORWAY PAVING THE WAY

Responsible research and innovation has been an important influencer in Norwegian science and innovation policy (see TIPC pilot year case study). The Research Council of Norway (RCN) is gradually advancing experimental initiatives. Experiments can be seen as strategically important while typically carried out bottom up.[68]

For example, the Digital Life Norway may be seen as a 'governance experiment' by creating new types of coordinator positions and a research school (within which experimentation occurs). Further it aims "to create economic, societal and environmental value for Norway from biotechnological research and innovation through encouraging transdisciplinary research".[69] These may be signs of an emerging *experimental governance culture* at RCN. This interpretation is backed up by a white paper "Strategic Initiative Digital Life – Convergence for Innovation" and a virtual centre that functions as a learning platform,[70] a potential mechanism for *supporting experimentation*. In a sense, RCN is 'caring' for its investments and finding out new ways of working. However "without the prior development of the RRI framework, conducted as an extensive collaborative and cross-cutting process (October 2013 – December 2015),  together with the international advisory group, collaborating with EPSRC-staff and the boards of the large-scale technology programmes, countless meeting and discussions with stakeholders and business, neither the call process nor the DLN would have experimental qualities".[71] As part of this process, learning platforms were sought in the proposals and it required researchers to rethink their roles as citizen scientists to explore hidden understandings of what they do and unintended consequences of their work.[72]

While Digital Life Norway aims for environmental and social value, transformation aims have been described to relate to transforming the research and innovation system as a whole to be more anticipatory, reflexive, inclusive and responsive.[73] These aims are clearly aligned with TIPC aims, while the meeting ground between RRI practices and transformation needs further exploration. From the perspective of TIPC, further EPEs could engage in combining transformation in processes with the strengthening expectations regarding environmental and social value, and how the processes could be embedded more broadly into the system.

## 3.6 CHALLENGE-DRIVEN INNOVATION AND POLICY LABS IN SWEDEN

VINNOVA is the Swedish government agency for funding R&D and innovation. It has long oriented to new ways of working and has experimented with how to embed continuous reflexivity into the organisation and carried out challenge-driven programmes. For example Challenge-Driven Innovation (CDI) is a programme launched in April 2011. The main aim is to fund projects that develop sustainable solutions for tackling current societal challenges. Cross-sectoral cooperation between a variety of public and private stakeholders is encouraged and prominence is placed on a more holistic approach to innovation, including social and organisational aspects. Challenges in this context are understood not just as a threat but also as an opportunity for economic growth. This had led to a programme design that is believed to stimulate opportunities for transformative innovations by encouraging demand, challenge and user-driven projects spanning various actors and industries. Some key insights which have emerged from this experience are that: (1) challenge-driven funding schemes demand moving away from disciplinary organisational structures; (2) bottom-up approaches also need guidance – for many actors it may be more difficult to respond to a completely open programme than it is to understand what

[68] Elisabeth Gulbrandsen & Ellen Veie, Research Council of Norway, 3.9.2018
[69] RCN, 2016. Strategic Initiative Digital Life – Convergence for Innovation. Accessed 20/3/2019: file:///C:/Users/pk230/Downloads/DigitalLife-astrategicinitiativeinBIOTEK2021.pdf
[70] Email communication with Elisabeth Gulbrandsen 27.9.2018
[71] Email communication with Elisabeth Gulbrandsen 27.9.2018
[72] Elisabeth Gulbrandsen & Ellen Veie, Research Council of Norway, 3.9.2018
[73] Email communication with Elisabeth Gulbrandsen 27.9.2018

is expected (designing flexible, adjustable guidelines could be the key); (3) reflection, evaluation and revision is vital – new programmes and mechanisms have unintended consequences that need to be understood and addressed. New schemes should therefore allocate time and efforts for reflection and evaluation and be prepared to revise the instruments continuously. Finally, (4) sustainability transitions require policy mixes – no one single instrument will be sufficient to address all challenges in a sector. Instead, different instruments should be coordinated in order to stimulate and foster various activities that as a whole enable system transformation.[74]

This has generated a learning journey and, for example, Strategic Innovation Programmes have been added to the portfolio. However the approach has not yet been institutionalised. In addition, while programmes set explicit measures to open up networks for new collaborations and crossing policy silos, outcomes regarding the support for experiments has been limited.[75]

One of the example EPEs in VINNOVA has been their funding for policy labs. The idea behind policy labs has been to create a space for different actors across policy domains to meet to strengthen the authorities' ability to meet the issues and needs that may arise during the innovation process for innovative companies in regulated industries, in aiming for sustainable social development.[76] For example, there is a link between start-up funding from VINNOVA and the regulation of start-ups by the Financial Regulation Agency, which could be better addressed through joint policy labs.[77] It is also regarded as important

that those who are affected by the rules must be represented in the policy lab. VINNOVA also funded a policy lab in the Swedish Tax Agency from December 2017 to April 2018 that aimed to explore how to get more private people to declare tax from letting their private residence, and is currently funding a design policy lab work by a university. There is also an interest in transition labs.[78] The focus in policy lab work is the joint exploration and learning. Thus, potential for transformative innovation policy, is to connect the ongoing policy lab work better to the activities to tackle grand challenges that are at the heart of many of VINNOVA's programmes.

## 3.7 CONCLUSION ON EPES IN MEMBER COUNTRIES

It appears very likely that in all the member countries there is a lot more experimentation conducted by members, other government organisations, and other actors. Some of these experiments were referenced during the interview. In Finland, these activities include, for example, those conducted by the Prime Minister's Office experimentation team or the Finnish Environment Agency under the Ministry of the Environment. In Colombia, the policy innovation labs coordinated by the National Planning Department is another example. Overall, urban living labs are proliferating,[79 80 81 82] while there is also an increasing interest in policy labs in many of the member countries. It needs to be discussed whether it makes sense to explore a wider range of experimental initiatives in member countries from a transformative point of view in a far more systematic way during the second TIPC working programme year.

[74] TIPC TILH Case Study Sweden, Fuenfschilling, L.; Bauer, F.; Clemente, J. (2017)

[75] Grillitsch, M, Hansen, T, et al. 2019. Innovation policy for system-wide transformation: The case of strategic innovation programmes (SIPs) in Sweden. Research Policy 48(4), 1048-1061

[76] https://www.vinnova.se/en/m/inspiration-for-innovation/finansinspektionen-startar-nytt-innovationscenter/

[77] Interview with Jacob Hellman, Vinnova, 5 September 2018.

[78] Anderson, N, Ernits, H, Stolz Ehn, A-K 2018. Från living labs till transition labs
En forskningsöversikt och kartläggning av innovationsmiljöer för hållbara städer. VINNOVA rapport 2018:03. https://www.vinnova.se/contentassets/f7b65278f6274c11a2ad5d865896073d/vr_18_03.pdf

[79] Acuto, M, Steenmans, K, Iwaszuk, E, Ortega-Garza, L. 2018. Informing urban governance? Boundary-spanning organisations and the ecosystem of urban data. Area, DOI: 10.1111/area.12430

[80] Coetzee, H, du Toit, I-M, Herselman M. 2012. Living Labs in South Africa: An analysis based on five case studies. The Electronic Journal for Virtual Organizations and Networks, Vol 14

[81] Korsnes, M, Berker, T, Woods, R. 2018. Domestication, acceptance and zero emission ambitions: Insights from a mixed method, experimental research design in a Norwegian Living Lab. Energy Research & Social Science 39:226-233

[82] von Wirth, T, Fuenfschilling, L, Frantzeskaki, N, Coenen, L. 2019. Impacts of urban living labs on sustainability transitions: mechanisms and strategies for systemic change through experimentation. European Planning Studies 27(2):229-257.

When designing EPEs or interventions for existing EPEs, it has to be taken into account that all member organisations have differing mandates and organisational formats. Context really matters. The most typical examples within member organisations are challenge-related research funding programmes that address social or environmental sustainability. Many EPEs may, however, need collaboration across government sectors and reach out to non-innovation policy domains. This need is increasingly recognised by TIPC members, and some initiatives, e.g. policy labs exist.

