



TIP RESOURCE LAB

TOOLS · ACTIONS · LEARNINGS

Component 1: Developing a theory of change for a sociotechnical system

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User guide

The world is facing severe challenges, such as climate change, species depletion, poverty, and inequality. These challenges are complex and intertwined – the consequences of historical developments in science, technology and society, including the denial of planetary limits, the false dichotomy of humanity and nature, and the neglect of social justice.

Science and engineering can contribute to solving these challenges, but solutions to deep-rooted problems also require fundamental change in practices and behaviours. Public policy can make an important contribution, but is often constrained by existing practices and rules, based on incremental improvement rather than fundamental change.

Grounded in sustainability transitions research, Transformative Innovation Policy (TIP) thinking contends that to solve the severe and complex social and environmental challenges of our age, we need a ‘systemic’ understanding of society and a transformative theory of change that does not rely only on policy or technological innovation.

This **User guide** to **Component 1**, the first in the Transformative Innovation Policy Resource Lab (TIP Resource Lab), sets out how a systemic understanding of how we meet social needs, viewed through the lens of transitions theory and anticipatory thinking, can help us to reframe our understanding of how change happens and identify areas, activities and programmes for policy experimentation.



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Section 1: Understanding the system

A TIP approach thinking embraces a systemic understanding of society. A systemic understanding of society has many advantages. First, it allows individual actors to collaborate, coordinate and negotiate with other actors to gain complementary knowledges and a fuller understanding of the severity and depth of societal problems.

Secondly, a systemic understanding allows us to look beyond the market mechanisms – demand-supply, production-consumption – to recognise values, cultures and expectations that drive choices and decisions.

Third, given the intertwined nature of sustainability challenges, a systemic view enables actors to think beyond sectors of the economy, or growth, de-growth and post-growth debates. Historically, economic development, at the cost of environmental degradation and social inequality has done severe harm by marginalising entire populations, destroying species and ecologies. Viewing societies as a combination of systems, addresses the inherent issue of separating economy from society. A systemic lens helps us to focus on holistic development of humans as part of nature, living within planetary limits.

Before we go into how changing socio-technical systems can help us to solve social and environmental problems, let's first explore what a system can be comprised of.

Pentagonal system maps help us to visualise and illustrate the position and relationship of elements within a particular socio-technical system required to meet societal needs, e.g. a system for water supply.

In TIP theory, actors, materials, and rules are the key elements that comprise a system. The socio-technical aspect of a system is inclusive of many actors, but those actors who play a direct role, keeping the system running, are often the focus of attention. These actors can be organisations, formal or informal groups, or individuals. They may belong to multiple dimensions of the system, such as science and technology, policy and governance, investment and finance, society or culture and markets. Within a system, actors collaborate, interact, negotiate and coordinate their actions in their own interests and, sometimes, with regard to the interests of others.



Example: Infrastructure development and biodiversity loss

Policymakers working with social scientists, and with local communities, are better equipped to tackle local injustices caused by infrastructure development (eg. highways) that adversely affects local biodiversity (eg. animals crossing the road).



Example: Energy efficient cookstoves

Slow uptake of energy efficient cookstoves, despite policies and rapid innovations around cooking technologies, can only be understood from the perspective of socio-economic affordabilities; the roles of men and women in cooking for families; family sizes; and eating habits.



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Systems of interest in transitions work also have a material basis: actors possess and/or use materials to meet their own or others' needs. Materials include the technologies, products, and infrastructures present in a system.

Finally, actors within the system follow rules. These are not only regulations, but also values, norms and habits that direct us towards choices and action. They may be regulative, such as laws, guides and regulations; cognitive, such as ideas, values, perspectives and beliefs; or normative: those assumptions, mindsets and customs deeply embedded in societies and often followed subconsciously.

Actors, materials and rules are the three things that makes a system unique in its composition. It is not only technology, policy, nor organisational culture, but a specific combination of all, and these combinations are always socio-technical in nature. A system map becomes apparent when we consider the connections and alignment between the three categories – this structure is what keeps the socio-technical system in one piece, forming what we call 'a regime'.

