

# Assessing SEI's policy engagement

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**SEI report**  
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## 1. Introduction

The Stockholm Environment Institute (SEI) was formed in 1989 with a mission to induce change towards sustainable development by bridging science and policy. Its vision is to facilitate “a sustainable prosperous future for all”. The SEI mission is “*To support decision-making and induce change towards sustainable development around the world by providing integrative knowledge that bridges science and policy in the field of environment and development.*” Consequently, SEI is a research institute and all its research activities aim to have policy impact in some way. Although SEI has a goal to induce change towards sustainable development it does not advocate solutions or views based upon beliefs but only based on scientific evidence and understanding. Therefore, SEI is not an advocacy organization that takes a political stance on an issue, but is led by the science and does “advocate” the changes that need to be made to achieve sustainable development. SEI interacts with decision-making and policymaking at different institutional and organizational scales and levels. This includes decisions made by individuals to change behaviour, whether they are individual decision-makers at a community scale, in the private sector, in local authorities (including urban decision-making governance structures), or in national or international policy development processes.

SEI bridges science and policy, and the understanding of how SEI undertakes policy engagement and the impact it has is not always as clear as the success of our scientific endeavours. During the SEI 2015–19 strategy period, the organization invested in institutional learning to better understand its policy engagement and determine ways to improve it. The role of Policy Director was created in 2013 to initiate activities to help understand how SEI undertakes policy engagement, and how others consider the interaction between knowledge on decision and policymaking to occur, as well as to identify ways to increase SEI’s capacity to engage with these decision-making processes and have high impact. The Policy Director-led team undertook a programme of activities to better understand SEI’s engagement with decision-makers, enhance the capacity of SEI staff, and improve the organization’s chances of achieving significant impact on decision-making.

This report represents an assessment of how we engage with policy and decision-making, the outcomes of that engagement and the characteristics of SEI that enable successful outcomes to be achieved. It puts into context the engagement of SEI research and researchers with decision and policymaking processes around the world, draws out understanding, and offers lessons on how we might improve what we do.

Although indices ranking institutions are controversial, SEI has ranked highly in the Go To Think Tank Index of the Think Tanks and Civil Societies Program of the University of Pennsylvania, having been either number one or two in the environmental think tank category since 2013. One criterion in developing this ranking is the “ability to produce high quality, rigorous and policy-oriented research that is accessible to policymakers, media and the public”. This implies that SEI is recognized as undertaking credible research and, since another criterion is the “impact of a think tank’s research on policymakers and other policy actors”, it also implies that it has meaningful impact on policy and decision-making.

In assessing SEI’s impact, “policy engagement” has been defined as “Engagement by SEI with key decision-makers and processes leading to a change in agendas, capacities, and decisions, as a result of the knowledge that is supplied or co-generated”. This is a development of the definition in the SEI report *Getting to Policy Impact: Lessons from 20 Years of Bridging Science and Policy with Sustainability Knowledge* (2009), which was the first attempt to understand SEI’s policy impact. In this report, policy impact was defined as “an observed change in the public policy process (and/or content) as a result of the knowledge that is supplied (or co-generated)”. This has been adapted in our recent work to emphasize the focus on changing the agendas, capacities and decision-making of individuals (empowering people) to make change occur, and not limiting it to “public policy” processes.

SEI is an institution that was initiated by policymakers in the Swedish Government who were inspired by international policy processes, especially the UN Stockholm Conference in 1972, which provided SEI with its name, and also the Brandt Commission report of 1980 and the 1987 World Commission on Environment and Development report *Our Common Future* (also known as the Brundtland Report). It was set up as an independent science-based research institute, and whilst the scientific method is well understood by SEI's scientific researchers, the ways in which engagement can feed back into the decision and policy-making processes, and how it can be made more effective, are less universally understood: SEI researchers have an understanding of the processes in their area of work, but this understanding can sometimes be rather abstract and theoretical, and does not always cross disciplinary and sectoral boundaries.

Relevant literature is reviewed in more depth below, but relatively recently Weible et al. (2012) have stated that “The study of research utilization in decision-making and policy implementation is so complex and multifaceted that the assumption that a single framework or theory can explain all its facets and effects is absurd”. Further, recognizing that there are different governance structures (i.e. decision-making structures) around the world, and that these governance structures are subject to change, SEI seeks to engage with “a diversity of societal actors” who “negotiate” and “implement” the governance patterns” and thereby affect outcomes (Loorbach 2010, pp.161, 165). While at SEI we understand that there is no one approach that can work in all different contexts and that we need to be adaptive and use approaches that are appropriate to the decision-making context, that does not mean that we cannot learn from our own, and other people's, experiences of working at the interface between knowledge creation and decision-making, and improve the impact of what we do.

To understand SEI, it needs to be understood that the Institute has grown out of the “Nordic mindset”. In a recent (2018) talk at the Nordic Urban and Rural Development Day at the Nordic COP 23 pavilion in Bonn, Nikolaj Sveistrup, Head of Programme at the Danish Architecture Centre, said, “I often hear the question how much our Nordic solutions cost, but you cannot buy our Nordic way of thinking. You have to change your mindset.”<sup>1</sup> Part of that mindset is a collaborative ethos, but another strong element is reliance on knowledge. It was Sweden that proposed the UN Stockholm Conference in 1972. In that highly significant conference many issues and concepts that are still relevant today were first brought together to galvanize the global community to focus on the links between environment and development. The first SEI Executive Director, Gordon Goodman was a key author of *Our Common Future*, in which the concept of sustainable development was coined. This legacy, informed by other important international developments (e.g. the Rio meetings and the Sustainable Development Goals process), has allowed SEI to evolve in the way that it has.

SEI is a think tank *and* a research institute with a combined focus on environment and development – in other words, undertaking [academic] research, but at the same time engaging with decision-makers at different scales from local to global, and this combination sets it apart from other international sustainable development institutions. The logic of SEI's mission is grounded not just in a socio-political understanding but also, intrinsically, in a science-informed understanding of sustainable development.

SEI is only one of many institutions and initiatives trying to understand how science and decision-making interact and we need to learn from what others are doing. In the next section (Section 2) we examine relevant literature on the link between research and policy, exploring different models for engagement between scientific research and decision-making, as well as practical advice on this interface made by different like-minded institutions and other impact assessment exercises. Section 3 outlines the different efforts that have been made over the past few years to understand and improve the success of SEI's policy engagement.

<sup>1</sup> See: <http://www.nordicinnovation.org/news/nordic-solutions-cannot-be-bought-it-is-a-mindset/>. Webpage accessed 29 Aug. 2018.

Section 4 introduces the main case studies that are used to assess aspects of SEI's policy engagement. These cases are chosen to highlight important aspects of SEI's outcomes, pathways of engagement, or characteristics of SEI or the decision-making context it interacts with. Of course, in an institution with more than 250 staff working on many issues in most parts of the world, and with a 30-year history, a limited number of case studies cannot represent all the work we do, but those chosen serve to illustrate key points.

Section 5 considers the different outcomes of SEI's activities and policy engagement, demonstrating how different outcomes have been achieved with reference to different case studies (or "change stories") which illustrate different aspects of SEI's policy engagement. Section 6 outlines the pathways to impact that SEI has used to engage with policy and decision-making, as illustrated by the different case studies. Section 7 considers the enabling conditions that affect SEI's policy engagement, which are divided into two groups: the characteristics of SEI that affect how it engages, and the influence of the external decision-making context within which SEI operates.

Finally, Section 8 considers the learning outcomes for SEI that can help to guide the organization in the future and increase its relevance and effectiveness at achieving its mission.

## 2. Models of science-policy engagement relevant to SEI's work

SEI has, over the years, considered concepts and frameworks of policy impact as they relate to both its mission and its research. For example, in 2009 it produced the research report *Getting to Policy Impact* (Forrester, Nilsson and Lee et al. 2009). That report analysed in detail six case studies for which claims had been made that SEI had impact, and examined how the research activities and communication and policy engagement in each case had led to that impact. While acknowledging that exactly *how* and *when* policy impact happens is disputable (following Weiss 1979), the report makes the point that policy impact for sustainable development is related to processes as well as outcomes (2009, p.3). This report both builds on and further refines work done in the 2009 report. In this section we review literature and models of science-policy engagement that are relevant to SEI's historical and ongoing work.

Policy impact with respect to human and environmental sustainability is closely related to science communication and issues of science representation in the media, as well as issues of public participation (e.g. see Berkhout, Leach and Scoones 2003; Kasemir, Jäger, Jaeger and Gardner 2003). This has necessitated new ways of thinking about the science-public relationship but also the public-policy relationship (e.g. see Jasanoff 2004; Wilsdon and Willis 2004) as well as encouraging natural science and social science researchers to work together. Further, while historically the notion of policy engagement may have been premised on a linear model of a science-to-policy communication process (by both natural scientists and policy scientists), the idea that there are simple starting and finishing points has been “convincingly overthrown in empirical and theoretical policy science” (Forrester, Nilsson, Lee et al. 2009: Hudson and Lowe 2004, p.223 ff.). There is a large body of knowledge that puts forward more complex and nuanced models of engagement and, further, a linear model is rarely useful for explaining policy change.

As Owens (2015) observed, those trying to find straightforward answers to what works in trying to make better use of scientific knowledge in decision-making encounter some difficult issues, often due to the complexity of these interactions in different situations. Knowledge does not simply flow from one sphere to another; instead, the mechanisms by which ideas exert influence are subtle, indirect and long term, as knowledge creeps into policy in diffuse ways, which are unavoidably context dependent (Owens 2015). She also emphasizes that the issue is not just about basing decisions on “sound science” but also on qualities which give rise to “good advice” such as independence, transparency, defensibility, fitness for purpose and authority. Scientific research also helps define the nature of public policy problems, which in turn may be incorporated into changing institutional arrangements (Carson and Burns 2009).

Using knowledge in – and providing knowledge into – complex human-environment systems is further informed by insights from complexity science (cf. Norberg and Cumming 2008; Ramalingam and Jones 2008) and this has implications for policy (see Cairney 2012; McConnell 2018). Both Ramalingam and Jones and Cairney offer us key concepts of complexity that are relevant to the work of SEI and its policy relevance. These include the interconnectedness and interdependence of elements and dimensions; nonlinearity (i.e. tipping points); system sensitivity to initial conditions; and the fact that systems are populated by adaptive agents (Ramalingam and Jones 2008, p.viii; Cairney 2012, p.348). Cairney also tells us that complexity theory “appears more likely to be used to produce practical advice to practitioners” and thus “help solve real policy problems” (2012, pp.355, 365). Thus, any discussion of SEI's approaches to policy engagement should not simplify the substance or processes involved. Cairney, based largely upon the work of Teisman and Klijn (2008) and Mitleton-Kelly (2003), also provides key policymaking insights: firstly, that law-like behaviour is difficult to identify because the policy process is “guided by a variety of forces”. Thus “a policy that was successful in one context may not have the same effect in another due to many, many variables”. Secondly, systems “appear to have “self-organising capacities” and are difficult to predict; and thirdly, context is critical and “is unstable and often changes rapidly” (Cairney 2012, p.349).

SEI's pragmatic take on policy impact has grown out of both the Institute's inception (see Introduction) and out of a "middle-range theory" of how sustainable development needs to work in practice (cf. Geels 2010; Betz 2016). Geels tells us that "transitions [to sustainability] do not come about easily, because existing regimes are characterized by lock-in and path dependence, and orientated towards incremental innovation along predictable trajectories" (2010, p.459). In part, this is because neither social science nor natural science "grand theories" (i.e. of sustainability) easily allow for integration and contextualization (Betz 2016). But middle-range theories have significant explanatory power and are empirically testable at the practical level (Merton 1968). It is at this level that we can better serve the interests of environment and sustainable development policy and practice: that is, by engaging with "real world" issues.

Notwithstanding the fact that SEI has this practical focus, several of its centres are either based in, have Memorandums of Understanding (MoUs) with, or close links with universities and are de facto academic research institutes. Universities increasingly also wish to ensure that their research has policy impact. This section reviews cross-disciplinary literature on policy impact in order to contribute to the debate on how to achieve it.

## 2.1 Models of science-policy engagement in the academic literature

The fact that, to operate in public, science needs credibility has been long recognized (Gregory and Miller 1998). More recently, Dunn and Laing (2017), discussing science-policy interactions, tell us that "for more than a decade, a popular theory amongst scholars of science-policy, has been that research is most effective at informing policy and decision-making processes when it is **credible, relevant** and **legitimate**". To this list one can add **iterativity** (Sarkki et al. 2015) which describes the "dynamic, continuous and multi-directional interactions between science, policy and society related to SPIs [science-policy interactions]" (Sarkki et al. 2015, p.505). However, while accepting that these characteristics are important, Dunn and Laing suggest that the issues most frequently raised by policymakers "fit instead within the quartet of applicability, comprehensiveness, timing, and accessibility" (2017, p.151). Nonetheless, as Cash et al. (2003, p.8088) note, "Active, iterative, and inclusive communications between experts and decision-makers proves crucial to systems that mobilize knowledge that is seen as salient [i.e. relevant], credible, and legitimate in the world of action". This formulation, we suggest, is particularly relevant to the field of sustainable development and for reaching the Sustainable Development Goals (SDGs).

In another recent paper, van der Hel and Biermann (2017) present specific practical strategies for achieving salience, credibility, and legitimacy with respect to work around the SDGs. In terms of salience, they suggest that important factors include integration, independence of advice, and the promise of solutions; for credibility, they suggest peer review, individual credentials and communality of science; for legitimacy, inclusive representation, formal recognition (e.g. through international/UN accreditation) and participative processes.

Van der Hel and Biermann also provide a "framework for reflection" (2017, p.218) that can be used to assess institutional engagement and is based on three "modes of authority", which are characterized as "assessment-orientated", "advice-orientated", and "solution-orientated" (2017, p.217).

Based on a literature review carried out by Oliver Taherzadeh at SEI in 2016, we have identified four enduring models of science-policy interaction that seem especially relevant to SEI and its engagement with policy and decision-making:

1. **The problem-solving model.** In this model, demand (from policymakers) to identify an appropriate decision for a given (time-sensitive) problem is met by the supply of information or understanding necessary to inform a solution or decide among a set of alternative solutions (Weiss 1979). Here, the role of research is primarily to fill knowledge gaps in policy problems.

Yet within this model policymakers often rely on in-house expertise to inform policy design rather than outsourcing research to academic and external experts and actively creating new channels for policy engagement, rendering the policymaking process less porous to new ideas and information (Caplan 1979). However, viewing the problem that research is poorly utilized in policy as simply a shortcoming of communication – that is a failure to produce “useable knowledge” which helps policymakers solve complex problems – does not fully explain the problem of science having little effect on policy (Owens 2005).

2. **The political model.** In this model, policymakers' pre-existing worldviews, intellect, or vested interests (i.e. within the sphere of politics – see Weiss 1979) shape how receptive they are to new evidence. While the political model illustrates the need for researchers to reflect on the salience of their work within the wider agenda of policymakers and other stakeholders, and question whether it is necessary or helpful for problems to be re-framed in order to increase uptake of their associated evidence base by policy, SEI has stuck to its mission to *provide integrative knowledge that bridges science and policy* and to ground that knowledge in the best available scientific (including social scientific) data. Nonetheless, it is critical to understand the wider agendas of policy and decision-makers.
3. **The incrementalist model.** This model follows Lindblom (1980), and suggests that practical realities lead decision-makers to examine a small number of policy alternatives to address a problem, often opting for those that differ only marginally from the status quo. This tends to lead to gradual policy change rather than radical system-wide changes that scientific research may imply are needed. This model is particularly relevant to SEI's research where there is a clear need to balance critical, scientifically objective analysis with solutions and evidence which influence policy and decision-making. While the dominant goal of policymakers is to reach agreement, consensus in research findings and recommendations – i.e. within an integrated assessment – can help to alleviate issues around lack of readily available, or conflicting evidence, leading to greater reliance on high-quality research to shape policy outcomes.
4. **The enlightenment model.** This model also diverges from the linear model of policy impact and challenges the notion of “direct hits” and causing “short-term action”, in which a single piece of research has the potential to produce an immediate shift in policymaking. Instead, it suggests that research affects policy in more subtle ways, such that “ideas come into good currency, knowledge ‘creeps’ into policy, and what is thinkable begins to change” (Owens, Rayner and Bina 2004). This infers that while individuals and organizations can “make a difference”, it is rarely solely by their own devices.

That literature review also noted that, in practice, policy often precedes scientific evidence and expert advice, rather than embodying it (Owens, Petts and Bulkeley 2006). However, theoretical models designed to explain the science-policy divide can help connect our research approach with a deeper understanding of the role scientific evidence plays in policymaking. Such framings often challenge the idea that policy is informed by research and analysis in a straightforward, linear manner, and understanding these more complex framings of science-policy interaction can help researchers negotiate the barriers to and opportunities for policy impact.

Although features of effective science-policy engagement are reflected in the literature, Weible et al. (2012) identify a need for organizations wishing to have an impact upon policy to develop “deep knowledge” of – and long-term participation in – the policy system in order to influence it. The notion of policymaking as a purely technocratic, value-free and easily influenced process is too highly stylised. However, while policy is rarely evidence-based, it is frequently evidence-informed, accommodating evidence alongside broader economic interests, societal demands, pragmatics, and dominant narratives and values, which carry varying levels of currency in different decision-making processes (Rose 2014).

The four models of science-policy interaction described above interact with four critical conceptual theories of how research-policy relations work in practice: firstly, that knowledge shapes policy; secondly, that politics shapes knowledge; thirdly, that research-policy relationships are characterized by the co-production of knowledge; and fourthly, that science and policy each work in autonomous spheres (Boswell and Smith 2017). These four theories are proposed by Boswell and Smith as an alternative to the linear model that often overlooks the complexities of research-policy relations.

We have attempted to link the four conceptual theories in Boswell and Smith with the four selected models of science policy interaction in Table 1. What is striking about Table 1 is that the appeal of the problem-solving model to a research-to-policy organization is the amount of power and control this appears to place in researchers' hands, whereas the other models suggest a much more unequal power relationship. The incrementalist and enlightenment models suggest that the influence of research is much less direct. In co-production processes where there is both political will and scientific capacity, working together could help to shift influence from the more diffuse enlightenment model to a model where attribution is clearer.

Table 1. The relationship between models of research-policy interaction and critical conceptual theories of research-policy knowledge relationships

		Policy influence is more easy to attribute		Policy influence is more difficult to attribute	
		Problem-solving model	Political model	Incrementalist model	Enlightenment model
Agenda setting potential is high.	Knowledge shapes policy.	Gaps identified by the researcher and filled by the research organizations.		Consistency in research findings from multiple sources helps to build consensus.	Knowledge gradually creeps into policy. Pathways are not clear cut.
	Co-production	Researchers and policymakers work together.	Researchers work with policymakers, but agendas are set by policymakers.		An evolutionary approach to knowledge transfer is implied, with little space for working together.
Agenda setting potential is low	Policy shapes knowledge	Gaps identified by policy actors and filled by research organizations.	Research organizations have little agenda-setting power.	Policy shapes the form in which knowledge needs to be presented to policymakers in order to be influential.	
	Autonomous spheres	Researchers and policymakers work separately.	Research organizations work in a responsive mode away from policy (and politics).		The relationship between research and policy is subtle, but research can shift agendas.

## 2.2 Practical approaches and methods to enhance science-policy engagement

This section also reviews the more practical approaches that have been developed and used by different organizations to help them engage with policy and decision-making at different scales. SEI has previously developed suggestions for practical improvements to the science-policy process in its *Getting to Policy Impact* report in 2009. The report made ten suggestions to enhance the policy impact of sustainability knowledge. These are:

1. Recognize differences in timing between research and policymaking
2. Acknowledge the realities of the positional policymaking context
3. Maintain the balance of collaborative and independent research
4. Make use of strong champions
5. Facilitate joint learning processes
6. Facilitate trust building and continuity among partners
7. Consider implications of other policy spheres
8. Acknowledge the progressive nature of policy impact
9. Deploy user-friendly analyses, models and scenarios
10. Speak the right language

In the same year that *Getting to Policy Impact* was published, Professor M.J. Chadwick gave a lecture at SEI's 20-year celebrations titled "From Science to Policy: The IKEA Principle – Constructing Policy from the Information Flat-Pack". In this he explained that practitioners trying to link science and policy need to overcome information asymmetry; that is, the difficulties decision-makers have in knowing the right questions to ask, and that researchers have in knowing what knowledge is relevant. This implies that research organizations need to be clear and explain information that is not being asked for, in cases where that knowledge is new to the decision-making process. In Chadwick's lecture he outlined five issues that need to be considered to improve the science-to-policy process, each of which is a two-way process:

1. **Appreciation:** understanding the systems involved by both sides
2. **Lucidity:** clarity in communicating ideas and knowledge
3. **Learning:** being open to learning rather than "selling" solutions
4. **Embodiment:** acting upon the information
5. **New initiatives:** being innovative

From a user perspective, Inke Schauer (German Federal Environment Agency – UBA) gave a lecture in 2015 where she set out important aspects of successful engagement between policymakers and scientists, which are outlined below. Schauer emphasized that these need to be understood from the outset of engagement.

1. Define the **user** (of the information)
2. Define the **purpose** (why does the user need the knowledge?)
3. Define the **aim** (how will the project supply the necessary knowledge)
4. Define the **object** (i.e. the context and limits of the system being assessed)
5. Define the **method** (steps needed to reach the aim)
6. Define the **process and participation** (who needs to be involved, for what reason and when)
7. Define the **transfer and communication** (who needs to know what, and how will the information be communicated).

In the following subsections we discuss further frameworks, methods and approaches that have been developed to help understand how research can engage more successfully with decision-making. There are also planning tools, and methods for measuring the influence that research has on decision-making. These include:

- outcome mapping
- the approaches and guidance developed by institutions with a similar goal to SEI of linking knowledge with decision-making, mainly in relation to development
- the application of a theory of change (ToC) to plan policy engagement at the outset of project, and
- UK Research Excellence Framework (REF) approaches that are being used to try to assess the impact of university research in society.

### Outcome mapping: impact versus outcomes

When referring to the impact of research on sustainability, people tend to mean significant and lasting changes in the well-being of many people, or the quality of the environment (intended beneficiaries). Such assessment of “impact” can be problematic because of the complexity and fluidity of development, policymaking and decision-making processes that require the involvement of many different actors over a considerable period of time. When “impact” happens, it is often the product of a confluence of events over which no single agency has control or can realistically claim full credit (Earl, Carden and Smutylo 2001). Therefore, the idea of “outcome mapping” has been developed, which places outcomes as the end point of assessment of influence on different decision-making contexts.

Outcome mapping is a method first developed by the International Development Resource Centre (IDRC) as a way to identify and present the qualitative impact of its research in terms of changed behaviour and practice. The primary purpose of the method is not only to assess but also to plan projects, and it recognizes that multiple, non-linear events lead to change (Earl, Carden and Smutylo 2001). Outcome mapping aims to bring about tangible change. It was developed with international development in mind, and can also be applied to projects (or programmes) on research communication, policy influence and research uptake.

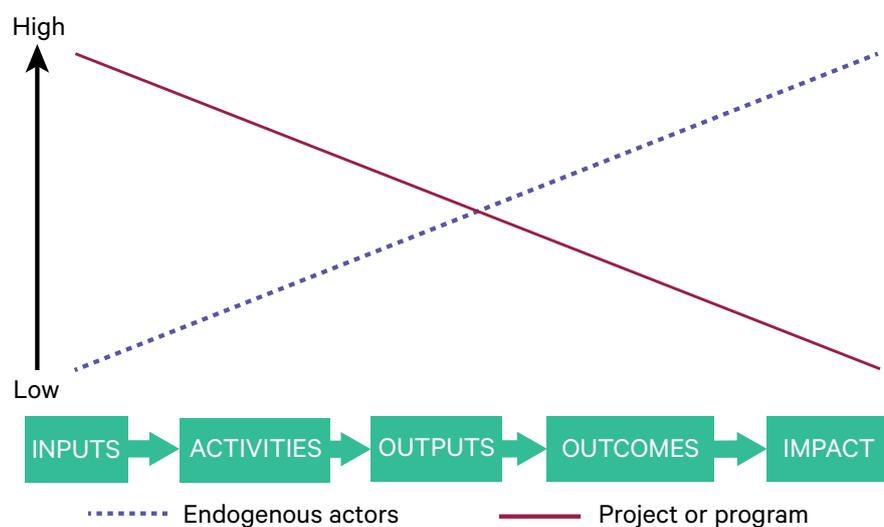
Outcome mapping introduces monitoring and evaluation at the outset of projects, and provides a set of tools to understand outcomes, defined as behavioural changes, among “boundary partners” – that is, the decision-makers and other partners working directly with the project or programme. Identifying the behavioural changes that a project aims to deliver becomes synonymous with its outcomes. Outcome mapping can be used as a stand-alone methodology or in combination with other approaches.

Outcomes, in the context of outcome mapping, have been defined as changes in the behaviour, relationships, activities or actions of the people that the organization works with directly (Earl, Carden and Smutylo 2001).<sup>2</sup> These outcomes give the partners the knowledge, tools, techniques, capacity and resources to contribute to development and decision-making processes (i.e. the impact). As such, it is easier to attribute “outcomes” to SEI’s activities rather than “impact” on people’s well-being or environmental quality, whilst at the same time acknowledging that impact is very important and in some cases SEI’s contribution to impact can be assessed (but usually only through deliberate assessment, which rarely happens). However, in order to learn and improve our engagement with policy and decision-making processes, it seems more fruitful to concentrate on outcomes that can be more readily identified. Also, identifying “impact” implies greater reliance on the linear model of science-policy interactions and cause and effect, which is rarely seen in the “real world”, which is considerably more messy and complex than the linear model allows for. Such a linear model forms the basis of approaches such as Logical Framework Analysis (LFA) and Results-Based Management (RBM), which can be useful planning tools but can encourage expectations that when activities lead to key results, this inevitably will lead to “impact”, which is naive. As Figure 1 shows, an organization such as SEI has more influence on the activities and outputs of projects, less control over outcomes, and the least control over impact. Through this, the influence of endogenous actors in the relevant policy areas increases the further you get towards impact. In other words, delivering impact is mainly in the hands of the decision-makers and other stakeholders involved in developing change in any particular locality.

