



A toolkit for the systemic review of science, technology, and innovation policy

A resource for science granting councils, policymakers, and practitioners



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Evi-Pol

Enabling more effective use of evidence in policy and decision making by science granting councils



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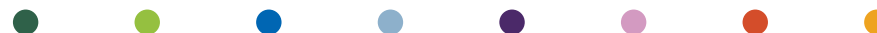
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Preface

In sub-Saharan Africa, national systems of innovation take distinctive forms. Science granting councils play a central role, and balance multiple mandates to set national research agendas, manage funds for research and innovation activities, gather evidence on science, technology and innovation (STI) and advise on STI policy. They typically do so with limited funding, human resources, and organisational capacity.

To strengthen their capacities to better perform these intermediary functions, the Science Granting Councils Initiative (SGCI) was launched by a consortium of international funding agencies, led by the International Development Research Centre (IDRC).

Currently, 16 sub-Saharan African countries are participating in the SGCI from East, West and Southern Africa. The Evi-Pol project, which ran from November 2020 to February 2023, responded to one theme under the SGCI Phase Two, through a consortium led by the African Centre for Technology Studies (ACTS) in Kenya. It focused on strengthening the role that science granting councils play in identifying, managing and using evidence in policy and decision making.

Rather than follow a traditional model in which experts *parachute* in to *transfer* skills and knowledge, the Evi-Pol project took a different approach to providing technical assistance. The project design was based on a participatory approach, that emphasised consultation from the start, the co-creation of solutions, bringing in local consultants and building local networks. Flexibility in the design and process was encouraged. Using this model, much of the first year of the project was spent developing work plans, frameworks, and instruments through (virtual) consultative meetings and workshops. The technical assistance provided was thus demand-driven and customised to the needs and capabilities of each science granting council, and included interactive workshops, peer-to-peer learning opportunities and one-on-one coaching.

In collaboration with partners in the Université Cheikh Anta Diop de Dakar (UCAD) in Senegal and ACTS in Kenya, CeSTII led activities to support science granting councils to strengthen their capabilities to conduct reviews of national STI policy. The work was led by Il-haam Petersen, supported by a team of CeSTII researchers and local STI policy consultants. Glenda Kruss, with Il-haam Petersen, was responsible for overall project conceptualisation, oversight and co-ordination at CeSTII. Nicole van Rheede, Pilela Majokweni and Setsoheng Mayeki contributed to testing the STI policy review templates and co-facilitated interactive workshops with the science granting councils. Prof John Mugabe, a consultant based at the University of Pretoria, conducted introductory training in designing, monitoring and evaluating national STI policy. Darryn Whisgary, as project manager, played a key role in team co-ordination, liaising with the science granting councils and keeping the project activities on track.

Working with the participating science granting councils, and in some cases, the ministries responsible for STI, the team produced a toolkit for conducting reviews of STI policies. The toolkit curates a set of lenses, practices and templates customised for use by science granting councils.

A big thank you to the STI policy unit managers, SGCI co-ordinators and leadership at the science granting councils and representatives from the ministries who contributed to the creation of this toolkit as a resource accessible beyond the Evi-Pol project.





ABOUT THIS **TOOLKIT**

Why this toolkit

Orienting investment in science, technology and innovation (STI) to address deep-rooted social, economic and environmental challenges is on the agenda of development agencies and policymakers in Africa.

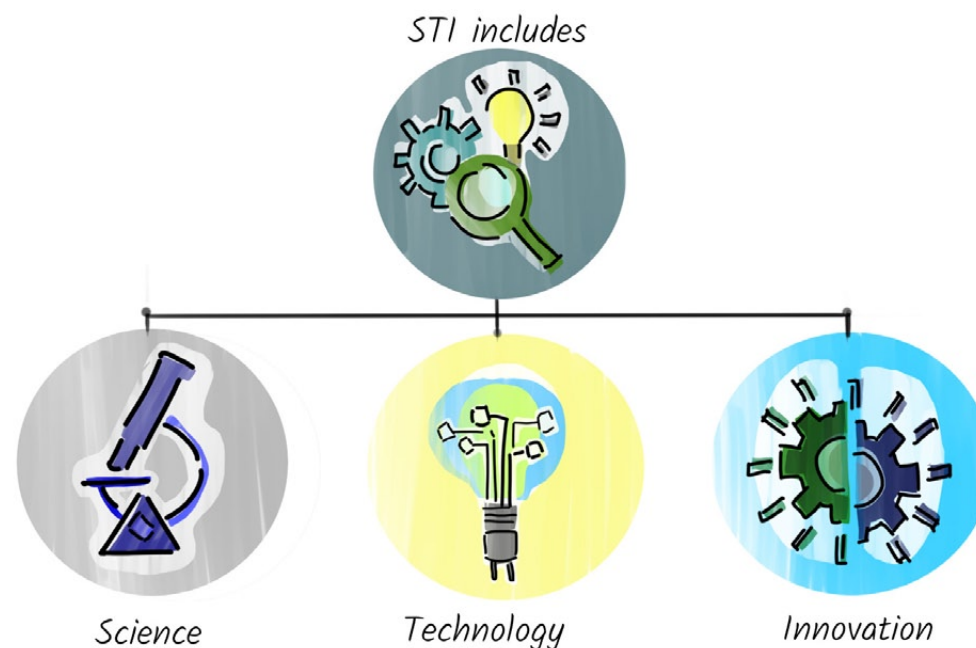
National STI policy frameworks are key. African countries are, therefore, starting to review and revise them to align with national development plans, the Sustainable Development Goals (SDGs) and the African Union Agenda 2063. Some countries are formulating national STI policy frameworks for the first time. For example, in 2022, the Democratic Republic of Congo adopted its first comprehensive national STI policy, and Mozambique started revising its 2003 science and technology policy. Namibia and Zambia adopted new national STI policies in 2021 and Senegal drafted its new STI policy in 2022.ⁱ

Experience from countries in the global South points to the danger of copying STI policy from advanced economies where innovation systems are more mature and development priorities differ. Instead, African countries are encouraged to base the design of national STI policies on an understanding of their national systems of innovation and capabilities aligned with national and regional development priorities.

This is difficult without tools to assess national systems of innovation, policy alignment and co-ordination, and policymakers often lack access to such tools. There are no consolidated empirically based methodologies and tools to review African STI policy frameworks and innovation systems. Instead, there tends to be a reliance on consultants from advanced economies, as our experience of working with African countries, through the Science Granting Councils Initiative (SGCI), shows.

African science granting councils play an important role in national policy discussions as STI policy champions, and they grant funds for research and development (R&D) and STI activities. They must balance these mandates, often with limited funding, human resources and organisational capacity.

This toolkit offers a set of practices that African science granting councils and policymakers can use to support and direct their reviews of STI systems and improve STI policy effectiveness. Over the past two years, we have worked with African science granting councils to understand their challenges and needs as STI policy champions. After several engagements we selected, extended and customised a set of practices and templates to assess policy alignment and co-ordination challenges, and



systematically gather evidence to inform the review of national STI policy. This toolkit includes these practices and templates, each rooted in a well-established analytical framework or lens.

This is not an exhaustive compendium of policy review practices and there are many other useful tools available for this purpose (see **Additional Resources**). Rather, the intention is to make available a user-friendly set of practices workshopped and customised by the Evi-Pol team together with African policymakers and science granting councils.



SYSTEMIC REVIEW OF STI POLICY
A key focus is to assess alignment of national STI policy with national, regional and global development goals, as well as the alignment of development goals across government.



What the toolkit is about

The lenses and practices making up the toolkit are intended for use by policymakers and practitioners to conduct evidence-based reviews of STI policy. STI policy reviews form part of STI policy monitoring and evaluation (M&E) but can be used to inform other parts of the STI policy cycle.

Different STI policy review types serve different objectives including review of the national system of innovation (NSI), the entire policy regime, specific development goals, sectors, functions or policy instruments. The term *policy review* is used in a broad sense to reflect the process of assessing policy intent and alignment, to inform the design, implementation or monitoring of policy. The tools and practices are based on a systemic approach that emphasises the mobilisation of STI to achieve social and economic development goals and sustainability. It involves the systematic collection of evidence across a system, to build an evidence base that can be shared and updated over time.

The practices in this toolkit are not entirely new. They have been customised and validated by African science granting councils and policymakers through the SGCI project and aim to:

- guide the systemic review of STI policy, i.e., across government departments and entities, to strengthen alignment, coherence and co-ordination to meet national development plans and the SDGs.
- offer fresh lenses and templates for the systematic gathering of evidence so that policy analysis, design and evaluation is grounded in its national context.



The practices are collaborative to encourage creativity and stakeholder engagement. They are based on lenses that enable policymakers and practitioners to think differently about policy review, design and monitoring and break from traditional linear approaches that provide limited insights. Creative and engaged approaches are required to shift to STI policy that brings about transformative change. This toolkit provides a selection of customised practices as a start!



SYSTEMATIC GATHERING OF EVIDENCE

The collection of evidence through a structured method with clear inclusion and exclusion criteria.



Who the toolkit is for

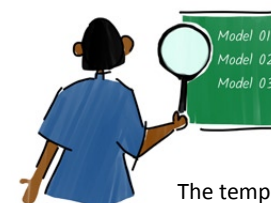
The toolkit is intended for use by science granting councils, policymakers, decisionmakers, practitioners and researchers who play a role in STI policy review, formulation, implementation and monitoring. Science granting councils are key role-players in the policy cycle, contributing directly or indirectly, regardless of mandate (see Table 1).

Table 1 Policy roles and functions of science granting councils participating in the SGC

Policy roles and functions	
Science granting councils with STI policy mandate	Science granting councils with no STI policy mandate
STI policy formulation	Collaborate or co-ordinate with ministry/government department championing STI
Lead or co-ordinate the reviews of national STI policy	Contribute to policy reviews (e.g., provide data on research funding, participate in a national task team co-ordinating policy reviews)
Implementation	Implementation partner
Monitoring and evaluation	Contribute data for monitoring and evaluation
Common challenges: keeping up with rapid change in the policy environment, limited resources (e.g., small teams, limited funding)	

How to use the toolkit

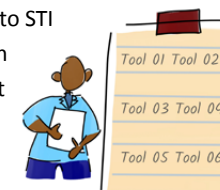
The toolkit is designed to take readers through the process of conducting a systemic review of national STI policy. The practices included are interrelated and designed to be used in a modular fashion, and together with the templates provided, can also be used as standalone tools to facilitate stakeholder engagement for a bottom-up participatory policy process.



The practices are included in Section 2. For each, a brief description is provided followed by step-by-step guidelines and templates for implementation.

The templates are provided in the toolkit and editable versions can be found in an accompanying **Excel file**. The templates are flexible and easy to adapt and customise for your needs.

Each practice is based on a specific approach to STI policy that emphasises participation, inclusion and alignment of STI policy, across government and the NSI. This is described in Section 1, focusing on three lenses that guide how to understand and assess policy using the practices in Section 2. We recommend that you first familiarise with the lenses before going on to implement the practices.



The practices include options that are straightforward and cost effective, as well as more sophisticated options that require specialised knowledge and more time to complete but enable a more in-depth and systematic review (Figure 1).

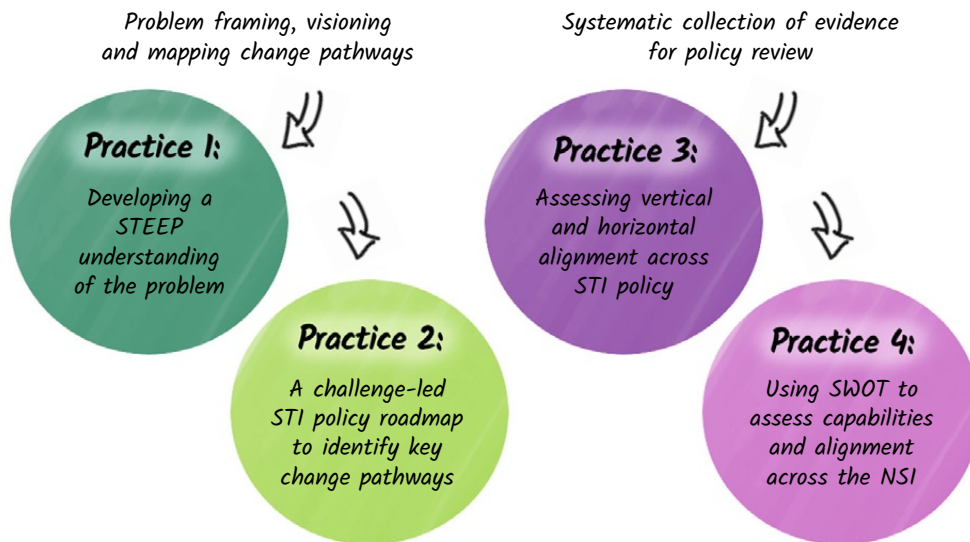


Figure 1
Practices for a systemic review of STI policy

The first two practices are focused on problem framing, visioning and mapping change pathways. The aim is to facilitate a process to understand and frame the *problem*, identify the long-term policy objective(s), and map courses of action collaboratively with stakeholders.