It is not a difficult task to identify a socio-technical regime where dominant actors, materials and dominant rules have a mutual alignment between each other. Together, they represent a stable configuration of key actor-networks; materials that are central ingredients to the system; and collectively held rules (a combination of laws, values and practices) guide the actions of the dominant actor-networks.

What is more difficult is to identify the strength or vulnerability of this configuration. We know the configuration is sufficiently robust if it persists; discovering its weaknesses and instabilities is more challenging. This challenge has implications in developing a transformative theory of change.

Understanding a system – its actors, materials, rules and the regime – is a necessary step to break down and address persistent problems. The problems, at the generic level, are perhaps familiar to the practitioners. However, research on TIP shows that a systematic unpacking of the issues helps in identifying vulnerabilities and instabilities that may not be immediately obvious, and therefore determine where and how to intervene to tackle problems through socio-technical system change.



Example: Maintenance of an electricity grid

The need to maintain an electricity grid as a material foundation of an energy system requires many actors to work together. Their working together, is however guided by rules – not just regulations, but also values, norms and habits. How people behave in response to crisis, the organisational routines they follow, and the worldviews that determine your actions – are all rules that shape the system.



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Section 2: Developing a vision for change

There are many theories of how change happens, some explicit and many implicit. The TIP approach employs a very explicit generic theory of change, based on the study of historical processes, evolutionary and institutional theories of change.

The ideas driving a TIP theory of change are based around:

- Unevenness of social and technical change over time, leading to change coming in surges
- Importance of rules: that heuristics and practices must change to produce fundamental change
- Centrality of niches (protective spaces for different practices) as carriers of new rules alternative to those currently dominant

Together, these suggest that the potential for change varies over time and across different contexts. When change occurs, it is accompanied by new rules, whose origins may be found in niches that served as testbeds for their creation and development. Applying this theory of change to the existential challenges of today leads to the central proposition of TIP – by cultivating new or strengthening existing niches, it is possible to catalyse fundamental change in society.

In practice, however, achieving this catalysis is difficult because of the stability of existing sociotechnical regimes, and the relatively slow pace at which 'landscape' factors (such as trends, demographics or events) evolve in ways that question, delegitimise and pressure the existing regime to change.

This short statement of TIP theory, derived from the academic framework called the Multi-level Perspective (MLP), raises two questions:

- Firstly, why are existing sociotechnical regimes stable?
- Secondly, how does the landscape change over time to exert an influence on the process of change?

A fundamental characteristic of a regime is its stability. Stability is what allows the regime to reproduce over time and to operate according to standardised and well-understood practices. Stability, however, does not mean fixed: the composition of actors, materials and rules evolves incrementally over time, giving regime stability a dynamic quality. Recognising these diverse sources of stability is a step towards change.



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Example: Dynamic quality of regime stability

In the Global South, informal rules, frugal practises, social and environmental volatility – as well as constant adaptations to existing and emerging threats – may stabilise current practice and incremental, rather than transformative, change. New practices and rules may be only reluctantly considered, and deeper, more fundamental change is often resisted. In the Global North, divisions between the privileged and the marginalised engender a fear of change and reinforce the power of regime actors to resist fundamental change.

Regimes are influenced by the wider 'landscape' of social values and beliefs of a society: the persistence of past alterations to the terrain, and by events, shocks and trends. Ordinarily, regimes are well-adapted to landscape pressures and a favourable landscape is a source of stability to the incumbent regime. However, landscapes are subject to change and these changes may reduce the reproductive fitness of existing regimes.

Trends and possible abrupt change in the landscape should be considered when planning a TIP theory of change. The early signs of regime transformation are often to be found in landscape development, and identifying and amplifying these landscape pressures, can hasten the transition process.