SEI adopted the outcome mapping approach to develop its monitoring, evaluation and learning activities. Outcome mapping also helped to develop the first attempt at a system to gather information through a bespoke tool called the Project Monitoring, Evaluation and Communication (PMEC) system, which has been rolled out across the Institute and is being

<sup>2</sup> Compare this approach with how outcomes are discussed in Section 5.

Figure 1. Relative influence along the results chain



(Source: Smutylo 2001)

used in projects. SEI's monitoring, evaluation, and learning strategy was further developed to make it more fit-for-purpose.

### Views from like-minded institutions assessing the science-policy interface

We decided to examine some of the thinking from two like-minded institutions, the Overseas Development Institute (ODI), and the Institute of Development Studies (IDS). ODI is an independent, global think tank that promotes global progress and prosperity by focusing on improving the lives of the world's poorest people. One of its areas of work is Research and Policy in Development (RAPID), aimed at improving the integration of local knowledge and research-based evidence into policymaking. ODI has developed an approach to understanding its policy impact known as ROMA – the RAPID Outcome Mapping Approach. ROMA is basically an approach to improving policy engagement. It comprises a suite of iterative questions and techniques which ODI or any other organization can use at any stage in their policy engagement process to “improve how they diagnose the problem, understand the types of impact their work could have on policy-making, set realistic objectives for policy influence, develop a plan to achieve those objectives, monitor and learn from the progress they are making and reflect this learning back into their work”. ROMA draws heavily on the concepts underpinning outcome mapping. Importantly, through use of their own internal experience, the ODI approach shows how improved project management can actually help researchers effectively manage projects that influence policy by using an outcomes-based approach, which enables simplified project management while acknowledging that “Development rarely follows a linear input-output-outcome impact model” (see Pellini 2011). Thus, as well as providing utility to practitioners, ODI's ROMA approach falls nicely in line with current policy-science thinking (see academic literature above) in that it “assumes that political environments and social realities are extremely complex and that simple, linear engagement strategies for research and policy-making are insufficient”.

ODI has also used its own experience, analysing about 50 development projects, to provide simple practical advice on how engagement with decision-makers can be improved. ODI produced a policy brief in January 2017, “10 Things to Know About How to Influence Policy with Research”<sup>3</sup>, which summarized 10 important aspects that need to be considered in planning policy engagement:

<sup>3</sup> See: [www.odi.org/publications/10671-10-things-know-about-how-influence-policy-research](http://www.odi.org/publications/10671-10-things-know-about-how-influence-policy-research)

1. Know what you want to influence
2. Know who you want to influence
3. Know when to influence
4. Build relationships and networks
5. Policy development is not a linear process
6. Policymaking is inherently political
7. Plan your engagement
8. Focus on ideas and be propositional
9. It takes time, stick at it
10. Monitor, learn and adjust along the way.

The Institute of Development Studies (IDS) is a multi-faceted, university-based research institute at the University of Sussex (UK) specializing in development issues. It works closely with another institute at Sussex, the Social, Technological, and Environmental Pathways to Sustainability (STEPS) Centre, which was formed between IDS and the Science Policy Research Unit (SPRU), also at the University of Sussex. IDS has a research area concentrating on evidence, policy and practice and has developed thinking around policy impact<sup>4</sup>. One of the goals of this approach is the “presentation of knowledge to make it more appropriate and engaging for audiences in different contexts”.

Underlying the work of IDS is the recognition that “engaged excellence” requires collaboration with governments, international NGOs, local civil society, citizens, donors, businesses and many others to achieve positive change, strategically informed by research and knowledge, as shown in Figure 2.

Figure 2. The IDS engaged excellence approach



Source: [www.ids.ac.uk/essay/using-open-knowledge-to-improve-development-outcomes](http://www.ids.ac.uk/essay/using-open-knowledge-to-improve-development-outcomes)

Thus, in the approach is the recognition that for academic research to have significant impact on decision-making, all four pillars of engaged excellence (Figure 2) must be employed. In order for research to have an impact on both the understanding of a problem and the knowledge to address a problem, it must be co-constructed. To do so successfully requires that enduring partnerships must be built with the full range of policy and society actors who can influence outcomes.

<sup>4</sup> E.g. see: [www.ids.ac.uk/essay/using-open-knowledge-to-improve-development-outcomes](http://www.ids.ac.uk/essay/using-open-knowledge-to-improve-development-outcomes)

## Theory of change

The different models and practical advice from different institutions acting at the science-policy interface provide useful input to plan policy engagement. This can be used in conjunction with an approach that has been much used to plan interventions – developing a theory of change during the planning process and implementation of the project or programme.

The theory of change (ToC) has been described as “a comprehensive description and illustration of how and why a desired change is expected to happen in a particular context”<sup>5</sup>. Thus, and like much of what has been described above, it is focused on filling in the gaps between what the researchers’ understood purpose is, and what the end-users’ needs are. Put simply, it says, “If I do this research and answer this question I believe it will impact upon the system in this way.”

A theory of change can be mapped within an outcomes framework. The outcomes framework then provides the basis for identifying what type of activity or intervention may lead to the outcomes identified as preconditions for achieving the long-term goal. Weiss (1995) popularized the term “theory of change” as a way to describe the set of assumptions that explain both the mini-steps that lead to the long-term goal and the connections between programme activities and outcomes that occur at each step of the way.

A theory of change requires specificity about goals and about the conditions needed to reach them (see discussion on enabling conditions in Section 7). Therefore, the effort results in a useful guide for research as well as a “paper trail” of any putative impact. Getting one’s boundary partners to “buy into” your theory of change is important. Importantly, the ToC process hinges on defining “pathways of change” (see discussion of pathways in Section 6). One of the purposes of formalising such pathways, with concomitant underlying assumptions about the change process, is that they can be communicated and also tested. One important assumption is about the “contextual or environmental factors that will support or hinder progress toward the realization of outcomes”: within SEI’s work we refer to these as “enabling conditions” and we deal with these in Section 7.

## The UK Research Excellence Framework (REF) Approach

SEI is not the only organization that is under pressure to explain what impact they are having in the world – universities are also required to explain how their activities are a benefit to society. At the forefront of this are UK universities where the “impact” analysis has been formalized within a “Research Excellence Framework” or “REF”. However, the language used in the UK REF seems different to the way in which SEI considers outcomes, looking instead to credit individual research efforts when it comes to assessing the impact of specific policy changes. This is in contrast to SEI’s approach, as stated earlier in this document, which usually considers individual research efforts to be just one contribution among many in terms of the overall influences which lead to changes in policy. In practice, the activities assessing the outcome / impact in the REF framework and what we, and other institutions, are trying to do to assess these linkages is essentially rather similar.

Boswell and Smith (2017) summarize the assumptions underpinning the REF impact case studies and state that UK Research Council pathways to impact statements often fail to reflect available evidence and theories, and that these are formed from simplistic supply-side models. Boswell and Smith acknowledge that one of the reasons why the linear model continues to be used in the UK research impact arena is that the alternative approaches proposed would require resource-intensive expertise and methodologies to implement, and that buy-in to this would be difficult to achieve.

<sup>5</sup> See: [www.theoryofchange.org/what-is-theory-of-change](http://www.theoryofchange.org/what-is-theory-of-change) (accessed 01/10/2018)

Assessing “Impact” determines 20% of the overall result of the REF and is defined as “any effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia”. In the last iteration of the REF in 2014, each submission included impact case studies (four-page documents that describe impacts that had occurred) and an impact template (a document explaining how the submitted unit had enabled impact from its research during the assessment period, and its future strategy for impact). There was a great deal of supporting evidence collected to substantiate the claims made in the impact statements. The “reach and significance” of the impact case studies were assessed in terms of how far the approach and strategy are conducive to achieving impacts. Interestingly, the SEI York centre, being part of the University of York’s Department of Environment and Geography, is required to produce REF submissions. The criteria for assessing impacts were “reach” and “significance” (see <https://www.ref.ac.uk/2014/panels/assessmentcriteriaandleveldefinitions/>).

There are a number of good practice examples of impact case studies. A selection of the highest rated (4\*) case studies submitted to the UK’s 2014 REF can be found at <http://www.fasttrackimpact.com/resources>. A number of lessons learned and concerns were identified from the first time this activity took place. One insight in particular is worth emphasizing: “The ways in which Universities pursued and demonstrated research impact in REF2014 led to a range of ethical concerns where research is co-produced. [...] In particular, one way in which Impact Case Studies in REF2014 were problematic was the claiming of impact by the academic researcher and the linear connection made to academic-owned research and ideas” (Pain et al. 2019, p.9). When trying to justify an impact, there can be a tendency to over-extend the influence of an individual piece of research, whereas in reality any policy decision is inevitably the result of the sum of a large number of influences, of which only a few will be related to scientific evidence.

### 3. Process of assessing SEI's engagement with policy and decision-making

To understand how SEI researchers undertake policy engagement we used an inductive approach to support the deductive approach explained in Section 2 (assessing the literature). In doing so, we:

- developed a semi-structured interview protocol (see Annex 1)
- interviewed centre directors and theme leaders and analysed some staff discussions on relevant topics
- transcribed the discussions and coded them
- grouped the codes and structured them under the overarching categories of “outcomes”, “pathways”, and “enabling conditions”, and
- used other codes identified from this discussion to structure the following sections.

The semi-structured interview focused on asking the interviewees about key outcomes that they would identify from their knowledge and experience, asking why they picked out these activities; what outcomes they achieved and who they influenced; how they defined the success of the outcome; how SEI influences boundary partners or processes; and which approaches/pathways were used to influence policy and decision-making. Two discussions with SEI centre directors and one with a senior researcher were transcribed and coded. In addition, we transcribed and coded a webinar on the theme of “theory of change”, which focused on SEI's activities aimed at influencing international climate policy, and a text associated with the “success stories” from the survey on KPIs.

We used a grounded theory approach (Corbin and Strauss 1990; Charmaz 2006) and initially examined, compared and categorized codes from the text. These initial codes emerged from the focus of the interviews and the questions asked. We then considered the connections between different codes related to emerging patterns. We then developed main categories emerging from the codes and classified other codes that emerged under these. The main classification (Tier 1 codes) relate to:

- **outcomes of engagement** – a range of policy-related outcomes (and impacts) at different scales in different parts of the world
- **pathways of influence** – interaction and engagement with policymakers and policy processes that allowed these outcomes to be achieved, and
- **enabling conditions** – that contributed to achieving the outcomes using the different pathways, including the characteristics of SEI as an organization, and the decision-making context of the particular issue.

Under each of these codes we had a number of secondary and tertiary sub-codes (Tier 2 and Tier 3 codes). These are outlined in Table 2. These codes have informed the way by which we have analysed SEI's policy engagement and the framework developed is used in this report to assess the different aspects of SEI's policy engagement. They have also been used to develop a critical narrative of the impact stories in the 2016 and 2017 SEI annual reports.

Further work on understanding SEI's approaches to engagement with decision and policymaking was developed by examining staff attitudes about what is important in having an influence on policy and decision-making. We used the codes to develop a series of statements and asked people to allocate the statements according to the extent to which they agreed and disagreed with them. Their answers were then located on a weighted symmetrical “triangular” grid, in which participants sort the statements ranging from those which least represent their view at one end to those which most represent their view at the other. This data was analysed using factor analysis. Q methodology is a subjective method, but its statistical approach enabled us to discover three different types of discourse that concern how individuals understand the interactions between SEI and the policy and decision-making communities that we interact with.

Table 2. The different codes developed from the transcripts of interviews, feedback and webinars relating to policy engagement

Main (Tier 1) organization of codes	Tier 2 and Tier 3 codes (in italics) showing detail associated with the main (Tier 1) organisation of codes
Outcomes	Increased awareness of an issue; debates are reframed; people are brought together; networks are built; capacity is built; institutions strengthened; behaviour changed; new policies implemented; government schemes redefined; sustainable platforms/processes after project closes; methodologies are developed; programmes of work are in a good state; outputs well-received; SEI’s work is published; partners wish to continue collaboration with SEI; funder is happy with progress; additional or continued funding is secured; work contributes to career development of boundary partners; evidence of SEI’s influence is apparent from large attendance at events ( <i>organized by SEI or featuring SEI research</i> ); SEI’s work is cited; meetings include SEI’s work; written evidence from boundary partners.
Pathways to influence	A well-developed theory of change; direct engagement in a policy process; meeting boundary partners at the places of work; regular contact with decision-makers; SEI involvement in analysis related to an issue; continued work over a long period of time; undertaking demand-driven research and working with decision-makers; SEI work being part of the evidence base for decision-makers; SEI research used in negotiations; SEI involvement in capacity-building; using modelling to provide insights and communicate information; support and research on policy implementation; timely research; staying “one step ahead”; using media as a route to decision-makers; funder support to undertake in-depth monitoring and evaluation to create learning; being a grant administrator and setting the rules; writing outputs including reports, academic publications that can be shared with decision-makers; working in partnership, <i>including collaboration; close contact with individuals</i> ; participation of decision-makers in project; engagement with policy process, e.g. <i>as an advisor; engaging NGOs; engaging policymakers; working with influential individuals</i> ; or attending events, <i>where SEI can be panel members; organize events; participate at conferences</i> ; having a booth at an event.
Enabling conditions	<p><b>SEI organizational characteristics</b></p> <p>SEI’s organizational characteristics includes demand based on previous work and the collective body of research; research coherence; geographic advantage; research often funded by decision-makers; importance of monitoring and evaluation; internal dialogue and learning; understanding the funding landscape; and SEI image made up of the following characteristics: <i>balanced perspective, reputation, trust, autonomy, convening power, cooperative, (scientific) credibility, friendly, non-aggressive, soft approach.</i></p> <p><b>SEI’s relation to issues and problems</b></p> <p>SEI bridging gaps in research; new research approach; SEI expertise in an area; enduring connection of SEI with issue; previous work in a problem space; identifying emerging research priorities; timing of research; effective interactions with boundary partners, often working in closely together in partners; understanding user needs in relation to an issue; effective messaging; informal relationships; multi-stakeholder involvement; regularly being part of consortia; and understanding the context, <i>including understanding boundary partner values; understanding problem area; matching solutions to contexts.</i></p> <p><b>SEI’s understanding of the characteristics of policy/decision-making systems</b></p> <p>Understanding political contexts and decision-making dynamics.</p>

In these different discourses, different aspects are emphasized as being important by people with different profiles, which gives an insight into the different attitudes of SEI staff members. The first discourse focused on bringing voices of marginalized communities into decision-making processes and working in partnership. The second discourse focused on influencing existing policy processes, often at national or international scales, through partnerships. The third discourse focused on communication with decision-makers as pathways to influence. It seems appropriate that there are different attitudes and priorities of people in SEI to engagement between science, knowledge generation and engagement with decision-makers, because there is not one single way in which these interactions develop.

In order to more deeply assess the engagement of SEI with different decision and policy-making processes, we developed a number of case studies that in subsequent sections we analyse according to the main coding categories set out above. The case studies are also informed with reference to the second tier of codes. We have also assessed these in relation to the different models from the literature as described in Section 2. We selected the case studies from the impact stories that were presented by different SEI centres in the 2016 and 2017 annual reports. In addition, we selected further case studies that are known as having significant outcomes. We have assessed some case studies in detail, while others are included to emphasise that some aspects were seen in several cases in different parts of SEI.

## 4. Case studies used to illustrate and assess the outcomes of SEI's engagement

These case studies represent “success stories”, in that they have been selected from cases that SEI centres<sup>6</sup> and SEI Initiatives<sup>7</sup> have highlighted as examples of SEI activity that has delivered significant outcomes. In addition to the 18 cases we have addressed in some depth, we use additional examples of SEI's work to show where some aspects have been reinforced in other activities SEI has undertaken. The case studies have also been chosen to highlight the geographical breadth of the work of SEI, work related to different centres, at different scales, on different topics, and covering issues that are important to SEI, such as gender and social equity connections to the Sustainable Development Goals. This means that the choice of case studies has not been made objectively on the basis of specific criteria, but instead to help examine different aspects of SEI's work and support the analysis of outcomes, pathways of engagement and impact of enabling conditions that are examined in the different sections.

The path from where a project begins to where it will end is rarely clear. Equally, it is a gross oversimplification to think that the addition of scientific “evidence” (or “advice”, as policy or decision-makers will see it) in any way clarifies this messy and complex process. It must be understood that politicians see and use scientific evidence within a whole gamut of other “evidences”, including public opinion, experience of the effect of previous policies, and of course economics (or at least what economists are telling them).

Taken within this understanding of context, the case studies we have collected and assessed show us that SEI is active across the range of the two continuums: some cases tend towards knowledge shaping policy, while others change over their lifetimes from one “quadrant” to another along the vertical continuum or appear to be more like autonomous spheres. This is because *there is no right way to influence policy*. What can be said from a perusal of Table 1 is that it is easier to ascribe influence to those projects which work closer to the problem-solving end of the horizontal continuum. However, a study of the literature (see especially section 2.1) might suggest that in order to meet SEI's aims, to follow its mission and to bring about its vision, it is necessary also to move towards the right-hand-end of the horizontal continuum. We have not tried to slavishly fill in every box of Table 1; rather we feel that the cases show something of the range of scientific endeavour to engage with policy, alongside the range of political contexts available for that impact. Further they show a range of “longitudinal” cases where it is possible to observe changes over time, while others are briefer snapshots of particular points on one or other of the continuums.

### 4.1 The case studies

The main cases we have analysed are briefly introduced below. These cases are the Arctic Resilience Synthesis Report; the US ban on drilling for oil in the Arctic; the development of the UNEP/WMO integrated assessment of black carbon and tropospheric ozone and subsequent work with the Climate and Clean Air Coalition; and a programme of capacity-building and support for energy and climate planning with the Kingdom of Morocco's Ministry of Energy, Mines and Sustainable Development. We also examine work with the Swedish steel industry and its development of low carbon steel; cross-border climate change impacts; and then climate-smart land management of UK peatlands. We then move to consider disability-inclusive disaster-risk reduction in Asia; the Sustainable Mekong Research Network, SUMERNET, in Southeast Asia; and further activities planning the future for the Chindwin River Basin in Myanmar. We continue on the water theme with cases studies on water planning in Bolivia and California; a case study of the Climate

<sup>6</sup> SEI has its headquarters in Stockholm, and seven centres around the world in the UK, the US, Thailand, Kenya, Estonia and Colombia.

<sup>7</sup> Since 2015 SEI has invested programmatic funds from Sida in a number of initiatives that represent areas where SEI has a significant track record.

Change Adaptation and Water Governance (CADWAGO) project; and then consider the flow of plastic waste into the Baltic Sea in the BLASTIC project. Waste is also the focus of the next case study, which investigates projects on sustainable sanitation systems that have been undertaken at SEI, especially in Burkina Faso. We then move to projects with a broader outlook, including one on the Sustainable Development Goals and their interactions, and another on PRINCE (Policy-Relevant Indicators for National Consumption and Environment) which examined the global impacts of Swedish consumption. The remaining case studies are rather different in nature, focusing more on local- and community-scale issues. The first is the Co-Motion project on inclusive and sustainable transport and mobility in York. We then discuss projects engaging with informal settlement residents in Nairobi on air quality concerns, which directly led to the Kenya Air Quality Network. We also refer to other projects in the following sections which are not described here but which reinforce some of the points that emerge from the analysis.

Since the 2000s, SEI has been strongly engaged in projects in the Arctic region. SEI led the development of the Arctic Resilience Synthesis Report (Carson 2017), which identified the critical policy-relevant insights of the Arctic Resilience Report (Arctic Council 2016), providing one of the high points of SEI's work on Arctic issues. The synthesis report is specifically aimed at policymakers "concerned with strengthening people's capacity to effectively navigate rapid, substantial, and potentially disruptive environmental and social change in the Arctic and to harness change that supports the well-being of northern peoples". It follows in a long line of continuing community and policy-relevant work, for example through the implementation of the Arctic Resilience Action Framework (ARAF) which provides the Arctic Council with a common set of Guiding Principles and Priorities for Action, for which SEI among others provided technical expertise.

Further SEI research related to the Arctic informed US President Obama's decision to permanently ban Arctic oil and gas drilling (which is being contested by the Trump administration). Throughout 2016, SEI researchers analysed how decisions to make vast public lands available for oil, gas, and coal extraction would affect global CO<sub>2</sub> (carbon dioxide) emissions, as part of SEI's core-funded initiative on fossil fuels and climate. SEI assessed the role of public lands in relation to efforts to meet the Paris Agreement's 2°C target and made the case for why future leasing of US public offshore areas for oil exploration was inconsistent with climate goals.

SEI coordinated the UNEP/WMO (United Nations Environment Programme/World Meteorological Organization) integrated assessment on black carbon and tropospheric ozone (2011), which focused on the importance of Short-Lived Climate Forcers and their impact on near-term climate change, and the benefits that could accrue from measures that reduce BC and methane emissions (see UNEP/WMO 2011). This showed how measures could significantly reduce warming in the near term, and, when added to ambitious CO<sub>2</sub> mitigation, could achieve a temperature increase of less than 2°C above pre-industrial temperatures. In addition, it showed that millions of premature deaths could be prevented each year and that millions of tonnes of crop losses could be avoided from reduced particulate matter and ozone air pollution. A subsequent UNEP report published in the same year (UNEP 2011) conducted further analysis to make the findings more policy-relevant and which fed into the emerging international policy interest in the issue. In 2012 the findings were also published in *Science* (Shindell et al. 2012). SEI has subsequently been working within the Climate and Clean Air Coalition (CCAC), an international coalition of countries and non-state partners whose formation was heavily influenced by the UNEP/WMO assessment, to reduce short-lived climate pollutants through initiatives on national action planning and regional assessments.

Since early 2015, SEI has been working with Morocco's Ministry of Energy, Mines and Environment on a program of capacity-building and support for energy and climate planning. A core objective has been to develop an energy system model owned and operated by the Ministry to free the government from reliance on consultants for projections and scenario analysis. Through workshops and joint modelling exercises with Ministry staff, SEI has built a national energy system model and used it to explore business-as-usual scenarios as well as a range of mitigation options for energy and transport.

SEI has been working closely with the Swedish steel industry developing explorative scenarios that have helped to develop an action plan for the industry in 2050, that include the development of low carbon footprint steel. The collaboration started after SEI chaired a panel at a side event which led to discussions with the steel industry to incorporate the latest sustainability thinking. The Swedish steel industry, through the Swedish Steel Producers' Association (Jernkontoret) has now developed a long-term vision for 2050, supported by SEI's expertise in scenario building and the Sustainable Development Goals (SDGs). The vision encapsulates the industry's intention to play an active role in society by shifting its operations to become more sustainable and has mapped out factors that the industry needs to consider when developing their strategies (see [www.jernkontoret.se/en/vision-2050/societal-value-creation](http://www.jernkontoret.se/en/vision-2050/societal-value-creation) and [www.jernkontoret.se/en/publications/steel-and-the-steel-industry/meeting-the-un-global-goals](http://www.jernkontoret.se/en/publications/steel-and-the-steel-industry/meeting-the-un-global-goals)).

Climate risk is location-specific and requires a local response, but in the globalized world, cross-border impacts of climate change can occur. The melting of land-based ice contributes to sea-level rise, which affects countries and cities that are not large emitters, yet which suffer from the impacts of sea-level rise. Other examples are more subtle, such as cases where droughts in India have had knock-on effects on rice prices in many parts of the world. SEI developed an area of work on "transboundary climate impacts", which shows the impacts of climate change on the movement of people, on financial flows and on transboundary ecosystems, as well as impacts related to trade. The project mapped countries that are at risk from cross-border effects to develop a Transnational Climate Impacts Index.

Further work related to climate change investigated the effect of using different land management practices (e.g. do nothing, brush collection, mowing, and burning) when managing peatlands and blanket bogs in the UK that are currently managed for grouse shooting. The goal was to understand how carbon sequestration can be increased at the same time as enhancing biodiversity and reducing downstream flooding. The aim was to underpin the development and refinement of possible management practices. The context was that the UK Department for Environment, Food, and Rural Affairs (Defra) is moving towards a Peatland Carbon Code and is funding schemes for peatland restoration in order to increase carbon sequestration, but these schemes were not based on any evidence of which management practices will actually enhance sequestration. There is also a policy focus in the UK by the Environment Agency and urban authorities on reducing flooding in cities and farmland near rivers and streams that are fed by water from the peatlands. Further, there is a desire by many conservation agencies to increase plant, insect and bird diversity in these vast upland sites. The peatlands are also important for income-generation activities such as sheep grazing and grouse shooting.

Through the Disability and Disasters project, SEI collaborated with the University of Sydney and local disability organizations in Southeast Asia to develop a three-step approach to make disability-inclusive disaster risk reduction a reality, which empowered people to become agents of change and resilience. People with disabilities are among the most vulnerable groups during disasters. They are four times more likely to die when a disaster strikes than those without disabilities, yet they remain largely unaccounted for in disaster risk reduction efforts. The project built a strong empirical evidence base on challenges faced by people with disabilities in disasters, developed platforms for the empowerment of people with disabilities, and identified opportunities for mainstreaming disability-inclusive disaster risk reduction.