Practice 1 focuses on analysing the social and cultural, technical and technological, economic, environmental, and political and policy (i.e., STEEP) factors acting as barriers to and drivers of the key societal problems to be addressed through STI policy.

Practice 2 uses a backcasting techniqueⁱⁱ to emphasise the value of imagining a desired future in which the key societal problems have been addressed. This involves articulating the long-term objective(s) necessary to achieve this desired future, and moving backwards in time, from the future to the present, to identify the change pathways that must be facilitated through policy to achieve this desired future. The outcome of this is a challenge-led policy roadmap to devise specific courses of action and policy objectives. This emphasises societal challenges as the starting point and key focus for STI policy and includes transformative innovation policy approaches.



BACKCASTING

A 'technique that makes you look back from a future scenario, identifying and assessing changes and actions for that future to come true'. It is useful for strategic planning, to set an agenda for change. (De Vicente Lopez and Matti, 2016: 110)

The second two practices focus on the systematic gathering of evidence to assess alignment across STI policy, government and the national system of innovation.

Practice 3 aims to guide the creation of an evidence base to assess how well current STI policy is aligned and identify suitable policy instruments to implement the courses of action and achieve the policy objectives. Based on a tried and tested methodology,ⁱⁱⁱ an output is a database including information on a range of policy documents and specific policy instruments important for achieving the desired impact.

Practice 4 focuses on assessing existing capabilities and alignment across the NSI to identify priority areas to strengthen the system to support new courses of action and achieve policy objectives (Figure 2).

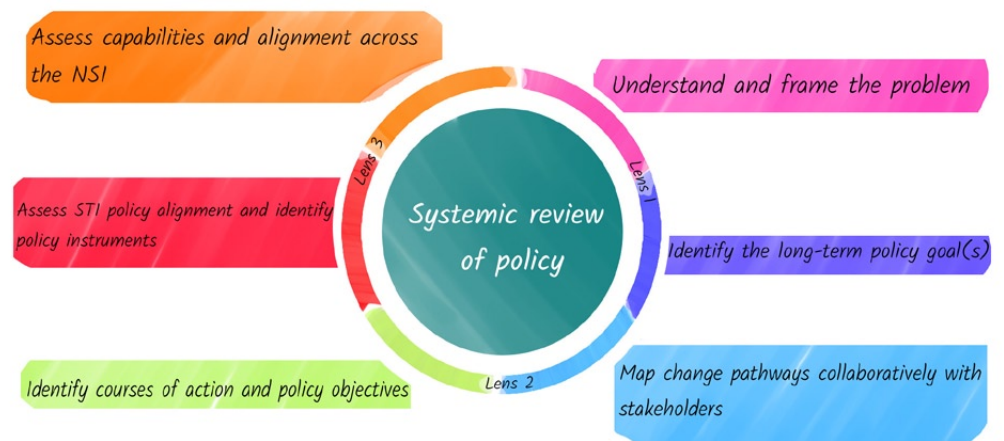


Figure 2
Outline of the set of practices





HOW TO APPROACH A **SYSTEMIC REVIEW OF POLICY**



Lens 1: Collective framing, visioning and road mapping change pathways

Collective framing and visioning create deliberative spaces for government and stakeholders to co-create shared understandings of the policy problems, visions, objectives and potential change pathways while drawing on the best available knowledge and expertise.^{iv}

A focus on problem framing

Different stakeholders will likely have different interpretations of the same problem. For example, the informal economy may be seen by some as a nuisance and a hindrance to economic growth; others may see it as a space for creativity, locally derived solutions and innovative entrepreneurship; while others may view the informal economy and its growth as increasing livelihood opportunities to lift people out of poverty. These diverse interpretations imply different policy instruments and will evoke different responses from stakeholders.

For African countries, a key challenge is how to decide on, prioritise and frame goals within the sphere of what is possible,^v needed and feasible in contexts of severe resource limitations and competing agendas. A further challenge is that for some African countries STI policy is relatively new and not firmly embedded. This is why it may be difficult to elevate STI on the political agenda and ensure sufficient resources and commitment from policy actors to support its implementation.

Problem framing is thus crucial. It is important that the interpretation or framing of the policy problem resonates with and appeals to key decisionmakers and stakeholders.



Definition: **PROBLEM FRAMING**

Framing is how a problem is interpreted and articulated.

A focus on visioning and road mapping



Definition: **VISIONING**

Visioning is about 'picturing the desirable future and describing what it might look like'. Visioning involves imagining and creating a feasible scenario of what the future will look like when the problems are solved. Visioning is about foresight, with an emphasis on imagining, rather than making predictions based on current trends and evidence. (De Vicente Lopez and Matti, 2016: 110).

Visioning makes it possible to bring a fresh perspective to articulating directionality and identifying the long-term goals important to address the policy problem. When done collaboratively with a wide range of stakeholders, the desired future envisioned through national STI policy can be collectively articulated. Thereafter road mapping is used to develop potential change pathways as strategies for action to achieving the desired future. Tools for mapping and analysing sociotechnical systems are useful for this task ([Practice 1](#) and [Practice 2](#)).

Collective framing, visioning and road mapping

Collective framing and visioning are about consensus building, from the bottom-up, to co-create shared understandings of the problem, objectives and vision. The advantage of this is that it brings together stakeholders with diverse and complementary expertise for bottom-up and locally driven policy formulation.^{vi} This is important for African countries where local expertise for policy formulation is lacking, and the typical solution is to *parachute* in approaches led by international consultants. The culture of and capacity to organise and manage bottom-up, participatory policy processes may also pose a challenge.



In developing new STI policy, it is important to consider how *convincing* the framing of the policy problem and solutions, articulated through long-term goals, are to decisionmakers and stakeholders. These questions should be considered when deciding who to include in the process:

- who needs to be convinced?
- whose interpretations and desired futures are currently considered and foregrounded?
- who is missing, left out or excluded?



CHALLENGE-LED APPROACHES TO STI POLICY

Challenge-led approaches to STI policy have taught us that addressing complex development challenges, such as inequalities, depends on transformative change in the right direction.

Collective framing, visioning and road mapping are participatory and designed to facilitate the inclusion of a wide range of stakeholder groups to contribute to STI policy informed by an understanding of the needs, capabilities and experiences of all participants. The collective process increases the likelihood that the framing and articulation of the desired future will enjoy the support of a wide range of stakeholders. When more stakeholders are convinced, more will be committed to implement the policy to reach the desired future and intended impact.

Successful policy design and implementation also depend on alignment and co-ordination across government and the national system of innovation. This is the focus of **Lens 2**.





Lens 2: Alignment with development priorities across policy and policy actors



A major concern for those designing national policy in African countries is where to direct resources to achieve the biggest impact over the long term, given the complexity of development challenges and the limited resources available.^{vii} A review of national STI policy designed to address this must start by asking: Are the right policies in place? Where are there synergies, duplication, and gaps across government departments? Where can alignment and co-ordination be improved? Who are the key partners to support implementation to achieve the intended impact?

A systemic policy review is designed to address these important questions. A key focus is to assess the alignment of the national STI policy with national, regional and global development goals, and the alignment of development goals across government. A systemic review of national STI policy distinguishes between government departments and agencies:

- directly involved in *STI policy* such as the department of science and technology or national research foundation,
- directly involved in *policy oriented to socio-economic development* such as the department of small business development, and
- directly involved in *contextual policy* such as the department of trade and industry or national treasury, which set out framework conditions.

Assessing horizontal alignment

Policy reviews conducted to inform the design of new national STI policy, or to update policy, typically focus on reviewing a single STI policy document and economic or industrial policy only. A shortcoming of this is that it has limited value for understanding the extent to which STI policy is aligned with socio-economic policy more broadly. *Horizontal alignment*^{viii} is crucial to improve co-ordination and coherence across government departments responsible for championing STI and achieving development priorities. For example, gender equality is a key strategic goal promoted at the national, regional, and global levels, but policy reviews to inform the drafting of new national STI policies and implementation plans seldom address national gender policies. A systemic approach draws attention to the importance of *horizontal alignment*, to also assess the extent to which national gender policy includes the use of STI to advance gender equality. While the focus of the policy review may be on national policy, it is also important to assess and understand the extent of alignment with regional and international development priorities (e.g., STISA-2024, SDGs).





Policy drivers and rationale

Identifying the typical drivers (indicators) and capabilities of a national system of innovation in a specific context, is a useful starting point, to inform the rationale for a state's policy intervention and role in a national system of innovation. This can be done based on desktop research and engagement with experts, to identify the main causes of system failure that inform the need for and direction of policy interventions. See **Practice 4** to conduct an analysis of capabilities and alignment across the national system of innovation.



TIP:

See the **Additional Resources** section for an example that describes the policy aims and rationale, worldview, and objectives aimed at harnessing STI to advance one key development priority, inclusive development (STI4ID).

See **Practice 3** for guidelines to conduct a review of STI policy using this lens.



Policy worldview

For STI to steer social, economic and environmental development requires a change in understanding and thinking about STI goals, actors, and processes.* STI for development requires a different focus from the typical emphasis on economic growth. For example, the policy mix is required to foreground inclusivity and emphasise the inclusion of people and groups traditionally marginalised from the economy and formal innovation systems, alongside wealth creation and economic growth. It is necessary to also focus on sectors that are most relevant to these groups such as education, health and small-scale agriculture and, importantly, to consider the *direction* of STI in these sectors. For example, are agricultural innovations affordable, accessible, and sustainable?

This change in focus requires the consideration of a wider set of processes such as new or improved solutions to address social problems and learning and diffusion to improve the uptake and use of STI. For example, are women smallholders able to access, adapt and use new agricultural innovations targeted at small-scale farmers? Such wider processes come with new constraints and involve a new set of actors and relations, for example, informal sector actors, NGOs and other intermediaries, and university-informal sector relations. There is a growing body of research about innovation by such new actors.



Policy objectives

Policy objectives provide *a set of core directions*^{xi} for better alignment with social and economic development goals to enable transformative change. As core directions, the objectives guide the analysis of each policy document selected for the review, to understand how STI policy addresses development goals. To what extent do the policies promote the use of STI to shift development in the right direction and anticipate future challenges? The core analysis should be informed by desktop research and consultation with experts in the field as well as other stakeholders such as industry and civil society as far as possible.

To complement understanding alignment across STI policy and government, **Lens 3** assesses alignment across the national system of innovation.





Lens 3: Alignment across the national system of innovation



The national system of innovation (NSI) approach is now widely used as a framework for STI policy. Most country STI policy frameworks include specific objectives and interventions to strengthen the NSI, although the NSI of each country is different. Therefore, copying policy and strategies from other countries should be done with caution. National reviews to inform policy processes should include an assessment of the NSI. Specifically, this systemic analysis should include an assessment of capabilities and the extent to which actors and networks contribute to the attainment of shared development goals.