The existing EPEs were often mentioned to exist in the margins of the activities of the member organisations, and even then sometimes hampered. For example, the challenge-related calls in Sweden and Responsible Research and Innovation calls in Norway were influenced by rules and bureaucracy regarding how innovation funding is conventionally organised. Similar experiences were reported from other countries.

At the same time, some cultural changes towards experimentation were observed through a new generation of policymakers, and increased focus on integrating aspects of responsible research and innovation. Overall, it is clear that the culture of policymaking changes slowly, and there will be variation between civil servants in terms of how open-minded or risk averse they are vis-à-vis EPEs. In many places, the existing regulatory and institutional structure still favours traditional RDI funding formats. Yet at the same time, member organisations mentioned the move away from requirements pertaining to specific outcomes/deliverables to transformative solutions/outcomes and a wish for acceptance of a higher risk of failure.

Our overall conclusion from the interviews is that there is a strong interest in EPEs, while at the same time there is a need for better ways of assessing whether they will lead to transformative outcomes. This will help to legitimise EPEs and may help navigate institutional hurdles. For this reason our work has been focused on identifying a portfolio of leverage points for EPEs, which we call *transformative outcomes*. This work has been based on desk research (literature review) and discussions during the TIPC engagement week. We want to emphasise that these transformative outcomes should be seen as *an input into a participatory co-creation process* with participants when EPEs are designed, implemented and evaluated. In this process certain elements could become prominent, and others may be added. The TIPC evaluation working group has developed a specific proposal for formative evaluation which incorporates the elements but also leaves ample place for such a co-creation process.

# 4. TRANSFORMATIVE OUTCOMES OF EPES

Transformations are very complex processes which can take several decades. Individual EPEs cannot bring about such a transformation. What they can do is to contribute to processes that constitute a transformation (or transition) and potentially shape the process underway alongside other factors. In other words, individual EPEs, or a portfolio of EPEs, can lever specific transformative outcomes.

EPEs themselves can also take a lot of time to generate and unfold, and may comprise multiple interventions. Establishing new EPE within the current TIPC framework (2018-2023) may not be feasible. Therefore, TIPC activities may also focus on existing EPEs to accomplish their transformative aims and making existing projects, programmes or policies (latter comprising both instruments and broader strategies) more transformative, as well as on setting up a new project, programme or policy with transformative aims.

How do we know whether a project, programme or policy has been made more transformative? We propose that work on EPEs in the context of TIPC focuses on a set of *transformative outcomes* that may, in combination, influence full transformations. EPEs could focus only on a limited number of these outcomes or a wider range. In any case, the broad goal is that the EPEs are focused on experimenting with forms of interventions that influence these outcomes.

Please note that the proposed transformative outcomes, presented in Section 4.2, link closely to TIPC criteria (directionality, societal goals, system-level impact, learning and reflexivity, conflict vs. consensus, and inclusiveness[83]) which have been used in selecting TIPC case studies and can also be used for selecting TIPC-EPEs. Although the transformative outcomes resonate with these criteria, they are put to use for another purpose: helping to shape the transformation processes by making them more transformative.

## 4.1 TRANSFORMATIVE PROCESSES GROUNDING TRANSFORMATIVE OUTCOMES

The set of *transformative outcomes* we have identified draw from the sustainability transitions literature, particularly literatures on Strategic Niche Management (SNM)[84] [85] and the Multi-Level Perspective (MLP)[86] This literature indicates that a transformation of socio-technical systems towards improved sustainability is a result of an *interplay between three processes*:

**1.** Successful niche building;

**2.** Niche expansion and embedding; and

**3.** Destabilisation and opening up of socio-technical regimes

Most often, these processes operate in parallel to each other, and all three are important for a successful transformation. Different sequences have been noted as transition pathways.[87] For instance, transformation could start with the destabilisation of existing regimes or strong niche building. Our stylised presentation here is based on the assumption that transformations require the interplay of these three processes.

Many historical transitions have been shown to present distinct phases,[88] in which there are emphasis on some of these processes. During the **pre-development phase**, there may be a stronger emphasis on niche building, while limited niche expansion and opening up of regimes may also feature. Generally, however, pre-development is described as a combination of articulating societal needs but reluctance to change existing arrangements.[89] **Acceleration phase** places a stronger emphasis on niche expansion and opening up regimes. Niches attract more users and begin to compete with incumbent solutions,[90]

[83] http://www.tipconsortium.net/about/

[84] Kemp, R, Schot, J, Hoogma, R, 1998. Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic management* 10, 175-198.

[85] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. T*echnology Analysis & Strategic management* 20, 537-554.

[86] Geels, F, 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy* 31, 1257-1274.

[87] Geels, F, Schot, J, 2007. Typology of sociotechnical transition pathways. *Research Policy* 36, 399-417

[88] Rotmans, Jan, Kemp, René, Asselt, Marjolein, van, 2001. More evolution than revolution. Transition management in public policy. Foresight 3 (1), 15–31.

[89] van Lente, H., Hekkert, M., Smits, R., van Waveren, B., 2011. Systemic intermediaries and transition processes. In: Guy, S., Marvin, S., Medd, W., Moss, T. (Eds.), Shaping Urban Infrastructures: Intermediaries and the Governance of Socio-Technical Networks. Earthscan, London, pp. 36–52.

[90] Kanger, L., Schot, J., 2016. User-made immobilities: a transitions perspective. Mobilities 11(4), 598–613.

while regimes may experience socio-cultural, economic, ecological and institutional changes, and collective learning.[91] In a stabilisation phase, the opening up of the regime is the salient process that may then close down around a new kind of regime. These processes may also go through iterative cycles, they are not linear.

Following the MLP perspective on sustainability transitions, we argue that it is worth distinguishing between socio-technical regimes and systems; change can be observed at the level of the system elements as well as for regime rules. Systems should be seen as the expression (phenotype) of underlying rules or routines (genotype). A socio-technical system encompasses both the supply-side and demand-side and can be understood as consisting of at least five subsystems:

1. science and technology;
2. market demand and consumer practices;
3. cultural practices;
4. governance, policies and politics; and
5. industry strategy and structure (including organisational practices and business models).

The development of these subsystems is guided by rule-sets. For example, the development of market demand and consumer practices is driven by specific market standards alongside consumer beliefs, habits and/or value. A socio-technical regime, thus, refers to the underlying system rules, some being seemingly invisible. Socio-technical systems co-evolve with regimes but various system expressions may result from a similar rule. For example, a specific consumer belief guiding action not to buy plastic packaged products can be expressed in various forms of alternative food packaging systems.

Transformations can be said to occur when there are substantial changes in these underlying rules ensuring that socio-technical systems will develop in new trajectories. In this understanding, it does not equal a product diffusion process. It is not only about the adoption of new products or processes, but also about system diffusion.[92] Transformation, thus, concerns change in:

1. systems as well as rules; and
2. the alignment between the 5 sub-systems and sub-regimes rules,
3. resulting in a new socio-technical regime.

Within the sustainability transition literature, it is sometimes assumed that experimentation is only useful at the very beginning of the transformation process and plays a role only for niche building. We argue that transformations benefit from EPEs throughout the process (from pre-development to stabilisation), while the context and focus of experimentation may change. Equally, EPEs can contribute to all three transformative processes: niche building, niche expansion and embedding, and the destabilisation and opening up of regime processes. For example, a review of governance experiments in the context of sustainability transitions noted different purposes for experimentation ranging from niche creation (associated with niche building) and market creation (linked to niche expansion) to societal problem solving (connected to a need to open up regimes that encounter fundamental problems).[93] A similar distinction between niche and regime linked experiments was noted by Sengers et al.[94] It is, therefore, not justified to tie EPEs only to the start of the transition process.