The Sustainable Mekong Research Network (SUMERNET) is an initiative for research and policy engagement bringing together research partners working on sustainable development in six countries of the Mekong Region: Cambodia, China (specifically Yunnan Province and Guangxi Zhuang Autonomous Region), Lao PDR, Myanmar, Thailand, and Vietnam. Launched in 2005, SUMERNET partners carry out policy-relevant research and outreach activities to inform and engage policymakers, planners and diverse stakeholders. SUMERNET began at a time of accelerated economic development in the Mekong Region. Major infrastructure projects such as roads, hydropower dams and irrigation projects were being planned and built. Many bilateral and

multilateral trade agreements were being made, and there was a vigorous debate going on about the region's future. Many development agencies expressed concerns and called for an integrated approach that would incorporate a greater diversity of views and perspectives into regional planning and policy. SUMERNET was established to meet the need for integrated research by supporting and promoting the use of scientific evidence in policymaking, with the overarching goal of contributing to sustainable development in the Mekong Region. SEI's role was to coordinate the network and help build relevant capacities of research partners to carry out research and to engage with the decision-making process for positive change in policy and practice.

The Ayeyarwady Futures and Chindwin Futures programmes were initiated in 2013 to support Myanmar in moving towards sustainable development through evidence-based participatory planning processes. The Ayeyarwady River Basin is Myanmar's most important river basin and changes to its resources could result in increased environmental degradation and the further marginalization of particular groups. SEI collaborated with the different government organizations, civil society organizations and universities to link science and governance in the water sector. The project provided an evidence base on the status of the Chindwin River so that multiple water users can have a foundation for dialogue on their hopes and concerns for the future and discuss management of the Chindwin River Basin.

Many regions suffer from problems associated with water. For example, shrinking glaciers, extreme droughts and management challenges threaten Bolivia's water supply. Water shortages have affected 125 000 families and 283 000 hectares of agriculture, and led to the declaration of a state of emergency. Bolivia's Ministry of Environment and Water was keen to have a uniform dataset that could act as a baseline to inform water planning in the regions. It engaged SEI to help develop this "national water balance" using our **Water Evaluation And Planning (WEAP)** system. SEI has also provided modelling expertise to the California State Water Resources Control Board through their Sacramento Water Allocation Model (SacWAM) update as it considers new in-stream flow regimes in the Sacramento Valley. SacWAM is a hydrologic and system operations model developed by SEI and the State Water Resources Control Board using SEI's own Water Evaluation And Planning (WEAP) software platform. It assesses potential revisions to requirements in the Bay-Delta Watershed, including the current update of the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary.

The CADWAGO (Climate change ADaptation and WAtER GOVERNance: reconciling food security, renewable energy and the provision of multiple ecosystem services) project, which ran from 2012 to 2016, saw a partnership between SEI and 9 other institutions. CADWAGO aimed to address the global challenge of water security through enabling appropriate responses to the impacts of climate change on water resources. Activities promoted systemic and adaptive transformations in water governance by developing knowledge to support conceptual, institutional and practice-based innovations. It was by way of these transformations in governance that CADWAGO intended to support the forms of multi-level and multi-stakeholder collective action that will improve climate change adaptation responses, from a water security perspective. Through this approach, it was envisaged that both the livelihoods of communities and the ecosystem services that are dependent on water would be enhanced. CADWAGO aimed to adapt European decision-making processes that have had a global impact, by building on lessons from case studies and creating a dialogue between researchers and stakeholders at different scales, in a series of governance learning events.

The BLASTIC project (2016-2018) was aimed at reducing plastic waste and, thereby, the inflow of hazardous substances into the Baltic Sea. One of the important outputs the project provided was a methodology for both mapping the most important sources and pathways of plastic litter entering marine environments, and monitoring litter in rivers and coastal waters/areas. The methodology was implemented in four urban areas: Tallinn (Estonia), Turku (Finland), Södertälje (Sweden), and Liepaja (Latvia). The project produced data about the marine litter in the pilot areas by mapping the sources and pathways and monitoring the amounts of litter in the aquatic

environment, and provided general guidelines for developing measures (i.e. action plans) for reducing marine litter in urban areas. The project took regional and national strategies down to a local level. The aim was to create lasting conditions that will ultimately contribute to the reduced inflow of hazardous substances and toxins into the Baltic Sea.

The right sanitation systems not only minimize health and environmental risks associated with open defecation and poorly managed waste disposal – they can also, in many cases, yield multiple benefits in areas from health to food security, resilient livelihoods, business growth, energy, and ecosystem services. SEI has a long history of research and development of sustainable sanitation systems with work in many countries, including a number of countries in Africa (see *“Sanitation, Wastewater Management and Sustainability: from Waste Disposal to Resource Recovery”* Andersson et al. 2016), exploring the social, governance, economic, health, environmental and technological dimensions of sustainable sanitation and wastewater management and resource recovery. During the 2015–19 Strategy period, an SEI initiative has focused on productive sanitation approaches, including fieldwork in Burkina Faso. This involved evaluating factors determining sustained outcomes of past productive sanitation interventions as well as developing a new implementation framework and associated tools for rural productive sanitation, where waste-related risks and resources are identified and progressively managed on both household and community levels. Through its SDG project, supported by internal funds under SEI control, SEI has provided a useable and intuitive conceptual framework suited to assess the interactions between Sustainable Development Goals. This has been widely taken up and has changed guidelines and ways of thinking about more integrated policy, planning and strategy within international organizations (such as the United Nations Development Programme - UNDP), in the research community, in some national governments, and in industry. It has strengthened the capacity for integrated decision-making amongst these partners. The question of how to pursue more integrated policymaking in implementing the SDGs became a burning issue for governments after the adoption of the 2030 Agenda in 2015, with its emphasis on policy coherence. A first necessary step towards coherence is to understand how the SDG issues interact and fit together – a challenge for researchers, practitioners, and policymakers, where limited advances had been made. SEI has carefully followed the development of the SDGs and provided advice to countries during their development through the Independent Research Forum (IRF). Recent research has concentrated on methods to assess coherence in the achievement of the goals (Nilsson et al. 2016). This has led to a continuous improvement of the methods used to make more nuanced and systemic assessment of the coherence of policies between different SDGs (e.g. Weitz, Carlsen and Trimmer 2019), with case studies in specific countries, such as Sweden (Weitz et al. 2018), Mongolia (Barquet et al. 2019) and for the EU (Weitz et al. 2019).

PRINCE (Policy-Relevant Indicators for National Consumption and Environment) was a consortium project which ran from 2015 to 2018. The team was led by Statistics Sweden and included experts from SEI and other institutions. It was commissioned in response to a call from the Swedish Environmental Protection Agency (EPA) and the Swedish Agency for Marine and Water Management (SwAM) to explore new ways to quantify and map the global environmental impacts of Swedish consumption. In a report published on 1st Nov. 2018 by the Swedish EPA, Naturvårdsverket, the PRINCE team summarised the outcomes, including new consumption-based indicators and modelling methods. These include:

- a new model constructed, and results for a new set of consumption-based indicators
- proof-of-concept that it is viable to link national environmental-economic data to an MRIO (multi-region input output) model
- a contribution to a coherent framework for a whole set of indicators of national consumption, and
- new types of environmental extensions, as well as new ways of looking at existing extensions that could be used in MRIOs.

EXIOBASE (an MRIO database) and the Swedish national environmental accounts already contained environmental “extensions” for calculating numerous environmental pressures such as greenhouse gas emissions, air pollutants, and use of land, fresh water and various categories of materials. However, an important aspect of PRINCE was developing new extensions for pressures that had not before been measured at national scale.

On a different scale entirely, the Co-Motion project built on the York Centre’s expertise in transport and sustainable living at a community scale. The project worked with older people, local councils, decision-makers and campaign groups to identify solutions to maintaining mobility in urban areas. Solutions were agreed with a broader group of citizens to ensure that they were likely to have wide acceptance and uptake. In York, the project has seen outcomes that reduce the blocking of footways. Advertizing boards on pavements have been banned and measures to encourage drivers to consider the needs of others and not park on pavements are being considered.

The Air Quality in Informal Settlements case study draws on three related projects, beginning with Citizen Science and Air Pollution, a project in the informal settlement of Mukuru in Nairobi, Kenya, where local people acted as champions to develop an evidence base on exposure to poor air quality by using personal sensors and time activity diaries to explore differences. This SEI Seed and Innovation-funded project spun off four follow-up projects: one, funded by Lira, extends the original approach to make a more detailed assessment of indoor air pollution in Nairobi and Addis Ababa; a second, the AIR Network (funded by GCRF through the UK Medical and Arts and Humanities Research Councils) uses creative methods to build links and identify solutions with informal settlement dwellers and policymakers; third, a UK NERC project led by CEH Edinburgh collected more detailed measurements of particulate matter and other air pollutants in Mukuru and Tupumue; and, finally, it led to a UK MRC / Kenya National Research Foundation-funded project exploring lung health determinants in young people in Nairobi, led by Liverpool School of Tropical Medicine. The Kenya Air Quality Network (KAQN) came about as a result of the Citizen Science and Air Quality project. Researchers involved in air pollution in Kenya came together at a workshop on citizen science and air pollution hosted by SEI at the end of the project in 2015, where multiple stakeholders in Nairobi, including government, academia, NGOs, international organizations (UNEP and UNHABITAT), and development organizations, met. The next day, they decided to form the KAQN. This was a rare opportunity for low-income community representatives to meet with government and air quality experts. The network has been developed to support national and local government in implementing plans and to create a strategic plan which includes a theory of change. The network operates through three working groups on: 1) Air quality data research and instrumentation; 2) Policy development and stakeholder engagement; 3) Education, training and public awareness. The approach is further explained in West et al. (2020).

## 5. Outcomes of SEI's activities

In this section the outcomes of SEI's work in the selected case studies are outlined. An explanation of the "impact" of SEI's activities is something that is often requested, and it is therefore important to understand what we mean by impact, outcome and outputs (see Section 2 section on Outcome Mapping). If we start with outputs, these are the direct products of the research and activities - these could be reports, papers or models developed using one of our tools or workshops with their conclusions and recommendations etc. (see also Table 2 for a full list of possible outcomes deriving from discussions with SEI staff). An output does not, by itself, constitute a change in the way people perceive an issue, and may not by itself build capacity or contribute to decisions. This is shown in Table 1, which demonstrates how easily-attributable outcomes may not always lead to lasting knowledge change (or "enlightenment" – c.f. Table 1).

The outcomes of SEI's activities are indicators of the potential of SEI research to contribute to a change in the world. Change (impact) is implemented by people we influence. In the main, SEI's work does not implement an "impact" in the world – such as a reduction in emissions, improvement in livelihoods, reduction of poverty, improved access to food, reduction in biodiversity loss, increased equality between genders and reduced inequity between different social groups, and so on. These impacts are generally achieved by the decision-makers we engage with – individuals in communities, or people in local and national governments or the private sector – rather than by SEI itself. SEI's role is to achieve the outcome of "influencing decision-makers" such that they are more inclined, empowered and motivated to deliver "impact".

It is often easier to document our contribution to ongoing knowledge [co]creation, policy and decision-making processes, than to a new policy or practice. This is because complex processes govern the responses to different problems and there are many influences in any change: these have been outlined in Table 1. In the main, we are able to point to outcomes of our engagement, and it is these outcomes which we understand to be a pre-requisite to impact, and that is the main focus of this section. At SEI we considered that our engagement with decision and policymakers can have different outcomes which can be characterised as changing people's or institutions' agendas, capacities or decisions regarding an important issue for environment and development:

1. **Agendas:** this refers to changes in the awareness, attitudes and agendas of decision-makers. Unless people are aware of a concept or issue, they cannot change their attitudes; without a change in attitude, little else will change; and a change in attitude can lead to people and institutions changing their agendas. This type of outcome is therefore a pre-requisite for impact.
2. **Capacities:** this refers to the enhancement of the abilities of institutions or empowered communities or people, which allows them to engage effectively on an issue in different parts of the world so that they are better equipped to address important issues relating to sustainable development. When discussing institutions we mean formal organizations as well as informal institutions.
3. **Decisions:** this refers to changes to the decision-making processes of different actors in international agreements, decision and policymakers at national or local scales, in communities, the private sector or other influential organizations. It also includes changes in the actual decisions taken or policies adopted. This also encompasses decisions made about implementing policies and plans – i.e. decisions related to practice.

These categories have been derived from the experience of people in SEI, but also reflect the literature on engagement between science and decision-making. For example, Meagher and Lyle (2013) discuss "conceptual use or impact", which is a wide-ranging definition of research use comprising the complex and often indirect ways in which research can have an impact

on the knowledge, understanding and attitudes of policymakers and practitioners, akin to our *Agendas* category. They also point to “capacity-building”, referring to education, training or even development of collaborative abilities, similar to our *Capacities* category. They discuss “instrumental use or impact” – the direct impact of research on policy and practice decisions where a specific piece of research is used in making a specific decision or in defining the solution to a specific problem – reflecting our category of *Decisions*.

## 5.1 Agendas: changes in awareness, attitudes and agendas:

In this section we consider the SEI case studies and how they have affected “Agendas”. The Arctic Resilience Report (2016) shows how a single key report presented at the right time can be a catalyst in the process of ongoing science-to-policy communication and an important signpost to the policy community of the commitment – as well as the ability – of the research community to support them. The report was presented in 2017 at the Arctic Council Showcase in Fairbanks, Alaska, which was designed to celebrate the close of the two-year U.S. Chairmanship of the Council (see <https://www.sei.org/featured/resilience-in-arctic/>). This presentation outlined key recommendations in the report, such as:

- Improving how data on human/ecological interactions is collected and assessed at the local level (known as “community-based monitoring”), and doing this in a more integrated way, using a “systems” approach. One such successful project that could be expanded is the *Circumpolar Local Environmental Observer Network*
- Setting up projects locally, and at the regional and national levels, that integrate different kinds of knowledge and academic disciplines, and prioritizing projects that engage with communities. The Scenarios project under the “North Slope Science Initiative” in Alaska illustrates this approach in practice
- Closely involving local communities in work to solve environmental problems, using local and Indigenous knowledge and interdisciplinary science as tools. The Arctic Waterways Safety Committee is a good example of such an approach.

Andres Jato, Sweden’s Senior Arctic Official, noted that “moving from science to concrete action is one of Sweden’s top priorities in its Arctic Council work, and we want to ensure that new knowledge really makes a difference” (<https://www.sei.org/featured/arctic-change-in-the-spotlight-at-meeting-of-senior-officials/>). Arctic Resilience Report Co-Chair Joel Clement, of the U.S. Department of the Interior, echoed that sentiment: “It’s essential for us to have solid science underpinning our policy development. The great teamwork we’ve had between scientists and those of us working on the policy side is helping to guarantee we not only have an excellent scientific report, but also a solid action plan that can strengthen resilience in the Arctic in very practical ways” (<https://www.sei.org/featured/arctic-change-in-the-spotlight-at-meeting-of-senior-officials/>).

On a not-dissimilar topic, there was initially considerable scepticism towards the concept of cross-border climate impacts. However, during the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat meeting in Bonn, in November 2017, some country representatives took a particular interest in this concept, which had been developed by SEI. Having grasped the concept, they reframed the ideas using terms that meant something to them – they called it a “*Societal El Niño*”, meaning change caused in one region could affect another in subtle ways. This stemmed from a common understanding that the *El Niño* change in the Pacific has a profound effect on the weather in other regions. This change in the narrative made it acceptable to others, and the Adaptation Committee made recommendations (see UN Adaptation Committee 2017) for national adaptation planning that included this concept and which were later endorsed by UNFCCC’s Subsidiary Body for Scientific and Technological Advice (SBSTA).

The Adaptation Committee agreed on a recommendation for this idea to be included in its report to Conference of the Parties meeting, COP23. The concept has therefore become part of the process, but this has not yet had an effect on negotiations. The next step would be to develop supplementary guidance for assessing transboundary climate risk, to be included in the UNFCCC Technical Guidelines for the National Adaptation Plans. There have been recent developments in relation to this work. SEI has linked with ODI and IDDRI, to establish the “Adaptation Without Borders Initiative” (Benzie et al. 2018; <https://adaptationwithoutborders.org/>) and also to organize an event at Wilton Park on Transboundary Climate Risks (<https://www.wiltonpark.org.uk/event/wp1670/>). The research and conceptual development undertaken by SEI have clearly changed the Agenda of the process on this subject, and it is having increasing influence.

As well as contributing to an existing policy process, SEI's work regarding the “Black Carbon and Ozone Assessment” led to the development of an entirely new international voluntary coalition of countries and non-state organizations – the Climate and Clean Air Coalition to reduce short-lived climate pollutants, or CCAC. The UNEP/WMO assessment contributed to this formation by ensuring that, during the development of the assessment, information and messages were well-presented to the policy community through side events and contacts between UNEP and key governments (e.g. at a UNFCCC side event in Bonn, and side events at the UNEP Governing Council or UNFCCC COPs), and that this captured the attention of the media, governments and academia, as well as the climate community engaged in the UN negotiations in the UNFCCC. This raised awareness of the potential for these measures to contribute to improving climate change and delivering clean air, and helped to change the agendas of key decision-makers. This included US climate negotiators, and ministers of environment in Sweden, Bangladesh, Mexico, Ghana, and Canada.

The findings outlined in the UNEP/WMO assessment created a political momentum around the issue of what are now termed Short-Lived Climate Pollutants (SLCPs). As Achim Steiner, the then-director of UNEP said, “If someone told you that by implementing a handful of measures, you could halve the rate of global warming, save millions of lives and avoid millions of tonnes of crop yield losses, what would you do: act of course!” (<http://www.ccacoalition.org/sites/default/files/resources/Time%20To%20Act%20to%20reduce%20Short-Lived%20Climate%20Pollutants.pdf>). As members of the Scientific Advisory Panel, SEI representatives continue to raise awareness among both country and non-state partners of the CCAC, frequently explaining the latest scientific findings in Working Group meetings where all partners are present. SEI also undertakes detailed discussions with decision-makers in countries in Africa, Latin America and Asia during the implementation of CCAC projects designed to support national planning on action to reduce emissions.

SEI often achieves significant outcomes through interactions with national-scale decision-making. SEI produced three outputs in 2016 that informed U.S. government research and policymaking on the topic of Arctic oil production. The first, an SEI working paper, addressed whether future leasing of areas for coal, oil, and gas extraction would be consistent with 2°C goals (Erickson and Lazarus 2016). The second, a website article, identified how the Department of the Interior was overlooking the largest CO<sub>2</sub> impact of offshore oil drilling (Erickson 2016). The final, a discussion brief, made the case for why future leasing of public U.S. offshore areas for oil exploration was inconsistent with climate goals (Erickson et al. 2016). SEI's methodology for assessing the CO<sub>2</sub> impacts of expanded offshore oil drilling was applied by the Department of the Interior, and showed a much greater CO<sub>2</sub> emissions impact than they had previously found, which helped to reframe the debate and contribute to the decision to permanently ban Arctic oil and gas drilling.

SEI's sustainable sanitation projects have also interacted extensively with a number of national governments. Drawing on research findings from a post-project sustainability evaluation of major ecological sanitation projects in Burkina Faso (Dickin et al. 2018), awareness on sustainability issues was raised amongst actors at regional and national levels who are working to implement sanitation services. These included donor agencies and government authorities at municipal and

regional levels. An additional piece of work (REACH) focused on gender dimensions of climate-related risks to WASH services, and on developing a new tool for assessing gender and social outcomes of WASH interventions such as the provision of sanitation services. Additionally, guest lectures at Swedish Universities have raised awareness in Sweden regarding these issues.

There are many examples of decision-maker agendas being influenced through close interaction between SEI researchers and decision-makers, working together to identify changes that will enhance sustainable development. A good example of the co-production of awareness and attitude change is the Chindwin Futures project. Broadly, the outcomes of the Chindwin Futures work helped to bring key stakeholders together to address issues. This is evidenced via citation of SEI's work, communications from boundary partners, continued collaboration with those partners, and additional and continued funding of work. In this case, SEI has successfully acted as a boundary organization between science and policy, facilitating consideration and discussions between decision-makers and other stakeholders about issues related to water management within the Chindwin River Basin. Capacity-building work is ongoing and SEI continues to inform and engage with partners through multi-stakeholder dialogues. While new policy has not yet developed, SEI has succeeded in bringing together stakeholders that had not previously interacted to discuss issues relevant to water management within the river basin, as well as raising awareness of different perspectives, uses and needs, and supporting a change in agendas.

A further example of close interaction between decision-makers and SEI is the case of the organization's work with the California Water Resources Board, which has led to an agenda change. Joint development of the WEAP model for the Sacramento River Basin by the Board, with SEI support, has enabled them to develop plans to mimic natural flows and optimise water provision for natural systems as well as human demands – something that they were previously unable to consider, as the tools they had been using could not consider this strategy. With this new knowledge, they are able to change their decisions regarding water resource management.

SEI's work on Air Quality in informal settlements in Nairobi, Kenya, revealed interesting perspectives related to awareness raising. According to pre- and post-activity questionnaires, local people in the Mukuru area show slightly raised levels of knowledge of air pollution following SEI's involvement. While local people had been aware of air pollution previously, they were not aware of the real health consequences of poor air quality: children with small lung capacity, high levels of respiratory illness etc. Working directly with local people led to a change in understanding of what the air pollution issues are in informal settlements. Previous understandings of air quality issues had focused on "smells" emanating from open drains, but now residents understand wider range of sources of pollution in the community, both indoor (mainly related to cooking) and outdoor. There was a danger that awareness would be raised on something that people couldn't act on, but the project subsequently looked at the options that could be taken by people living in Mukuru to address their air pollution exposure, such as switching from biomass stoves to biomass stoves to liquified petroleum gas (LPG). It also invited resident representatives to meet with government officials at a workshop, which led to the formation of the Kenya Air Quality Network. Close interactions between members of the Kenya Air Quality Network has shifted the emphasis on air pollution work in Kenya. Rather than just being a linkage between the research community and policymakers, it has become a much more broadly-based forum. The diverse membership of the network has made it possible to link different areas of policymaking, for instance creating increased linkages with the Ministry of Health, the Ministry of Environment, Meteorological Office, and sectoral ministries such as transport. The involvement of community members who are suffering from high air pollution has resulted in greater buy-in from local communities and their continued engagement. The activities of the KAQN have enabled the greater consideration of the issue of air pollution as a whole, increasingly addressing indoor and outdoor exposure together.

The CADWAGO project built on the insights of a series of case studies. In Sweden, the case study engaged in both theoretical and practical work, which increased awareness of the influence of

power in water governance conflicts. Findings stemming from the inclusion of gender-equity issues revealed that further attention needed to be given to the role of power, particularly in relation to its distortion of the outcomes of deliberative and systemic processes that are intended to address the controversies underpinning water governance. This finding was applied to other case studies within the project to ensure that community actions at catchment level were included in social learning processes. It changed agendas by helping the case studies to shift the way in which they addressed conflicts.

SEI has an important role linking decision-making at local and national levels. SEI's research on managing peat and blanket bogs in the UK has increased awareness of the issue in several ways. The research topic has been the subject of two UK Parliamentary debates, one of which was specific to the results of the SEI research. It has also led to considerable communication within and between different stakeholder groups involved in the management of peatlands, including government agencies, gamekeepers, local politicians, landowners and the influential IUCN UK Peatland Initiative. The research has increased the momentum of people seeking to understand the issues more clearly, evidenced by the many unsolicited emails and other communications SEI has received from land owners, farmers and other interested stakeholders, directly in relation to this research.

The project team regularly participated in knowledge exchange, which took place at the start of the project, as a workshop, during the project and at its end, through workshops held in 2017. It has also taken place throughout the study via the project's website (<http://peatland-es-uk.york.ac.uk/>). Knowledge exchange has occurred in relation to reducing climate change, increasing upland biodiversity and managing water flows, in particular preventing flooding in lowland UK, and has involved the scientific community, government agencies and other stakeholders such as land-users (e.g. gamekeepers and farmers), land managers (e.g. shooting associations), large land owners (e.g. United Utilities, Yorkshire Water) and land user groups (e.g. Moorland Association). Representatives from these groups were part of the Project Advisory Group (PAG) which met annually and discussed progress (annual reports), planned future work and suggested additional work. Moreover, the project team circulated shorter progress reports to a wider group of interested stakeholders, which was selected by the PAG.

So far, nine scientific papers have been published from the work (e.g. Carroll et al. 2015). Several more are in preparation and a final government report is shortly to be published. However, most of the results have already been presented at several national and international conferences (including in keynote lectures) during 2012 – 2017; these included meetings of the British Ecological Society, the International Symposium on Soil Organic Matter, and the BIOGEMON Symposium. Moreover, summaries of the scientific findings were presented to a special peatlands working group at the United Nations Framework Convention on Climate Change (UNFCCC) and a general project summary was presented to Natural England (NE) staff, and other upland interest groups, via a webinar in 2017. Further knowledge transfer was undertaken in several workshops, including one on Payment for Ecosystem Services, and in several presentations to upland user groups, including the Upland Hydrology Group and the Yorkshire Peat Partnership (YPP). Finally, the project was presented at site visits with representatives from the local farming community, upland user groups (e.g. Areas of Outstanding Natural Beauty (AONB), Moorland Association), water companies and staff from government agencies such as Natural England, including its Chief Scientific Advisor and Chief Executive.