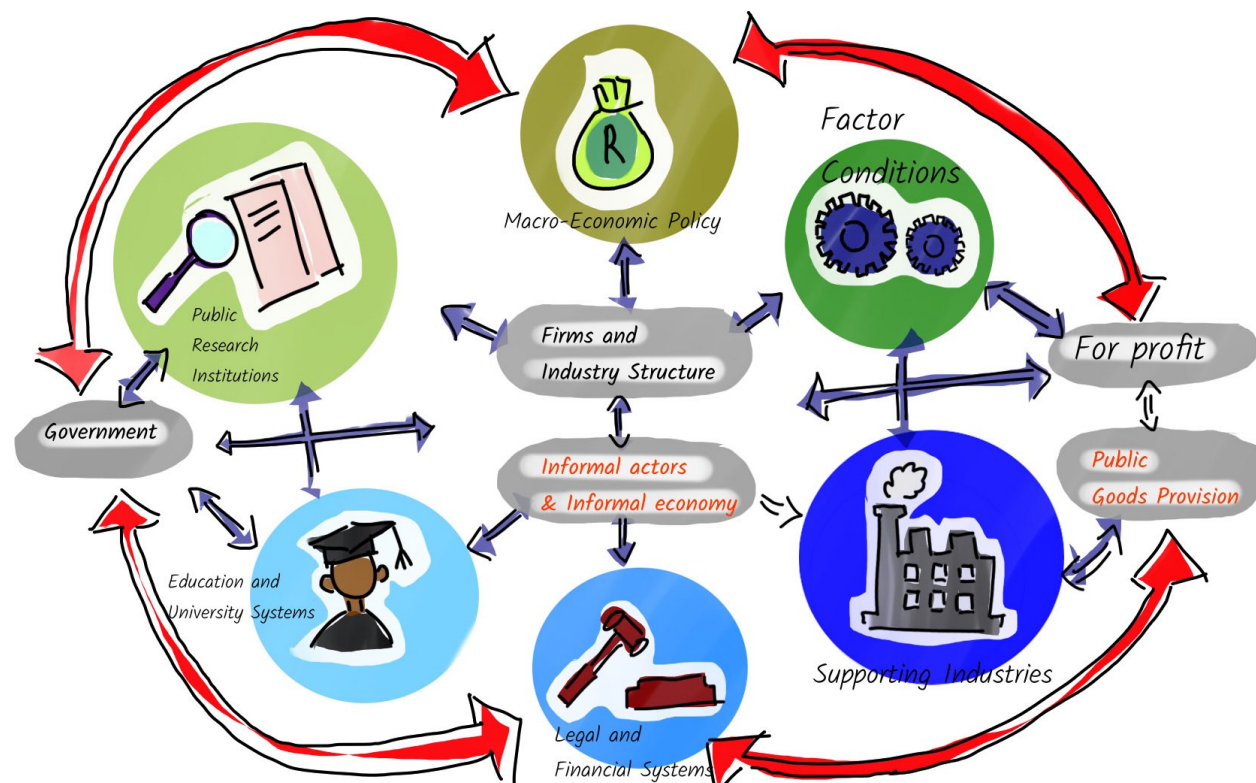


Figure 4
NSI framework adapted for a developing country context, based on Vanichseni's Industrial Innovation System.

Source: Petersen et al (2016) adapted from Von Tunzelmann (2010)



NATIONAL SYSTEM OF INNOVATION

Rather than follow a linear approach, the NSI approach emphasises STI capabilities, knowledge flows, interaction and learning between public and private sector actors involved in production, knowledge generation and use, and diffusion. It includes institutional frameworks as rules or guides for behaviour.

From a practical perspective, the NSI can be described as a *network of networks*^{xii} including systems or networks of production, innovation and knowledge systems. For example, as illustrated in Figure 4, the public and private education and university system, legal system and financial system form part of the overarching network of the NSI. Each sub-system includes networks with distinct institutional contexts and specific rules, norms and practices. Since the NSI framework is based mainly on advanced country contexts, it is important to adapt it to reflect the realities in developing countries, as Figure 4 aims to do. In the African context, national goals relate not only to competitiveness, but equitable socio-economic development. Structural unemployment is high, the informal economy is large and a substantial number of people participate in survivalist livelihood activities, all of which presents a challenge for STI policy development. Figure 4 reflects this, recognising the significance of informal economic activity and placing this at the centre with formal firms and industry, and the state in driving development and emphasising STI for wealth as well as public goods provision (e.g., STI to improve basic services).



Why assess alignment across the NSI

A network alignment approach^{xiii} foregrounds alignment between the goals of networks and the significance of network failures, rather than market failures. Systems are made up of sets of interlocking or complementary networks. Network misalignment relates to constraints on the flow of knowledge about technology and production at the system level and includes a number of possibilities:

- 1) Networks required to facilitate flows of knowledge may not exist between firms and their suppliers, or firms and universities and public research institutions, or between government, university and firm systems.
- 2) Networks may exist, but may have a goal that does not promote development for the system as a whole. For example, an industrial sector such as defence or mining may fund research in its own interest that limits the interest of the whole system, or the public good.
- 3) A network may exist and have a developmental goal, but functions such that it fails to achieve these developmental goals.



NETWORK FAILURE OR MISALIGNMENT

An instance of the failure of a system, rather than an individual firm or individual university, government agency, or network.



TIP:

A detailed description of the NSI framework and related concepts can be found in the handbook on STI policy produced as part of the first phase of the SGCI.^{xiv}

See **Practice 4** for guidelines to conduct an analysis of the NSI focussing on strengths, weaknesses, opportunities and threats (SWOT).

The three lenses described in this section are guiding frameworks for the *practices* that make up this toolkit, described next.



A SET OF CURATED AND **CUSTOMISED PRACTICES**

Here, we describe in detail a set of practices, curated and customised for use by science granting councils, policymakers and practitioners, to conduct a systemic review of STI policy. Figure 2 from the introduction illustrates the practices and their aims, included here for ease of reference.



Principles: systemic. challenge-led. strategic reflection. participatory. evidence-based

Figure 2
Outline of the set of practices



Practice 1: A STEEP understanding of the problem

*Building an in-depth understanding
of current trends, barriers and drivers
of the policy problem*

STEEP analysis is a widely used strategic planning technique, also known as PESTLE (political, economic, social, technological, legal and environmental) analysis. In the policy context, a STEEP analysis aims to understand the external or contextual factors impacting on a societal and policy problem, including social, technological, economic, environmental and political factors (see Figure 5).



Figure 5
STEEP analysis

Guiding questions:

- ➔ What factors impact the selected societal challenge? How have these changed over time?
- ➔ What are the drivers for addressing the societal challenge?
- ➔ What are the barriers to addressing the societal challenge?
- ➔ How does national STI policy address the societal challenge? How has this changed over time?

Why use a STEEP analysis

A big advantage of a STEEP analysis is that it can unpack the complexity of key societal challenges such as inequalities, poverty and climate change, often described as wicked problems.^{xv} The process thus yields useful insights for problem framing. The focus is not just the current state, but how problems have changed over time and the policy instruments that may have impacted this change, as barriers or drivers. STEEP analysis facilitates a bottom-up, participatory process. It is a good starting point for a visioning exercise and mapping change pathways informed by an understanding of the policy and external landscape.

When to use a STEEP analysis

A STEEP analysis is useful for policy formulation, particularly at the agenda-setting stage, to build a shared understanding of a problem. However, it may be used at any point in the policy process when it is necessary to reflect on the current situation, the effectiveness of policy instruments and progress over time.

How to conduct a STEEP analysis

Template 1
STEER analysis

		STEER ANALYSIS						
ANALYSIS OF EXTERNAL FACTORS IMPACTING ON SOCIETAL/POLICY PROBLEM		SOCIAL AND CULTURAL	TECHNICAL AND TECHNOLOGICAL	ENVIRONMENTAL	ECONOMIC	POLITICAL	POLICY	SUMMARY
WHERE ARE WE?	Past	E.g. Few female researchers, R&D	E.g. Lack of Centres of Excellence	E.g. Drought and flooding remain a challenge for the agriculture dependent economy				
	Now	E.g. Increased numbers of females in R&D but still majority male		E.g. Malawi Growth and Development Strategy given priority to developing agricultural sector.				
CURRENT SITUATION	Barriers	Girls dropping out increases after primary school. Gender stereotyping	E.g. Funded by investors, need more support from government.	E.g. Climate change related issues effect on biodiversity of water bodies				
	Drivers	Increasing focus and investment in STEM (female participation).	E.g. Establishment and strengthening of Centres of Excellence	E.g. Environmental strategy policy design				
	Policy Instruments							

Note: Examples included are based on engagement with science granting councils in Namibia and Malawi.





The first step is to understand the current situation and how conditions have changed over time. In relation to each contextual factor, describe how the situation was in the past and how it is currently. Guide the discussion to unpack the social and cultural, technical and technological, economic, environmental, and political and policy factors, focusing on each factor individually. If the stakeholder group prefers to have a less structured discussion, diligent (and speedy!) capturing of key points as they are mentioned during the discussion is crucial.

The next step is to consider the barriers or factors hindering progress in addressing the societal challenge. The discussion of change and progress or lack of progress often sparks debate on potential reasons for this. A focused discussion on barriers may help to understand blockages and gaps requiring intervention. It may also identify policy instruments that act as barriers or have unintended consequences that hinder progress. It is important to guide the discussion to focus on each STEEP factor.



Drivers contribute to progress and are closely linked to barriers. Drivers and barriers are thus often discussed together. It is important to be flexible and allow the discussion to flow. Encourage stakeholders to discuss drivers of the societal challenge that relate to each type of STEEP factor and identify policy instruments facilitating progress.



TIP:

Use **Template 1**^{xvi} to capture an analysis of the social, technical and technological, economic, environmental, and policy and political (STEEP) factors influencing societal challenges. It is useful to do a STEEP analysis on a regular basis to keep up with change and track progress.

The STEEP analysis provides a basis to identify trends and drivers influencing key societal challenges and change pathways important to address these challenges through STI policy. How to map change pathways is the focus of **Practice 2**.





Practice 2: A challenge-led policy roadmap to identify key change pathways

*Collectively articulating a long-term
vision and mapping change pathways
towards a desired future*

Challenge-led policy road mapping starts with visioning to articulate a desired future scenario in which a selected societal problem no longer exists, and then mapping potential change pathways to achieve this desired future. Change pathways have a temporal dimension. Mapping change pathways involves identifying specific courses of action required in the short, medium and long term to achieve the long-term objective. One roadmap may include several potential pathways, ranked by importance and feasibility. It is important to note that a multitude of pathways and interconnected pathways are possible. No single pathway represents a complete solution.

The challenge-led policy roadmap is based on a socio-technical roadmap and provides a fresh approach to policy.^{xvii} The emphasis is on imagining, rather than predicting, a desired future based on current trends, and identifying changes in people, organisations and routines that must take place to achieve the desired future. Rather than focusing on outputs to be counted, the focus is on the specific activities and resources needed to enable the changes.

Why use a challenge-led STI policy roadmap

A challenge-led policy roadmap provides long-term orientation and coherence, to guide policy, 'while opening up spaces for continuous learning and experimentation'.^{xviii} It is a tool to implement mission-oriented transformative innovation policy approaches. Policy road mapping starts with visioning and encourages stakeholders to agree on an interpretation and articulation of the desired future and long-term policy objective. It facilitates collaborative problem framing, from broad societal challenges to concrete problems to be addressed through policy. Together, stakeholders map and rank change pathways as potential strategies for action as well as activities and resources within their control. The process thus facilitates buy-in and ownership of the roadmap and policy, improving policy implementation and effectiveness. Policy instruments may also be identified.



CHANGE PATHWAYS

Composed of three basic elements: **changes** important to achieve the desired policy objective(s), **activities and resources** to achieve the desired changes, and specific **trends and drivers** that may create opportunities or hinder changes.

When to use a challenge-led STI policy roadmap

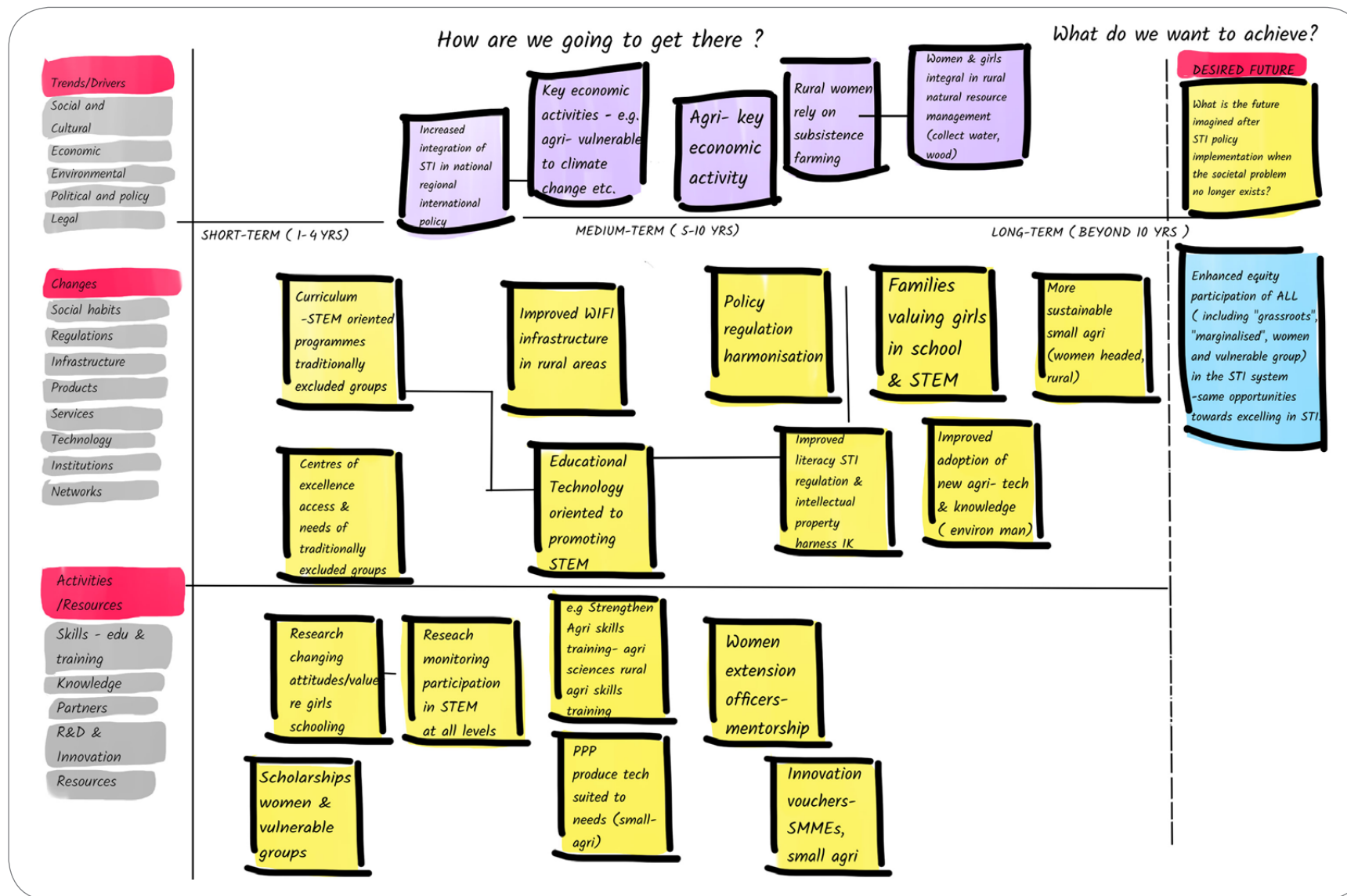
A challenge-led policy roadmap may be applied to complex problems involving long-term goals and a high degree of uncertainty.^{xix} It is thus suitable for strategic planning to address complex societal challenges through policy. It is designed to facilitate inclusion and stakeholder engagement. Road mapping is most useful during the policy formulation stage and should therefore be conducted at the start, to inform, confirm or improve policy problem framing. The basic elements of the roadmap – trends and drivers (assumptions), changes (outcomes), activities and resources (inputs) – align with elements of a theory of change framework, making it useful as a first step in developing a policy implementation plan that can form the basis for monitoring and evaluation.