While regimes are the dominant systems, there are often niche innovations emerging and threatening this dominant system from other locations in society. Niche innovations are not only technological, they also include new business models and arrangements for collective action. They may include linkages between systems, such as the present day surge of digitisation, which is offering new means of coordinating the sociotechnical systems of energy and mobility (electrical vehicles and multi-person transport) or mobility and food (online ordering and home delivery). Niche innovations are novel configurations of actors, materials and rules and, therefore, sociotechnical systems in their own right.

As a space that carries alternative rules, the niche allows interventions and choices that can create and nurture alternative technologies, rules and social networks as 'experimentation'. The alternative configurations often fragile and unstable; therefore policy action may be directed to 'protect' these niche alternatives from incumbent capture, co-optation or suppression.

Niches are the spaces in which we find the seeds of transformative change. Actors in a niche may be self-consciously creative and visionary in relation to the existing system, or exploring alternatives as they have learnt from the failures of the existing system to address the social needs of a group.

Section 3: Anticipation for a different future

Through these dynamics of regime, landscape and niche processes, constituting a TIP theory of change, the question of 'what can I do?' persists. What can an individual or a employee in an organisation do to effect socio-technical system change?

A key step is to anticipate futures in the niches. These anticipatory processes are radically different to 'planning' for change: anticipation brings into the



Example: Environmental social movements

A social movement that questions the moral legitimacy of exploitation of the environment (a change in values) would weaken existing regimes that depend upon such exploitation with, for example, monocultural agriculture.

Example: Covid-19 pandemic

A shock like the Covid-19 pandemic destabilises the rule that work must occur, primarily, in a workplace.



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foreground unconventional and transformative visions for the future, irrespective of the current feasibility of implementing the vision. Conventional planning, on the other hand, begins by identifying resource constraints and organisational or political limitations, and therefore tends to produce incremental change, even when seeking ambitious goals.

For systemic change to happen, niche actors must collectively hold and exercise visions for the future that fundamentally counter the dominant visions guiding the existing regime. Creating truly democratic and inclusive visions for plural futures requires collective effort to determine which niche innovations are desirable, and for whom.

These visions guide the creation of multiple transformation pathways, helping us to create alternative desirable worlds – an art and science at the heart of transformative change.

Systemic change, using anticipatory processes, therefore forces a systemic actor to look beyond a single socio-technical system, in which they may be embedded or have interests. It requires a holistic view of the nature of entangled interconnected systems, such as those of energy, mobility, food, water, housing or healthcare. We can't think of transport without energy, for example, while healthcare and food can only operate when people and goods are able to move around (the mobility system).

TIP thinking therefore invites us to zoom out – to see the entire ecosystem of interconnected niches, regimes and landscapes, and engage in anticipatory processes to create pathways towards democratically desirable, sustainable futures.

To implement TIP theory in practice, we need to articulate and apply it within the specific context of a project, programme or policy experiments. The TIP theory of change differs from conventional approaches to achieving impact through activities that generate outputs and outcomes in the direction of that desired impact. This input-output mapping is important for a planning process. However, a transformative theory of change begins with an anticipatory process: a key input in the process of development is the anticipation of desired systemic futures.

Anticipation employs skills associated with 'future literacy,' a process of imagining alternative rules (ways of performing socially useful functions) and assumptions driving these. This is what sets transformation apart from system optimisation: the latter is about responding to current challenges in the system, while the former is about anticipating challenges that will emerge in the trajectory of change and devising strategies to tackle these.



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Example: Private electric vehicles

Switching from petrol or diesel to electric private cars can be viewed as system optimisation, it addresses a single parameter of the carbon footprint of petrol engines. System transformation entails anticipating sustainability challenges that will arise as electric vehicles come into use and the persistent consequences of rules accompanying ownership of electric vehicles.

For example, a direct substitution of electrical from petrol vehicles would involve the social consequences of intensified global lithium mining for current battery technologies, little change in the massive use of land for parking unused vehicles, and continued pressure to build more paved roads that become congested upon completion.