[91] Safarzynska, K., Frenken, K., van den Bergh, J., 2012. Evolutionary theorizing and modeling of sustainability transitions. Research Policy 41, 1011–1024.
[92] Geels, F, Johnson, V, 2018. Towards a modular and temporal understanding of system diffusion: Adoption models and socio-technical theories applied to Austrian biomass district-heating (1979–2013). Energy Research & Social Science 38, 138-153.
[93] Kivimaa, P., Hildén, M., Huitema, D., Jordan, A., Newig, J., 2017.  Experiments in climate governance –a systematic review of research on energy and built environment transitions. *Journal of Cleaner Production*, 169: 17-29.
[94] Sengers, F, Wieczorek, AJ, Raven, R, 2016. Experimenting for sustainability transitions. A systematic literature review. *Technological Forecasting & Social Change*.

## 4.2 TRANSFORMATIVE OUTCOMES DERIVED FROM TRANSFORMATIVE PROCESSES

What forms of EPE are likely to induce desired transition dynamics? What 'terms of engagement' are most suitable for enabling transformations? To address these questions, we draw from a specific understanding of these dynamics derived from the sustainability transitions literature, and discussions with TIPC partners in various settings, to generate a list of *transformative outcomes* that could be considered and reflexively addressed on an ongoing basis to improve EPEs. These transformative outcomes do not point to fixed solutions; they draw attention to a set of questions and dilemmas (Table 2) that assist designing, further developing, conducting and evaluating EPEs (in a formative manner). Our proposition for transformative outcomes based on the transformative processes is:

**Successful niche building**

**1.** Shielding – broadening and deepening

**2.** Learning – broadening and deepening

**3.** Networking – broadening and deepening

**4.** Expectation dynamics – broadening, deepening and opening up

**Niche expansion and embedding**

**5.** Upscaling – increasing user adoption

**6.** Replication – local and trans-local

**7.** Circulation – accumulating and intermediating

**8.** Institutionalisation – creating formal and informal rules

**De-stabilisation and opening-up of regimes**

**9.** Destabilisation – de-aligning/disrupting subsystems and regimes

**10.** Opening up – unlearning and deep learning of regime actors

**11.** Empower niche-regime interactions

**12.** Changing perceptions of landscape pressures

Experimentation's role in niche-building and niche expansion has been studied since the inception of the sustainability transitions literature. Meanwhile, its role in destabilisation and opening-up regimes has received much less attention. TIPC has the opportunity to address this gap and further explore this point which is relevant for contemporary transformations (e.g. concerning phase-out and divestment from fossil fuels). Due to the state-of-art of the current literature, some of the sections below are tentative and need further exploration which is planned for year 2. The reader should take the descriptions of the outcomes, in particular the ones related to the institutionalisation of niches, and the destabilisation and opening up of regimes as indicative.

| TRANSFORMATIVE OUTCOMES | EXAMPLE QUESTIONS FOR EPES | RELATED DILEMMAS |
|---|---|---|

## NICHE CONSTRUCTION

| | | |
|---|---|---|
| **1 Shielding – broadening and deepening** | • What kind of shielding or protection mechanisms are provided by the EPE (e.g. finance, an arena for trial-and-error, exemptions from normal rules, a niche 'market')?<br>• Does the EPE aim to generate new types of shielding or learn about how shielding works? | Shielding is usually necessary to provide an early protective space for a new niche. Regulatory and administrative rules may make shielding difficult or impossible. Shielding is likely to benefit some actors more than others. |
| **2 Learning – broadening and deepening** | • Are there explicit objectives for learning in the EPE?<br>• How is deep learning encouraged?<br>• What support structures are created to enable overcoming administrative barriers or reduce sense of risk to individual?<br>• How is risk of failure addressed?<br>• How is learning distributed or transferred and evaluated?<br>• Who benefits and who suffers from the learning generated? | Learning in multiple ways is crucial for transformation. Problems are created if learning remains within individuals or small groups, or if learning does not result in any change and is too shallow. Further, it can be difficult to detect whether more subtle and non-codified learning has taken place. |
| **3 Networking – broadening and deepening** | • What range of different actors are included and supported in the EPE?<br>• What does the new network aim at (e.g. new niche creation, niche acceleration or embedding in existing regime, unlocking path dependencies)?<br>• To what degree are incumbent actors and newcomers involved in the EPE?<br>• How are new kinds of actors found and mobilised?<br>• How to involve incumbent actors but not let old views dominate?<br>• In business networks, how is balance created between small and larger companies?<br>• Who is coordinating the network, acting as an intermediary?<br>• How different actors are included in the process or kept aware of the process (transparency)?<br>• To what extent the people included represent the needs of the EPE target group?<br>• How are more marginal 'voices' or groups taken into account?<br>• How are the costs and benefits of the EPE distributed between different individuals, actors groups and the public and private sectors? | Transformation requires novel actors with novel ideas but they need to interact with incumbent actors to enable the diffusion of ideas of change to existing regimes. However, too strong incumbency can halt the process. The balance requires careful and continuous deliberation. Also, as networking is not the purpose but the means to seek transformation, the purpose of the EPEs defines in part useful forms of networking. Inclusiveness in some form is important to widen the support for the EPE. However, to engage a large group of people may slow down the process and also let more traditional views prevail (if knowledge of possible futures is weak). Just transitions also require a fair distribution of costs and benefits, while the opinions regarding what is 'fair' is likely to differ. |

| TRANSFORMATIVE OUTCOMES | EXAMPLE QUESTIONS FOR EPES | RELATED DILEMMAS |
|---|---|---|

## NICHE CONSTRUCTION

| | | |
|---|---|---|
| **4 Expectation dynamics – broadening, deepening and opening up** | • Does the EPE include expectations regarding environmental or societal sustainability or does it address a specific transformation challenge?<br>• How are different expectations accounted for and addressed?<br>• How does the EPE represent a change of orientation to current practices?<br>• How is the process for new vision creation enabled?<br>• Is support available for multiple pathways addressing the challenge?<br>• What is the level at which directionality comes to play in: overall strategic level, or programme or project level implementation?<br>• How is the articulation of potentially changing expectations supported beyond the lifetime of the EPE? | Transformation implies a sense of direction formed by the creation and consolidation of expectations around niches. This, however, presents much uncertainty around what eventually will be sustainable solutions in the long-term. Thus, the expectations are not fixed and change along the way. Especially at niche building phase, alternative pathways should be explored. |

## ACCELERATING AND EMBEDDING NICHE INNOVATIONS

| | | |
|---|---|---|
| **5 Upscaling – increasing user adoption** | • How does the EPE contribute to upscaling a niche, and which niche(s)?<br>• Is there a strategy or purpose to upscale experiments during or after the EPE?<br>• What is the approach to attract more users?<br>• What are the benefits and drawbacks of the upscaling approach?<br>• What barriers and opportunities are present? | Upscaling is a very instrumental and often technology-focused way to think about embedding, and it may not be well suited for all types of niches and experiments. |
| **6 Replication – locally and translocally** | • How can the EPE enable the replication and learning from experiments/projects/niches?<br>• What support structures are in place to advance replication and context specific adjustments for doing the same experiments elsewhere? | Replication can be a very good way to accelerate niches, but it is not always straightforward as context specific adjustments, i.e. 'translation', and learning are required. |
| **7 Circulation – accumulating and intermediating** | • How can the EPE support the flow and circulation of knowledge and ideas, as well as resources, within the EPE?<br>• Are specific intermediary actors or platforms set up to support circulation during the EPE?<br>• What support is available to enable circulation after the EPE has ended? | Circulation has the advantage of taking into account real word 'messiness' but as it is so fluid it can be difficult to concretely advance. |

| TRANSFORMATIVE OUTCOMES | EXAMPLE QUESTIONS FOR EPES | RELATED DILEMMAS |
|---|---|---|

## ACCELERATING AND EMBEDDING NICHE INNOVATIONS

| **8 Institutionalisation – in formal and informal rules** | • Are there processes in place to identify what are the ways in which an experiment/niche alternatives can become more permanent/ mainstream?<br>• What are the mechanisms planned for institutionalising learning into rules and practices; and policy outputs into formal governance structures?<br>• Is the EPE proposing a more experimental actor-network configuration on a permanent basis?<br>• Who is the actor driving institutionalisation?<br>• Are specific intermediary actors in place to support institutionalisation? | The ideal time for institutionalisation is difficult to set, and any attempts may succeed or fail in creating more permanent change. Too early institutionalisation may lead to an ineffective outcome, if the experiment has led to non-desired effects. Further, vested interests may try to institutionalise experiments pre-maturely for economic/political gains – or prevent institutionalisation if experimentation is used as an avoidance strategy. |