TIP:

Use **Template 2** for visioning and to map change pathways together with stakeholders.

How to develop a challenge-led STI policy roadmap



Template 2
Challenge-led
STI policy roadmap

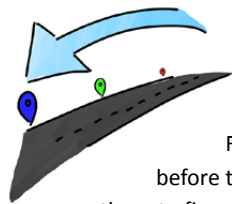
Note: Examples included are based on engagement with science granting councils in Namibia and Malawi.





Identify one key societal challenge for the roadmap. Ideally, the same societal challenge as for the STEEP analysis but this is not a prerequisite. Start by considering the desired future that you (collectively) want to achieve through the STI policy. Remember, the aim of visioning is to imagine and articulate a desired future scenario when the selected societal problem no longer exists. Guide the discussion to articulate a single long-term objective. These questions can guide the discussion:

- What is the long-term objective and desired impact?
- What is the timeframe in which the long-term objective should be achieved?
- What are the specific targets?



Next, work backwards to identify the changes that are needed, in the long, medium and short term, to achieve this desired future. Start by asking: What are the last changes needed to achieve the long-term objective? These are the changes that must take place in the long term. Then ask: For those changes to happen in the long term, what needs to take place before then, in the medium term and short term? The timeframes are defined as: three to five years (short term), five to 10 years (medium term) and 10+ years (long term).

These are provided as a guide and may be adapted to meet your needs and align with the proposed policy timelines.

Changes are a basic element of the roadmap like the outcomes of a typical theory of change. The focus here is on the observed changes in people (individual level), organisations and practices (relational) that are necessary to achieve the long-term objective. The changes include a range of types: social habits, regulations, infrastructure, products, services, technology, institutions, and networks. It is important to consider and note links between changes. Changes may be interrelated or interdependent. For example, for a new product, such as a STEM curriculum, to be implemented, some technological or infrastructural changes need to be made.



As you consider the changes that need to take place, identify trends and drivers at the system level that may impact on each of the changes but are not directly addressed by them. For example, for some changes to take place, the economy must grow. These could be discussed as a separate step or together with the changes.

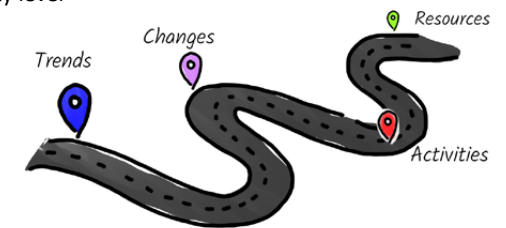
Trends can be described as the assumptions that are a basic element of a typical theory of change. The emphasis is on identifying the range of factors including social and cultural, technological,

economic, environmental, and political and policy factors. There is thus overlap with the STEEP analysis, which can be used to inform the analysis of trends and drivers. These factors may add pressure to the system, resulting in lock-in which may hinder, change or create opportunities for changes to take place.

For each change identified, ask the group to suggest activities and resources needed for the change to take place. What are the activities or resources that different stakeholders need to commit to bring about the changes identified? Capture the key activities and resources suggested. Types of activities and resources include skills (education and training), knowledge (e.g., research), partnerships and networks, research and development and innovation (RDI), and resources (e.g., funding).



The final step is to connect related changes, trends and drivers, and activities and resources. This will reveal specific change pathways. Step back and allow time for the stakeholders to view and discuss the change pathways you have identified together. Then discuss the priority level of each change pathway for the current STI policy. Lastly, rank and prioritise change pathways that can be included in the STI policy or implementation plan. This may help identify programmatic thrusts to include in the STI policy.



TIP:

We recommend doing the visioning and change pathways before the review of policy text. It is useful to have an in-depth understanding of the societal challenges and policy problems that will be the focus of the systemic policy review.

The change pathways to be addressed through STI policy may be used to inform the focus and parameters of the STI policy review. For example, if the change pathways, as courses of action for policy, emphasise addressing inequalities, particularly spatial inequalities and rural development, it will be important to include rural development policy in the review along with other relevant policy texts. **Practice 3** focuses on how to conduct a review of policy text.





Practice 3: Assessing vertical and horizontal alignment across STI policy

Aligning policy to implement change pathways

Ideally, the STI policy review will build on the problem framing and visioning completed using Practice 1 and Practice 2. However, this is not a prerequisite. A co-ordinated approach across STI policy, socio-economic policy and policy setting framework conditions is necessary to achieve a collectively articulated long-term development vision and implement change pathways. STI policy is seen as a *crosscutter* and should contain ‘systemic instruments’^{xx} to steer STI toward addressing complex societal challenges. Through the step-by-step guide to analysing policy and related documents, evidence on policy worldviews, objectives, goals, instruments and networks is collected and recorded in a database that can be shared and updated over time. The evidence base may be analysed to inform an in-depth understanding of *horizontal and vertical alignment*^{xxi} across policy regimes for better co-ordination and coherence.

With such an evidence base, it is possible to assess how policy has evolved over time and to identify specific policy instruments that need to be assessed for impact. While the systematic collection of evidence has value, the practices and templates can also be applied in a *light* way to assess a small selection of policy documents for specific tasks or to learn the approach to better direct in-depth reviews of national STI policy conducted by independent consultants.

Why assess vertical and horizontal alignment across STI policy

Conducting a systemic review of policy reveals gaps and duplication across policy and government units requiring intervention, as well as synergies and alignment that may need strengthening. The evidence base created can support agenda setting and identify potential partners for policy implementation. It may also complement other data collected as part of a wider policy review process, for example, stakeholder surveys. *What is most useful is the list and description of policy instruments* identified as crucial to achieve the intended policy goals and impact. Specific policy instruments can be selected for further *investigation to assess impact and monitor policy progress*.

When to assess vertical and horizontal alignment across STI policy

A systemic policy review assessing alignment is most useful for updating or designing new national STI policy. This is when countries usually invest in in-depth reviews of policy, often with independent international consultants. The review may also be conducted when developing or improving plans for implementation or monitoring. For these stages, it is useful to build a database of ministries, government departments and agencies, their relevant policy documents, and their policy instruments for steering STI towards achieving development goals.



TIP:

Use **Table 2** to create an Excel database to record the key information from the policy documents reviewed. Each category is recorded in a separate Excel column. See the examples in the **Additional Resources** section.



How to create an evidence base to assess policy alignment and identify key policy instruments



The first step is to identify the development goal that will be the focus of the policy review. The **problem framing, visioning and mapping change pathways** tools can be used to identify and articulate the development goal collaboratively with stakeholders. The availability of resources, including the budget and time allocated for the review, and the staff or consultant time available will determine the number of policy documents that can be covered. For example, in a systemic review to assess the readiness of the South African policy environment to implement an innovation for inclusive development agenda, 83 policy documents were analysed by a team of three researchers (one full-time and two part-time) over three months.

Identify the objectives important to address the development goal. As *core directions*, the objectives are used to assess the direction of policy, specifically the extent to which it addresses the selected development goal. For example, promote innovation at the local level, to include traditionally excluded social groups (see the **Additional Resources** section for more examples). The core directions should be informed by desktop research and consultation with experts in the field and other stakeholders (e.g., industry and civil society).



POLICY OBJECTIVES

A set of core directions for better alignment with social and economic development goals to enable transformative change.



Select the government departments and agencies to include, distinguishing between departments and agencies contributing directly to:

1. contextual policy (e.g., department of industry and trade)
2. socio-economic development policy (e.g., ministry of gender, children and social welfare)
3. STI policy (e.g., department of science, technology and innovation)

The review should cover the range of policy and related documents – i.e., white papers, strategies, acts, and regulatory documents – selected for relevance to the development priority identified. It is possible to also include the strategic framework documents, annual reports and other key documents of government departments and stakeholders – to assess policy implementation, to an extent.

The next step is to read and review each policy document selected. **Table 2** provides a guide to the review of the policy texts and the recording of key information in a uniform and systematic manner. For each category, the reviewer assesses the presence, absence or interpretation within the policy text. In populating the template, the reviewers build up an Excel database linking policy objectives, goals and instruments, and worldviews. *This is a tool for strategic planning.*



Table 2 Guide for building an Excel instrument to capture evidence from the STI policy review

Category (based on Lens 2: Alignment across policy)	Instrument category	Definition	Notes and instruction for reviewers
REFERENCE INFORMATION	Government department/ agency		Record the name of the department or agency as stated on the document.
	Title		Record the full title of the document. Copy and paste, where possible, for accuracy.
POLICY WORLDVIEW Aim: Identify the ways each department/ agency conceptualises STI to achieve the selected development challenge, given the range of possible terms and definitions that can be used.	STI focus	What is the focus and direction of STI promoted? Is the focus on economic growth and wealth creation mainly? Is the direction of STI considered – i.e., the wider societal impact (e.g. inequalities, environmental degradation)?	Examine and record how the policy defines STI. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.
	STI processes	To what extent are wider processes of STI considered – i.e., diffusion, uptake, learning, etc.?	Examine and record whether the policy is suggesting the inclusion of new processes to accommodate a new/expanded STI for development vision. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.
	Target group	Which target groups were identified in the policy text? To what extent are the needs and participation of non-traditional actors such as community-based organisations prioritised?	Record the main target groups mentioned. The document may mention specific groups or refer to a wider group (STI for all). Copy and paste references from the text. Indicate page numbers/sections for ease of reference.
	Key terms and definitions	How does the policy text define STI? Is it based on a traditional focus on technology led innovation, for example? How is the development challenge defined? How is the relationship between STI and the development challenge described?	Examine and record how the policy defines STI and/or the development challenge, and how it proposes to address the development challenge through STI (if it does). Copy and paste references from the text. Indicate page numbers/sections for ease of reference.
	New actors	Are new actors and relations identified? New actors include stakeholders not traditionally identified as partners, for example, informal sector actors, intermediaries such as NGOs, and university-informal sector relations.	Examine and record whether the policy is suggesting the inclusion of new actors in decision-making roles / governance structures, to accommodate a new/ expanded STI for development vision. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.
OBJECTIVES, GOALS AND INSTRUMENTS Aim: Analyse policy objectives, goals and specific instruments that may relate to STI for addressing the development challenge.	Objectives	Broad statement of intent, often found in the stated policy vision or goal. Does the policy aim to address any of the core directions to address the development challenge?	Record objectives relevant for the focus, STI towards achieving the development challenge. Copy and paste references from the text. Indicate page numbers/ sections for ease of reference.
	Specific goals	Goals are more specific than the objectives and are linked to practical policy instruments (indicating how well the policy was thought out).	Record goals relevant for the focus, STI towards achieving the development challenge. Copy and paste references from the text. Indicate page numbers/ sections for ease of reference.
	Policy instruments	The range of mechanisms and structures created by government departments and agencies to facilitate policy implementation.	List policy instruments aimed at steering STI towards achieving the development challenge. Also identify policy instruments important for achieving the development

Continues overleaf...