Working at the national and city level, the BLASTIC project shows how agendas, attitudes and awareness can be changed through careful and targeted communication. The blog post, "Problem of plastic waste in the Baltic on the rise" (05 June 2018 - <https://www.sei.org/about-sei/press-room/media-coverage/problem-plastic-waste-baltic-rise/>) details how Harmen Spek, the innovation manager at a Dutch plastic pollution awareness body, the Plastic Soup Foundation, was quoted as saying that "the problem of floating islands of plastic, or "plastic soup", is rising and needs a change of thinking to be combated". Spek made the comment while speaking as

an external expert on the Estonian TV daily news *Aktuaalne Kaamera*, so the message was communicated widely. A significant part of the waste coming into the Baltic from Estonia is made up of insulation foam used in the construction industry and, in the same story, SEI Senior Expert Harri Moora is quoted as saying “Surprisingly this source is clearly more evident [in Estonia] than in Finland or Sweden”. The reason behind this might be that expanded polystyrene (so called EPS) is widely used as insulation material in Estonia due to recent high rates of renovation of Estonian housing. In another blog post, “Changing cabins on Tallinn beach highlight the problem of marine plastics” (05 July 2018 - <https://www.sei.org/featured/changing-cabins-tallinn-beach-highlight-problem-marine-plastics/>), BLASTIC reports on public information boards on Pirita beach in Tallinn, Estonia. Tallinn Deputy Mayor, Züleyxa Izmailova, is quoted here saying that “Tallinn has taken a number of measures to reduce marine litter, raising people’s awareness on the issue being one of them”. This can be directly linked to the BLASTIC project, as it has carried out awareness-raising activities on marine litter in Tallinn City. The measures have also been developed in cooperation with, and under the guidance of, SEI Tallinn, within the BLASTIC project.

A further example of where agendas have been changed at a national level is the close collaboration between SEI and the Ministry of Energy and Mines of the Kingdom of Morocco. By providing credible quantitative estimates to top civil servants, this collaboration led to an increased awareness of the potential for renewable energy to supply electricity in Morocco as well as of the role that energy efficiency and demand-side measures can play in reducing electricity production requirements. The quantitative evidence has buttressed Morocco’s policy shift toward clean electricity and efficiency, including in its national energy strategy and power-sector investment plans.

Changing the agendas of decision-makers is not confined to governmental processes at different scales; decision-makers in the private sector also often have the capacity to enact rapid change. The collaboration between SEI and the Swedish steel industry has led to a “silent revolution”. When the collaboration started, the industry representatives involved were mainly talking about government requirements. A year into the joint projects, the industry had created a plan of how their actions would add societal value. This was based upon discussions about the use of Agenda 2030 as a map of business opportunities for the industry, in which they saw themselves as a key actor in the development of important transitions.

At a very different policy level, and again showing how, at certain key moments, research input can help shape policy *and* influence thinking, during 2014-2015, SEI’s SDG project developed a first set of ideas for how one might start to conceptualize interlinkages between the SDG issues in a way that is useful to policymakers and supports integrated decision-making. In early 2016, SEI’s Måns Nilsson presented a draft framework for mapping SDG interactions at a workshop convened by ICSU (The International Council for Science). ICSU subsequently adopted the framework and applied it in a large international project (ICSU 2017), and Nilsson was invited by *Nature* to write a Comment (Nilsson et al. 2016). This publication drove interest internationally, from science, but also from policy, communities. The SDG Interactions Framework has (e.g. in September 2017) had observable outcomes, in that it has changed how some international organizations, policy analysts and researchers think about the challenge of integrated decision-making, and has made available a practical framework for systemic thinking in the policy process. Before this work was developed, despite the goal of providing an integrated framework, the assessment of interactions was very shallow, which could lead to poor and incoherent policy development. Countries welcomed the framework SEI presented – there was a lot of interaction with the Swedish Government, who were able to present a more holistic plan as a result, incorporating cross-cutting themes, and the approach has been trialled in different countries.

Also changing awareness, attitudes and agendas, the PRINCE project was developed to produce a new, scientifically-based framework for monitoring the environmental impacts linked to Swedish consumption, both inside and outside Sweden’s borders. This was done using the latest modelling and statistical techniques, including indicators for several environmental pressures

rarely monitored at macro level, along with a baseline monitoring report and case studies. The idea behind PRINCE was to explore which indicators could be used to follow-up Sweden's "Generational Goal" – the overarching goal of its environmental policy – which states that the country's major environmental problems should be eliminated within a generation, without worsening environmental or health problems abroad. "In some ways it can be seen as an explicit commitment that Sweden will take care of its total consumption footprint, not just the part that falls within Sweden," says SEI Research Fellow Elena Dawkins, a member of SEI's PRINCE team. "It was a multi-faceted challenge," she continues. "We had to develop a way of regularly measuring Sweden's consumption footprint. We had to make international data compatible with the detailed environmental and economic data that Sweden has on its own economy, emissions and resource use in order to compare trends in the domestic and external footprints. We also had a wish list of environmental pressures to develop indicators for, some of which had never been measured at national scale by any country before."

## 5.2 Capacities: enhanced institutions and empowered communities

Unlike changing agendas, raising awareness or modifying or changing attitudes, increasing capacity is much more about what we leave behind after the initial knowledge [co]creation phase has begun to move towards some sort of policy implementation phase. This includes not just increased knowledge (awareness) on the part of local communities and social and political institutions, but also the ability to act upon, and plan for the implementation of that knowledge (i.e. capacity).

Enhancing the capacities of institutions is an ongoing process, as is demonstrated in the developing work in the Arctic. This started with what might be called "preparatory work", progressing through the production of scientific insights (such as the Arctic Resilience Report), which were then able to lead on to implementation work, such as is outlined in the *Arctic Resilience Action Framework* (ARAF). Thus, simply handing off science insights to the policy community seldom produces change (except perhaps under conditions of crisis). There are many parts and variables, static and dynamic, dependant and independent, so some kind of ongoing strategic engagement and support is likely to be extremely important in facilitating such a change process. What is also important is that it is informed by a theory of change (including changes in scientific thinking, policy and practice) and of how changes scale up, and includes a variety of steps toward activities and changes embraced as desirable by bodies such as, in this case, the Arctic Council. This is a key part of the process of getting from insight to action. Furthermore, by including issues related to social and economic development, local communities have also been involved. This also means that the work done at a relatively high-level – i.e. with the Arctic Council – is related to grassroots issues in Arctic communities. Knowledge flows both ways.

Similarly linking local and regional to international spheres, the next steps of SEI's empirical SDG interactions work include finalizing an internal pilot study in Sri Lanka, refining the guidelines and enabling a more general rolling-out of tools, both for SDG implementation strategy in public policy and for the business sector. They also include developing a knowledge system based on the framework, under the auspices of the UN Global Sustainable Development Report (GSDR), ICSU and/or Future Earth. There is potential for the framework to have direct influences on national development plans and investments. Such influences would trigger more coherent and efficient development programming for poverty alleviation and other 2030 Agenda goals.

At an international level again, but with respect to very different issues, SEI was the first NGO to sign the agreement to join the Climate and Clean Air Coalition (CCAC) and has supported the development of this international process since its inception. Two members of SEI sit on the CCAC's Scientific Advisory Panel and represent it at meetings of all the partners, building the capacity of partners from different countries through talks and discussions. SEI also

engages as a lead partner in national planning and regional assessment initiatives. At the moment, SEI is enhancing the capacity of 30 countries to undertake quantitative analyses around black carbon, using the SEI-developed LEAP-IBC tool (Long-range Energy Alternatives Planning system enhanced by the Integrated Benefits Calculator). This work is being funded through the SNAP (Supporting National Action and Planning on short-lived climate pollutants) initiative. The idea is to increase capacity to plan emission reductions in participant countries, usually working with their Ministries of the Environment and sometimes supported by in-country, university-based academics.

At national and regional levels, SEI's research on peat and blanket bogs has increased the capacity of boundary partners, enabling them to make more informed decisions. This capacity is built not just into the institutions of government, but also into private and "semi-state" industry, with immediate knock-on benefits for sustainability. For example, the UK water companies such as United Utilities and Yorkshire Water are interested in catchment water quality and its linkage to drinking water quality, with potential implications for the water treatment required and associated financial costs. Their capacity has been increased through the project and they use the SEI research findings to help with their planning and decisions. Whilst providing much needed policy evidence and advice on burning and alternative blanket bog-management impacts on ecosystem services, the research also has the potential to demonstrate realistic, practitioner-relevant outcomes with multiple benefits to all stakeholders. The subject of the research has enhanced policymaker and practitioner capacity to manage the peatlands by providing information relevant to mitigating climate change, increasing upland biodiversity, and managing water flows and flooding in the UK. The breadth and relevance of the project and the broad inclusion of practitioners from the its start, in addition to the fact that it has been ongoing for seven years, have increased the momentum of people wanting to understand the issues more clearly. This has been evidenced by many unsolicited emails, other communication and also co-funding from landowners, farmers and other interested stakeholders.

At the national level again, and as a clear example of real capacity being built for a sustainable future, the work between SEI and the Bolivian government using WEAP (SEI's Water Evaluation And Planning system) allowed the Bolivian Ministry to develop its own hydro-climatic baseline scenario for the whole country. This was a great step forward. It gave them, for the first time, control over the planning of water resources using a tool that they could develop themselves. It was also a step which would save them money, as each future consultancy contract would not need to start by developing a baseline – an unnecessary and expensive process. From this baseline they have developed a National Watershed Plan which will be used as a starting point to put into place different strategies to improve water availability and flood risk evaluation in Bolivia. The Bolivian Ministry knew that they needed a tool and a framework to develop plans for water management; having found out about WEAP, they developed a relationship with SEI. This tool development has allowed different groups in Bolivia to integrate their planning, which will lead to better outcomes and policy coherence. The Bolivians created an inter-institutional platform for tool development, involving universities and different agencies. SEI had a sub-contract with the Ministry in Bolivia, which was able to master the tools and innovate in the use of WEAP. Data and research were integrated into the platform so that the capacity-building also allows an efficient transfer of the latest research findings directly to practitioners.

A very similar story is told by SEI's work with the Moroccan Energy Ministry. A core objective of the country's energy and mitigation planning project has been to develop an energy system model which is owned and operated by Morocco's own Ministry, thus freeing the government from reliance on external consultants for projections and scenario analysis. This is a key focus for the LEAP modelling activities: to develop the capacity of practitioners in countries to develop their own energy system models and estimate greenhouse gas (GHG) emissions. This aim is premised on the understanding that when practitioners from within the country itself, often with the involvement of government, develop results from models that they own, there is a much greater impact on their national policy than when external consultants develop results in reports

to that government. Through workshops and joint modelling exercises with Moroccan Ministry staff, SEI has built a national energy system model and used it to explore “business-as-usual” scenarios as well as a range of possible mitigation options for energy and transport. LEAP has allowed them to develop hourly calculations of energy supply from renewables and for energy demand, and determines how different sources of electricity can be balanced and how the ideal mix of different sources of electricity can be developed.

In the work with the Climate and Clean Air Coalition, the LEAP tool has been enhanced by including the capacity to estimate emission scenarios for air pollutants. It also includes the Integrated Benefits Calculator (IBC), which enables users to estimate air pollution impacts on health and agricultural production, as well as providing estimates for the impact of emissions on global warming. This enhanced LEAP-IBC tool is being used to strengthen the capacity of about 30 countries to develop emission inventories and scenarios, and to input the estimates into their planning processes. This work is developing capacity in the countries to use and develop the tools, and there is evidence that the projects are leading to increased integration between the parts of government that are responsible for climate change and air pollution in several countries, including Ghana, Cote d'Ivoire, the Maldives and Colombia. Similar to the WEAP case in Bolivia, the investment of SEI's own funds into research undertaken by SEI through, for example, its initiative on Low Emissions Development Pathways, has been directly transferred to practitioners through the addition of different impacts of air pollution to the IBC.

Again, by building capacity at the national level in an interesting way, it can be argued that the PRINCE project developed its own decision-making process: i.e. it made its own context. Of course, this was in response to the political will to follow-up on Sweden's “Generational Goal”, which aims to eliminate major environmental problems in Sweden within a generation, without worsening environmental or health problems abroad. In a simplistic way, PRINCE also provided the institutions involved with a way to see how they could measure things that were already politically important. The key motivation throughout the project was to enable such follow-up of the “Generational Goal”. From an SEI perspective, the aim was also to produce a methodology that would be available to use in other countries. The methodology can be applied in other countries that have recorded national environmental economic data in a similar way to Sweden; it is predominantly applicable for other smaller countries. For larger countries, existing models like EXIOBASE already suffice. PRINCE was also seen as a way to underpin ongoing research interests such as down-scaling national environmental accounts to capture sub-national heterogeneity and increasing capacity to address issues like shipping emissions and fisheries.

The SEI project team consider PRINCE to be a very successful project with high potential for additional impact in the coming years. The current outcomes of the project cover all three areas of impact that are in the new draft SEI theory of change. For example, the model is being incorporated into Swedish national environmental economic accounts for some indicators through a change in accounting procedures at Statistics Sweden; there is increased awareness of the external impacts of Swedish consumption within Sweden; and it has received very good media coverage. Further, there is the potential for the capacity-building of government officials (including those from EPA, SwAM and the Chemicals Agency) through a number of dialogues on different subtopics of the project. The International Maritime Organization (IMO) is supporting additional work on shipping emissions, leading to new conversations with new partners and new funders, and there is also interest in the UK in using the methodology as input to risk assessments. Furthermore, within SEI, the PRINCE work has informed and fuelled other ongoing work such as the TRASE-related projects on supply chains, as well as the SEI initiative on Producer to Consumer Responsibility (P2CS).

At the regional and national level, a series of important partnerships have been built with key local and national water resources management and development stakeholders in Myanmar. Partnerships were built with both governmental and non-governmental organizations involved in the Ayeyarwady River Basin, during Phase 1 of the Ayeyarwady Futures Project (AFP). A

formal cooperation agreement was reached with the Myanmar Directorate of Water Resources and Improvement of River Systems (DWIR), which acts as the Secretariat of the National Water Resources Committee (NWRC), and joint activities were carried out with national experts organized through the Myanmar Environment Institute (MEI). Collaborative work and partnerships between various state, civil society and private actors at different levels in the water sector were key to SEI's engagement with decision-makers. Building on the Ayeyarwady Futures program, the Ayeyarwady Futures Partnership (AFP) aims both to strengthen the roles of key existing organizations in linking science and governance in the water sector, and to fill gaps among them. The AFP is designed to work as a boundary organization between policy and science in close consultation with Myanmar stakeholders and in the context of existing institutions and mechanisms in the country.

Capacity-building activities with the private sector have increased in SEI, and an awareness of the SDG framework has been effectively transferred to the Swedish steel industry; this is helping them to develop their own capacity to build plans in a way that will enhance sustainability. Also, in a second stage of this collaborative work, a tool has been developed on the interactions between SDGs, called the "Agenda 2030 Compass". It has been tested in a workshop with representatives from both the steel industry and the Swedish government, and is generating a lot of interest. The discussion with the steel industry does not just involve talking about the goals, but also assesses how changes in production, or different processes, affect all of them. It then helps to assess how activities affecting each of these goals interact with attaining other goals. There have been some important spin-offs from the work with the steel industry. For example, SEI has used the approaches of the work with the steel industry to work with the Swedish forestry industry under the framing of a Swedish bio-economy in 2050. Other work has been with the mining industry (Linden Gruppen), which uses three of the scenarios SEI has developed with them to get the four main assets of the group to work together more closely to improve sustainability services by 2030.

At a city level, the Co-Motion project has developed the capacity of local NGOs by providing them with information that they would not otherwise have access to and, in doing so, levelling power imbalances that had previously existed with decision-makers. Co-Motion involved non-state actors in creating evidence. Having gathered information, briefing documents were produced which were provided to other actors, such as NGOs representing older people, and the York Business Improvement District, which gave them access to the same information as the City Council. They were therefore able to lobby from a stronger position for changes to support older people.

The Kenya Air Quality network was also able to strengthen the capacity of local government institutions by providing them with information and protocols. County-level government in Kenya has the mandate for implementing air quality regulation. However, county governments could not effectively enforce legislation due to a lack of knowledge on monitoring and impacts. The KAQN has provided advice on monitoring that gives counties the information they need to enforce legislation. Similarly, at a community level, those areas that have been involved with the KAQN now have evidence of the impacts of air pollution on their own households and communities. This knowledge means that they are in a better position to address sources of internal air pollution in their own homes and those of their neighbours. Community-level interventions occurring at the same stage as research has helped to maintain successful interventions beyond the life of the project. In addition, proposals that have come through the KAQN include community members as a part of the research proposal, which means that changes to their capacity on these issues tend to be sustained for longer.

It is also important to acknowledge the necessity of building capacity within SEI itself. One significant aspect of the BLASTIC project is that it builds on other SEI projects, run not just by the Tallinn Centre (see <https://www.sei.org/publications/state-baltic-sea-report/> and <https://www.sei.org/publications/towards-sustainable-waste-management-in-the-baltic-sea-region-countries-the-contribution-of-universities/>). These projects and the resulting associated, and recognised,

expertise within SEI – which has been combined with other recognised expertise in the Baltic region and has involved “end users” such as the City of Tallinn, from project inception – have all helped to create the enabling conditions of *credibility, relevance, legitimacy* and *iterativity* suggested in the literature (see this Report, Section 2).

The necessity of building the capacity of stakeholders based on SEI expertise is shown clearly by the particularly close relationship between the SEI office in Davis, in the US, and the California Water Resources Board. The capacity of the Water Resources Board to plan water-use was limited by the outdated tools they had at their disposal. When key people who understood the potential of more advanced models like WEAP assumed prominent positions in the Water Board, they developed a relationship with SEI. The subsequent development of a WEAP model of the river basin has significantly enhanced their capacity, which has, in turn, allowed them to model different strategies for managing water flow to both supply human demands and increase the quality of the habitat for different species. This is leading to a revolutionary policy to mimic natural flows at 60% of the natural cycle, which has been shown from the modelling to provide the optimal balance for nature, and which can also supply people's needs. This happened *because* of the capacity within SEI. As an example of raised capacity within SEI, the series of projects on air quality in Kenya have been realised when the internal institutional capacity of the SEI Africa centre to deliver air quality projects has been built up.

### 5.3 Decisions: changes in decision-making processes or decisions:

Much of SEI's work reported here, can best be thought of as “work-in-progress”. Further, as Table 1 (page 8) shows, policy influence in terms of defined outputs is often easier to show where the research community is solving problems, often presented by decision-makers requiring advice on how best to achieve their goals, rather than by changing agendas (which is thought to occur when research orientates decision-makers towards sustainable development). Such policy outputs, where they can be identified, can be seen as outcomes in themselves, but also as part of an iterative process of changing the world towards a more sustainable future. Thus, while the work is promising, and while there are definite process outcomes, there is often little definite policy output to point towards. However, this is not always the case.

Outputs are often most easily seen at a local level, where connection to the decision-making process can be quite direct. Such outputs are also often clearly linked to changes in attitudes. For example, the Tallinn City Deputy Mayor, Züleyxa Izmailova, is quoted saying that “Tallinn has taken a number of measures to reduce marine litter [...]. The use of disposable plastic cups in Tallinn during public events will be banned starting October 2019. We can contribute to it by keeping the streets and beaches clean by not throwing cigarette butts or candy wraps on the ground to start with” (see reporting on the ban <https://news.err.ee/979560/tallinn-to-ban-single-use-plastic-at-public-events>). At the time of the project, Züleyxa Izmailova was the Deputy Mayor responsible for environmental matters and is very “green” in her mindset (being the leader of the Estonian Green Party at the time of the BLASTIC project). However, the Tallinn Municipal Waste Management Plan has a separate chapter on marine litter which, along with the measures in the plan, have been directly influenced by the BLASTIC project. This can be pointed to as a definite output (i.e. decision), as well as a process outcome.

Similarly, the Bangkok Metropolitan Authority will now include disability action plans in its emergency training, directly as a result of work done by SEI and its partner organizations through the Disability and Disasters project. Following engagement with the SEI project, including through training it provided, the Thailand Department of Disaster Prevention and Mitigation has agreed to integrate disability-inclusive disaster risk reduction into the curriculum of its training academy.

In some cases, policy decisions can be taken, only to be rescinded due to political changes. On December 20th 2016, United States President Obama and Canadian Prime Minister Trudeau

permanently withdrew nearly all Arctic oil and gas resources (and much of the U.S. Atlantic) from future oil and gas drilling. In enacting this ban, they used the same climate argument SEI had articulated in our December 1st discussion brief: that oil and gas activities should only be pursued if they are “consistent with national and global climate and environmental goals”, thereby showing a direct correlation. President Obama and Prime Minister Trudeau concluded, as SEI had just weeks earlier, that new Arctic oil and gas drilling would not be consistent with the global call to limit warming to 2°C. But, of course, this decision has since been contested by the Trump administration.

A final example of this is changes in policy at a city level, achieved by the Co-Motion project. Co-Motion presented recommendations to the City of York Council based on what older people had said would improve their mobility. In particular, the removal of advertising boards from pavements, the prevention of car parking on pavements and the provision of small areas of green space in the city. Since that point, advertising boards have been banned, and measures to encourage drivers to consider the needs of pavements users and discourage parking on pavements are under discussion. Other direct infrastructure improvements have also been made, such as the re-surfacing of pedestrianised streets in the city centre. The contribution of the Co-Motion project to these changes is unclear, but evidence on the impacts of these activities was clearly presented and the proposals that Co-Motion made were seen as being credible, having been made by groups who would benefit from the changes, in addition to having been shown to be welcomed by the wider public.

Also showing ongoing promise, but with definite policy outputs recognisable in the pipeline, the formation of the Climate and Clean Air Coalition to reduce short-lived climate pollutants (CCAC) was a decision which was heavily based upon the findings of the UNEP-WMO (United Nations Environment Programme and World Meteorological Organization) assessment of 2011. This assessment was referred to as an important influence by United States of America’s then-Secretary of State, Hillary Clinton, during its launch in 2012. SEI had an important role in this through the coordination of the UNEP-WMO assessment and UNEP near-term report (UNEP 2011), which is a more policy-oriented report based on the assessment findings. In 2011, SEI also organized a workshop in Dhaka with the Ministries of Sweden and Bangladesh. Hosted by the Ministers of those two countries, the issues related to Short-Lived Climate Pollutant (SLCP) mitigation were discussed with stakeholders and representatives from Canada, Mexico and the US. SEI also developed a side event at the Durban COP in December 2011, which was attended by the Ministers of Canada, Sweden and Ghana, along with a representative of the US White House. We helped build capacity of country representatives in order to facilitate their decision-making. In January 2012, Sweden, the US, Canada, Ghana, Bangladesh and Mexico initiated the “Climate and Clean Air Coalition” (CCAC) to reduce short-lived climate pollutants. From the initial six countries, plus UNEP, this voluntary network has grown to include about 60 countries, and about the same number of intergovernmental organization and NGOs. The role of UNEP in developing the political interest in it was key and SEI worked very closely with the UNEP Chief Scientist and Climate Officer. This decision was the start of SEI’s engagement with different countries within CCAC initiatives.

The support SEI continues to give to countries through the CCAC SNAP Initiative (Supporting National Action and Planning) feeds into their decision-making processes. SEI is working with more than 16 countries in Asia, Africa and Latin America, supporting their planning and implementing the LEAP-IBC tool to reinforce this effort with quantitative estimates. In Ghana, working with the Ghana Environmental Protection Agency, the support provided by SEI has informed the development of their National Short-Lived Climate Pollutant (SLCP) action plan, and has influenced the measures in their Nationally Determined Contribution (NDC) and air quality plans. One of the policies in their National SLCP plan and NDC is to implement Soot-Free buses. In deciding upon the technology, they weighed up both compressed natural gas (CNG) and electric buses and have shifted to electric. This is partly because of the focus of the Green Climate Fund, to which they were applying, but also because the SEI LEAP-IBC tool

has been used to show the benefit of this for clean air and climate. As of December 2019, 6 countries had finalised their national plans and 4 had had them adopted as official government documents and were therefore shifting to implementing their strategies.

Similarly, the SEI draft framework for mapping Sustainable Development Goal (SDG) interactions, which was adopted by the International Council for Science (ICSU) in 2017, has since informed processes and guidelines in the UN system (such as the UN Development Assistance Framework -UNDAF - guidance) and the Organization for Economic Cooperation and Development (OECD) Policy Coherence for Development (PCD). SEI has been invited to numerous conferences with, for example, the UN Development Programme (UNDP), the UN Department of Economic and Social Affairs (UNDESA), the OECD, and the UN Environment Programme, as well as several science meetings. Substantive results have included the identification of gender equality as an SDG with strong co-benefits across all other SDGs (Nilsson et al. 2016). In parallel, SEI has advanced the concept towards application in a systemic, quantitative approach for a comprehensive SDG strategy (Weitz et al. 2018). UNDP Asia-Pacific has funded a first pilot study to apply the framework in national policy development in Sri Lanka (on-going). The framework has also been applied by the Swedish steel industry, and has contributed to articulating business and societal benefits of the industry's 2050 vision. Here, the "Agenda 2030 Compass", a new tool, has proved very useful enabling decision-makers to account for interactions between goals. This work thus both shows some initial outputs and points to significant outcomes.

Results from SEI's collaboration with the Energy Ministry of the Kingdom of Morocco have informed the energy-sector component of Morocco's NDC and the development of Morocco's national energy strategy. Here, there is good evidence that the numbers from the LEAP analysis have been used in key government documents supporting these processes. The detailed energy modelling has enabled Morocco to plan for a 80-90% renewable energy future and become a global leader in deploying these technologies.