## OPENING UP REGIMES AND UNLOCKING PATH DEPENDENCIES

| **9 Destabilisation – de-aligning/ disrupting subsystems and regimes** | • How does the EPE aim to unlock path dependencies?<br>• How are barriers and path dependencies identified, and which are selected in focus of the EPE?<br>• How does the EPE stimulate regime actors to identify tensions between various regime dimensions, e.g., between market demand and technologies on offer, or between regulatory requirements and demand, with respect to the environmental and social sustainability challenges?<br>• Does the EPE provide potential for learning about alternative regime arrangements?<br>• Are social movements taken on board either in the process of identifying path dependencies and tensions, or in pursuing destabilisation?<br>• How are resistance and objections addressed?<br>• How is the transparency of the process guaranteed? | Destabilisation via disrupting subsystems within a regime or arrangements across several regimes may be necessary to rapidly respond to urgent environmental and social problems. However, it is difficult to persuade those in dominant positions who are often beneficiaries of the current regimes. Social movements, systemic intermediaries and institutional entrepreneurs can facilitate destabilisation processes, but the influence of their actions is dependent on a range of factors (e.g. mandate, resources, credibility and neutrality in the eyes of other actors). |

| TRANSFORMATIVE OUTCOMES | EXAMPLE QUESTIONS FOR EPES | RELATED DILEMMAS |
|---|---|---|

## OPENING UP REGIMES AND UNLOCKING PATH DEPENDENCIES

| | | |
|---|---|---|
| **10 Opening up - unlearning and deep learning or regime actors** | • Does the EPE encourage regime actors to question their own assumptions, cognitive beliefs and values?<br>• Do they identify anomalies clearly?<br>• Do they re-assess the potential of applying regime rules for solving problems?<br>• To what extent does the EPE provide new ways of working and being to enable reconfiguration? | Opening up is important to enable regime actors to see alternative options and new opportunities and pressures clearly. However, unlearning and deep learning can be costly, requiring new organisational and administrative structures. |
| **11 Empowering niche-regime interactions** | • How does the EPE support regime actors to build new alignments and networks with niche actors and perhaps also with new actors who favour specific transformations?<br>• Are the efforts addressing a particular niche or multiple niche pathways?<br>• Are the networks created formal or informal, small or large?<br>• How are more marginal 'voices' or groups taken into account?<br>• How the costs and benefits of the EPE are distributed between niche and regime actors? | New forms of alignment brings questions about a just distribution of costs and benefits. Uncertainties regarding the future may favour an approach that building connections to multiple niches, but then limits resources allocation to and deepening knowledge about a particular niche. |
| **12 Changing perceptions of landscape pressures** | • How does the EPE encourage regime actors to re-assess the importance and requirements of landscape developments (trends and shocks) related to environmental and social problems?<br>• How are changing perceptions of landscape pressures leading to new or changed expectations regarding the regime or viability of new niches? | Re-assessing landscape developments brings questions about whether to promote and socialise certain views and lobby for them. |

For each of these processes we can identify a number of leverage points which contribute to transformation. We discuss each of them in turn.

## 4.3 SUCCESSFUL NICHE BUILDING

### 4.3.1 Transformative outcome: Shielding – broadening and deepening

Niches are spaces which provide protection for alternative socio-technical systems to develop. Such protection is necessary, because transformative innovations that hold a promise for sustainable development, and around which a new system can be built, fail at least initially to compete with dominant technologies and systems on an economic basis. Actors investing in the niche (so called niche actors) can upgrade the performance of transformative innovations and systems by nurturing them.[95] This nurturing will not only help to boost the performance of the transformative innovation (make it more competitive) and system but also construct the niche.

Niche protection consists of active and passive shielding (geographic, institutional and cultural).[96] The latter comprises of supportive conditions which happen to be present in a certain moment of time and within a certain space (city, nation-state, regions). These conditions may, for example, consist of a group of wealthy people willing to invest in an underperforming and costly pioneering innovation, or a group of civil society actors who promote an alternative way of living.[97] Active shielding consists of specific interventions from political actors and others who deliberately create positive conditions for these innovations, for example, through R&D or deployment subsidies, preferential tax treatment, public or collective purchasing, voluntary agreements, regulation, and/or information campaigns. The boundary between passive and active is fluid (and depends on when we look at this: active ones may become passive ones over time). The main point is that shielding measures create protection and a space for alternative solutions which otherwise will not get a chance to develop.

Shielding measures are usually not transformative in themselves; they provide a context.[98] An important question is which kind of shielding (context) would best enable transformation. Politicians and civil servants may want to experiment with different kinds of shielding policies, nurturing transformation through niche building. Drawing on the distinction between passive and active shielding, we call a process *broadening of shielding* when both passive and active shielding exist simultaneously. In turn, *deepening of shielding* refers to processes, where active shielding becomes passive over time, because it has transformed the context. This can happen, for example, via institutionalisation of policies on emissions reduction or energy efficiency.

If successful, the transformative innovation and the emerging system around it may be able to compete head on with the prevailing socio-technical regime. Shielding alone, however, is not sufficient for niche building, and nurturing is needed. This nurturing aims at intervening in three distinct niche building processes: learning, networking and expectation dynamics. The assumed centrality of these processes comes from the SNM literature,[99] [100] and builds upon many insights from the innovation studies literature. We discuss each process separately, each constituting a transformative outcome.

### 4.3.2 Transformative outcome: Learning – broadening and deepening

For learning to contribute to transformations, it needs to be broad and deep. Broad learning refers to learning in multiple dimensions, including:

a) Technical, scientific and design aspects, including infrastructure
b) Markets, user preferences
c) Cultural and symbolic meanings

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[95] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. *Technology Analysis & Strategic management* 20, 537-554.

[96] Smith, A, Raven, R, 2012. What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy* 41 (6), 1025–1036.

[97] Smith, A. (2007). Translating sustainabilities between green niches and socio-technical regimes. *Technology Analysis & Strategic Management*, 19(4), 427-450.

[98] In some cases, policy instruments can simultaneously provide shielding and be transformative in the institutional-regulatory context (Kivimaa, P, Kern, F, 2016. Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. *Research Policy* 45 (1), 205–217.)

[99] Kemp, R, Schot, J, Hoogma, R, 1998. Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic management* 10, 175-198.

[100] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. *Technology Analysis & Strategic management* 20, 537-554.

**d)** Industry networks and strategy

**e)** Regulations and government policy

**f)** Societal and environmental impacts

These dimensions can be addressed via changes in rules as well as more visible system elements. Learning should ideally cover all these dimensions, because successful niches eventually form a new regime, constituting all five regime dimensions (a-e), while societal and environmental impacts denote the directionality of change.

The concrete activities or functions linked to learning include, for example, knowledge gathering, processing, generation and combination; technology assessment and evaluation; prototyping and piloting; investments into new ventures, communication of knowledge; education and training; provision of advice and support; the practices of responsible research and innovation, and the activities aimed at creating conditions for learning by doing and using.[101] However, more important than the functional undertaking of these activities is the retaining of learning derived from specific experiments and the 'translation' of this learning 'into more generic and mobile forms'.[102]

Such learning needs to be reflexive to enable actors to anticipate and monitor the *directionality* of the emerging niche – and aim to make adjustments to the progress of transformation accordingly. Directionality refers not only to environmental sustainability but also to addressing social inequalities.[103] Thus, a question should be asked regarding who benefits, and who suffers, from the learning generated, and specific attention should be given to marginalised and vulnerable groups, in order to ensure just transitions.