Category (based on Lens 2: Alignment across policy)	Instrument category	Definition	Notes and instruction for reviewers
		<p>May include:</p> <ol style="list-style-type: none"> 1) Regulating instruments (acts and legislation proposed) 2) Supportive actions (this is the broadest term – technically it could include any active instrument) 3) Financial instruments 4) Collaborative decision making 5) Establishment of institutions 6) Advisory body 7) Institutional reform 8) Interventions 9) Schemes 	<p>challenge even if STI is not included. This may be an example of misalignment, where STI could be integrated for greater impact. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>
<p>POLICY GOVERNANCE</p> <p>Aims:</p> <ul style="list-style-type: none"> - identify policy structures that promote coordination and collaboration around STI for development at diverse levels - identify if there are plans to ensure and assess policy impact - assess the quality of the policy 	<p>Government departments/agencies mentioned (and responsibilities)</p>	<p>Who are the policy actors involved and how do they work together?</p>	<p>List the government departments and agencies to be involved in implementation. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>
	<p>Other actors mentioned (and responsibilities)</p>	<p>Who are the policy actors involved and how do they work together?</p>	<p>List any other types of actors (e.g., NGOs) to be involved in implementation. Where possible, record the responsibility of each. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>
	<p>Relationship between actors (structure)</p>	<p>Was it delegated to a lower-level department or implementation agency? What is the level of the actor?</p>	<p>Where possible, record the responsibility of each actor in implementation. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>
	<p>Level (national/regional/sectoral)</p>	<p>At which level is the policy targeted? National, regional and/or sectoral?</p>	<p>Record the level of the policy. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>
	<p>Implementation plan</p>	<p>Is there an implementation plan?</p>	<p>Record details of the plan for implementing the policy. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>
	<p>Diffusion plan</p>	<p>Is there a plan for diffusion (i.e., take the policy to the target groups)?</p>	<p>Record any plans to diffuse the policy/regulation. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>
	<p>Monitoring and evaluation mechanism and indicators</p>	<p>Is there a plan for monitoring and evaluation? Is there any indication of indicators for assessment?</p>	<p>Record details of the plan for monitoring and evaluation, and indicators mentioned. Copy and paste references from the text. Indicate page numbers/sections for ease of reference.</p>

Continues overleaf...



Category (based on Lens 2: Alignment across policy)	Instrument category	Definition	Notes and instruction for reviewers
REVIEWER'S ASSESSMENT Aim: Reviewers provide their own sense of the contribution of the policy.	Potential contribution		Use the objectives adopted as core directions for policy to assess the extent to which the goals and objectives of the policy align with STI that addresses the development challenge. Indicate any ways in which the policy may contribute to such an agenda.
	Significant gaps		Use the objectives adopted as core directions for policy to assess the extent to which the goals and objectives of the policy align with STI that addresses the development challenge. Indicate any gaps in the policy.
ADDITIONAL INFORMATION	Reviewer initials		
	Comments		







The final step is to draw out evidence from the database to address policy questions.



There are many ways to analyse the policy information recorded in the Excel database and a few are listed below. More advanced analysis can be conducted using qualitative analysis software such as NVivo (see a paper by CeSTII team members, Il-haam Petersen and Glenda Kruss).^{xxii}

A straightforward way to analyse the policy information is to search for key words and terms. For example, if the policy objective is to promote grassroots innovation, the database lists the related policy goals and instruments linked to the relevant policy texts. Since the database is searchable, it is possible to search for all policy documents and instruments promoting grassroots innovation using key words or terms. Policy makers can then refer to the specific texts for greater detail. The policy instruments can be extracted using **Template 3**, relating the instruments to the policy objectives and the relevant government departments.



 Policy goals	 Policy instruments (by type and name)	 Main target groups	 Policy documents	 Government departments/ agencies	 Assessment of alignment
<i>E.g., Link informal sector into innovation systems: Promote entrepreneurship</i>	<i>E.g., Establishment of institutions: 1) Small Enterprise Development Agency (DSEDA)</i>	<i>E.g., informal businesses, women, youth</i>	<i>E.g., National Small Business Amendment Act 2004 (NSBAA)</i>	<i>E.g., Department of Small Business development (DSEDA)</i>	<i>E.g., Limited focus on access to technology and development of basic skills</i>
ADD	ADD	ADD	ADD	ADD	ADD

Template 3
Identifying key policy instruments to achieve policy goals



TIP:

Use **Template 6** in the **Additional Resources** section to assess and highlight mis/alignment:

- Networks to facilitate flows of knowledge about technology and production may not exist:
⇒ focus on new instruments to address gaps
- Networks may exist, but goals may not promote development for the system as a whole:
⇒ focus on coordinating and aligning existing policy instruments, to integrate STI and socio-economic development goals
- Networks may exist, but fail to achieve these developmental goals:
⇒ focus on designing and strengthening implementation strategies





Practice 4: SWOT to assess capabilities and alignment across the NSI

A systemic analysis highlighting the strengths, weaknesses, opportunities, and threats in the national system of innovation

This section and the SWOT analysis indicators are based on a training workshop and guide document developed by Prof John Mugabe, Professor of Science and Innovation Policy at the University of Pretoria, South Africa.



Definition: **SWOT ANALYSIS**

A SWOT analysis is a strategic planning tool that is widely used to analyse a policy, programme, or intervention. It is one of the easiest techniques for conducting a systemic review of policy.

A SWOT analysis can form part of a systemic policy review, usually once stakeholders have been identified, or it can be undertaken independently of other practices. The focus is on assessing the strengths and weaknesses of a country's national system of innovation as well as opportunities and threats (SWOT). Strengths and weakness relate to factors internal to the system, whereas threats and opportunities relate to factors outside of the system. For example, well-resourced research labs focused on climate change is a strength, and strong political will and push to align with the SDGs is an opportunity. The SWOT analysis tool is flexible enough for a broad assessment of the NSI, or a more focused analysis to assess the readiness of the NSI to mobilise STI to address societal goals, such as climate change adaptation and mitigation, or to assess functional aspects of the systems such as financing of STI. While the system falls within national borders, it is important to recognise and assess the openness of the system to flows of knowledge, the introduction of new ideas and technologies, and the mobility of actors between the national, regional, and international spheres.



Why use a SWOT analysis

A SWOT analysis is flexible and easily adapted to your needs. It does not require specialised expertise to design or implement. What is required to gather quality intelligence or data is a good set of indicators to guide the analysis (see **Template 4** and the guidelines that follow). If done correctly, a SWOT analysis identifies opportunities to leverage rather than focusing mainly on strengths and weaknesses. There is a tendency for policy reviews to emphasise weaknesses, which leads to a policy approach focused on fixing problems rather than leveraging opportunities or strategising to address threats. If conducted on a regular basis, it can also be used to monitor the system.

A SWOT analysis is also useful to encourage participation, buy-in and commitment, at local and (domestic) regional levels. Include as wide a range of stakeholders as possible – from policy, academia, business, and civil society – to enlarge the policy constituency. For example, if gender equality is a focus for policy, include representatives from the ministry championing gender policy. In this way, it is possible to include and consider alignment across government and policy.

When to use a SWOT analysis

A SWOT analysis may be conducted at any time or point in the policy cycle. The frequency of use depends on the purpose and context. Some countries conduct a SWOT analysis of the NSI on a regular basis as part of their foresight exercises. Other countries have institutionalised SWOT analyses as part of strategic planning conducted once or twice a year to keep ahead of threats and leverage opportunities as they arise. In rapidly changing contexts, it is important to conduct a SWOT analysis on a more frequent basis.





NOTE:

If done correctly, a SWOT analysis identifies opportunities that may be leveraged rather than focusing mainly on strengths and weaknesses.



TIP:

Complement and confirm reflections from stakeholders with key indicators such as R&D and innovation survey data and the Global Innovation Index. Assess quality where possible rather than quantifying evidence. For example, it is not sufficient to count policies without an assessment of their quality. These principles need to be built into the design of the SWOT analysis.

How to conduct a SWOT analysis of the NSI

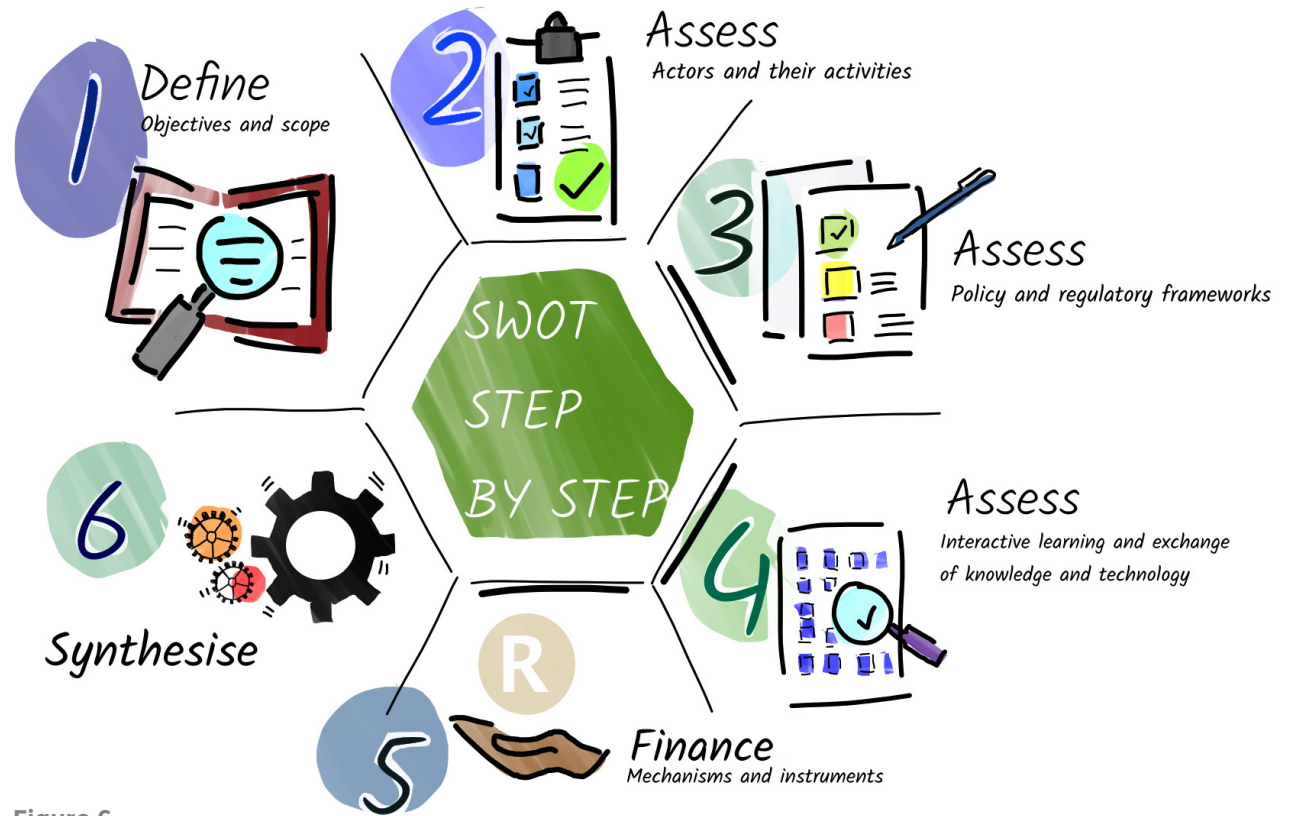


Figure 6
SWOT analysis steps

The process is summarised in Figure 6.

The first step is to define the objective and scope of the analysis. Is the objective to assess:

- the NSI more broadly?
- the readiness of the NSI to mobilise STI to address a specific societal goal? If so, which goal?
- functional aspects of the systems such as financing of STI? Specify which aspects.



To define the scope, based on the resources available, including funding, time, and human resources, consider whether the assessment needs to be:

- a rapid assessment involving desktop research and one engagement with a small number of key stakeholders
- broader and more in-depth involving desktop research and two or more stakeholder engagements

Identify the stakeholder groups to include based on the objective and scope.

The third part to consider in designing the SWOT analysis is the indicators to include based on the objective and scope. You may use these indicators, in four clusters, to design your SWOT analysis.

These cover the key features of the NSI:

1. Actors and their activities in the NSI – diversity in the types of actors (e.g., different types of companies, research councils, policy implementation agencies, and consumer groups), and their activities.
2. Policy and regulatory frameworks – rules or guides for behaviour.
3. Interactive learning and exchange of knowledge and technology – learning, which involves acquiring new information and knowledge, and doing things differently; linkages, interconnectedness or active interactions.
4. Financing mechanisms and instruments.