A final example of process impact with a defined future promise of impact is that, as a result of collaboration with SEI, the California Water Resources Board is developing a new water flow regime. This is undergoing a process of inclusion into regulations and will subsequently be put into practice, once all legal steps have been taken. This is a revolutionary new approach that mimics natural flows, at a certain percentage of that flow (60%), so that it can maximise the benefits to natural ecosystem structure and function, as well as providing water for human use. SEI's own modelling tool, WEAP, has allowed this planning to be developed. Previous tools would not have been able to model this regime and so the application of WEAP has facilitated this innovation. The legal process which will enable its implementation is currently taking place and will lead to new regulations, with the first proposals being made to the State Board. One thing that is clear is that changes in regulations do not happen quickly, and that, to have an impact, effort needs to be made over a long period of time. The work in Bolivia with WEAP is at an earlier stage but has already fed into the National Watershed Plan that is being developed for the country, though the tool will allow different scenarios for water-use to be developed for watersheds across the country. However, like much of SEI's work reported here, the process of moving from problem-solving to enlightenment and of getting sustainability arguments on the agenda, can best be thought of as "work-in-progress". This does not, however, mean that we cannot point to policy impact; rather, it means is that that impact is in ongoing policy processes.

At a national industrial level, a number of decisions have been taken by the Swedish steel industry. A significant one is the launch of "HYBRIT" (Hydrogen Breakthrough Ironmaking Technology), which emerged during the first year of the collaboration with SEI. This is a joint venture project involving major Swedish steel companies (SSAB, LKAB) and Vattenfall (a major Swedish power company), that endeavours to revolutionize steel-making by replacing coking coal, traditionally needed for ore-based steel making, with hydrogen in the steelmaking process by 2025. Steel making currently accounts for about 10% of all Swedish CO<sub>2</sub> emissions and such a change would dramatically reduce this percentage. The Head of Research of SSAB was heavily

involved in the SEI project, which contributed to the development of the “HYBRIT” strategy being taken seriously and the provision of its framing.

Similarly, the wider Arctic Resilience process can also best be thought of as “work-in-progress”. Its initial work was driven by individual SEI researchers, and led up to the Arctic Resilience Report being accepted as an Arctic Council project. It progressed through the acceptance of that project and the research work, to the publication and reception of the Report itself, and subsequently to follow-up engagement aimed at operationalizing the report’s insights. SEI staff are very much engaged in follow-up work, for example through work with the Arctic Council that will influence the extent to which the insights developed in the scientific reports find their way into the policy and practice of the Arctic Council. This occurs through generalized contact and explicit follow-up projects (e.g. related to Arctic Wetlands).

The importance of follow-up work cannot be overemphasised. Through multi-stakeholder dialogues in Myanmar, for example, SEI initiated discussions about water quality and its management; this work is continued with the Sagaing regional government, where it is aimed towards the establishment of a River Basin Organization (RBO). The importance of continued work is further seen with respect to the Arctic resilience work in the Senior Arctic Officials’ report from the Fairbanks Ministerial Declaration: “To implement the ARAF [Arctic Resilience Action Framework], Arctic States, P[ermanent] P[articipants], and W[orking] G[roups]s will share actions that they are taking to build resilience and a team of experts will identify opportunities to measure and evaluate progress. Reflecting the cross-cutting nature of resilience, the Arctic Council Secretariat (ACS) will assist in the coordination of the implementation of the ARAF. This work will be conducted within the Sustainable Development Working Group, in coordination with other Working Group secretariats. Working Group secretariats shall provide existing information on resilience-relevant working group activities to the ACS. Finland hosted the first biennial Arctic Resilience Forum in 2018 to evaluate and discuss the Arctic’s collective progress towards building resilience.”

The Kenya Air Quality Network (KAQN) has been helping to implement government policy on air pollution, to clarify relationships and responsibilities and to identify where resources are necessary to effect change. There has been a recent devolution of responsibility to county level in Kenya, and this resulted in a lack of clarity on the relationship between and responsibilities of national government and counties. The KAQN was able to start a dialogue between these actors that has resulted in an agreement to work together. Budgets at county level now acknowledge the need for funding for air quality management and, in turn, this means that funding is available from national government in priority areas. Additionally, the KAQN has contributed to the formation of a Policy Action, at Nairobi county level and has assisted national government on a national strategy plan for air quality management, embedding the use of LEAP-IBC in the Kenyan government as a means of informing decision-making.

The CADWAGO project had an unanticipated opportunity, which extended their influence on decision-making from a national to international scale. Project partner colleagues at the Open University were invited to present the project’s systemic approaches to water governance to the OECD. This presentation led to a contribution and change to the OECD “Principles of Good Water Governance”. The project team attribute this outcome to the adoption of a co-learning approach throughout the project, with SEI researchers working with non-academic stakeholders within the case studies and throughout the governance learning events. This created the opportunity to influence the process and resulted in changes in the documentation of the principles.

## 6. Pathways of engagement

Different pathways are used by SEI to engage with decision-makers and policymakers, thereby inducing change towards sustainable development. In the work assessing discussions with SEI staff, a number of different common pathways have been identified, which have, in this section, been used to create a classification in order to emphasise some of the features of how SEI engages with partners to induce change. We consider that the structure of this section is a sensible aggregation of the codes discussed so far, which are used to assess the pathways featured in this section's case studies.

### 6.1 Developing scientific evidence for decision-making

One effective path to provide knowledge for decision-making is to develop synthesis reports to provide an overview of knowledge related to a specific area. Major evidence was presented to stakeholders in the Arctic Resilience Synthesis Report. This was the culmination of SEI's involvement in presenting the evidence in books by respected international publishers such as Petrov et al. (2017), alongside many individual Arctic-relevant projects that set the ball rolling. This is now being supported and carried forward by ongoing implementation work (e.g. the Arctic Resilience Action Framework - ARAF); this includes identifying existing good practices and continuing to build a "Community of Practice", "mainstreaming" ideas in policy and working groups, and agreeing on the monitoring and assessment of results. It is clear that it is not just the report which provides the evidence that has led to successful engagement, but the ongoing engagement itself.

As well as synthesis reports, the involvement of SEI in developing assessments is an important pathway to advising policymakers and supplying evidence. The power of assessments lies in the fact that they review the current status of the peer-reviewed literature and are multi-authored, therefore suffer less from author bias, are seen as more authoritative and are understood to reflect the current state of knowledge about a subject. SEI researchers have been lead authors and coordinating lead authors of a number of international assessments including the IPCC assessment reports (Klein), the UNEP GEO assessments (e.g. Kuylentierna, Emberson, Hicks, Persson, Thomalla), IPBES assessments (Gardner) and other assessments such as the Global Energy Assessment (Emberson, Rockström). One assessment report that was very influential was the UNEP/WMO assessment on black carbon and ozone which SEI coordinated and where SEI researchers (Kuylentierna, Hicks, Vallack, Emberson) were involved as lead authors in every section. All of these assessments provided decision-makers with evidence they felt they could trust; as one UNEP representative said, "it provides them with the confidence to do the right thing, based upon the evidence".

One aspect that is important in the UNEP/WMO assessment, as well as subsequent UNEP regional assessments of climate change and air pollution (where SEI had important roles), is that the assessment process developed new knowledge as well as assessing the literature. Modelling was carried out (by IIASA and NASA-GISS) to identify key strategies that could halve the rate of near-term warming by 2050 and reduce air pollution impacts on health and agriculture, avoiding millions of premature deaths and millions of tonnes of lost crops. The important innovation was to first identify a limited number of concrete measures that would reduce emission significantly and to create a simple graph showing the impact of these measures on global temperature over time. The focus on solutions and the graph enabled the report to have political impact.

Other SEI work has provided evidence related to very specific issues that can feed into policy and decision-making processes. The sustainable sanitation initiative has focused on the production of reliable data on motivations for continued use of ecological sanitation facilities at a household level, as well potential reuse value and applications of waste in a municipal level sanitation system. Further, it provides enhancement of a "proof of concept"-level tool for

city planners to support implementation. Information on inequalities in provision and use of facilities is also being used to inform advice on future development.

The Kenya Air Quality Network (KAQN) has been able to provide information and evidence that has enabled policymakers to act. The evidence base on air quality in Kenya is still quite limited; decision-makers can feel tied because there is not sufficient evidence to allocate resources and, in particular, projects tend to be too short-term to allow for an understanding of the impacts that develop over time. These include, for instance, health effects related to air pollution, although the Tupumue project, which spun out from the AIR Network, is a three year project exploring lung health determinants in young people in Nairobi. The KAQN “Air quality research on data and instrumentation” working group has used evidence to develop monitoring protocols and quantify impacts.

SEI has also used synthesis reports, backed up by the development of experimental evidence on a key knowledge gap related to managing peat and blanket bogs in the UK. This is important due to the large store of carbon in peatlands, which are vulnerable to climate change as well as management practices. These ecosystems are important for both conservation and the provision of vital ecosystem services. SEI addressed the key evidence gaps on the effects of alternative bog management interventions, as identified in a literature review. This provided scientifically robust and meaningful data upon which to base policy advice and subsequently inform management decisions, considering both environmental and socio-economic implications, including working toward a cost-benefit analysis. Experiments were then set up in three replicated sites; this is important as it provides evidence that the results are of general relevance. The experimental approach with catchment- and plot-level replication and careful field design was crucial to generating reliable outputs. The experimental data, backed up by the synthesis report, has provided policymaker and practitioner-relevant information in relation to reducing climate change, increasing upland biodiversity and managing water flows, in particular preventing flooding in the UK. To our knowledge, this research project is the only current UK, and in fact global, long-term replicated plot- and catchment-scale experiment on blanket bogs to provide such a robust test platform. This is particularly so in relation to the most recently identified knowledge gaps around prescribed burning and recommendations for future research (i.e. Harper et al. 2018).

At a local level, SEI has used evidence-gathering processes that seek to ensure that the opinions of those who are affected by an issue are sought, and that the solutions developed as a result of this evidence-gathering are checked, not only with the groups that will be directly affected, but also with others who might have competing interests or who might derive co-benefits. The Co-Motion Project first asked older people for solutions that might benefit them; these solutions were then presented to a cross-section of the wider public to establish which measures might have co-benefits for other groups, as well as which solutions would be acceptable and would be likely to be supported. This co-produced method, with those affected generating solutions and sense-checking, along with reflection by a generous sample of the wider population, gave the proposals legitimacy that would not have been present in a purely academic exercise.

SEI has developed new evidence using different methodological approaches. At the heart of the PRINCE project’s indicators is a new model that links Swedish economic and environmental statistics with a multi-regional input-output (MRIO) database, EXIOBASE 3, in order to model the international supply chains that feed Swedish consumption. This information has then been used to calculate the resulting environmental pressures (emissions and resource use) of Swedish consumption, and identify where in the world those pressures occur. It can also be used to understand the environmental pressures associated with different components of demand within the private and public sectors and the impact of the different products and services that are consumed. The project resulted in a new set of consumption-based indicators incorporating new types of environmental extensions, as well as new ways of looking at existing extensions that could be used in MIRO studies.

An important aspect of PRINCE was the development of new extensions for pressures that had not previously been measured on a national scale, including the world's first indicators for the aggregate use and emissions of hazardous chemical products in Swedish consumption. "Naturvårdsverket was keen to see how it is possible to measure the chemical impacts of Swedish consumption. A key difficulty that had to be overcome was the sheer number of different hazardous chemicals – and that they are used for so many different purposes in all sectors of society. So we had to create a set of indicators that together would tell a representative story of the overall use and emissions of hazardous chemical products for Swedish consumption," says Linn Persson, of PRINCE. The team produced five aggregate chemicals extensions, some based on use of hazardous chemicals and others on emissions, focusing on different aspects such as eco- and human toxicity. They also developed extensions for agrochemicals and veterinary antimicrobials. "These indicators have an exciting potential, but they are only as good as the data available. We had to rely on national reporting of chemicals use in different countries, and it is patchy and inconsistent, particularly outside the EU. This work really underlined the need for more standardized reporting of hazardous chemical use," says Persson.

The BLASTIC project was designed to provide a methodology for mapping the most important sources and pathways of marine plastic litter and monitoring litter in rivers and coastal waters/ areas. It also addressed the key evidence gaps on the effects of plastics in seas and oceans, considering both environmental and socio-economic implications. SEI's centre in Tallinn developed the BLASTIC methodology for mapping the sources and pathways and contributed to the monitoring methodology with partners (e.g. IVL in Sweden). The actual mapping in Estonia was undertaken jointly by SEI Tallinn and the City of Tallinn, and SEI researchers monitored rivers using the developed methodology. Other partners in Finland, Sweden and Latvia undertook mapping and monitoring with their respective municipalities.

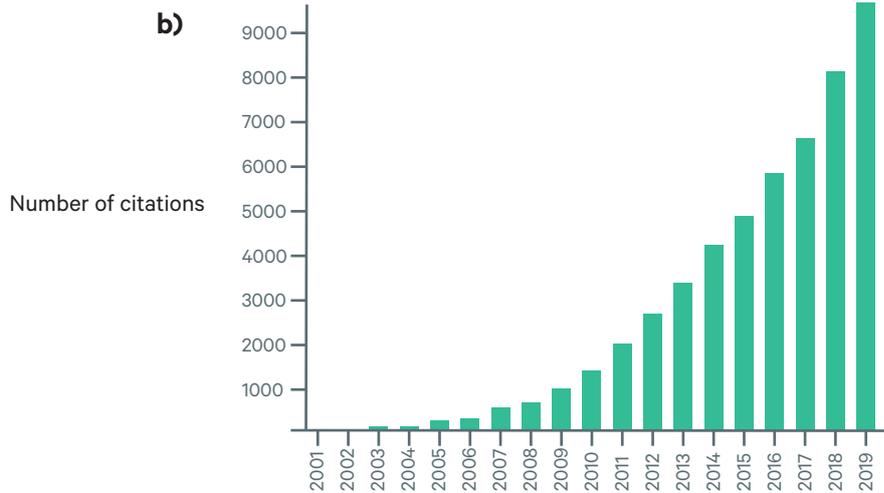
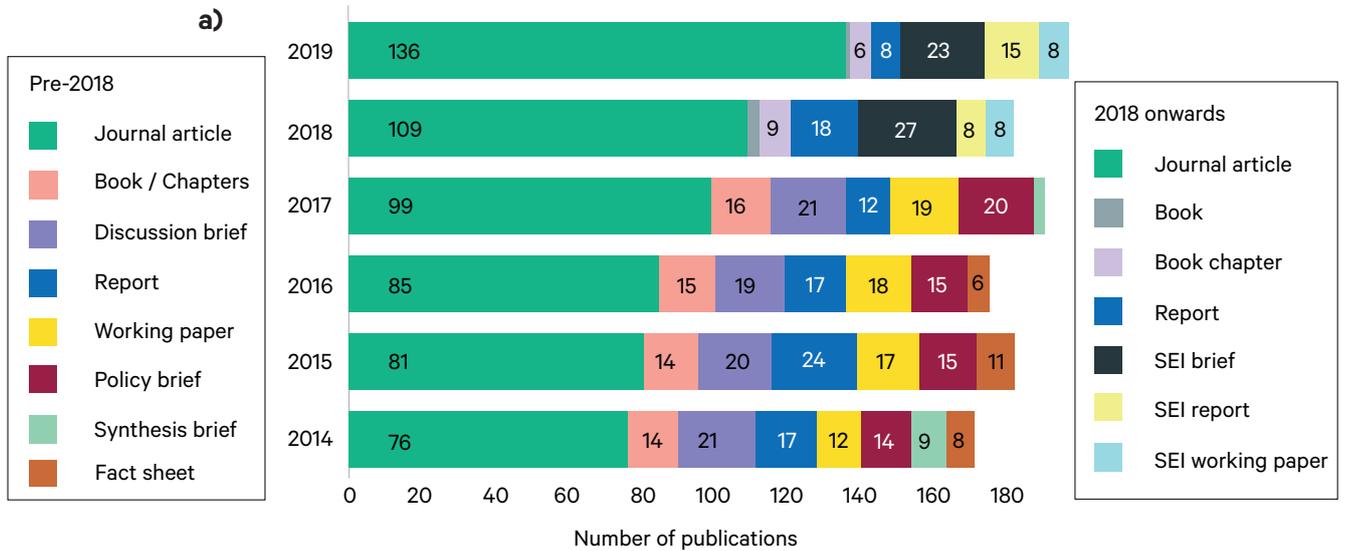
In some cases, the evidence required by policymaking has been demanded by decision-makers. For example, the Chindwin River Basin work was demand-driven by policymakers and other end users. Research was timely and partners were engaged within and through existing institutions, and outputs were used to create an evidence base which was shared effectively with boundary partners. With regards to the status of the Chindwin River, this included rainfall, hydrology, livelihood dependencies and water quality, with the aim that the multiple water users within the river basin could have a proper foundation for dialogue on their hopes and concerns for the future of the Chindwin River, and could discuss means of management.

The support SEI has given to the California Water Resources Board and the Bolivian government also responded to specific needs of those decision-makers. In California, SEI worked with practitioners to develop a model that could be used to assess the best water flow amount and pattern, to both provide users with their water needs and maximise environmental quality.

The credibility of the SEI's research is critical to its successful engagement with decision- and policymaking. Some of the main ways in which this has been strengthened over the years have been an increased emphasis on writing peer-reviewed articles associated with different projects, an increasing number of peer-reviewed articles being produced and an increasing number of citations of articles including SEI authors (see Figures 3 a and b).

A number of the articles produced are in high impact factor and prestigious journals, which also helps SEI's credibility and provides a strong platform for reaching out and informing a wide audience about the results of particular projects. For example, the UNEP/WMO Assessment was promoted by the publication of an article in *Science*, the journal of the American Association for the Advancement of Science (AAAS) (Shindell et al. 2012), which has been followed up by another *Science* article on a similar subject (Shindell et al. 2017). The SDG work was published in *Nature*, the long-respected international journal of science (Nilsson et al. 2016), which made this thinking available to a wide audience and consolidated the methods as a standard way to assess SDG implementation. However, some of the most successful policy engagement is under-reported.

Figure 3. a. Number of peer-reviewed journal articles including SEI researchers, and SEI publications, from 2014-19  
 b. Number of citations between 2001 and 2019 involving SEI authors, from 2001-19.



This is because, when working with governments as a trusted partner, much of the data and knowledge about institutional relationships can be very sensitive and once governments have been trained to develop models, they own the data that they produce. In some cases, therefore, in order to maintain the relationship with policymakers and be in a position to advise them and have impact, data resulting from the work SEI does is under-reported.

## 6.2 Communicating the message

SEI used many forms of communication with respect to the Arctic resilience work. The scientific synthesis report is the most obvious, but they also included a digital report (“Into the Blue”), several academic articles and involvement in academic books, as well as other initiatives such as working with young people and future leaders (<https://www.sei.org/perspectives/future-challenges/>). Critically, it is SEI’s ongoing involvement in the *Arctic Resilience Action Framework* which is helping to make these different communications via different media “stick”. Communication also occurred through SEI participation in Arctic Council meetings.

The communication associated with the PRINCE project was very successful, particularly in the last part of the work with media outreach and the final production of outputs. The SEI approach of working with communications embedded in the research project was new to the other partners, and while this placed unanticipated strain on SEI, the effort has reaped fruit. For future projects of this kind, the message that it is necessary to plan for communication both at the project's end and beyond cannot be overemphasised.

The BLASTIC project has benefited from ample media coverage throughout its course. This has, in part, been thanks to the fact that marine plastic waste is a topic people can easily relate to, meaning that the media want to cover it. The array of communication forms used to convey the BLASTIC message have included: press releases; regular blog posts by experts and politicians in the Baltic Sea area ([www.blastic.eu/blog/](http://www.blastic.eu/blog/)); a social media campaign with short videos; active participation in marine health-related conferences such as the EUSBSR Forum in June 2018 ([www.balticsea-region-strategy.eu/9th-annual-forum/temporary-seminar-list/590973-marine-plastic-in-the-baltic-sea](http://www.balticsea-region-strategy.eu/9th-annual-forum/temporary-seminar-list/590973-marine-plastic-in-the-baltic-sea)); and participation in the Our Ocean Conference in October 2017 (<http://ourocean2017.org/>). In addition, SEI Tallinn targeted the local media directly, which led to research results of the BLASTIC project being covered more-or-less continuously by the national evening TV news.

The government decision-making processes engaged in by the Kenya Air Quality Network (KAQN) are set out in the country's constitution, but network members were not necessarily aware of how that decision-making works. KAQN's policy development and stakeholder engagement working group has helped network members understand the decision-making context at both national and county levels. This ensures that, not only is research carried out in a way that is considered legitimate by policymakers, any consultation conducted as part of research meets the requirements of the Nairobi County. Similarly, in SEI's work on air quality in informal settlements (Citizen Science and Air pollution, AIR Network and Tupumue) participatory approaches including citizen science, theatre and music, have opened up dialogues between industry representatives and Mukuru residents, helping both groups to understand each other's perspectives within the local policy context. This has brought participants together in a way that has never previously happened. It has also given residents a better understanding of decision-makers' difficulties and contexts (and *vice versa*) and has allowed for an understanding of the barriers that exist.

Considerable communication within and between different stakeholder groups occurred in the project on UK management of peatlands, including with government agencies (Defra and Natural England), game keepers, local politicians, landowners and the influential "UK IUCN Peatland" initiative. The project team regularly participated in knowledge exchange. This took place at the start of the project in the form of a workshop, during the project such as through annual reports to the Heather Trust, conferences and site visits, and at the end (e.g. workshops in 2017). It has also taken place throughout the study via the project's website (<http://peatland-es-uk.york.ac.uk/>). The project team also circulated shorter progress reports to a wider group of interested stakeholders, who were selected by the Project Advisory Group (PAG). Nine scientific papers have been published from the work (e.g. Carroll et al. 2015). However, most of the results have already been presented at several national and international conferences. Moreover, summaries of the science findings were presented to a special peatlands working group at the United Nations Framework Convention on Climate Change (UNFCCC) and a general project update was presented to Natural England staff and other upland interest groups via a webinar in 2017.

Other projects emphasised the importance of direct, two-way communication with decision-makers, whether through more conventional information sharing workshops or more creative means. The Co-Motion project held feedback workshops with both council officials and other organizations, so that all were privy to the same information, and this contributed to levelling the power dynamics between these groups. The project team found that this openness of approach, though crucial to achieving outcomes, led to a difficult balance between maintaining a long-term relationship with decision-makers and ensuring equitable information sharing. In person, focused workshops have also proved the most effective means of work for the Kenya

Air Quality Network. The workshops allow the network to draw on small amounts of funds from partners (to allow the project funds to stretch further) and to break down activity into small achievable chunks. The buy-in from partners contributing to these workshops has also helped to build and maintain engagement.

The CADWAGO project used creative methods to build communication and understanding between project partners. During one of the governance learning events, international project team members and stakeholders witnessed the traditional Sardinian method of conflict resolution, “La Rasgioni”, in which a people’s court allows different voices to be expressed, and people share food before the verdict. After the project, other researchers, in collaboration with CADWAGO project members, adapted the method to a UK context. Titled “the Reasons”, it was designed to address water management in a way that constructively undermined the role of the expert and recognised different forms and expressions of knowledge, allowing participants to think about and understand the perspectives of those with whom they were in conflict, in a way that hadn’t previously been possible. A similar technique was used in the air quality in informal settlements work, where participants were invited to take part in an activity called “legislative theatre”. This approach used theatre as a means to understand conflicting viewpoints and the decision-making context, in order to enhance communication between citizens and decision-makers. The “Legislative Theatre” technique has been used to work through solutions to air quality issues, with local people playing out the solutions decision-makers suggest. Murals and stories which have been shared through story telling events have also been created as outputs to raise awareness.

As part of the Ayeyarwady Futures Project (AFP), SEI has created factsheets, films and profiles regarding this work and plans were developed to publish a book detailing its research findings. Even though SEI did not have specific media engagement targets, AFP has attracted some attention in the national and local media. The national officers of DWIR (Myanmar’s Directorate of Water Resources and Improvement of River Systems) have cited SEI’s work in water quality monitoring on national media. Within the Chindwin River Basin, several landmark development activities, mainly around mining, have sparked environmental protests related to water quality decline and other environmental damage. Thus, environmental pollution and its link to mining was a key concern amongst the regional government and communities, sometimes making national news programmes (cf. the BLASTIC case study in Estonia). In Myanmar, some of this media pressure may have led to DWIR announcing that water quality was in a critical condition, citing SEI’s work as evidence. In addition to the timeliness and relevance of our work, and our relationships with boundary partners, SEI also regularly attended important regional and national events related to water. We have annually presented our work at the Greater Mekong Forum on water, food and energy, the national World Water Day in Myanmar and other events. With findings from SEI research, we have used stakeholder consultations as platforms for discussion and dissemination, and SEI personnel have presented findings to Parliament’s Natural Resource Committee, and the Chief Minister in Myanmar.

### 6.3 Enhancing capacity of decision-makers

One of the key ways to ensure successful engagement with decision and policymaking is to enhance the capacity of researchers, practitioners and decision-makers in the different countries SEI works with, to enable these stakeholders to develop their own insights for their policymaking. Some of this is done through engagement that increases their knowledge or formalises it in a way they can use. Another successful way is to transfer the capacity to undertake their own analyses by teaching them to use certain tools, including those developed by SEI. Thus informed and empowered, the decision-makers in the countries can provide quantitative estimates, or new framings that include knowledge from collaborations with SEI, for their policymakers. It is our experience that when the information comes from partners within the countries, the impact of the knowledge is much greater. Therefore, empowering decision-makers by enhancing their capacity is a feature of many SEI projects.

The work of SEI enhanced the capacity of representatives from the Swedish steel industry allowing them to understand how to use the SDG framework and put the goals into the context of scenario development. SEI has done this by helping the representatives to develop scenarios using different scenario-building techniques, and through the development of the tool the “Agenda 2030 Compass”. This then has fed into their industrial policy development.