Learning processes include first-order learning (accumulation of facts and data) and reflexive second-order learning (enabling changes in frames and assumptions; linking to the creating of conditions for learning). 'Deep' refers to the distinction between first order and second order learning,[104] and it applies to all dimensions of broad learning. For example, first order learning is about *optimising* the electric vehicle, while second order learning is asking questions about the need to mobility and place of the EVs in a broader set of mobility options, i.e. *questioning our assumptions*.

The SNM literature assumes that sustainable regime shifts require second order learning (by all actors). Second-order learning is directly related to the idea of socio-technical regimes comprising rule-sets and transforming these underlying rule-sets that drive the system. It, thus, entails a change in cognitive beliefs and values. When second order learning is missing, the process should not be regarded as transformation, and merely as regime optimisation. Second order learning is also highly important for implementing the notion of directionality in the transformation process, since through second-order learning actors open up to learn about various directionalities and, in the end, become convinced that they should support a change of directionality of the system.

### 4.3.3 Transformative outcome: Networks – broadening and deepening

The creation and expansion of new networks is a core process in successful niche building. Networking aims to create a community behind a new technology socio-technical niche, facilitate interactions between relevant stakeholders, and provide necessary resources (money, people, and expertise).[105] [106] This kind of networking needs to be *broad* and *deep*.

[101] Kivimaa, P. 2014. Government-affiliated intermediary organisations as actors in system-level transitions. Research Policy 43: 1370-1380.

[102] Turnheim, B, Kivimaa, P, Berkhout, F, 2018. Chapter 12: Experiments and Beyond, in Turnheim, Kivimaa, Berkhout (eds.), Innovating Climate Governance: Moving Beyond Experiments. Cambridge University Press, Cambridge, pp. 216-241

[103] Schot, J. Steinmueller, W.E. 2018. Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy* 47, 1554-1567

[104] Brown, H, Vergragt, P, 2008. Bounded socio-technical experiments as agents of systemic change: The case of a zero-energy residential building. *Technological Forecasting and Social Change*, 75(1), 107–130.

[105] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. *Technology Analysis & Strategic management* 20, 537-554.

[106] van der Laak, W., Raven, R., Verbong, G., 2007. Strategic niche management for bio-fuels: analysing past experiments for developing new biofuel policies. Energy Policy 35, 3213–3225.

Broad is operationalised in two ways: (1) including industry, government, users and civil society and (2) including niche and regime (incumbent) actors, with a substantial voice for niche actors, i.e. newcomers and actors who want to break regime rules and unlock path dependencies. Research has shown that broad networks induce second order learning, and also that user and civil society involvement is crucially important for second-order learning. Broad networking is not only important for functional reasons but also impacts directly on the directionality of the transformation process, in particular its inclusive nature. Intermediary actor are important in broad networks in different ways: to act as seemingly neutral actors to facilitate dialogue, and at the same time work towards consolidating the niche.[107]

These networks should be also deep, meaning that the actors involved in niches are in the position to mobilise resources and commitment from organisations and networks they represent. Here the notion of underlying networks is relevant. This means, for example, that some actors may simultaneously advocate a niche but have a significant position in a regime (either the regime that a niche addresses or another regime) to have mobilising power. For example, an electricity company may be an influential actor in advocating the electric vehicles niche, or an ICT company advocating a new mobility services niche.

Deep means also the consideration of inclusivity and different 'voices'. The starting point of the sustainability transitions literature has not been focused on social justice and questions of inclusivity, which have more recently began to receive attention. Inclusiveness is an important consideration, because 'transitions have

the potential to create or reinforce injustices',[108] while experimentation (e.g. basic income experiments) may also provide an avenue to explore new solutions to social problems. Transitions include significant issues of justice, the (re-)distribution of benefits and costs, and poverty – that need to be explicitly addressed and continuously evaluated via different elements, including networks. The idea of 'just transitions'[109] should be embraced as part of the networks contributing to niche building. Inclusiveness and diversity, thus, mean that a niche, or an experiment, should aim to generate processes that take into account and enable the participation of a wide range of actors, including also more marginalised groups and poorer people. This does not necessarily mean that all kinds of people are actively involved but that their views are taken into account and they are kept informed about the processes – in ways that are accessible to different groups.

### 4.3.4 Transformative outcome: Expectation dynamics – broadening, deepening and opening up

The need to develop ambitious and positive long-term expectations to steer transition processes in societally desirable directions is well acknowledged in transitions research.[110] Expectations forming around niche building are shared, specific enough to provide guidance for learning and exploration, and legitimise actions taken to shield and nurture.[111][112] Expectation dynamics should lead to the formulation of shared visions, taking into account also needs and requirements of different actors (broadening) and sustainability aims (deepening).[113] Articulation of expectations and visions can partly shape societal developments, for example, by creating a shared narrative for actors (policymakers, citizens, civil society,

[107] Kivimaa, P; Boon, W; Hyysalo, S; Klerkx, L, 2019. Towards a typology of intermediaries in sustainability transitions: a systematic review and a research agenda. Research Policy, 48(4): 1062-1075

[108] Köhler J, Geels F, et al., 2019. An agenda for sustainability transitions research: State of the art and future directions. Environmental Innovation and Societal Transitions.

[109] Swilling, M, Anneche, E, 2012. Just Transitions: Exploring Sustainability in an Unfair World. UCT Press & United Nations University Press.

[110] van Lente, H., Hekkert, M., Smits, R., van Waveren, B., 2003. Roles of Systemic Intermediaries in Transition Processes. International Journal of Innovation Management 7, 247–279.

[111] Schot, J, Geels, F, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Technology Analysis & Strategic management 20, 537-554.

[112] van der Laak, W., Raven, R., Verbong, G., 2007. Strategic niche management for bio-fuels: analysing past experiments for developing new biofuel policies. Energy Policy 35, 3213–3225.

[113] Kivimaa, P, 2014. Government-affiliated intermediary organisations as actors in system-level transitions. Research Policy, 43(8): 1370–1380

business and industry) and legitimacy for a direction of travel. Policy cannot alone create these visions but can contribute to these by indicating directionality (e.g. through strategies, programmes, regulation, subsidies and taxation) that support the efforts of others towards sustainability. Institutional entrepreneurs[114] are likely to play a role in these processes.

While directionality connects to all of our transformative outcomes, it is particularly guided by expectation dynamics. Directionality has been defined as '*making social choices over alternative pathways of development*' by explicitly considering direction in policymaking and creating a process of developing collective priorities about the kind of future we want.[115] Thus, for example, research and innovation funding, should be directed on the basis of environmental and social sustainability alongside economic development – and form genuine justifications for public funding. Following the work of Andy Stirling, we would like to call this process *opening up* of expectation dynamics for the question of directionality.

The original SNM hypothesis was that expectation dynamics in experiments would contribute to successful niche building, because expectations and visions may become more robust (shared among the broad network), more specific (about directionality) and having a higher quality (substantiated by the results of experiments and other studies). This hypothesis has not been confirmed in research. Expectations do not seem to change much,

mainly due to the fact that in the experience expectations are never challenged or further developed, probably because they are often important for the actors' own belief in the importance of the transformative innovation. Expectation dynamics follow a hype-cycle pattern,[116] shaped by policy and media discourses. While accepting that hype cycles may be unavoidable, our hypothesis still is that it would be important for experiments to contribute to the *broadening* of expectation dynamics (or its robustness, with the inclusion of different groups of actors), *opening up to directionality* (defined as opening up of expectations to various socio-technical options and providing specific reasons why some are preferred) and *deepening* of expectation dynamics (or its quality, in terms of considering different dimensions of sustainability).