The next steps assess the strengths, weaknesses, threats, and opportunities within each category.

The NSI framework includes seven types of actors (see [Lens 3](#)). For each, assess their strengths and weaknesses, and then threats and opportunities:

- R&D institutions
- Higher education institutions (public and private)
- Basic education, and technical, vocational education and training (TVET) (public and private)
- Private sector enterprises (SMMEs and large companies)
- Non-governmental organisations (civil society)
- Policy and regulatory agencies
- Legislative bodies



Ask: What are the strengths and weaknesses of the key institutional actors in the NSI? What are the threats to and opportunities for these actors (and their activities) in the NSI?

Next, assess the policy and regulatory frameworks in the same way. First ask, what are the strengths and weaknesses of current policy and regulatory frameworks for STI (and the NSI in general)? Second, what are the threats to and opportunities for existing policy and regulatory frameworks?



Five types of policy and regulatory framework are covered here:

- Explicit STI policy frameworks, which also includes Intellectual property protection policy
- Contextual policy – setting framework conditions:
 - Human resource development policy
 - Trade and investment policy frameworks
 - Public procurement policy frameworks

This list should be adapted based on the objective and scope of the SWOT analysis. For example, if the objective is to assess the readiness of the system to mobilise STI to advance gender equality, then it is important to also assess gender policy. Remember gender is an example of socio-economic policy (see [Lens 2](#) and [Practice 3](#)).



Next, assess the dynamism of the NSI in relation to interactive learning and the exchange of knowledge and technology. First ask: what are the strengths and weaknesses of the NSI in terms of the quality of linkages, exchange of information and technology, and learning? Second: what are the threats and opportunities for the NSI in terms of the quality of linkages, exchange of information and technology, and learning?



Categories to consider include:

- industry-university linkages (exchange programmes)
- institutional linkages among R&D institutes
- R&D institutes-private sector linkages
- R&D institutes and university linkages to policy bodies
- R&D institutes linkages to consumer associations
- country's participation in regional, continental, and international programmes
- international mobility of researchers, technicians, and engineers

Adapt and add to this list based on the knowledge flows and linkages that are important for your country. For example, the scale and quality of university linkages with communities and informal actors may be important to consider, particularly if the objective of the SWOT analysis is to assess the readiness of the NSI to orient STI to reduce inequalities.

The final cluster of indicators relate to financing mechanisms and instruments.

Template 7 in the Additional Resources section includes the following public R&D funding mechanisms and instruments to consider:

- public innovation funding mechanisms and instruments
- corporate/business R&D financing mechanisms and instruments
- corporate/business innovation funding mechanisms and instruments
- multilateral and bilateral international funding mechanisms and instruments
- private philanthropic funding mechanisms and instruments



It is important to adapt this list based on the objective and scope of the SWOT analysis. For example, you may want to consider funding for grassroots innovation or university-community interaction.

The guiding questions for this final step are:

- What are the strengths and weaknesses of existing research and innovation financing mechanisms and instruments?
- What are the threats and opportunities to (strengthen) current mechanisms and instruments?

The final step is to synthesise the inputs and develop a summary of strengths to optimise, weaknesses to reduce, threats to counter and opportunities to leverage for the effective implementation of change pathways. It is important to include additional information and data gathered using desktop research. For example, data on linkages could be obtained from national R&D and innovation survey data, if available. The STEEP analysis (**Practice 1**), change pathways map (**Practice 2**) and systematic review of policy text (**Practice 3**) will also yield insights to inform the SWOT analysis. For example, changes required to achieve the long-term policy goals may relate to specific weaknesses in capabilities or weak alignment in the NSI.



TIP:

Use **Template 4** to capture the stakeholder discussion and synthesise the evidence gathered. You may also use the template in the **Additional Resources** section to draft a summary report.



NATIONAL SYSTEM OF INNOVATION (NSI)

Template 4
SWOT analysis
assessing
capabilities and
alignment across
the NSI

External

Opportunities 

What are the opportunities for:

- key actors in the NSI?
- current STI policy & regulatory frameworks?
- NSI - quality of linkages, knowledge exchange, & learning?
- strengthening financing mechanisms & instruments?

Threats 

What are the threats for:

- key actors in the NSI?
- current STI policy & regulatory frameworks?
- NSI - quality of linkages, knowledge exchange, & learning?
- strengthening financing mechanisms & instruments?

Internal

Strengths 

What are the strengths of:

- key actors in the NSI?
- current STI policy & regulatory frameworks?
- NSI - quality of linkages, knowledge exchange, & learning?
- financing mechanisms & instruments?

Strategies to make use of Opportunities through our Strengths

Strategies to prevent Threats through our Strengths

Weaknesses 

What are the weaknesses of:

- key actors in the NSI?
- current STI policy & regulatory frameworks?
- NSI - quality of linkages, knowledge exchange, & learning?
- financing mechanisms & instruments?

Strategies to make use of Opportunities to minimize Weaknesses

Strategies to minimize the potential dangers lying in areas where Weaknesses meet Threats





Conclusion

*Questions addressed through
the four practices included
in this toolkit*

This toolkit provides a set of four practices curated and customised for use by African science granting councils, policymakers and practitioners to guide the review of STI policy. Each practice is informed by an analytical lens, which should ideally be read before implementing the practice. Together, the lenses and practices guide STI policy reviews that are systemic and evidence based, informed by participatory processes and strategic reflection. Table 3 summarises the questions addressed through implementing the four practices. These align with well-established STI policy review frameworks such as UNCTAD’s STI Policy (STIP) review framework.^{xxiii} The toolkit may thus be useful as part of wider STI policy review processes.

Table 3 Questions addressed through the four practices included in this toolkit

Focus	Questions	Practice
Contextual factors, enabling environment	<p>What factors – social and cultural, technical and technological, economic, environmental, political and policy – are important to address key societal challenges? How have these changed over time?</p> <p>What drivers contribute to progress in addressing the key societal challenges?</p> <p>What are the barriers hindering progress in addressing the key societal challenges?</p> <p>How does national STI policy address key societal challenges? How has this changed over time?</p> <p>Which policy instruments have unintended consequences that hinder progress?</p> <p>Which policy instruments contribute to progress in addressing key societal challenges?</p>	<p>Practice 1: A STEEP understanding of the problem</p> <p>Template 1: STEEP analysis</p> <p>Template 5: STEEP analysis</p>
Innovation system		
Actors, capabilities and activities	<p>What are the strengths and weaknesses of the main institutional actors in the NSI?</p> <p>What are the threats to and opportunities for institutional actors (and their activities) in the NSI?</p>	<p>Practice 4: SWOT to assess capabilities and alignment across the NSI</p>
Linkages and networks	<p>What are the strengths and weaknesses of the NSI in terms of the quality of linkages, exchange of information and technology, and learning?</p> <p>What are the threats and opportunities for the NSI in terms of the quality of linkages, exchange of information and technology, and learning?</p>	<p>Template 4: SWOT analysis assessing capabilities and alignment across the NSI</p>
Institutions	<p>What are the strengths and weaknesses of current policy and regulatory frameworks for STI (and the NSI in general)?</p> <p>What are the threats to and opportunities for existing policy and regulatory frameworks for STI (and the NSI in general)?</p>	<p>Template 7: SWOT analysis – indicators for assessing capabilities and alignment across the NSI</p>

Continues overleaf...



Innovation system	Questions	Practice
Financing	<p>What are the strengths and weaknesses of existing research and innovation financing mechanisms and instruments?</p> <p>What are the threats to and opportunities for (strengthening) existing research and innovation financing mechanisms and instruments?</p>	
Strategies	<p>What strategies can make use of opportunities through strengths?</p> <p>What strategies can prevent threats through strengths?</p> <p>What strategies can use opportunities to minimise weaknesses?</p> <p>What strategies can minimise the potential dangers that exist where weaknesses meet threats?</p>	
STI policy mix		
Strategic objectives	<p>What policy objectives are important to address the key societal goals? What are the long-term objectives and desired impact?</p> <p>What changes are needed, in the long, medium and short term, to achieve development goals?</p> <p>What activities and resources are needed for the changes to take place? What activities and resources do different stakeholders need to commit to bring about the changes needed?</p> <p>What are the courses of action? What is the time frame in which the long-term goals should be achieved? What are the specific targets?</p> <p>What is the readiness of the NSI to mobilise STI to address key societal goals?</p> <p>To what extent is STI policy addressing the key societal challenges?</p>	<p>Practice 2: Challenge-led policy roadmap towards identifying key change pathways</p> <p>Template 2: Challenge-led STI policy roadmap</p> <p>[See also Practice 3 and Practice 4 for guidelines to assess capabilities and alignment across the NSI]</p>
Policy focus areas / worldview	<p>What is the focus and direction of STI? (e.g., is the focus on economic growth and wealth creation mainly?)</p> <p>To what extent are wider processes of STI considered – i.e., diffusion and uptake, learning, etc.?</p> <p>Which target groups are prioritised in policy? To what extent are the needs and participation of non-traditional actors such as community-based organisations prioritised?</p> <p>How does the policy text define STI (e.g., is it a traditional focus on technology led innovation)? How are the key societal challenges defined? How is the relationship between STI and key societal challenges described?</p> <p>Are new actors and relations identified?</p> <p>Does the policy aim to address any of the core directions to address key development challenges?</p>	<p>Practice 3: Assessing vertical and horizontal alignment across STI policy</p> <p>Template 3: Identifying key policy instruments to achieve policy goals</p> <p>Template 6: Policy alignment, misalignment, co-ordination, and gaps</p>

Continues overleaf...











STI policy mix	Questions	Practice
Policy instruments	What policy instruments are crucial to achieve the intended policy goals and impact?	<p>Practice 3: Assessing vertical and horizontal alignment across STI policy</p> <p>Template 3: Identifying key policy instruments to achieve policy goals</p> <p>Template 6: Policy alignment, misalignment, co-ordination, and gaps</p>
	What types of policy instruments are identified to facilitate implementation? What are the specific policy instruments?	
	Which policy instruments are already implemented? Which policy instruments can be selected for further investigation to assess impact and monitor policy progress?	
Policy coherence/ alignment	Are the right policies in place?	
	Is the STI policy mix internally consistent and coherent? Are policy objectives, goals and instruments aligned with new approaches to mobilising STI for transformative change?	
	Is STI policy aligned with other areas of public policy, socio-economic or contextual, relevant for key societal goals?	
	Where can alignment and co-ordination be improved? Are there synergies, duplication, and gaps across government departments?	
	Is STI policy aligned with socio-economic policy more broadly?	
	Is STI policy aligned with regional and international development priorities (e.g., STISA-2024, SDGs)?	
Policy actors/ implementation	Who are the main actors active in the STI policy process, from agenda setting and policy design to policy evaluation? Who is missing or excluded?	
	How inclusive is the process of policy design?	
	Which departments and agencies are important to include in the STI policy review?	
	Which policy texts should be included in the STI policy review?	
	Who are the key partners to support implementation to achieve the intended impact?	
	What are the worldviews and responsibilities of bodies responsible for policy implementation?	
	At which level is the policy targeted? National, regional, or sectoral?	
Policy evaluation	Is there an implementation plan?	
	Is there a plan for diffusion (i.e., taking the policy to the target groups)?	
	Is there a plan for monitoring and evaluation? Are there any indicators for assessment?	