When SEI works with countries using tools like LEAP and WEAP, many of the most successful examples are from building up capacity over an extended period of time. In the Morocco case, the close interaction over a number of years has enabled a rapid increase in the capacity of the practitioners in the Ministry of Energy and Mines to undertake their own, increasingly sophisticated, analyses. The way this works is that, over time, SEI is able to add more and more functionality to the model, as the skills of the practitioners increase. Also, given the very flexible nature of LEAP, the model can be formed to answer the specific policy questions being asked.

The case of WEAP in California and Bolivia also points to the success of developing relationships over a number of years, allowing them to undertake increasingly sophisticated modelling and become more independent in developing their models over time. Both LEAP and WEAP have been deliberately produced to enable practitioners with a propensity for using such models to be able to develop national and regional models with limited support from SEI. In many cases, such modellers attend regular training courses delivered by SEI that explain different aspects of the tools and introduce new modifications which have been made as these tools develop. LEAP has been used by thousands of practitioners in 190 countries. Clearly, most of these are not the result of multi-year, well-resourced projects, but the success of close engagement is interesting. In the work with the CCAC (Climate and Clean Air Coalition) countries, the use of remote training – using Skype, or other such platforms – enables regular contact and gradual improvement of datasets and LEAP-IBC applications. We have been working to build the capacity of people in different institutions in Ghana, mainly focusing on Daniel Benefor, a LEAP user from the Ghana EPA: he can be seen as an “empowered person” who has the capacity to run LEAP-IBC and is now in a good position to inform policy in his country. He works with Simpson Attieku from the Energy Commission and it is interesting to note that he received his LEAP training from other Ghanaians – a case of training the trainers, or, as Simpson said, of LEAP being an example of “true technology transfer”.

It could be argued that SEI's PRINCE project simply provided the institutions involved with the capacity to measure things they were already politically concerned about. Additionally, there is the potential to further build the capacity of government officials (including in the Swedish EPA and the Chemicals Agency) through a number of dialogues on different subtopics of the project, and there is interest in the UK in using the methodology as input to risk assessments.

## 6.4 Using tools to support the decision-making process

Most or all of the projects use some sort of analysis methodology or model to facilitate analysis: this could be referred to as a “tool” used in the project. Here, however, we are more concerned with what can be conceived of as a standalone tool, which can be transferred to end users and used by them after our project engagement ends, thereby building capacity amongst those users to facilitate sustainable development themselves.

The Ministry of Energy and Mines in Morocco realized that they wanted to develop in-house capacity to undertake their own energy modelling. They were fed up with being reliant on international, donor-funded consultants in order to develop their planning. At best they would receive reports and limited training, and they were often not given access to the model, meaning that the analysis carried out was essentially a black box to them. They had heard about the SEI LEAP model and made contact. SEI's Jason Veysey developed a “Morocco starter model” and undertook training with them in a week-long event. The modellers from the Ministry of Energy

and Mines were able to see how they could develop results, even after a week's work, which they were very happy about, and they also realized that significantly more support was needed in order to become self-sufficient. They managed to persuade GIZ and UNEP to fund a longer capacity-building exercise. The model has been developed as a joint exercise over several years. The design of the LEAP tool has facilitated the application in Morocco – it is designed to be readily used by practitioners and is transparent and flexible, so it can be tailored to users' needs. LEAP has a large user base: it is utilized by thousands of practitioners in 190 countries. Even without active projects between SEI and specific countries, the results of SEI's activity is helping energy, GHG and now air quality planning in many parts of the world. The LEAP community has a membership of almost 40 000 users in 197 countries (January 2019).

WEAP also has thousands of members in its WEAP forum (31 000 in 188 countries, as of January 2019). A similar story can be seen with the development of WEAP in California and Bolivia. In both cases, people in government had requirements for the further development of their water planning and, once they became aware of the capabilities of WEAP, they sought a relationship with SEI. The use of WEAP has allowed the practitioners in Bolivia to be in charge of the tool development themselves. They have developed a national water balance tool and are now making it accessible to different practitioners in the country so that it can be integrated into planning in different areas of Bolivia, with the aim of developing a management at the basin level. In California, innovation in water management was limited by the analytical tools which the California State Water Resources Board had been using. These were rather outdated and therefore limited their ability to think innovatively about the state's legal water regime. This has now been overcome by the work with SEI, which has allowed them to use WEAP to develop their water management.

Another model called Trase (Transparent Supply Chains for Sustainable Economies) is a supply chain platform that enables users to understand the flows of so-called “forest-risk commodities” (i.e. commodities such as soy, palm oil, and beef, the production of which entails deforestation). It dynamically maps and visualises the movement of commodities from their point of production to the importers in consumer countries around the world. Through such blanket transparency, Trase reveals the movements of almost the entire internationally traded volume of the commodity and identifies the various actors (traders, exporters, importers, shippers) along the supply chain. Trase complements this mapping with other information to create a powerful decision-support tool for governments and companies. Trase is recognised as the only source of data for assessing progress towards Goal 2 of the 2014 New York Declaration on Forests: eliminating deforestation from the production of agricultural commodities. Unlike WEAP or LEAP, users do not create their own datasets but can interrogate the existing datasets through a web-based interface.

SEI and the Swedish Steel Producers Association (Jernkontoret) have previously collaborated on creating a suggested strategic action plan (Swedish) to achieve their vision. They are now working together with the steel industry to develop a societal value “compass”: a methodology and toolkit with which the industry as a whole, as well as individual producers, can evaluate different options in terms of their impact on broader societal ambitions and goals. The compass combines social capital accounting approaches with the Sustainable Development Goals (SDGs) framework to quantify the societal value potentially created (or subtracted) by a given option, under conditions of future uncertainty. The methodology also uses cross-impact balance analysis to assess how progress on one SDG target may affect progress on others. This generated spin-off work, as the tools were able to be applied in the forestry industry – as part of a project on the Swedish Bioeconomy in 2050, and also within the Lindéngruppen, where SEI used three scenarios to make the four assets of that group work together.

Several tools have been developed by the initiatives related to sustainable sanitation. One is “Clean and Green Village”, a novel sanitation promotion framework that has been developed through participatory collection of evidence on health and environmental risk and reuse

pathways (see Dagerskog and Dickin 2019). Another new, survey-based tool is the Empowerment in WASH Index (EWI), used to measure women's empowerment and gender outcomes in the WASH sector, in order to inform better design of WASH interventions and to monitor and evaluate progress. REVAMP (Resource Value Mapping) is another tool intended to support urban planners and developers in shifting to a circular economy, by estimating and visualizing the resources that could be recovered from the organic waste streams in a city. The tool is currently being co-developed with researchers, policymakers and other key stakeholders in Chia (Colombia) and Naivasha (Kenya). At the heart of the PRINCE indicators is a new model that links Swedish economic and environmental statistics with a multi-regional input-output (MRIO) database, EXIOBASE 3, in order to model the international supply chains that feed Swedish consumption. This information is then used to calculate the resulting environmental pressures (emissions and resource use) of Swedish consumption, and where in the world those pressures occur. It can also be used to understand the environmental pressures associated with different components of demand within both the private and public sectors, and the different products and services that are consumed.

Sometimes SEI uses tools as part of its research and not for capacity-building. These are often the more complex and specific tools that help to develop the evidence base. For example, SEI led the development of a peat age cohort modelling tool called MILLENNIA, which was adapted to compliment the field work experiments outlined in this case study (Carroll et al. 2015). The MILLENNIA peat cohort model predicts past, present and future soil carbon budgets and fluxes under changing climates in peatlands (Heinemeyer et al. 2010).

The Kenya Air Quality Network (KAQN) has used the LEAP-IBC model on several levels, firstly providing training for Ministry of Environment officials. The Ministry of Environment have also identified other Ministries who would be likely to use LEAP-IBC and together they have pinpointed additional functionality that they would like to see built into LEAP-IBC, such as a calculation of the impacts of large afforestation schemes on net CO<sub>2</sub> emissions projects which east African governments have invested in.

## 6.5 Developing networks and working with champions

SEI works with networks of other researchers, where the other partners have skills or competence that it does not. These networks allow research institutions to work together on an issue and have a greater impact. Further networks are ones where SEI researchers can actively engage with policy and decision-makers. Champions can be partners of SEI in projects or can indeed be SEI staff themselves who have particular access to decision-making bodies and can influence them by acting as translators of the science for these policy audiences.

The collaboration with the Swedish steel industry started when the then-SEI Executive Director, Johan L. Kuylenstierna, was asked to join a panel at the Almedalen meeting (a democratic meeting place for everyone held in Sweden each year with representatives from all political parties and others) and a conversation started with the Steel industry about collaboration. The fact that SEI was present at this meeting of decision-makers, and that Johan was asked because of his skills and position, allowed this collaboration to develop. We were also helped by champions at Jernkontoret, such as Eva Blixt, who took the messages emerging from the collaboration with SEI and promoted them across the industry. Working with an industry trade organization provides a link to the entire network of steel industries. An important aspect of the work was that SEI and Jernkontoret (the Swedish Steel Producers Association) were partners in a project, as opposed to it being a consultancy relationship, which led to a closer partnership.

The shift to using WEAP in the California Water Resources Board (CWRB), and the move away from previous models, occurred because of the broad network SEI had with practitioners in California, developed over a long time, mainly in relation to joint research projects. Eventually

these same people moved into positions of responsibility in the CWRB; because of the long association with SEI, they understood the capabilities of WEAP and therefore made the change from existing models to WEAP. Thus, we can work with champions, or help facilitate others to become champions; both approaches work.

The presentation in 2017 – by Marcus Carson, author of the Arctic Resilience Report (ARR) – at the Arctic Council Showcase in Fairbanks, Alaska, was designed to celebrate the close of the two-year U.S. Chairmanship of the Council (see <https://www.sei.org/featured/resilience-in-arctic/>) but also to present the work [back] to champions. “One of the most powerful elements of the ARR is that it has involved close collaboration not only among different scientific disciplines, but also close interaction with policy-makers,” said Carson, who led the project. “Collaborations like this take real work, but the benefit is that we know this report will make an impact, and its recommendations are better and likelier to be implemented.” (<https://www.sei.org/featured/arctic-change-in-the-spotlight-at-meeting-of-senior-officials/>). This close collaborative work has continued through iterative follow-up work with the Arctic Council.

A similar iterative interaction has been established by SEI with the Climate and Clean Air Coalition (CCAC) and the 120 or so partners that have joined it (over 60 of which are countries). SEI is involved in leading two initiatives of the CCAC, is an implementer on several of them and has two people on the Scientific Advisory Panel. SEI staff have also attended all of the Working Group meetings, where all partners meet, and the science-policy dialogues where key issues relating to the mission of the coalition are discussed. This has allowed SEI to have access to representatives of different countries, as well as the UN and research organizations. These fora have also provided excellent platforms from which to allow knowledge to be shared by SEI with decision-makers. Similar advantages have been achieved through the attendance of SEI researchers at the UNFCCC Conferences of the Parties (known as COPs) and their inter-session meetings. There, SEI has organised and presented at different side events and contributed to discussions in key groups. SEI has been present at every COP, since they began.

Another success factor in spreading the information developed under the Managing Peat and Blanket Bogs in the UK project has been the engagement of gamekeepers from the sites where the experiments took place. These gamekeepers have acted as champions of changing management at the local level for the project in their respective local and professional communities.

As described above, SEI Tallinn worked closely with the City of Tallinn as a project partner both in designing the BLASTIC project and in implementing its outputs. The Estonian Ministry of Environment was also a key stakeholder, involved during the whole project. In particular, the Tallinn City Deputy Mayor, Züleyxa Izmailova, who is very environmentally aware, can be considered a project champion, as well as a prime user of project outputs.

SEI had undertaken some regional projects in Bolivia using WEAP. The then-Vice-Minister for Environment was responsible for the region in which SEI had worked. When he became national Minister of Environment he really wanted to work with SEI and develop the WEAP tool for Bolivia. The fact that one SEI staff member was from the region had a very beneficial effect on the development of the partnership. So much of the success of collaborations is about building relationships between people – and, in this case, the people in the government got on well with SEI researchers. Of course, this also builds on the fact that the WEAP tool is appropriate for the job in hand and has a good international reputation. The work has facilitated co-creation of the model for Bolivia, allowing innovation of policy relevance.

Myanmar is undergoing rapid socio-economic transformation, as part of which old institutions are changing and many new ones are being created. Several of these have potentially important roles at the boundary between science and policy and this has created a window of opportunity

(timing) for substantially improving how river basins are governed. A new National Water Resource Committee (NWRC) has been formed, supported by an Expert Group that takes care of the most important issues in Myanmar's water sector. In this work, SEI had a very reliable and well-regarded local partner, the Myanmar Environmental Institute (MEI), comprised of retired, highly reputable academics who volunteer their time to work on environmental issues. SEI's affiliation with MEI, coupled with its own research, allowed trust to be built with the government. Multi-stakeholder approaches and the long-term duration of the study (ongoing since 2013) alongside its use of evidence as a way to stimulate discussion amongst the same set of stakeholders has allowed for better policy engagement. Other factors also contributed to SEI's success, such as its relationship with the Directorate of Water Resources and Improvement of River Systems (DWIR) and with the Sagaing regional government.

The Chairman and Director of the Myanmar Environmental Institute and its primary stakeholder engagement specialist made multiple trips to the Chief Minister and DWIR's regional office and had a close relationship with the staff there. Thus, not only was SEI able to build trust and informal relationships, it was also able to closely engage with processes and updates on the status of mechanisms it proposed for river basin management and research activities such as water quality monitoring. Collaboration with stakeholders continues, as evidenced by supporting letters from the Sagaing government and regional DWIR showing that they wish to continue working with SEI, as well as a support letter from the Sagaing regional government showing endorsement for the establishment of the Chindwin River Basin Organization, which SEI helped to design. SEI has signed on a three-way memorandum of understanding (MOU) between SEI, MEI and the regional government regarding SEI involvement with research, policies, and other activities related to the river basin.

The Kenya Air Quality Network came about as a result of a meeting that brought together those working on air pollution in Kenya, along with decision-makers from different policy areas. It has solidified engagement with the private sector and industry as well as with people from all sorts of fields such as civil society, medicine, government and NGOs. Through the network it is possible for people who would not normally have access to government to make contact with influential figures. The founding members of the KAQN have acted as champions and now lead the groups within the network. The involvement of the Ministry of Environment, and particularly the Environment Secretary, acting as Co-Chair of the network as well as the Director of Kenya Meteorology (who hosted the meetings) was key in this work.

The network developed by the CADWAGO project has had enduring connectivity. The governance learning process enacted in numerous workshops and events created a space for co-production of knowledge. This process went beyond traditional processes of learning and supported co-learning across the science-society interface, respecting and building on the diversity of participants. The ensuing insights on governance transformations and new or strengthened networks appear to be a lasting result of the project. Members of the network have developed continued collaborations, in order to work together beyond the life of the project. In contrast, the Co-Motion project worked with established networks. A disadvantage of this approach was that the existing tensions and competing needs of the constituencies that these organizations and groups represented were also present in the network, and Co-Motion's work with the network had to take into account the dynamics that this had created.

The case studies mentioned above work at individual and community scales as well as with institutions and decision-making bodies. Working with champions has been important to SEI's work, not just with institutions. The Citizen Science and Air Pollution pilot project (which was linked to the formation of the KAQN) worked with six community champions who represented different demographics within the community and allowed access to these groups. In turn, it was through working with NGOs which have the trust of the community and act as gatekeepers that these community champions were reached.

## 6.6 Working closely with decision-makers

Many of the most successful outcomes have come from activities where there has been a close working relationship between SEI researchers and decision-makers, often sustained over a long period of time. This has allowed for the development of both trust and an understanding of the issues faced by decision-makers, such that the work of SEI can be more tailored to the needs of the decision-makers it works with.

A close partnership developed between SEI and Jernkontoret (the Swedish Steel Producers Association), as well as with specific steel industries. This was a direct linkage to decision-makers within industry who had the power to develop strategies and influence investments. By working in close connection with an industry, concerns were raised about the potential for SEI to be used to “greenwash”. However, this was not a risk as the partnership allowed SEI to provide impartial advice which the industry could adopt or reject; this meant that the integrity of SEI was protected and we could work closely with decision-makers in an important sector.

As has already been discussed, many of the successes using SEI’s signature tools have come from interactions with government representatives over a long period of time. Both LEAP and WEAP have been around for decades and have built up a community around them, where different users can learn from each other. In the case of energy planning in Morocco using LEAP and water planning in California and Bolivia using WEAP, some of the more in-depth and successful interactions have come from longer-term projects where SEI got to know the decision-makers well. The Bolivian project was characterised by very regular contact between SEI and the project partners and included visits by SEI to Bolivia, regular Skype calls and an SEI organised study tour to California for key Bolivian project members. This was designed to get them away from their desks, and allow them to experience the issues and responses to water problems in California and work with SEI staff.

The same is true for the work with the Climate and Clean Air Coalition (CCAC), where SEI staff have opportunities to frequently meet the national representatives. One difficulty in developing relationships relates to the changes in government that occur when a new government is elected. In Latin America, this can result in major changes in personnel at a high level and sometimes a change in direction. This means that capacity and support for a project can easily be lost. One way around this is to have long-term commitments and projects in countries to be able to manage the transition between different administrations.

## 7. Enabling conditions

There are characteristics of SEI that enable the organization to successfully engage with decision-makers and have impact, and there are conditions of the external environment affecting the success of our engagement. This section considers these in relation to the case studies. A critically important facet of the science-policy engagement process is that the message(s) being communicated by the research organization – in this case SEI – has “credibility” (see section 2.1 for the back-up of this argument from the literature). We can deconstruct some of the elements of what goes to build this credibility by looking further into our case studies and considering other aspects of SEI that enhance the success of engagement with policy and decision-makers. This is the focus of the first part of this section. In addition to the characteristics of SEI that enable successful engagement, successful outcomes are influenced by external contexts, and the success of engagement is also determined by the ability of SEI to understand the decision-making context. This is the focus of the second part of this Section.

### 7.1 Enabling conditions related to SEI as an organization

The expertise, character, approach and culture of SEI are some of the most important aspects that affect the organization's ability to undertake significant research and engage successfully with decision and policymaking at different scales and in different parts of the world that have very different cultures.

#### SEI Expertise

An important component of SEI's success in engaging with policy and decision-making is its expertise in different areas. This expertise can be characterized as depth in certain topic areas and in cross-cutting skills that can be applied to different topic areas. Many projects bridge gaps in research, or apply new research approaches to address different issues. In some topic areas there is a deep knowledge of issues which are exemplified by the SEI initiatives which have been built up by projects funded through demand based upon previous work, and which have now received funding from core funds. These include projects focusing on: climate change; air pollution; energy policy; adaptation to different environmental risks; sustainable sanitation; the importance of behaviour and choice in the adoption of different measures; SEI tools; Sustainable Development Goals; sustainable production and consumption; and urban issues. Cross-cutting skills include: tool development; social science research; scenario building; different public participation approaches, including citizen science; and policy coherence. The credibility of SEI as an organization working on the full breadth of sustainable development issues is also built upon its collective body of research and policy engagement, and not just its experiences in any one sector, issue or policy process.

The Arctic Resilience work is exemplary in showing SEI's ability to bring together an understanding of the scientific issues and also an understanding of the policy context, in particular: an understanding of how the Arctic Council itself works (see Nilsson and Meek 2016); an understanding of the role of the media (see Nilsson et al. 2016); an understanding both the academic debates and context, and the interplay between academic and social issues (see Larsen and Nilsson 2017); and an ability to synthesize the academic debates and present them in a policy-relevant manner (e.g. see Carson 2017). This work is continued through SEI's ability and willingness to continue iterative working with the Arctic Council and other technical and political experts.

During the development of the research for the Managing Peat and Blanket Bogs in the UK project, the depth of scientific expertise in SEI helped to advise on specific aspects of the project and allowed further aspects, not considered in the initial project design,

to be incorporated. This included estimating the emissions from burning versus mowing and their impact on air pollution, as well as assessing impacts on birds via modelling of insect populations.

Sometimes the connections can be with industry partners rather than policy decision-makers: SEI has worked very closely with the steel industry and their stakeholders. The industry strategy had outlined that nothing of societal value should leave the industry by 2050 (i.e. no useful waste should be externalised, no pollution etc.). SEI said that they should interact with the society they wish to protect to develop the scenarios. Therefore, a series of workshops were convened and facilitated by SEI involving government agencies, academia, cultural organizations and civil society representatives. Again, it is the range of expertise within SEI – not just as technical experts but as a partner able to facilitate the workshops – that allows close relationships to be built. These workshops helped to frame the scenarios. When it came closer to the action plans, it was more an issue of working with the steel industry itself, as there were technical issues to solve to realize the scenarios developed in the workshops. SEI provided a methodological approach to develop the scenarios. The workshops developed 63 suggestions and these were combined into portfolios, discussed by the steel industry, and narrowed down to form an action plan. It helped that people involved from SEI had experience of having run the development of explorative scenarios. Also, SEI had experience in facilitating the process using simple techniques that ensured well-structured outputs. The partnership was an important factor for success. For the steel industry, this represented a change from their normal use of consultants – it was more of an equal relationship. For SEI, this represented a new relationship with the private sector, and there were concerns in SEI that this could be perceived as a “green-washing” of the steel industry. However, the way in which SEI contributed was to deliver advice. The steel industry owned the results of the exercise and, all-in-all, it is a very positive result for both sides.

The Co-Motion project found that SEI’s position as a respected and credible source of information enabled them to simply present evidence based on findings without the need to justify the validity of their interest in the topic or declare a position based on representing a particular group. The Kenya Air Quality Network has been able to be effective in influencing Kenyan air quality processes and policy implementation because SEI Africa has detailed knowledge and experience of Kenyan policy processes and was able to efficiently direct policy engagement at all levels, for instance ensuring that permissions for working within communities could be secured. The Africa Centre was able to ensure that the project was funded to engage with policy from the start.

### **Flexibility of the organization**

SEI’s success also relies on it being very flexible and changing tack during projects to realize new opportunities that emerge. This is significant for policy impact as it is not always clear what the opportunities to influence decision-making are at the beginning of a project and so being able to realize them as they emerge is an important attribute for SEI. SEI is a project-based organization and, as such, it has to be able to identify emerging research priorities and understand the funding landscape in order to deliver the funding that will allow the projects to occur. There has been an increase in core funding for SEI activities over the last strategy period and this has allowed the organization to make more significant investments in research, especially in the development of the different initiatives. This has meant that SEI can invest where it sees the need, rather than being reliant on the strategic focus of different funding organizations. This can also be important in allowing it to maintain long-term relationships. For example, SEI’s core funding programme has been crucial to the Kenya Air Quality Network twice, firstly through the project that gave rise to the network, and secondly through its current funding. The network is now establishing a viable business model where activity is carried out through partner institutions while also establishing a more formalized way of working.

## Identity of SEI

One aspect of the success of SEI has been that it is an organization based upon a long tradition and has not deviated from the mission it was set up with in 1989. The mission itself is strongly influenced by the findings of the Stockholm 1972 conference and SEI development has continued to be influenced by the evolution of the sustainability debate – through involvement in the Brundtland report, the UN Conferences on Sustainable Development and the development of the Sustainable Development Goals and 2030 Agenda. The Swedish base for SEI has been very important to the development of SEI, for the reasons outlined in the introduction – it is a country where the sustainability debate is quite well ingrained in society and support from the Swedish establishment has been essential. It is important for SEI to remain rooted in the ideas, world view and character of its originators. These, in some ways, reflect the attitudes of Sweden when SEI was set up, with a pragmatic world-view and optimism that considered change to be possible and that we can make a difference. This too needs to remain part of SEI's DNA. Having origins in Sweden has also entailed that there is an enhanced consideration of the gender and social equity aspects of different issues. This has always been there, but there is now an increased focus on including these aspects in a meaningful way in different research projects, which is positive. Also, the intricate linkage highlighted at the Stockholm 1972 conference between poverty and environmental degradation means that the focus on the relationship between poverty and the environment remains another key concern of SEI.

A further feature of SEI which has been enhanced over the years is the organization's distributed nature, with a number of centres in different parts of the world. SEI started as a distributed network when the offices of the Beijer Institute in Stockholm, York and Boston became the initial three centres of SEI. This was then expanded by the addition of Tallinn, followed by Asia, Oxford, Africa and now Latin America. There is a real geographic advantage in SEI's distributed centre structure. It allows different academic cultures to influence and develop SEI's research, and researchers to embed themselves in the particular issues and context of the regions where they are located. There has also been an increasing linkage to universities in the different SEI locations. This ranges from being formally part of a university (York), to co-location with a University (the Boston Office and Asia centre) and to the development of different agreements with Universities (e.g. with KTH and Stockholm University). This is an important part of our network building and, fortunately, this geographic dispersion has not caused an issue with identity. People working for SEI have a strong sense of the organization's identity, what it stands for and what it tries to do, essentially as described in the mission statement.

The existence of SEI centres in different parts of the world that can each access the broad expertise in the organization has been an important component in the success of policy influence. This has been the case with regards to the Kenya Air Quality Network, where presence on the ground has been an essential component in the success of that network development, but the existence of deep expertise in air pollution issues and citizen science in the York centre has also contributed. Similarly, although SEI-Tallinn has a long history (since 1992) of working with municipal and national government, during this time it has also become known as a legitimate source of high quality and policy-relevant knowledge due to its own in-house expertise and its ability to work with high-quality external (to Estonia) technical partners. Work such as the Chindwin Futures Project has been greatly enhanced by the location of a substantial SEI centre in Southeast Asia.