## 4.4. EXPANSION AND EMBEDDING OF NICHES

Nurturing a niche is not sufficient for transformation. It is likely that many niches do not scale up, hindering a transition and niche acceleration. In the literature various aspects are stressed and different frameworks and typologies exist for this process of expansion and embedding for niches and experiments.[117] [118] [119] [120] In this document, we synthesise these results into a framework with four elements: growth/upscaling, replication, circulation and accumulation, and institutionalisation.[121]

[114] Jolly, S, Spodniak, P, Raven, R, 2016. Institutional entrepreneurship in transforming energy systems towards sustainability: Wind energy in Finland and India. Energy Research & Social Science 17, 102-118.

[115] Schot, J. Steinmueller, W.E. 2018. Three frames for innovation policy: R&D, systems of innovation and transformative change. Research Policy 47, 1554-1567

[116] Verbong, G, Geels, F, Raven, R, 2007. Multi-niche analysis of dynamics and policies in Dutch renewable energy innovation journeys (1970–2006): hype-cycles, closed networks and technology-focused learning. Technology Analysis & Strategic Management 20, 555-573.

[117] Naber, F, Raven, R, Kouw M, Dassen T, 2017. Scaling-up Sustainable Energy Innovations. Smart Grids in the Netherlands. Energy Policy 110, 342-354.

[118] van den Bosch, S, Rotmans, J., 2008. Deepening, Broadening and Scaling up: a Framework for Steering Transition Experiments. Knowledge Centre for Sustainable System Innovations and Transitions (KCT). Retrieved from http://hdl.handle.net/1765/15812

[119] Jolly, S., Raven, R., Romijn, H, 2012. Upscaling of business model experiments in off-grid PV solar energy in India. Sustainability Science, 7(2), 199–212.

[120] Geels, F., Raven, R, 2006. Non-linearity and expectations in niche-development trajectories: Ups and downs in Dutch Biogas Development (1973–2003). Technology Analysis & Strategic Management, 18, 375–392.

[121] Drawing influence from Turnheim, B, Kivimaa, P, Berkhout, F, 2018. Chapter 12: Experiments and Beyond, in Turnheim, Kivimaa, Berkhout (eds.), Innovating Climate Governance: Moving Beyond Experiments. Cambridge University Press, Cambridge, pp. 216-241

### 4.4.1 Transformative outcome: Upscaling – increasing user adoption

The expression of scaling up is based on the idea of technology diffusion, where a technology when scaled up implies bigger units and broader market infiltration.[122] In the context of socio-technical change it is harder to apply, but in a general sense implies that the niche grows in size, so that it involves more people (in particular users) and organisations.[123] This growth could happen simply because of expansion. For example, car sharing is not only used by a specific group of people but usage becomes more wide-spread. Alternatively, this could happen because the boundaries between niches become fluid, for example, electric vehicle use and car-sharing niches start to merge, because many people driving electric vehicles become car-sharers. In diffusion theory this is the key factor for upscaling: more adoption by people. Also for system diffusion it is very important that more people start to use the system (various elements), or perhaps we should say use the rules and mainstreaming them into the practices of consumers, businesses or public administrations. Thus, for EPEs the question is by which mechanisms EPEs could learn about the ways to upscale a particular niche or a merger of two niches.

### 4.4.2 Transformative outcome: Replication – locally and translocally

Replication refers to the geographical expansion of the niche. The niche is replicated or reproduced in another place. Replication can refer to a process of rebuilding the entire niche of just focus on specific elements of the niche.[124] This process of replication is not necessarily based on connection, it happens that similar niches emerge at different places without a strong connection. We also do not assume that replication leads to similar niches, since circumstances may differ substantially and niche development is place based and specific for

each context. So replication in another place may lead to adaptation and in the end a different type of niche – being more transformative in one place and less in another.

Yet to consider niche development as replication and contributing to the overall process of niche expansion certain minimum similarities should be in place, and replication should not only involve an element of contextualisation, but also of de-contextualisation in order to grow a larger market and expand the niche leading to broader socio-technical change. This de-contextualisation implies mobility of various system elements and various rules to be replicated in new contexts, in which they have to be anchored to influence particular contexts.[125]

### 4.4.3 Transformative outcome: Circulation – accumulating and intermediating

Circulation refers to ideas, people, rules, products and texts circulating between niches. It focuses on the process of de-contextualisation and re-contextualisation. This circulation is often promoted and facilitated by specific actors who aim for building connections across niches and experiments. We may call them intermediary actors. They help the accumulation of lessons and ideas across various niches and regimes, and claim this learning process as their territory. Circulation is a stepping stone for the process of the building of a social-technical regime but should not be conflated with it, because it does not aim for that.[126]

### 4.4.4 Transformative outcome: Institutionalisation – in formal and informal rules

Institutionalisation is a crucial process of generating more permanent influence. Institutions are building-blocks of social order that integrate collectively enforced expectations with respect to the behaviour

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[122] Turnheim, B, Kivimaa, P, Berkhout, F, 2018. Chapter 12: Experiments and Beyond, in Turnheim, Kivimaa, Berkhout (eds.), Innovating Climate Governance: Moving Beyond Experiments. Cambridge University Press, Cambridge, pp. 216-241

[123] Jolly, S., Raven, R., Romijn, H, 2012. Upscaling of business model experiments in off-grid PV solar energy in India. Sustainability Science, 7(2), 199–212.

[124] Turnheim, B, Kivimaa, P, Berkhout, F, 2018. Chapter 12: Experiments and Beyond, in Turnheim, Kivimaa, Berkhout (eds.), Innovating Climate Governance: Moving Beyond Experiments. Cambridge University Press, Cambridge, pp. 216-241

[125] Carvalho, L, Lazzerini, I, 2018. Anchoring and mobility of local energy concepts , in Turnheim, Kivimaa, Berkhout (eds.), Innovating Climate Governance: Moving Beyond Experiments. Cambridge University Press, Cambridge, pp. 49-68

[126] Geels, F., Deuten, J., 2006. Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete. *Science and Public Policy* 33, 265–275.

of actors or the enactment of activities, including rights and obligations for actors.[127] Thus, for niches to institutionalise, the rules and norms emerging around a niche should become more collectively adopted and stable. Geels and Deuten describe this process as 'establishment of dominant cognitive rules', including knowledge to be institutionalised via standards and text books resulting in a collective knowledge reservoir.[128] People participating in the niche need to agree on common definitions, standards and preferred types of behaviours and interpretations. This involves a process of professionalisation and use of agreed rules in socialisation processes and education programmes linked to the niche turned into a regime. This is not straightforward, as the new standards compete against pre-existing ones. A process of legitimising innovation through the development of narratives can be a useful way,[129] to be experimented with.

## 4.5. DE-STABILISATION AND OPENING UP OF REGIMES

Sustainability transitions research has recognised that niche building and expansion are not sufficient, and transformative change also requires processes changing the regimes from within. However, in the literature, this dimension has attracted less attention, as the focus of the sustainability transitions and innovation studies has been on the emergence of potentially disruptive innovations. Influenced by the sustainability transitions literature, we name associated transformative outcomes as destabilisation,[130] opening up, empowering niche-regime interactions,[131] and changing perceptions of landscape pressures.

### 4.5.1 Transformative outcome: Destabilisation – de-aligning and disrupting subsystems and regimes

Multiple or significant negative environmental or social impacts often call for regime destabilisation to allow new niches to transform the incumbent regimes. This process has been labelled as regime destabilisation, the "weakening reproduction of core regime elements" that are seen as necessary to create "windows of opportunity" for embedding niche innovations.[132] The process of destabilisation of regimes can also be conceptualised as unlocking existing path dependencies that may involve all system elements: science and technology, markets and user preferences, industrial structures, regulations and policies, and the underlying organisational structures. A regime-shift therefore entails changing course, and the creating of new path-dependencies.