ADDITIONAL **RESOURCES**

References and further reading

- Chaminade, C., and R. Padilla-Perez. 2017. The challenge of alignment and barriers for the design and implementation of Science, Technology and Innovation policies for innovation systems in developing countries. In *Research Handbook on Innovation Governance for Emerging Economies: Towards Better Models*, edited by S. Kuhlman and G. Ordoñez-Matamoros, 181–204. Cheltenham, UK: Edward Elgar.  For an understanding of vertical and horizontal alignment across STI policy (relevant for **Lens 2**, **Lens 3** and **Practice 3**)
- De Vicente Lopez, J., and Matti, C. 2016. *Visual toolbox for system innovation. A resource book for practitioners to map, analyse and facilitate sustainability transitions*. Transitions Hub Series. Climate-KIC, Brussels.  For more information on socio-technical systems mapping including visioning and mapping change pathways (relevant for **Lens 1** and **Practice 2**) and other useful tools for stakeholder engagement processes
- Diyamett, Makundi and Sheikheldin. 2019. *Science, Technology and Innovation (STI) policy training for Africa: a basic module on reconciling theory, practice and policies*. A Handbook prepared by the Science, Technology and Innovation Policy Research Organization (STIPRO) on behalf of the ACTS Consortium under the Science Granting Councils' Initiative (SGCI), Theme III.  For a detailed overview of the national systems of innovation approach (relevant for **Lens 3** and **Practice 4**)
- Foster, C., and Heeks, R. 2015. *Policies to support inclusive innovation*. Development Informatics, Working Paper 61, Centre for Development Informatics, University of Manchester, UK.  For an overview of a systemic STI policy review focused on innovation for inclusive development (relevant for **Lens 2** and **Practice 3**)
- Hanlin, R. 2022. *Strengthening monitoring and evaluation and learning in African science granting councils: a guide*. Nairobi: ACTS.  For an understanding of STI policy reviews as part of M&E
- Miedzinski, M., Mazzucato, M. and Ekins, P. 2019. *A framework for mission-oriented innovation policy roadmapping for the SDGs: The case of plastic-free oceans*. UCL Institute for Innovation and Public Purpose, Working Paper Series (IIPP WP 2019-03). <https://www.ucl.ac.uk/bartlett/publicpurpose/wp2019-03>  For an understanding of mission-oriented transformative innovation policy, policy roadmapping and conducting a STEEP analysis (relevant for **Lens 1**, **Practice 1** and **Practice 2**)
- Petersen, I., and Kruss, G. 2019. Promoting alignment between innovation policy and inclusive development in South Africa. *Development Southern Africa*, 36:3, 351-375, DOI: <https://doi.org/10.1080/0376835X.2018.1490175>  For background information and more detailed overview of the systemic policy review methodology focussing on alignment and identifying policy instruments (relevant for **Lens 2** and **Practice 3**)
- Petersen, I., Kruss, G., Rust, J., Juan, A., and Tele, A. 2016. Is South Africa ready for 'Innovation for Inclusive Development'? A review across national policy. Report to the DST prepared by the Education and Skills Development programme, Human Sciences Research Council, Pretoria.  For background information and more detailed overview of the systemic policy review methodology focussing on alignment and identifying policy instruments (relevant for **Lens 2** and **Practice 3**)



- Schroth, F., Glatte, H., Kaiser, S., and Heidingsfelder, M. 2020. Participatory agenda setting as a process — of people, ambassadors and translation: A case study of participatory agenda setting in rural areas. *European Journal of Futures Research*, 8(6). <https://doi.org/10.1186/s40309-020-00165-w>  For more information on participatory policy processes, specifically agenda setting (relevant for **Lens 1**)
- Schot, J., and Steinmueller, E. 2018. Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47 (9): 1554-1567.  For an overview of challenge-led innovation policy, specifically the transformative innovation policy approach (relevant for **Lens 1**, **Lens 2** and **Practice 3**)
- UNCTAD. 2019. *A Framework for Science, Technology and Innovation policy reviews harnessing innovation for sustainable development*. United Nations. https://unctad.org/system/files/official-document/dtlstict2019d4_en.pdf  For a framework for STI policy review and a detailed list of questions that can help in analysing innovation systems, government policies and relations with SDGs
- Von Tunzelmann, N. 2007. Approaching network alignment. Draft Paper for the U-Know Consortium: Understanding the relationship between knowledge and competitiveness in the enlarging European Union.  For a more detailed understanding of the network alignment approach (relevant for **Lens 2**, **Lens 3**, **Practice 3** and **Practice 4**)
- Von Tunzelmann, N. 2010. Technology and technology policy in the post-war UK: ‘Market failure’ or ‘network failure’? *Revue Déconomie Industrielle* 129–130, 237–58.  For a more detailed understanding of the network alignment approach (relevant for **Lens 2**, **Lens 3**, **Practice 3** and **Practice 4**)

Glossary of key concepts and terms

Backcasting	A 'technique that makes you look back from a future scenario, identifying and assessing changes and actions for that future to come true'. It is useful for strategic planning, to set an agenda for change (De Vicente Lopez and Matti, 2016: 110).
Challenge-led STI policy	Challenge-led policy emphasises societal challenges as a starting point and key focus for STI policy and includes mission-oriented transformative innovation policy approaches.
Challenge-led policy road mapping	This starts with visioning to articulate a desired future scenario when a selected societal problem no longer exists, and then mapping potential change pathways towards this desired future.
Change pathways	Change pathways are composed of three basic elements: changes important to achieve the desired policy objective(s), activities and resources to achieve the desired changes, and specific trends and drivers that may create opportunities or hinder changes.
Collective framing and visioning	Consensus building, from the bottom-up, to co-create shared understandings of the problem, objectives and visions.
Horizontal alignment	Alignment across STI policy and socio-economic policy – or the extent to which STI policy is aligned with national, regional, and global development goals.
National system of innovation (NSI) approach	Rather than follow a linear approach, the NSI approach places emphasis on STI capabilities, knowledge flows, interaction and learning between public and private sector actors involved in production, knowledge generation and use and diffusion. It includes institutional frameworks as rules or guides for behaviour.
Network failure or misalignment	An instance of the failure of a system, rather than an individual firm or individual university, government agency, or network.
Policy objectives	A set of core directions for better alignment with social and economic development goals to enable transformative change.
Policy worldview	A specific understanding and thinking about STI goals, actors, and processes.
Problem framing	How a problem is interpreted and articulated.
Socio-technical systems	An approach to understanding innovation processes and transitions. Components of a sociotechnical system include: Landscape (macro-level), regimes (meso-level), niches, (micro-level) and feedback loops between all levels (De Vicente Lopez and Matti, 2016: 64).
STI policy review	Part of the process of STI policy monitoring and evaluation that also informs the whole STI policy process. Different types of STI policy review serve different objectives including review of the national system of innovation or the whole policy regime, and review focused on specific development goals, sectors, functions, or policy instruments.
SWOT analysis	A strategic planning tool that is widely used to analyse a policy, programme, or intervention. SWOT refers to strengths, weaknesses, opportunities, and threats.

Continues overleaf...



Systematic gathering of evidence	Collection of evidence through a structured method with clear inclusion and exclusion criteria.
Systemic review of STI policy	This emphasises mobilising STI to address social, economic, and environmental challenges. A key focus is to assess alignment of national STI policy with national, regional and global development goals, as well as alignment of development goals across government including departments and agencies <i>directly</i> involved in STI policy, socio-economic policy and contextual policy.
Theory of change	A description of how changes and impact will take place.
Vertical alignment	Alignment across policy objectives, goals and instruments, and how these align with new approaches to mobilise STI towards transformative change.
Visioning	Visioning is about ‘picturing the desirable future and describing what it might look like’. It involves imagining and creating a feasible scenario of what the future will look like when the problems are solved. Visioning is thus about foresight with an emphasis on imagining rather than making predictions based on current trends and evidence (De Vicente Lopez and Matti, 2016: 110).

Examples of other STI policy review methodologies

Methodology	Overview
UNCTAD STI Policy (STIP) review	‘(I)ncludes a diagnosis of the national system of innovation (NSI), an assessment of the STI policies in place, and is normally complemented by in-depth studies of specific sectors, institutions or STI-related problems that are of particular relevance to the country under review’. Undertaken by UNCTAD at the request of member states. As of 2022, UNCTAD has completed STIP Reviews in 19 countries, most recently in Zambia, the Dominican Republic, Uganda, Ethiopia and Panama. (https://unctad.org/topic/science-technology-and-innovation/STI4D-Reviews)
UNESCO Go-SPIN (Global Observatory of Science, Technology and Innovation Policy Instruments)	‘Upon request by the country, a country profile, representing a comprehensive study of all the science, technology and innovation (STI) policies, can be developed by UNESCO and published in the online series of GO-SPIN country profiles “Mapping Research and Innovation”. This includes a description and analysis of the components of a country’s STI system.’ (https://en.unesco.org/go-spin/country-profiles)
OECD Reviews of Innovation Policy	‘(O)ffer a comprehensive assessment of the innovation system of individual OECD member and partner countries, focusing on the role of government. They provide concrete recommendations on how to improve policies which impact on innovation performance, including R&D policies. Each review identifies good practices from which other countries can learn.’ Only South Africa has had an OECD review conducted and this took place over 10 years ago. (https://www.oecd.org/sti/inno/oecd-reviews-of-innovation-policy.htm)
STI for SDGs Roadmap	‘(D)efined as a forward-looking policy framework, action plan and/or strategy, to continuously guide effective actions that utilize STI to achieve the SDGs with a country-wide scope, including at national and subnational levels, also with implications at the international level.’ Currently at a pilot stage. Provides a means to review STI activity in a country against 10 elements within three categories: 1) analytical and deliberative inputs, 2) policy outputs, and 3) process and implementation. (https://sdgs.un.org/sites/default/files/2021-06/GUIDEBOOK_COMPLETE_V03.pdf)

Source: Adapted from Hanlin (2022: 6).

Example of a customised framework for a systemic review of policy focusing on STI for inclusive development

It is well recognised that STI is a key driver of economic growth but, in recent years, it has become clear that STI may actually foster inequalities and hinder economic and social development and environmental sustainability. Promoting STI for inclusive development is necessary, particularly for African countries with high levels of poverty and inequality. The focus is on assessing the extent to which national STI policies are geared to advance STI for inclusive development (STI4ID).

To assess how and whether the policy environment enables STI and inclusion, it is important to define what transformative STI for inclusive development (STI4ID) policy goals would look like.

The objectives illustrated in Figure 7 were identified via desktop research and corroborated through stakeholder engagement and a further review of literature in the country context.

Drawing on the STI4ID objectives the policy review was designed to assess:

- the policy worldviews articulated through the stated strategic objectives and goals in the policy documents; and
- the extent to which the policy instruments proposed in the policy documents promote objectives of STI for inclusive development.

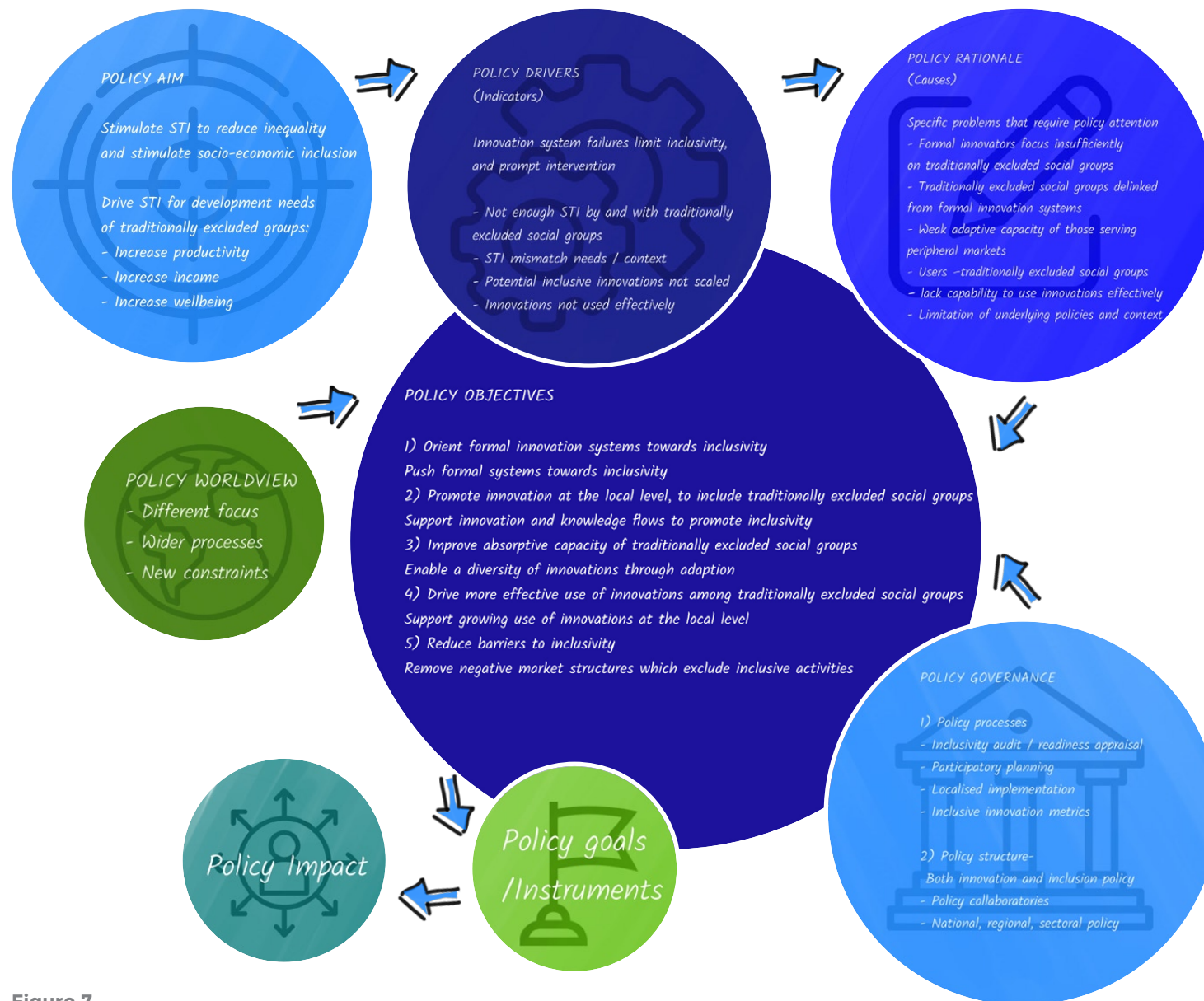


Figure 7
Framework for analysing policy

Source: Adapted from Foster and Heeks (2015) and Petersen and Kruss (2019). Further adaptation was made during a workshop, on 14 September 2021, with a national task team co-ordinated by Malawi's National Commission for Science and Technology.