## SEI image and attributes

Although this has not been an aspect directly assessed from the case studies, SEI's image is an important asset in our work in different parts of the world, and has enhanced the organization's ability to engage with decision-makers and different decision-making processes. These attributes

have come up in different conversations that led to the original codes identified in the analysis of policy engagement (Section 3, Table 2). There is a perception within SEI and also, we believe, amongst external partners, that SEI is a fairly non-aggressive organization, that is friendly and not overly competitive. We get the impression that people from SEI are seen as fairly easy to get on with and as good collaborators, and this encourages long-term relationships. This is not the only way in which an organization like SEI can be successful, but is a niche that is suited to an institution with its roots in Sweden, and it is a niche – or brand - that should be carefully preserved. Further attributes that are important for SEI are in relation to having autonomy, which is crucial for trust, as is transparency. One thing that SEI is trying to further develop in terms of being a learning organization, is how to identify ways of developing this learning without it becoming overly bureaucratic. SEI also, of course, needs to be seen as an authoritative source of knowledge on key issues with which we have heavily engaged.

## 7.2 Conditions of the external environment affecting the success of our engagement

The conditions of the external context are almost impossible for SEI to control. However, it is imperative that we understand these conditions and do our best to mitigate negative effects and make the most of positive opportunities. Such conditions can include:

- timing
- the context of decision-making, and
- policy windows.

Some important lessons are: to recognize opportunities when they arise, to recognize what is possible within the opportunities presented and to act. The Chindwin Futures Project focused on integrated water resources planning and management efforts to support newly formed river basin management structures. The Upper House of Parliament in Myanmar agreed to the formation of the Ayeyarwady River Commission (ARC) in February 2013 and the National Water Resources Committee (NWRC) was formed by the Presidential Decree in July 2013, with a new Ayeyarwady River Basin Development Master Plan to be developed. A further reason that the Chindwin Futures work came about relates to the fact that Myanmar received a large financial loan from the World Bank (WB) to conduct a comprehensive assessment of the basin, coinciding with the timing of the SEI project. This circumstance worked both for and against SEI. While it highlighted that water was an important topic, the World Bank loan put a lot of pressure on water institutions in Myanmar, particularly national water institutions whose time and capacity became strained with the attention of several actors much larger than SEI, that wanted to work within Myanmar's water sector. Our focus on the Chindwin River Basin thus became both political and informed, yet strategic. On the one hand, we were informed by our stakeholders that a study on the Chindwin was needed because of its critical issues. However, we were also side-lined by national government water institutions from conducting larger-scale work within the main stem of the river (the Ayeyarwady), as many “big players” wanted to claim the work there. Nevertheless, the move towards the Chindwin has been good thus far, as SEI is now gaining recognition as an organization that has the most knowledge of the Chindwin, the Ayeyarwady's largest tributary. This is despite a complete change in the central and regional government after the general election in 2016. Importantly, we are also recognized for being reliable and having a bottom-up, multi-stakeholder approach and good collaboration with regional government entities. SEI received strong support from all stakeholders, including the regional government, for implementation of the follow-up project related to biodiversity conservation and ecosystem services in the Chindwin (CBES project), which was recently completed. Our work has influenced enhancement of biodiversity conservation practice in this area. (<https://www.sei.org/featured/chindwin-basin-biodiversity-faces-serious-threats-urgent-conservation-measures-needed-say-seis-scientists/>). This is an example of a case where SEI was close enough to the decision-making to influence the context.

Other examples show how SEI can build upon a range of external factors, including the rise in awareness of global climate change and thus the Arctic as a global issue (<https://www.sei.org/perspectives/future-challenges>). Other more specific external factors in this case included the US Chairmanship of the Arctic Council and the willingness of the Council to continue iterative working with SEI and other technical and political experts. The Arctic Resilience Report was developed in the context of the Arctic Council and therefore had a direct link with an existing decision-making process, with a policy audience waiting for the report. In 2013, the Arctic Council consolidated its role at the centre of Arctic governance (Nilsson 2018a). During its chairmanship of the Arctic Council (2015–2017), the USA engaged as an active proponent of Arctic cooperation, using the region as a showcase for strong global climate policy. This provided SEI with an opportunity to have greater impact with the timing of the report. Nilsson (2018b) analysed how different overarching arguments come and go and are supported, dismissed or re-invented within the political sphere. This analysis highlighted economic development and national competitiveness as prominent recurring arguments, but also that the policy discourse has moved from nation-building and military security towards a broader security perspective, with attention to energy supply for the US and, more recently, also to the implications of climate change.

At a national level, the relevance of the project managing peat and blanket bogs in the UK to the decision-making context, reinforced by the timing of the research, enabled the project to receive government funding and contributed to its success. As the work on peat bogs occurred directly with the UK ministry responsible for the environment and rural issues, Defra, the research team was aware of governmental concerns and priorities from the start of the project. Different boundary partners were all invited to a workshop at the beginning of the project and were able to define which management practices would be trialled in the experiments. This enabled SEI to further understand the decision-making context, made the results even more policy-relevant and sensitised the practitioners and decision-makers to the fact that this project was going on. The project's stakeholder- and practitioner-focused approach, including the formation of the inclusive "Project Advisory Group", consisting of several key stakeholders, was a key part in understanding the decision-making context. The relevant UK context is that Defra was moving towards a Peatland Carbon Code, and are now funding schemes for peatland restoration in order to increase C sequestration, but these were not based on any evidence of which management practices on grouse moors might actually enhance sequestration. SEI's research was able to fill this gap. Further relevant context is that there is a significant policy focus on flooding and water quality in cities and farmland near rivers and streams that are fed by water from the peatlands. There is also a desire by many conservation agencies to increase plant, insect and bird diversity in these upland sites. Furthermore, the UK peatlands are also important for different income-generation activities such as sheep grazing and grouse shooting. Understanding this has been very important for the SEI team.

SEI's PRINCE project responded quickly to a political groundswell in Sweden to meet its "Generational Goal" of eliminating major environmental problems in Sweden within a single generation, while not worsening environmental or health problems in other parts of the world. This project was also driven by user needs for knowledge, not with regard just to the "Generational Goal", but also to specific needs such as Naturvårdsverket's desire to see how to measure the chemical-related impacts of Swedish consumption, as noted in the "Developing Evidence" above.

In some cases, SEI can capitalize upon its own internal expertise to place itself in the line of topical research before it becomes commonplace. Plastics in seas and oceans has now become the subject of a major political and social debate. However, SEI was engaged in tackling this problem long before the issue was developed due to an increasing scientific and NGO focus and became such a big media story. The BLASTIC project officially started in 2016 but its design began as far back as the beginning of 2015. Further, the BLASTIC project is an outcome of some earlier projects that led to the need to address marine litter as a problem (see also "Capacities" above). These projects include RECO Baltic 21-Tech, where SEI Tallinn was a partner

(see <https://www.sei.org/publications/towards-sustainable-waste-management-in-the-baltic-sea-region-countries-the-contribution-of-universities/> mentioned earlier) and MARLIN, where SEI Tallinn was not a partner, but which focused on beach monitoring. All of this engagement was helped by the close relationships with decision-makers in the both the City of Tallinn and national government. The City of Tallinn had previously been involved in several waste management projects in which SEI Tallinn had participated. Therefore, when the BLASTIC project was initiated in 2015, they recognized that they have an ongoing role to play in this problem and were happy to partner with SEI-Tallinn. The City of Tallinn officials were an integral part of the project, and they were involved in the discussions during the project initiation and development phase, to discover their needs. The Tallinn Environmental Department was the official partner involved and it also brought in other departments of the Tallinn City municipal government. Further, the Estonian National Ministry of Environment was involved as a key stakeholder during the whole project and numerous meetings were held with the Waste department as well as with the Marine department. As a result, there is clause in a new waste act proposal that all municipal waste management plans must address marine litter. This close interaction helped SEI to make sure that their work fitted local and national policy demands.

The case of the development of the UNEP/WMO assessment is interesting. It emerged that a focus on the short-lived climate forcers was important and would provide a timely addition to the climate debate and a useful link between the climate change and air pollution agendas. However, it was not linked to any particular event. As it happened, however, a number of interests were being aligned. Individuals in several governments saw that a focus on these substances would be politically useful. There were also a number of key individuals in prominent positions that were able to act as champions for the findings of the assessment as they emerged. An opportunity then arose, as there was a feeling that collaboration on the findings emerging from the assessment could free up the global climate negotiations which were at a difficult stage after the Copenhagen COP. The idea was that a voluntary agreement by a group of countries willing to take action on the emissions of short-lived climate pollutants could make progress. Therefore, the origin of the assessment was not in response to any particular policy window of opportunity, but it fitted into the policy needs of several countries that formed the Climate and Clean Air Coalition. This was facilitated by the close linkage between the assessment leadership (including SEI) with several governments – SEI with Sweden and Bangladesh, and UNEP with other country representatives. Flexibility in the development of the assessment allowed it to feed more effectively into the emerging political interest in addressing these substances.

The work on arctic oil and gas exploration was much more closely linked to the ongoing policy process. The group in the US centre had been following US national energy policy development closely for decades and were also aware of the strong NGO activity on this issue. By being aware of the issues, and the timing of policy developments, the group were able to make arguments that addressed key policy concerns. This approach was also used on the work SEI did on the Keystone XL pipeline. As in the case of the Arctic oil exploration, having followed the development of US energy policy for a long time, the group in the SEI US centre understood the timing and key issues required for the US government to make a decision. SEI's demonstration that the pipeline would lead to a net increase in CO<sub>2</sub> emissions was used as evidence in the decision to stop the pipeline (which may now be overturned by the Trump administration).

There are many projects that work directly with national and regional governments, increasing their capacity. Therefore, this automatically means that the decision-making context is well-connected to the projects. For example, the work on WEAP in California and Bolivia supports governments to achieve their own agendas and add scientific context to ongoing decision-making. Also, the work on LEAP in Morocco is supporting the government's own energy planning, and the use of LEAP-IBC through the CCAC initiatives, working directly with different government departments, is enabling decision-makers to enhance their policy development from inside the governments.

In some cases, SEI can fill gaps in the policy sphere with knowledge that already exists within its own science research base. For example, there are some very prominent water conflicts that have emerged in Bolivia which have constrained development, and the Bolivian Ministry needed a way to co-ordinate this. An adequate governance system which would have allowed this did not exist and so the Ministry set up the process and approached SEI for help realizing their vision. The fact that the person SEI had worked with previously became Minister for the environment was very significant for the success of the project.

There has been an increasing realization in the private sector that, not only do they need to keep abreast of recent developments to guide their industrial strategy, but that sustainable development also offers business opportunities. This has provided SEI with opportunities to further engage with decision-makers in industry. Steel-making is an investment-heavy industry and its members need to access substantial financial resources to upgrade their operation. They therefore need to plan carefully and use the most relevant expertise and knowledge. Companies in Sweden are at the top of the value chain and are keen to look at new ways of doing things to give themselves a competitive edge; this provided an opportunity for SEI to engage with these more specialized companies, which are more agile and interested in sustainability as a new business angle. These opportunities also exist in other sectors, and the experience of working with the steel industry has led to further linkages with the forestry and mining industries.

## 8. Discussion of SEI's engagement with decision and policymaking: ideas regarding good practice and improving outcomes

In the assessment of SEI's policy engagement we have used the analytical framing of **outcomes, pathways of engagement** and **enabling conditions**, in order to try and make sense of the complex reality of the interface between decision-making and scientific knowledge. As Owens (2015) has said, "ideas come into good currency, knowledge 'creeps' into policy, and what is think-able begins to change"; these interactions can also be subtle and lack clarity. For this reason, when looking back at the case studies and the analysis of them, it is clear that there is a large degree of overlap between the different categories chosen for the analysis and inevitably some repetition occurs, as the issues, and the various ways of looking at them, are not mutually exclusive.

### 8.1 Discussion of SEI's outcomes from engagement

We have divided outcomes into **agendas, capacities** and **decisions**. Almost all activities of SEI affect agendas, with some going on to increase capacities and potentially leading to decisions being made. There are fewer cases of decisions being made that can be directly related to SEI activity. This is because the research we do often focuses on actions that will need to be taken in the future. Decision-makers often simply have not yet managed to institutionalize the decisions made in relation to the projects discussed in this document, which have mainly occurred in the last 5 years. It is also more difficult to attribute decisions, and especially impact, directly to SEI as they will be the subject of many different influences.

Where clear linkages to decisions can be made, these are often with regard to ongoing policy processes in which SEI has been able to have an input. For example, because of the knowledge of the policy debates related to energy in the US, the research could fit into the time scale of a decision made by the Obama administration. In other cases, the decision-makers have had clear demands for support from SEI to help them make decisions. Therefore, for example, we can be confident that the capacity to undertake modelling in Bolivia will inevitably lead to substantial outcomes and impacts, now that the capacity of the Ministry there has been enhanced, enabling them to develop their own water resource modelling. Similarly, in California, the decision has been taken to change legislation in relation to results from WEAP modelling which, once implemented, will lead to a positive change in the water management. In the same way, the support SEI offers to Morocco is helping to provide them with the capacity to plan and balance their energy supply and demand, which we can be confident will lead eventually to decisions and implementation of infrastructure. As the plans show that renewable energy is the most cost-effective for Morocco, the impact in the future is likely to be further expansion of renewable capacity. This will be implemented by the government, but the collaboration to improve the energy model continues and SEI will therefore have contributed to the impact.

These are all cases where the outcomes are related to helping countries solve their problems by increasing their capacity for developing the knowledge to make their own decisions. Being able to give policy advisors the confidence to provide more robust advice to policymakers is an important outcome of SEI's engagement. However, in some cases the research is ahead of the decision-makers and we are at an earlier stage. An example here is the PRINCE project which has highlighted and quantified the problems of chemical release in other parts of the world required to supply goods in Sweden. The Transboundary Climate Risk project introduced a new concept of climate adaptation that was not on the agenda, as it had not been considered. As M.J. Chadwick (former SEI ED) wrote in his "IKEA Principles" – "*it is difficult to sell somebody a solution to a problem that they did not know they have*". In these

cases, the problems have been highlighted and found a foothold, but the policy response is not yet clear. However, in both cases, it helped that there were existing policy fora where these concepts could be taken up: in Sweden's generational goal to make efficient materials cycles free from dangerous substances and through the UNFCCC discussions. Neither of these have resulted in decisions, but the agendas have been changed and capacity of relevant decision-makers has been increased.

In some projects, the work has gone on for longer. For example, the CCAC / WMO assessment and follow-up is a process that started 10 years ago but is continuing. When developing the assessment, the anticipated outcome of the report was a change in agendas, by emphasising the need to consider the short-lived gases and particles that affect warming and air pollution impacts, especially in the near term. It did indeed change agendas and helped form the Climate and Clean Air Coalition. That forum, with SEI as an active participant, has been championing the need to take mitigation of these substances more seriously. The assessment helped change agendas as the report focused on the benefits of applying some specific solutions – this solutions-based focus was critical. The clarity of the message (and graphic) on the potential benefits of reducing warming and saving lives was also key. The summary for decision-makers was also backed up by a high-quality, peer-reviewed 350 page assessment, as well as a subsequent paper on the results, published in *Science* (Shindell et al. 2012).

Effectiveness when it comes to changing agendas is helped by long-term engagement with issues, decision-making processes and decision-makers themselves. This was emphasised in the case of helping the Californians to change their management of water flows in order to supply people and enhance ecosystems. SEI's work with researchers over decades paid dividends when these people took on posts in the Water Resources Board and were able to make changes partly based on the knowledge they had received through interaction with SEI, but also by engaging SEI to help them design the optimal strategies. Similarly, the success of the BC/ozone assessment was in part a result of SEI's strong networks, built over decades, involving key researchers on air pollution globally who could engage in the process and take lead author positions. The ability to know what science was needed to fill knowledge gaps in US fossil fuel policy was helped by the fact that individuals at the SEI US centre had been involved in the area for decades and understood the process well. The LEAP and WEAP tools (the energy and water planning tools used in many of these cases) have become successful because they were developed using sustainable funding mechanisms. Over their development's 30-year time frame, SEI has continuously improved the tools, ensuring that they are user-friendly through regular and repeated contact with a community of tool users around the World. Over this time there has also been a development of user and policymaker trust in these tools.

There are two conceptual ideas principally involved in increased capacities –the first is that of increased capacity through increased knowledge and the second is the transfer of capacity to allow decision-advisors and decision-makers to develop their own knowledge about an issue and feed this into decision-making. The first concept is a clear result of changing agendas, while the second is more closely related to the transfer of tools and methods to assess issues through collaboration with practitioners. We can point to many outcomes of SEI's work contributing to changing agendas and increased capacity of decision-makers to address their pressing issues. For example, this is true of the Arctic Resilience Report, which put the concept of resilience firmly on the agenda of the Arctic Council . This, alongside SEI interactions with the Council, has enhanced capacities to address this issue. In time, it is assumed that this will lead to decisions, which are facilitated by the fact that the Arctic Council is a mature 20-year old policy process with structures that can address these issues. If SEI is to move beyond changing agendas and building capacity, it is a question of remaining involved in the process and helping to develop changes in decisions and continuing to enhance capacity. If it does not, then in order to understand whether the work of SEI has led to decisions, it would be necessary to, at some point in the future, carry out an ex-post

analysis of the way in which the Arctic Council has taken this issue on. The only example of a formal ex-post analysis has been with the SUMERNET programme which used outcome mapping approaches to assess its significance. This was done because it was a funded activity requested by the donor. Funds for such activities are difficult to motivate but it could be valuable for SEI to do further such analyses to see how work in the past has led to outcomes and impact – i.e. resulting in beneficial changes to different “publics” or environmental quality. The positive changes proven from this ex-post analysis could inspire other partners within the network to engage the boundary partners more closely for future changes.

Another important aspect is the focus on the generation and communication of integrative knowledge – often from the perspective of many different stakeholders. SEI has used its convening power to bring together many different stakeholders, including those from marginalised communities in projects and programmes. For example, after working on air quality with informal settlement community representatives in Nairobi, SEI organized a meeting with different local and national government departments; this included the informal settlement stakeholders and was the first time these two groups had met. The meeting was so successful that SEI was asked to form a Kenya Air Quality Network, where representatives of different government, university and non-state partners could meet and discuss issues of air pollution. This approach of creating broad stakeholder engagement in projects is widespread in SEI, such as is seen in the Chindwin Futures Project, working with local and national decision-makers and local stakeholders. Also, the management of peatlands involved national and regional stakeholders with landowners, gamekeepers, private sector representatives and so on. In the main, taking this approach of using the convening power of SEI and broad engagement is well appreciated and helps develop strong projects with improved outcomes. In these cases, the projects have often managed to give a voice to disadvantaged people, or those not usually consulted on issues where they have a particular stake and particular “situated knowledge”.

Working with such diverse sets of decision-makers also enables SEI to develop a more holistic view related to the decisions that are made on an issue. For example, in the case of peatlands it allowed a balance to be made between climate change, biodiversity, managing water flows and livelihoods. This has been further exemplified by the SDG work, where methods to assess the interactions between different goals, in relation to actions and measures to achieve individual goals, have been developed at an empirical level. This has then been tested at national scales and also in the private sector through the interactions with the steel industry and follow-on work with the forestry and mining industries. This increased interaction with decision-making in the private sector has been a strategic priority for SEI over the 2015-20 period and, while it is increasing, it requires building up skills and networks in that area.

## 8.2 Discussion of SEI’s pathways for engagement

Different pathways are used by SEI to engage with different decision and policymakers, thereby inducing change towards sustainable development in different ways. Yet in assessing the case studies, a number of common pathways have been identified.

### Developing scientific evidence for decision-making

This is the basis and foundation of all communication and engagement associated with individual research activities. Robust and credible research is always needed in order for policy and decision-makers to want to engage with SEI. This is also the basis for being able to provide robust and credible evidence and advice and an important part of creating trust in SEI amongst decision-makers. One important way to demonstrate that SEI develops credible and robust evidence is for it to have a sufficiently high number of peer-reviewed articles, as well as authorship of other credible outputs such as UN assessments (e.g. IPCC assessment reports;

UNEP assessments etc.) that are also extensively peer-reviewed. Some of these need to be in highly regarded and prestigious journals, and cross-, multi- and trans-disciplinary credibility can also be delivered by publishing different disciplinary aspects of the same empirical work in journals from different disciplines to show that the research is equally robust according to different research communities. These universally acknowledged ways of publishing research also promote trust in research which is carried out by SEI, but is not published in peer-reviewed journals. In these cases, the research is still allied to the endorsement of SEI as a trusted source of knowledge, generated as a result of work published in the peer-reviewed literature. However, trust can easily be broken and there needs to be care taken when publishing knowledge, to ensure that it is robust. Internal mechanisms are therefore required to maintain quality.

In the case of tools or methodologies that SEI uses and distributes, the credibility is not necessarily linked to peer-reviewed published outputs by SEI but rather is related to a significantly-sized user community making use of these tools, their shared experience over time, and transparency in the tools such that users can, in a sense, “peer-review” them independently. These tools also incorporate widely accepted methods which have already been peer-reviewed, as a way to enhance credibility. Also, other users of the tools publish their work in peer-reviewed journals which also provides credibility for the tools SEI has produced. However, even in these cases it is always a good idea to develop peer-reviewed articles on the tools, which can only enhance their credibility and trust.

### **Communicating the message**

To have an impact, the evidence from research needs to be made available to a wide audience, including all relevant decision-makers at all levels of decision-taking. Being able to provide credible advice also relies on being able to communicate knowledge in an accessible way, tailored to different audiences. Almost all research staff in SEI participate in, and provide formal presentations at, meetings of other researchers, and also communicate with decision-makers at different scales, from local to global. This form of communication enhances trust, as it is also built upon developing relationships with decision-makers and stakeholders in different parts of the world. There is a need to continuously improve the ability of research staff to communicate verbally and interact effectively with different people. However, this only reaches specific audiences and a limited number of people. It therefore needs to be enhanced by modern, as well as more traditional, communication products. These can be SEI syntheses, reports, blogs, policy briefs, E-books, Twitter feeds or Facebook pages. Thus, outreach via different media is very important. The inclusion of skilled communicators related to all the different forms of communication in SEI, and linked to specific projects, is therefore a vital component of communicating evidence.

### **Enhancing capacity of decision-making**

The SEI approach to inducing change relies upon empowering decision-makers such that they can take decisions that are informed by evidence. This involves both evidence of actual current states of the environment and the human affect upon them and best-possible evidence on the likely effects of future human actions with respect to the environment. This needs to be encapsulated within SEI's twin environment and development focus. Most projects will have an element of increasing the knowledge of decision-makers and hence their capacity to act on this information. Such knowledge can empower them and also make policy advisors more confident in putting forward their case to policymakers. The other way in which SEI increases capacity is by providing tools and methods to the practitioners in the different countries and communities; it can also affect empowerment by enabling practitioners to develop their own insights and knowledge with which they can enhance the use of evidence in their decision-making. There are many examples in the case studies where strengthening institutions is an important way in which we have empowered individuals and organizations and better enabled them to address different issues important for sustainable development.

### Using tools to support decision-making

Tools allow the transfer of scientific knowledge in forms which are clear and readily understandable and which readily empower decision-advisors and decision-makers to make plans and implement them. Further, transfer of the use (i.e. “ownership”) of tools enables those decision-makers and their technical advisors to develop new knowledge to support their decision-making. As well as tool development, training practitioners in their use to build capacity has been a “signature” pathway by which SEI has engaged with decision-makers using well-established tools such as LEAP and WEAP. Now, many SEI projects and initiatives are developing different tools to support decision-making. One thing that is clear from the more well-established models is that plans need to be made to enable the tools to be supported, maintained and further developed in the long term. There are many cases of good tools dying due to lack of resources once project funds have dried up.

### Developing networks and working with champions

Few projects are undertaken by SEI that do not involve work with other scientists or research organizations. SEI also attends formally organized networks of policymakers and scientists, and almost all projects have some engagement with decision-makers and/or policy advisors. SEI also has links to individuals who are able to very effectively work at the interface between knowledge and decision-making, as champions for different causes; some of these individuals are from SEI itself, and others who are from organizations or communities with which it works. It would be valuable to consider how we can use the capacity of key people in SEI who have access to decision-makers, or skills in communicating with them, to promote research more broadly. One caveat is that, while dependence on one individual champion for success may lead to short-term gain, impact may be stymied or even stopped altogether if that champion loses their ability to mobilize others: this is particularly true in terms of champions from the political sphere. Working with networks, or with champion institutions, may require more initial effort but may have a longer-lasting impact.

### Working closely with decision-makers

Working closely with decision-makers and in decision-making processes, especially over long periods of time is a well-established and effective way to engage, build trust with and influence decision-makers. This also enables the co-design of work with decision-makers in projects.

Under the work of the Policy Director, training sessions were developed at the Asia, York, Africa, Oxford and Stockholm centres. In each centre, and also in the 2017 SEI science forum held in Bangkok, which was participated in by people from different centres, there was an exercise asking people questions related to pathways. Participants were asked which pathways they mainly used and which they thought were most effective. There was an interesting mis-match between their replies. People realized the importance of working closely with decision-makers, working directly with them on projects (co-learning) and developing long-term relationships with them. However, the highest scores for what SEI did were writing reports and other outputs, organizing meetings, inviting key decision-makers to meet, or attending and sharing knowledge at meetings where policymakers were present. In the discussions about these results, it became clear that the reasons for this mis-match were that the projects’ demand outputs and time are spent there, and meetings are efficient ways of coming together and engaging with decision-makers, as well as only taking a short amount of time. People realize, however, that to achieve policy change it is essential to develop personal relationships and engage closely – often working together in projects. Overall, investing time over the long term is highly effective. The problem is that resources are not as easily available for spending the time needed to develop these close relationships, to do the “boring stuff” in policy processes (see Top Tip #9 in Section 9.4), and to invest time after the end of short-term projects. To solve this, we need to be able to mobilize more funding that will allow researchers to spend more time actively engaging with decision-makers. This could be done, for example by organizing time differently in projects or using non-project-specific funds.