Once the need for changing a dominant regime is established (eg. fossil fuel based energy), policy experiments in niches can help us to imagine radically new, alternative systems (without considering plausibility), therefore, envisioning possible pathways to the alternative, anticipating challenges in implementing this path and accordingly, supporting the direction of the desired change.

Anticipation helps to provide the necessary input into developing alternative configurations of actors, rules and materials in the niche, and involves navigating expectations of actors, as well as the regime, about the multiplicity of goals, processes and impacts of the envisaged change. These processes are often highly negotiated and political.

Policy experimentation activity, using anticipatory processes as an input, has multiple outputs, outcomes and impacts. We have found it useful to distinguish outputs from outcomes. In a transformative project, an 'output' may be a workshop or study report, which describes what happened and the key results and observations from the project; while the 'outcome' describes what we have learnt from the activity itself – the intangible directions in which change has happened. Has the change been truly transformative? We therefore measure the transformative potential of niche experiments through outcomes in a theory of change process.

Section 4: Developing a transformative theory of change

If we build a transformative theory of change (TTOC) as a deliberate attempt to alter the operation of an existing system, we are already aiming at a transformative effect. The questions that remain are:

- How do we know that systemic change has the desired effect?
- How could it better achieve the aim?

To help us answer these, TIP theory and TIPC members have identified 12 transformative outcomes to help in the planning and analysis of projects with transformative objectives.

In a TToC, transformative outcomes are leverage points for a succession and iteration of change processes that include both niche building and the opening up of the regime.



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Example: Mobility systems

For example deep learning and deep networking amongst niche actors are transformative outcomes for the niche-building process, while destabilised dominant practices (such as a fossil fuel-based mobility) is an outcome of the opening up of the existing regime.

Example: Focusing on areas with transformative potential

If collaboration appears to be the most promising outcome from a project, we may focus on deep networking as a transformative outcome in the TToC. This enables us to focus limited resources, capacities and complementary actions in fulfilling that particular outcome, based on the evidence of the course of action in the project.

In a TToC, transformative outcomes help us to find normative justifications for why regime change needs to happen or how it has happened in that direction. In a particular context, we might be confronted with a choice of which innovation to upscale; and whether to, and how to, unlearn the existing norms of the regime. Arriving at outcomes in a theory of change – which translate into a transformative outcome – helps locate existing niche innovation efforts at or near a particular leverage point.

Developing a TToC is not a linear process. The reiteration of outcomes in terms of transformative outcomes may require ongoing review of anticipatory processes and activities. For instance, if deep networking emerges as a desired transformative outcome, we might then adjust the activities of a project towards increased trust, coordination and involvement of actors.

Another aspect of developing a TToC is to reflect on our assumptions at every stage – in terms of inputs, activities, outputs and outcomes – to create scenarios in which these interplay with the desired course of systemic change.

The process for developing a TToC depends on the context, and might also evolve through the course of implementation within that context. This is what we call a 'localised' theory of change. The generic theory of change must be adapted according to localised, tacit knowledges and practices in order to be transformative. These distinctions make pathways involving change different for every transformation process.

A localised theory of change must therefore be concretised through negotiations of concepts and meanings in a context-sensitive way, following the convergence of stakeholders' collective consciousness and worldviews about how change is to be enacted. This is why system mapping and anticipatory processes are important elements of TIP development, inviting us to take stock of existing materials, capacities, and assumptions along each step of the way.

The TIP Resource Lab's Component 1 contains tools and learnings from TIP implementation to support us through the process and activities of creating transformative system change in a specific context.



Example: Localised theory of change

In some contexts, niches may already be mature and suitable for acceleration and mainstreaming; in others, niches with alternative rules may be absent, with action needed to help stimulate these. This makes the starting points for socio-technical change different across contexts.



Developing a transformative theory of change is not a linear process. The reiteration of outcomes in terms of transformative outcomes may require a follow-up review of anticipatory processes and activities.