The notion of path dependence is helpful because it alludes to the fact that regimes create specific directionalities. Socio-technical change is optimised following a certain path, for example, cleaning fossil fuels instead of increasing low-carbon production. Path dependencies become problematic when the path creates significant detrimental impacts in terms of sustainability and/or lead to inefficient or inferior systems when the world around changes. Path dependency has been described as extraordinary rigidity of the stabilised solution,[133] causing a lock-in where subsequent developments are predetermined as long as the lock-in exists.[134] Individual actors become entrapped in the system's dynamics.[135] The latter point is important, as

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[127] Streeck, W, Thelen, K. 2005. Introduction, in Beyond Continuity: Institutional Change in Advances Political Economies, W. Streeck, K Thelen (eds), Oxford University Press, pp. 1-39.

[128] Geels, F., Deuten, J., 2006. Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete. *Science and Public Policy* 33, 265–275.

[129] Fuenfschilling, L, Truffer, B, 2016. The interplay of institutions, actors and technologies in socio-technical systems — An analysis of transformations in the Australian urban water sector. Tech Forecasting and Social Change 103, 298-312.

[130] Turnheim, B, Geels, F, 2012. Regime destabilisation as the flipside of energy transitions: lessons from the history of the British coal industry (1913–1997).Energy Policy 50, 35–49.

[131] Smith, A, Raven, R, 2012. What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy* 41 (6), 1025–1036.

[132] Turnheim, B, Geels, F, 2013. The destabilisation of existing regimes: confronting a multi dimensional framework with a case study of the British coal industry (1913–1967). Research Policy 42, 1749–1767.

[133] Arthur, K, 1994. Increasing Returns and Path Dependence in the Economy, University of Michigan Press, Ann Arbor, MI.

[134] Sydow, J, Windeler, A, Müller-Seitz, G, Lange, K, 2012. Path constitution analysis: a methodology for understanding path dependence and path creation", Business Research 5, 155-176.

[135] Sydow, J, Schreyögg, G, Koch, J, 2009. Organizational path dependence: opening the black box, Academy of Management Review 34, 689-709.

destabilisation is also about disruptive processes that may make existing skills, capabilities and resources obsolete.[136] Thus, processes aiming for destabilisation should also consider aims to reskill people and convince, for example, incumbent industrial actors of the opportunities that exist through major reconfiguration. This also connects to the transformative outcome of niche-regime empowerment (Section 4.5.3) by requiring new actor-networks (that comprise both niche and regime actors) to take part in destabilisation processes.

In the context of destabilisation, also major policy change has been highlighted, because "it shapes both the direct support for industries… and economic frame conditions".[137] Further, such policy change should incorporate control policies that internalise environmental externalities via regulation and taxes (e.g. emissions trading); significant changes in regime rules incorporating structural changes in legislation or new overarching laws (e.g. the climate change act, or the transport service act), reduced support for regime technologies (e.g. removing subsidies, banning harmful technologies) and changing actor networks by breaking the dominance of incumbent-only networks.[138] The role of policy experimentation can be to explore the patterns, opportunities and challenges associated with destabilisation and destabilising policies – with an aim to create deep learning about different ways to mitigate problems associated with destabilisation.

Destabilisation processes are likely to require intermediaries that work with various ways of destabilisation, frequently simultaneously working on supporting niche building or expansions for several niches. Intermediaries can work on destabilisation by challenging old structures and disrupt markets, practices and networks in different ways: bringing up new discourses and ways of thinking,[139] convening innovation champions from different constituencies, renegotiating regime rules, and disrupting existing R&D alliances.[140]

## 4.5.2 Transformative outcome: Opening up – unlearning and deep learning of regime actors

A complementary or alternative process to destabilising, depending on the type of transition, is opening up. This is less about forces that specifically disrupt but more about regime actors (voluntarily) beginning to question their assumptions, cognitive beliefs and values, leading ultimately to new ways of thinking. In system terms such opening up may lead, for example, to new types innovation programmes (funding not only technologies and product development but also services and social innovations; and civil society alongside firms) or relaxing rules or assumptions regarding how things should be done.

Regimes need continuous enactment by actors; they are not cultural dopes who apply rules automatically. On the contrary, regime actors strongly believe in the viability of regimes for confronting problems, as well as its legitimacy. In other words, regimes fit the values of regime-actors. At the same time regime stability results from economic factors, since applying regime rules allows actors to respond to existing market demands in a cost-effective way. Shifting to new rules would generate higher costs for which the market does not exist or is small (a niche). This is associated with an acceptance of risks and uncertainty, and costs of reorganisation in short to medium term.

Unlearning and deep learning are important processes connected to opening up. Unlearning previous ways of thinking and behaving in systems is not easy but, is necessary, to open up to generate deep learning about alternative system configurations. For example, to use new shared mobility services, we need first to unlearn from the habits and thinking connected to private vehicles, before we can begin to develop new ways of creating and using shared mobility – possibly leading to new patterns around everyday lives.

[136] Abernathy, W, Clark, K, 1985. Innovation: mapping the winds of creative destruction. *Research Policy* 14, 3–22.

[137] Turnheim, B, Geels, F, 2012. Regime destabilisation as the flipside of energy transitions: lessons from the history of the British coal industry (1913–1997).Energy Policy 50, 35–49. P. 46

[138] Kivimaa, P; Kern, F, 2016. Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. *Research Policy*, 45(1) pp. 205-217

[139] Kivimaa, P., 2014. Government-affiliated intermediary organisations as actors in system-level transitions. *Research Policy* 43, 1370–1380.

[140] Matchoss K, Heiskanen, E, 2018. Innovation intermediary challenging the energy incumbent: enactment of local socio-technical transition pathways by destabilisation of regime rules. Technology Analysis and Strategic Management 30(12), 1455-1469.

### 4.5.3 Transformative element: Empowering niche-regime interactions

The interaction between niches and a regime, as well as between multiple regimes plays a role in transformation. For example, when or if electric vehicles gain a majority over conventional combustion engine vehicles, this involves interaction between the electric vehicles niche and the transport regime, as well as between transport and electricity regimes. The interaction of regimes, and their co-evolution around one or multiple niches, has been acknowledged in the sustainability transitions literature.[141] [142] [143]

What happens to a destabilised regime? Niches do not often replace a regime but their expansion leads to a reconfiguration of the ecology of regimes and niches. Regimes may become niches but new regimes do not just substitute for the old ones. In the transformation process, niches redefine needs, markets and institutions. They do not just fulfil the same need in another way. If this happens, it would be called a regime-optimisation. Under specific circumstances, regimes do not emerge from niche expansion but derive more fully from strategic reorientation of regime actors. There is an emerging literature which recognises the role of incumbents in driving regime change.[144] Although we acknowledge this role, in our analysis we assume a mixture of niche development, expansion and the opening-up of regimes following its destabilisation, with a varying importance of each process.

Empowerment is relatively recently conceptualised more specifically in the sustainability transitions literature. Smith and Raven suggest that this involves both processes that make niche innovations competitive within unchanged selection environments (fit-and-conform to the regime) and processes that contribute to changes in mainstream selection environments in ways favourable to a path-breaking niche innovation (stretch-and-transform the regime).[145] For example, biofuels have not significantly transformed the transport regime but largely fitted in the existing system around combustion engine vehicles.[146] Similarly, while electric vehicles require changes in charging infrastructure, so far changes to mobility patterns and rules have been minimal. In contrast, for example, shared mobility services, if empowered, involve more significant changes in regime rules and practices. It is clear that the stretch-and-transform empowerment is more rare and difficult. However, "when innovations are empowered to 'breakout' of their protective spaces, some induce far-reaching implications for wider institutions, infrastructures and other structural dimensions of the selection environment".[147]

Thus, transforming via niche-regime interaction relies on processes of change within the regime and society, and the economy more broadly.[148] This process can be difficult for both regime and niche actors, and transformation has been described as "a particular power struggle between the current regime, upcoming niches and landscape pressures".[149] Transformation is also complicated by niche actors' wishes to keep the protective measures in place, while they no longer may need such to compete.[150]

[141] Geels, F, 2007. Analysing the breakthrough of rock 'n' roll (1930–1970) Multi-regime interaction and reconfiguration in the multi-level perspective. Technological Forecasting and Social Change 74(8), 1411-1431.