While a traditional STI policy agenda tends to exclude low-income and vulnerable social groups, whether intentionally or unintentionally, policy promoting STI4ID emphasises STI *for, by and with* traditionally excluded social groups. In recent years, with the shift to harnessing STI for socio-economic development, spurred by the SDGs, for example, governments have begun to consider how to orient formal innovation systems to address the needs of traditionally excluded social groups. However, interventions tend to focus on including women, low-income groups, and other traditionally excluded groups as consumers of innovation mainly. Interventions thus typically incentivise large firms to produce new or significantly improved goods and services at affordable prices that address the needs of low-income groups, for example, or promote the expansion of access to higher education and STEM. This new policy objective, while in the right direction, thus emphasises STI *for* traditionally excluded groups. Promoting STI *by* and *with* requires policy objectives that enable more transformative change.

An STI4ID agenda is underpinned by a transformative approach to policy. An objective of STI policy should be to support learning and knowledge flows among actors at the local level to better enable innovation by traditionally excluded groups. This tends to be small-scale and take place at the local level, informed by in-depth knowledge of the local context. Innovations in the informal sector, for example, tend to be motivated by consumer needs providing solutions and products locally at affordable prices. Innovations by traditionally excluded groups tend to be constrained by lack of skills, funding, and other resources. Policy supporting innovation by these social groups needs to prioritise building the absorptive capacity of informal businesses and small and micro enterprises owned by women, for example, to adopt and adapt innovations to build their businesses and develop new or improved products and services for their local areas.

Policy intervention is necessary to support the use of innovations by informal businesses and other traditionally excluded groups. Creating markets for affordable innovations is an example of such an intervention. Another example is supporting NGOs, CBOs, and other intermediaries involved in supporting the diffusion of innovation and strengthening impact at the local level.

'(P)olicy and institutions can themselves become a limitation'^{xxiv} to STI4ID. Policies as well as government rules and norms may intentionally or unintentionally create barriers to social, economic, and spatial inclusion. Therefore, the fifth objective for transformative policy is to identify and remove barriers to inclusion.

Additional templates

- Template 5. STEEP analysis
- Template 6. Policy alignment, misalignment, co-ordination, and gaps
- Template 7. SWOT analysis – indicators for assessing capabilities and alignment across the NSI

Template 5 STEEP analysis

Factors	Where are we?		Barriers	Drivers	Specific policy instruments (indicate - barriers/drivers)
	Past	Now			
Social and cultural					
Technical and technological					
Economic					
Environmental					
Political					
Policy					



Template 6 Policy alignment, misalignment, co-ordination, and gaps

The following questions may guide the analysis, with the template below. Note that this includes examples extracted from a systemic review of STI policy in South Africa focused on STI for inclusive development.

These questions may be adapted to the aims of the STI policy review:

- 1 What is the nature of shared goals in the current policy networks?
 - Who are the main actors potentially involved, at national level?
 - What are their views on STI and/or on socio-economic development?
 - What are their specific policy objectives/development goals relevant to STI and/or socio-economic development?
 - What are the formal policy instruments intended to achieve these goals?

- 2 How are the goals and networks aligned with one another and the goals of STI for socio-economic development?

- 3 What are the spaces for policy alignment, to support network alignment?
 - Where is alignment that can be strengthened?
 - Where is misalignment that requires coordination?
 - Where are there gaps in alignment that require new interventions?
 - Where do development goals need to be shared more effectively?

Type of policy	Government department/ agency	POLICY OBJECTIVES				
		Objective 1 e.g., Orient formal innovation systems to include the needs and knowledge of informal actors	Objective 2 e.g., Reduce structural barriers in government to support informal sector development	Objective 3 e.g., Promote grassroots innovation	Objective 4 e.g., Improve absorptive capacity of informal actors	Objective 5 e.g., Drive effective use of innovations among informal actors
STI POLICY	E.g., Department of Science and Innovation (DSI): to enable science, technology and innovation in support of inclusive national development	Extend and align: [ADD]	Extend and align: [ADD]	Extend and align: [ADD]	Extend and align: [ADD]	Extend and align: [ADD]
		Misalignment: e.g., instruments focus mainly on R&D-led innovation	Misalignment: [ADD]	Misalignment: [ADD]	Misalignment: [ADD]	Misalignment: [ADD]
		Gap: e.g., DSI to create an integrated strategic focus to coordinate and create new instruments to promote innovation, participation and livelihoods in the informal sector	Gap: [ADD]	Gap: [ADD]	Gap: [ADD]	Gap: [ADD]
		Potential partners for co-ordination and alignment: e.g., DTI; DSBD; EDD; Presidency; DRDLR; DWS; DAFF	Potential partners for co-ordination and alignment: [ADD]	Potential partners for co-ordination and alignment: [ADD]	Potential partners for co-ordination and alignment: [ADD]	Potential partners for co-ordination and alignment: [ADD]
		Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]

Continues overleaf...



SOCIO-ECONOMIC DEVELOPMENT POLICY	E.g., Department of Small Business Development (DSBD): SMME development, including micro, small and medium enterprises and co-operatives in the formal and informal sectors	Extend and align: e.g., DSI to align with and integrate DSBD new policy instruments to promote technological upgrading, transfer and diffusion, to complement support for developing business management skills and improving standards	Extend and align: [ADD]	Extend and align: [ADD]	Extend and align: [ADD]	Extend and align: e.g., DSI and DSBD to align and coordinate funding instruments to create technology platforms and promote technology transfer
		Misalignment: [ADD]	Misalignment: [ADD]	Misalignment: [ADD]	Misalignment: [ADD]	Misalignment: [ADD]
		Gap: e.g., DSI to link with and introduce innovation policy instruments targeting the informal sector into DSBD's NIBUS programme to uplift informal businesses	Gap: [ADD]	Gap: [ADD]	Gap: [ADD]	Gap: [ADD]
		Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]
CONTEXTUAL POLICY	E.g., Department of Trade and Industry (DTI): Development of SMME clusters and economic zones	Extend and align: e.g., DTI with DSI and DSBD: expand clusters beyond the small set of formal sectors and focus more on participation by micro enterprises and technology entrepreneurs in the informal sector	Extend and align: [ADD]	Extend and align: [ADD]	Extend and align: [ADD]	Extend and align: [ADD]
		Misalignment: [ADD]	Misalignment: [ADD]	Misalignment: [ADD]	Potential alignment: [ADD]	Potential alignment: [ADD]
		Gap: [ADD]	Gap: [ADD]	Gap: [ADD]	Gap: [ADD]	Gap: [ADD]
		Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]	Policy instruments: [ADD]

Template 7 SWOT analysis - indicators for assessing capabilities and alignment across the NSI

Category of actors and activities	Strengths	Weaknesses	Threats	Opportunities
ACTORS AND ACTIVITIES				
R&D institutes	<ul style="list-style-type: none"> Adequacy of mandate, relevance, staffing, infrastructure, funding, etc. Productivity or performance in terms of research outputs 		<ul style="list-style-type: none"> National economic performance Leadership Potential institutional and legislative reforms 	
Higher education institutions	<ul style="list-style-type: none"> Relevance of academic and training programmes to the needs of the NSI/ country Productivity or performance in terms of research outputs 		<ul style="list-style-type: none"> National economic performance Leadership Potential institutional and legislative reforms 	
Basic education and TVET	Relevance of training curriculum to the needs of the NSI/ country		<ul style="list-style-type: none"> National economic performance and macroeconomic stability Stability (or discontinuity) in policy and legislative environment 	
Private sector enterprises	<ul style="list-style-type: none"> Existence of private companies (SMMEs and large) with R&D&I activities (departments or programmes) Participation of private companies in public R&D&I programmes 		<ul style="list-style-type: none"> Leadership and governance (extent to which political liberties are expanded) and organisational capacities including budgets for engagement in/ with STI 	
Policy and regulatory agencies (e.g., STI ministries and departments)	<ul style="list-style-type: none"> Existence and dynamism of a ministry or department dedicated to STI policy Existence and dynamism of technology/ innovation support agencies (e.g., bureau of technical standards) 		<ul style="list-style-type: none"> Political leadership 	
Legislative bodies e.g., parliamentary committees for STI	<ul style="list-style-type: none"> Existence and dynamism of legislative bodies that influence/ determine STI policy priorities, budgets, etc. 		<ul style="list-style-type: none"> Engagement in policy and budgeting for STI 	
POLICY AND REGULATORY FRAMEWORK				
Explicit STI policy frameworks	<ul style="list-style-type: none"> Existence, relevance (alignment with national and global SDGs) and effectiveness of national STI policy, implementation plan and policy instruments 			
Human resource development policy	<ul style="list-style-type: none"> Extent to which human resource development policy (for education, TVET and skills) contributes to the attainment of STI/ NSI goals 			
Intellectual property protection policy	<ul style="list-style-type: none"> Extent to which IPP policy contributes to innovation, knowledge, and technology transfer 			
Trade and investment policy frameworks	<ul style="list-style-type: none"> Extent to which trade and investment policy frameworks support R&D, innovation, and technology transfer 			
Public procurement policy frameworks	<ul style="list-style-type: none"> Extent to which public procurement is used as an innovation policy instrument 			

Continues overleaf...



Other	•			
INTERACTIVE LEARNING AND EXCHANGE OF KNOWLEDGE AND TECHNOLOGY				
Industry-university linkages (exchange programmes)	•			
Institutional linkages among R&D institutes	•			
R&D institutes-private sector linkages	•			
R&D institutes/ universities linkages to policy bodies	•			
R&D institutes linkages to consumer associations	•			
Country's participation in regional, continental, and international programmes	•			
International mobility of researchers, technicians, and engineers	•			
Other	•			
MECHANISMS AND INSTRUMENTS				
Public R&D mechanisms and instruments	•			
Public innovation mechanisms and instruments	•			
Corporate/ business R&D financing mechanisms and instruments	•			
Corporate/ business innovation financing mechanisms and instruments	•			
International (multilateral and bilateral) funding mechanisms and instruments	•			
Private philanthropic funding mechanisms and instruments	•			
Other	•			



Link to Excel templates that may be customised to purpose

To access the digital version of this toolkit, Excel templates and other Evi-Pol outputs and resources, scan the QR code below.



Alternatively, you can access these tools by visiting the CeSTII webpages at <https://hsrc.ac.za/divisions/centre-for-science-technology-and-innovation-indicators/>, or the HSRC's Research Output Repository at <https://repository.hsrc.ac.za>.

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- i See Hanlin (2022) for a more detailed account of the status of STI policy reviews of countries participating in the SGCI.
 - ii De Vicente Lopez and Matti (2016: 110).
 - iii Petersen and Kruss (2019)
 - iv Miedzinski et al. (2019: 1)
 - v Schroth et al. (2020: 1)
 - vi The idea of bringing together local experts with different sets of expertise.
 - vii Chaminade and Padilla-Perez (2017)
 - viii Ibid
 - ix Ibid
 - x Foster and Heeks (2015)
 - xi Ibid
 - xii von Tunzelmann (2007, 2010)
 - xiii Ibid
 - xiv Diyamett et al. (2019)
 - xv Miedzinski et al. (2019)
 - xvi This template was adapted from Kyrian Problem Resolver (2022) by Marcial Atiénzar.
 - xvii The challenge-led roadmap is an adapted version of the Socio-Technical Roadmap tool developed as part of Climate-KIC's visual toolbox on system innovation (De Vicente Lopez and Matti, 2016: 137).
 - xviii Miedzinski et al. (2019: 1)
 - xix De Vicente Lopez and Matti (2016: 137).
 - xx Smits and Kuhlmann (2004) cited in Miedzinski et al. (2019).
 - xxi Chaminade and Padilla-Perez (2017)
 - xxii Petersen and Kruss (2019)
 - xxiii UNCTAD (2019: 32)
 - xxiv Foster and Heeks (2015: 6)





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