[142] Raven, R, Verbong, G, 2007. Multi-Regime Interactions in the Dutch Energy Sector: The Case of Combined Heat and Power Technologies in the Netherlands. Technology Analysis & Strategic Management 19(4), 491-507.

[143] Sunderland, L-A, Peter, S, Zagata, L, 2015. Conceptualising multi-regime interactions: The role of the agriculture sector in renewable energy transitions. Research Policy 44(8), 1543-1554.

[144] Ghosh, B, Schot, J, 2019. Towards a novel regime change framework: studying mobility transitions in public transport regimes in an Indian megacity. Energy Research & Social Science, 51, 82-95.

[145] Smith, A, Raven, R, 2012. What is protective space? Reconsidering niches in transitions to sustainability. Research Policy 41 (6), 1025–1036.

[146] Upham, P, Kivimaa, P, Mickwitz, P, Åstrand K, 2014. Climate policy innovation: a socio-technical transitions perspective. Environmental Politics, 23 (5), 774-794

[147] Raven, R, Kern, F, Verhees, B, Smith, A, 2016. Niche construction and empowerment through socio-political work. A meta-analysis of six low-carbon technology cases. Environmental Innovation and Societal Transitions 18, 164-180.

[148] Smith, A, Raven, R, 2012. What is protective space? Reconsidering niches in transitions to sustainability. Research Policy 41 (6), 1025–1036.

[149] Avelino, F, Rotmans, J, 2009. Power in Transition: An Interdisciplinary Framework to Study Power in Relation to Structural Change. European Journal of Social Theory 12(4), 543-569.

[150] Ibid.

Another factor is that "individual actors have significant relationships (through which they seek to access resources to achieve their individual goals) that influence their behaviour simultaneously at a number of different scales", not only driven by economic concerns but also trust and culture.[151] However, at the same time, regime actors can work as proponents of change facilitating niche-regime interactions. For example, regime-based transitions intermediaries have been found influential actors in many cases; while partly constrained by their mandate, they are in an ideal position to advance day-to-day work with multiple niches.[152] They can, for example, support the creation of a policy environment that is favourable to niche innovations,[153] or translate new, potentially destabilising forms of regulation to a language that is easier for innovators to understand.[154]

### 4.5.4 Transformative outcome: Changing perceptions of landscape pressures

A broader outcome associated with destabilising and opening up is the changing perceptions of regime actors of landscape pressures. For example, while human influenced climate change has been known to occur for several decades, it is only recently that many regime actors – including large companies, the finance sector, and policy makers – have perceived this as a significant and real threat that influences activities across the society. Little research exists that have analysed the change in the perceptions of regime actors about the broader landscape. The changing of perceptions intertwines closely with opening up of regime actors to unlearn and change their ways of being and doing.

[151] Coenen, L, Benneworth, P, Truffer, B, 2012. Toward a spatial perspective on sustainability transitions. Research Policy 41, 968-979.
[152] Kivimaa, P., Boon, W., Hyysalo, S., Klerkx, L. 2019. Towards a typology of intermediaries in sustainability transitions: a systematic review and a research agenda. *Research Policy*, 48(4), 1062-1075.
[153] Polzin, F, von Flotow, P, Klerkx, L, 2016. Addressing barriers to eco-innovation: exploring the finance mobilisation functions of institutional innovation intermediaries. Technol. Forecast. Soc. Change 103, 34–46.
[154] Fischer, J, Guy, S, 2009. Re-interpreting regulations: architects as intermediaries for low-carbon buildings. Urban Studies 46 (12), 2577–2594.

# 5. CONCLUSIONS

The notion of EPEs can help foster a dialogue between practitioners, researchers and policymakers, enabling enhanced learning opportunities, and a new rationale well-suited for the challenges ahead. However, experimental approaches alone are not enough to advance transformative innovation. They need to embrace and support a range of transformative outcomes that facilitate the emergence and diffusion of new niches, as well as destabilise and open up regimes to new socio-technical systems – that better account the Sustainable Development Goals. Experimenting with these forms of policy action will also push research into new avenues, help develop novel methods, and provide insights into the governance of transformative change.

In this report we elaborated five types of experimental policy engagements (EPEs), of which at least four are potentially useful as part of transformative innovation policy: experiments within the confines of traditional policy instruments and processes; policymakers creating new experimental policy spaces and arenas; policymakers supporting already ongoing experimentation by supporting and consolidating learning (e.g. via intermediary actors and platforms), and policymakers engaging with more permanent forms of experimental culture – which may include the four other forms of EPEs.

We have initiated our exploration of this topic by a brief survey and interviews with participating TIPC member organisations. This shows that interesting experimental initiatives are taking place in TIPC member countries, but they are only a start in the journey towards transformative innovation policy. While transformative in some aspects, they do not yet take into account the broad array of elements needed to support transformation via experimentation.

Therefore, in this document, we propose a portfolio of 12 transformative outcomes drawing from the sustainability transitions literature, and have elaborated a tentative set of questions to aid their application in formulating or further developing EPEs. Further, we argue that it is important to recognise that experimentation is needed and can take place to support transformation processes of *niche building and expansion as well as regime destabilisation and opening up*. The specific categorisation of four regime destabilisation and opening up outcomes (destabilising, opening up, empowering niche-regime interactions, and changing perceptions of landscape pressures) is also a new contribution to the academic literature. Our elaboration of this dimension needs more work. We plan to further develop the understanding and usefulness of the transformative outcomes in concrete work with TIPC members on new and existing experimental engagements. In this work we aim to integrate the transformative outcomes into a formative evaluation method as developed and proposed by TIPC.[155]

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[155] Boni, A, Giachi, S, Molas-Gallart, J, 2019. Towards a Framework for Transformative Innovation Policy Evaluation, TIPC report March 2019.

# APPENDIX 1

# LIST OF METHODS AND PARTICIPANTS

## INTERVIEWS & SURVEYS:

Emilio Martinez de Velasco Aguirre & Teresa de Leon Zamora, Conacyt, Mexico 3.9.2018

Elisabeth Gulbrandsen & Ellen Veie, Research Council of Norway, 3.9.2018

Heli Karjalainen, Business Finland & Johanna Kotipelto, Prime Minister's Office, Finland 3.9.2018

Maria Isabel Velez Agudelo & Diego Andres Chavarro, Colciencas, 6.9.2018

Göran Marklund, Daniel Johansson and Jacob Hellman, VINNOVA, Sweden, 5.9.2018

Imraan Patel, Department of Science and Technology, South Africa, 21.9.2018

## POLICY EXPERIMENT WORKSHOP, 2.10.2018

A 4-hour workshop with 39 registered participants including all the TIPC members. The programme comprised a presentation of results from country interviews, an initial idea of transformative outcomes for EPEs, and a World café style design of funding call for transformative experiments (with three rounds).

The five modes of understanding of experimentation introduced in the research brief (Torrens and Schot, 2018) were accepted as a basis for further development of the work, yet it was agreed they need more examples using the material collected in the questionnaires and interviews conducted with representatives from each member country.

Two types of feasible TIPC experimental policy engagements were discussed: 1) strengthen transformative dimension of a new program; 2) intervention in existing program with aim to strengthen transformative dimension. The introduced list of transformative outcomes was seen as a reasonable starting point but in need of further development, in particular through process of co-design with the members. There was a need expressed for more examples of experimental policy engagement from the member countries, while others were emphasising the need to take a deeper approach to better understand country contexts and politics. The deeper approach was especially called for to analyse whether existing experimental engagements are really transformative or not (this is often difficult to see from very narrow descriptions). There was discussion about whether intervention such as a call can be transformative in itself, perhaps the preparation phase of the calls and implementation is more important. Another point raised was that we should also focus on tweaking governance structures and adding reflexivity, building networks and capabilities. It was argued that experimentation, evaluation and training are all connected, and perhaps can be seen as adding reflexivity. The issue was discussed to what extent TIPC can only act as observer, adding reflexivity, or can also be involved in the actual process.

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