### 8.3 Discussion of enabling conditions

There are characteristics both of SEI and of the operating environment which enable the Institute to successfully engage with decision-makers and have impact. The conditions related to SEI as an organization include its expertise, character, approach and culture, and represent one of the most important aspects that affects the ability of SEI to undertake significant research and engage successfully with decision and policymaking at different scales and in different parts of the world with very different cultures. SEI's expertise is both in-depth in certain topic areas and cross-cutting when it comes to skills that can be applied to these different areas. SEI's success as an organization working on the full breadth of sustainable development issues is also built upon its research and policy engagement, and not just its experiences in any one sector, issue or policy process.

SEI's flexibility is central to its character as an organization and is vital for its success, allowing for changes of approach during projects in order to take full advantage of opportunities that may emerge. This is highly important for policy impact given that, at the beginning of a project, it is not always clear what the opportunities to influence decision-making may be. Being able to realize them as they emerge is therefore a key attribute for SEI. The ability to identify these emergent research priorities, and the funding landscape, is crucial for SEI as a project-based organization, as this facilitates the delivery of the funding which will allow these projects to go ahead.

SEI's internal culture and identity are also important. SEI's adherence to its original mission, established at its 1989 inception, has played an important role in the organization's success. This mission is strongly influenced by the findings of the Stockholm 1972 conference and, over time, the development of SEI itself has been influenced by the development of the sustainability debate. At a broad level across the Institute, SEI has remained true to the ethos that poverty and environmental degradation are intricately linked, making this relationship a central concern of SEI.

SEI's distributed nature, with centres in many different parts of the world, is a further feature which has been enhanced over the years. This has both helped to focus SEI on these places and also to assist policy and decision-makers in these areas to become more familiar with SEI and its work, which has contributed to the organization's image and position as a trusted partner.

External environmental conditions, such as policy timing and "policy windows", and decision-making contexts, affect the success of SEI's engagement but are almost impossible for us to control. We can, however, understand and *respond* to them, as well as attempt to mitigate any negative effects and make the most of positive opportunities. In order to be able to understand and respond to the policy context and its own internal timing constraints, SEI needs to be close to and engage with the policy sphere, as all of the cases above show - we cannot remain aloof from it and expect policy and decision-makers to play by our rules. This applies as much to decision-making in industry as it does to "traditional" political policy spheres.

### 8.4 SEI's top tips for more successful policy engagement

In this section we conclude the policy assessment by outlining what we have come to understand as being some useful advice that can help staff from SEI and other institutions to improve their chances of successful engagement with decision and policymakers. We are not the first to try this. Indeed, SEI's publication "Getting to Policy Impact" had ten suggestions, and the ODI had another ten (See Section 2 for details of both of these). Further advice is given in the form of various lists, in Nilsson and Owens (2007) and in the presentation by Inke Schauer (see Section 2). The Top Tips from this assessment and some suggestions for how these can be achieved are as follows:

### **1. Enhance the credibility of and trust in SEI**

SEI needs to be seen as an institution that develops robust, relevant and credible knowledge. We also need to be trusted as an organization that can deliver policy-relevant knowledge, and interact constructively and in partnership with different types of decision-makers at different scales and in different parts of the world. Therefore, staff in SEI have to be able to undertake high-quality research, get on with people and understand the demands on decision-makers. These are characteristics of SEI which have helped us to be seen as a trusted and welcome partner across the world, and especially in Africa, Asia and Latin America.

### **2. Understand the political, social, cultural and economic context**

In order to develop useful knowledge at the right time, in the right place and with the right people, it is necessary to understand the whole context related to an issue, even if the research or activity only covers part of it.

### **3. Build or contribute to networks**

SEI's interventions are generally more effective when we work as part of a network, consortium or other type of collaboration, especially with people who have expertise in the fields required to provide the advice. This can also ensure that we don't "reinvent the wheel".

### **4. Be clear about what you want to influence**

It would be better if people had a much clearer idea of the outcomes that they anticipate, from the outset of projects. In the assessment of SEI impact stories, SEI staff are not always proficient at articulating the outcomes of their activities.

### **5. Know who you want to influence**

This should be clear from the understanding of the context in point No 2 of this list. This should include knowledge of the roles of different decision-makers and also take into account factors such as the nature of the institution you are seeking to influence. For example, in Ministries, people have more policy influence but move around quickly and are more vulnerable to elections, whereas officials in EPAs or DOEs are often in position for the long term.

### **6. Know when to influence**

By being aware of when inputs to the policy process are timely, policy influence can be greatly enhanced. Often the timings of research and policy development operate at very different speeds; in some cases this can be worked around, but in others it is simply not possible. In the case of the SDG work, questions were being asked which required answers in a two week time frame, but the research would take much longer. Sometimes this is just the way it is... Perhaps, however, by planning with the relevant decision-makers earlier on, such instances can be more frequently avoided.

### **7. Know how to influence and plan accordingly**

It would be useful for there to be an increased understanding of, and increased training for, staff in the different and most effective ways in which scientific engagement with policy and decision-making can work. It is important to plan your engagement with decision-makers. A well-developed and clear Theory of Change (ToC) is a very good tool for communication of the project in relation to impact. This is something SEI should invest in. We are good at developing activities and outputs and reasonable at engagement – but this is rarely planned in a formal way: outcomes

are not clearly outlined and the relationship of these to impact is not articulated. Having a well-developed ToC at the beginning of a project, developed as a shared understanding with the decision-makers involved, would be a good step forward.

## **8. Focus on solutions, not just describing issues and problems**

The environmental community is often accused of being good at identifying the problem but not at producing ideas about solutions; this leads to a rather negative outlook. A focus on solutions – which is what the policy community needs to implement – will create a much greater receptivity of our research.

## **9. Invest in the process of engagement**

It is clear from the assessment of SEI's policy engagement that many of the more successful engagements have occurred when SEI has a) been engaged in an issue over a long period of time; b) engaged with relevant decision-making processes over a long period of time; and c) developed personal relationships with individual decision-makers and institutions. This is time consuming and requires considerable resources. Ensuring that the engagement is properly resourced in projects is important and investment of core funds to allow this will also be important. As Stephen Lintner, SEI Board Member, emphasized, "if you want to be taken seriously and get embedded within a policy process, you have to volunteer to do the boring stuff". This takes time and needs to be well-resourced.

## **10. Communicate knowledge; understand that the messenger can be more influential than the message**

Being able to provide credible advice relies on being able to communicate knowledge in an accessible way, tailored to different audiences. Considering communication at the beginning of a project with dedicated communication staff can really enhance the effective transfer of knowledge to decision-makers. Some people are just good communicators and can convey a message more effectively than others – we should use this in our policy engagement. We can work with champions who have the ability, desire and legitimacy to communicate messages effectively and cross the boundary between science and decision-making. These figures can be from within SEI, or we can work with champions outside of SEI by including them in projects and programmes.

## **11. Enhance capacities of individuals and institutions to solve their problems**

It is very difficult to embed change in a country which does not have strong individuals in strong institutions who can push forward different agendas once they have the knowledge they need. Therefore, enhancing the capacity of individuals and institutions is a vital component of embedding scientific knowledge within a policy process. We should continue to invest in this.

## **12. Monitor, learn and adjust along the way**

We need to improve the learning processes in SEI in relation to projects, programmes and initiatives. There is also a need to continue to consider how the process of engagement with policy and decision-makers and processes can be improved. We also need to be better at outlining our impact – i.e. filling in the gap between outcomes and changes that affect people and environmental quality in real ways. This calls for more ex-post analysis to track our "impact". We also need to more regularly request feedback from the decision-makers that we work with to understand how they perceive what we are doing and how it can be improved.

## References

- Andersson, K., Rosemarin, A., Lamizana, B., Kvarnström, E., McConville, J., Seidu, R., Dickin, S. and Trimmer, C. (2016). *Sanitation, Wastewater Management and Sustainability: From Waste Disposal to Resource Recovery*. UN Environment Programme and Stockholm Environment Institute. <https://www.sei.org/publications/sanitation-wastewater-and-sustainability/>
- Arctic Council (2016). *Arctic Resilience Report*. Carson, M. and Peterson, G. (eds). Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm. <https://www.sei.org/publications/arctic-resilience-report/>
- Arctic Council Sustainable Development Working Group (SDWG) (2019). Arctic Resilience Action Framework (ARAF) 2017-2019 Implementation Project Final Report. Arctic Council, Ottawa, Canada <https://oaarchive.arctic-council.org/handle/11374/2376>
- Ashby, M. A. and Heinemeyer, A. (2019). Prescribed burning impacts on ecosystem services in the British uplands: a methodological critique of the EMBER project. *Journal of Applied Ecology*, 1-9. DOI: [10.1111/1365-2664.13476](https://doi.org/10.1111/1365-2664.13476)
- Ashby, M. A. and Heinemeyer, A. (2019). Whither scientific debate? A rebuttal of “Contextualising UK moorland burning studies: geographical versus potential sponsorship-bias effects on research conclusions” by Brown and Holden (bioRxiv 2019; 731117). DOI: [10.32942/osf.io/68h3w](https://doi.org/10.32942/osf.io/68h3w)
- Barquet, K., Trimmer, C., Stureson, A., Joyce, B. and Jambal, D. (2019). *Piloting the SDG Synergies approach in Mongolia*. SEI Report. Stockholm Environment Institute. <https://www.sei.org/publications/sdg-synergies-mongolia/>
- Benzie, M., Adams, K. M., Roberts, E., Magnan, A. K., Persson, Å., Nadin, R., Klein, R. J. T., Harris, K., Treyer, S. and Kirbyshire, A. (2018). *Meeting the global challenge of adaptation by addressing transboundary climate risk: a joint collaboration between SEI, IDDRI, and ODI*. SEI Discussion Brief. Stockholm Environment Institute, Institute for Sustainable Development and International Relations and Overseas Development Institute. <https://www.sei.org/publications/transboundary-climate-risk/>
- Berkhout, F., Leach, M. and Scoones, I., eds. (2003). *Negotiating Environmental Change: New Perspectives from Social Science*. Edward Elgar, Cheltenham, UK and Northampton MA, USA
- Betz, F. (2016). Contextual methodology in the social sciences: Historiography, middle-range-theory, and models. *Advances in Social Sciences Research*, 3(7). DOI: [10.14738/assrj.37.2108](https://doi.org/10.14738/assrj.37.2108)
- Boswell, C. and Smith, K. (2017). Rethinking policy “impact”: four models of research-policy relations. *Palgrave Communications*, 3(44). DOI: [10.1057/s41599-017-0042-z](https://doi.org/10.1057/s41599-017-0042-z)
- Cairney, P. (2012). Complexity theory in political science and public policy. *Political Studies Review*, 10. 346-358. DOI: [10.1111/j.1478-9302.2012.00270.x](https://doi.org/10.1111/j.1478-9302.2012.00270.x)
- Carroll, M., Heinemeyer, A., Pearce-Higgins, J., Dennis, P., West, C., Holden, J., Wallage, Z. and Thomas, C. (2015). Hydrologically-driven ecosystem processes determine the distribution and persistence of ecosystem-specialist predators under climate change. *Nature Communication*, 6(7851). DOI: [10.1038/ncomms8851](https://doi.org/10.1038/ncomms8851)
- Carson, M. (2017). *Arctic Resilience Assessment: Synthesis for Arctic Leaders 2017*. Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm. <https://www.sei.org/publications/arctic-resilience-assessment-synthesis-for-arctic-leaders-2017/>
- Carson, M. and Burns, T. R. (2009). *Public Policy Paradigms: Theory and Practice of Paradigm Shifts in the European Union*. Peter Lang, Frankfurt, Germany, New York, USA and Oxford, UK
- Caplan, N. (1979). The two-communities theory and knowledge utilization. *American Behavioral Scientist*, 22(3). 459–70. DOI: [10.1177/000276427902200308](https://doi.org/10.1177/000276427902200308)
- Cash, D., Clark, W., Alcock, F., Dickson, N. M., Eckley, N., Guston D. H., Jäger, J. and Mitchell, R. B. (2003). Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences*, 100(14). 8086-8091. DOI: [10.1073/pnas.1231332100](https://doi.org/10.1073/pnas.1231332100)
- Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. Sage Publications, London.
- Christensen, M. and Nilsson, A. E. (2017). Arctic sea ice and the communication of climate change. *Popular Communication*, 15(4). DOI: [10.1080/15405702.2017.1376064](https://doi.org/10.1080/15405702.2017.1376064)
- Corbin, J. and Strauss, A. (1990). Grounded theory research: procedures, canons and evaluative criteria. *Qualitative Sociology*, 13(1). 3-21. DOI: [10.1007/BF00988593](https://doi.org/10.1007/BF00988593)
- Dagerskog, L. and Dickin, S. (2019). *Clean and Green – A new implementation framework for sustainable rural sanitation*. SEI Brief. Stockholm Environment Institute. <https://www.sei.org/publications/clean-green-a-implementation-framework-rural-sustainable-sanitation/>
- Dickin, S., Dagerskog, L., Jiménez, A., Andersson, K. and Savadogo, K. (2018). Understanding sustained use of ecological sanitation in rural Burkina Faso. *Science of the Total Environment*, 613. 140-14. DOI: [10.1016/j.scitotenv.2017.08.251](https://doi.org/10.1016/j.scitotenv.2017.08.251)
- Dunn, G. and Laing, M. (2017). Policy-makers perspectives on credibility, relevance, and legitimacy. *Environmental Science and Policy*, 76. 146-152. DOI: [10.1016/j.envsci.2017.07.005](https://doi.org/10.1016/j.envsci.2017.07.005)

- Earl, S., Carden, F. and Smutylo, T. (2001). *Outcome Mapping; Building Learning and Reflection into Development Programs*. International Development Research Centre (IDRC), Ottawa, ON, Canada
- Erickson, P. (2016). *U.S. again overlooks top CO2 impact of expanding oil supply, but that might change*. SEI Perspective, Stockholm Environment Institute, 30 April 2016. <https://www.sei.org/perspectives/us-co2-impact-oil-supply/>
- Erickson P., Down, A. and Lazarus, M. (2016). *Making future U.S. offshore oil leasing more consistent with climate goals*. SEI Discussion Brief. Stockholm Environment Institute. <https://www.sei.org/publications/us-offshore-oil-leasing-climate-goals/>
- Erickson, P. and Lazarus, M. (2016). *How would phasing out U.S. federal leases for fossil fuel extraction affect CO2 emissions and 2C goals?* SEI Working Paper No.2016-02. Stockholm Environment Institute. <https://www.sei.org/publications/how-would-phasing-out-u-s-federal-leases-for-fossil-fuel-extraction-affect-co2-emissions-and-2c-goals/>
- Forrester, J., Nilsson, M., Lee, C., Moora, H., Persson, L., Persson, Å., Peterson, K., Simon, J. and Tuhkanen, H. (2009). *Getting to policy impact: some lessons from 20 years of bridging science and policy with sustainability knowledge*. Research report. Stockholm Environment Institute, Stockholm. <https://www.sei.org/publications/bridging-science-policy/>
- Geels, F. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, 39. 495-510. DOI: [10.1016/j.respol.2010.01.022](https://doi.org/10.1016/j.respol.2010.01.022)
- Gregory, J. and Miller, S. (1998). *Science in Public: Communication, Culture, and Credibility*. Plenum Trade, New York, USA and London, UK
- Harper, A. R., Doerr, S. H., Santin, C., Froyd, C. A. and Sinnadurai, P. (2018). Prescribed fire and its impacts on ecosystem services in the UK. *Science of the Total Environment*, 624. 691-703. DOI: [10.1016/j.scitotenv.2017.12.161](https://doi.org/10.1016/j.scitotenv.2017.12.161)
- Heinemeyer, A., Croft, S., Garnett, M. H., Gloor, M., Holden, J., Lomas, M. R. and Ineson, P. (2010). The MILLENNIA peat cohort model, predicting past, present and future soil carbon budgets and fluxes under changing climates in peatlands. *Climate Research (Special Issue: Climate Change and the British Uplands)*, 45. 207-226. DOI: [10.3354/cr00928](https://doi.org/10.3354/cr00928)
- Heinemeyer, A. and Swindles, G. T. (2018). Unraveling past impacts of climate change and land management on historic peatland development using proxy-based reconstruction, monitoring data and process modeling. *Global Change Biology*, 24(9). 4131-4142. DOI: [10.1111/gcb.14298](https://doi.org/10.1111/gcb.14298)
- Heinemeyer, A., Asena, Q., Burn, W. L. and Jones, A. L. (2018). Peatland carbon stocks and burn history: blanket bog peat core evidence highlights charcoal impacts on peat physical properties and long-term carbon storage. *GEO: Geography and Environment*, 5(2), e00063. DOI: [10.1002/geo2.63](https://doi.org/10.1002/geo2.63)
- Heinemeyer, A., Asena, Q., Burn, W. L., Jones, A. L. and Ashby, M. A. (2019). Response to: Comment on "Peatland carbon stocks and burn history: Blanket bog peat core evidence highlights charcoal impacts on peat physical properties and long-term carbon storage by Evans et al. *GEO: Geography and Environment*, 6(1). DOI: [10.1002/geo2.78](https://doi.org/10.1002/geo2.78)
- Heinemeyer, A., Sloan, T. J. and Berry, R. (2019). Assessing soil compaction and micro-topography impacts of alternative heather cutting as compared to burning as part of grouse moor management on blanket bog. *PeerJ*. DOI: [10.7717/peerj.7298](https://doi.org/10.7717/peerj.7298)
- Hudson, J. and Lowe, S. (2004). *Understanding the Policy Process*. The Policy Press, Bristol, UK
- International Council for Science (ICSU) (2017). *A Guide to SDG Interactions: From Science to Implementation*. Griggs, D.J., Nilsson, M., Stevance, A. and McCollum, D. (eds). International Council for Science, Paris. DOI: [10.24948/2017.01](https://doi.org/10.24948/2017.01)
- Jasanoff, S., ed. (2004). *States of Knowledge: The Co-Production of Science and Social Order*. Routledge, London, UK and New York, USA
- Kasemir, B., Jäger, J., Jaeger, C. and Gardner, M., eds. (2003). *Public Participation in Sustainability Science*. Cambridge University Press, Cambridge, UK
- Larsen, R. K. and Nilsson, A. (2017). Knowledge production and environmental conflict: managing systematic reviews and maps for constructive outcomes. *Environmental Evidence*, 6(1), Commentary. DOI: [10.1186/s13750-017-0095-x](https://doi.org/10.1186/s13750-017-0095-x)
- Lindblom, C. E. (1980). *The Policy-Making Process*. 2nd ed. Prentice-Hall, Englewood Cliffs, NJ
- Loorbach, D. (2010). Transition management for sustainable development: A prescriptive, complexity-based governance framework. *Governance*, 32(1). 161-183. DOI: [10.1111/j.1468-0491.2009.01471.x](https://doi.org/10.1111/j.1468-0491.2009.01471.x)
- McConnell, A. (2018). Rethinking wicked problems as political problems and policy problems. *Policy and Politics*, 46(1). 165-180. DOI: [10.1332/030557317X15072085902640](https://doi.org/10.1332/030557317X15072085902640)
- Meagher, L. and Lyall, C. (2013). The invisible made visible: using impact evaluations to illuminate and inform the role of knowledge intermediaries. *Evidence and Policy*, 17(3). 163-173. DOI: [10.1332/174426413X14818994998468](https://doi.org/10.1332/174426413X14818994998468)

- Meagher, L., Lyal, C. and Nutley, S. (2008). Flows of Knowledge, Expertise, and Influence: A method for assessing Policy and Practice Impacts from Social Science Research. *Research Evaluation*, 17(3). 163-173. DOI: [10.3152/095820208X331720](https://doi.org/10.3152/095820208X331720)
- Merton, R.K. (1968). *Social Theory and Social Structure*. Free Press, New York
- Mitleton-Kelly, E. (2003). Ten principles of complexity and enabling infrastructures. In *Complex Systems and Evolutionary Perspectives on Organisations: The Application of Complexity Theory to Organisations*. Mitleton-Kelly, E. (ed). Elsevier Science, Oxford, UK
- Morton, P. A. and Heinemeyer, A. (2018). Vegetation matters: Correcting chamber carbon flux measurements using plant volumes. *Science of the Total Environment*, 639. 769–772. DOI: [10.1016/j.scitotenv.2018.05.192](https://doi.org/10.1016/j.scitotenv.2018.05.192)
- Morton, P. A. and Heinemeyer, A. (2019). Bog breathing: the extent of peat shrinkage and expansion on blanket bogs in relation to water table, heather management and dominant vegetation and its implications for carbon stock assessments. *Wetlands Ecology and Management*, 27. 467-482. DOI: [10.1007/s11273-019-09672-5](https://doi.org/10.1007/s11273-019-09672-5)
- Nilsson, A. E. and Meek, C. L. (2016). *Organizational learning in regional governance: A study of the Arctic Council*. SEI Working Paper No. 2016-14. Stockholm Environment Institute. <https://www.sei.org/publications/organizational-learning-arctic-council/>
- Nilsson, A. E. (2018a). Creating a safe operating space for business: the changing role of Arctic governance. In *Competing Arctic Futures: Historical and Contemporary Perspectives*. Wormbs, N. (ed). Springer, Cham, Switzerland. 117–37.
- Nilsson, A. E. (2018b). The United States and the making of an Arctic nation. *Polar Record*, 54(2). 1–13. DOI: [10.1017/S0032247418000219](https://doi.org/10.1017/S0032247418000219)
- Nilsson, M., Griggs, D. and Visbeck, M. (2016). Map the interactions between Sustainable Development Goals. *Nature*, 534. 320-22. DOI: [10.1038/534320a](https://doi.org/10.1038/534320a)
- Nilsson, M. and Owens, S. (eds) (2007). *Policy Integration for Sustainability. Notes from a Roundtable Dialogue*. Stockholm Environment Institute. <https://www.sei.org/publications/policy-integration-sustainability-notes-roundtable-dialogue/>
- Norberg, J. and Cumming, G. (2008). *Complexity Theory for a Sustainable Future*. Columbia University Press, New York, USA
- Owens, S. (2005). Making a difference? Some perspectives on environmental research and policy: Commentary. *Transactions of the Institute of British Geographers*, 30(3). 287–92. DOI: [10.1111/j.1475-5661.2005.00171.x](https://doi.org/10.1111/j.1475-5661.2005.00171.x)
- Owens, S. (2015). *Knowledge, Policy and Expertise: The UK Royal Commission on Environmental Pollution 1970-2011*. Oxford University Press, Oxford, UK
- Owens, S., Rayner, S. and Bina, O. (2004). New agendas for appraisal: reflections on theory, practice, and research. *Environment and Planning A*, 36(11). 1943–59. DOI: [10.1068/a36281](https://doi.org/10.1068/a36281)
- Owens, S., Petts, J. and Bulkeley, H. (2006). Boundary work: knowledge, policy, and the urban environment. *Environment and Planning C*, 24(5). 633–43. DOI: [10.1068/c0606j](https://doi.org/10.1068/c0606j)
- Pain, R., Askins, K., Banks, S., Cook, T., Crawford, G., Crookes, L., Darby, S., Heslop, J., Holden, A., Houston, M., Jeffes, J., Lambert, Z., McGlen, L., McGlynn, C., Ozga, J., Raynor, R., Robinson, Y., Shaw, S., Stewart, C. and Vanderhoven, D. (2016). *Mapping Alternative Impact: Alternative Approaches to Impact from Produced Research*. Centre for Social Justice and Community Action. Durham University, Durham
- Pellini, A. (2011). *The RAPID Outcome Mapping Approach and Project Management for Policy Change*. Overseas Development Institute (ODI), London, UK. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/7173.pdf>
- Petrov, A. N., BurnSilver, S., Chapin III, F. S., Fondahl, G., Graybill, J. K., Keil, K., Nilsson, A. E., Riedlsperger, R. and Schweitzer, P. (2017). *Arctic Sustainability Research: Past, Present and Future*. Routledge, London, UK
- Ramalingam, B. and Jones, H. (2008). *Exploring the Science of Complexity: Ideas and Implications for Development and Humanitarian Efforts*. ODI working paper 285. Overseas Development Institute (ODI), London, UK. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/833.pdf>
- Rose, D. C. (2014). Five ways to enhance the impact of climate science. *Nature Climate Change*, 4(7). 522–24. DOI: [10.1038/nclimate2270](https://doi.org/10.1038/nclimate2270)
- Sarkki, S., Tinch, P., Neimelä, J., Henik, U., Waylen, K., Timaeus, J., Young, J., Watt, A., NeBhöver, C. and van den Hove, S. (2015). Adding “iterativity” to the credibility, relevance legitimacy: a novel scheme to highlight dynamic aspects of science-policy interfaces. *Environmental Science and Policy*, 54. 505-512. DOI: [10.1016/j.envsci.2015.02.016](https://doi.org/10.1016/j.envsci.2015.02.016)
- Shindell, D., Borgford-Parnell, N., Brauer, M., Haines, A., Kuylenstierna, J.C.I., Leonard, S.A., Ramanathan, V., Ravishankara, A., Amann, M. and Srivastava, L. (2017). A climate policy pathway for near- and long-term benefits: climate actions can advance sustainable development. *Science*, 356(6337). 493-4. DOI: [10.1126/science.aak9521](https://doi.org/10.1126/science.aak9521)

- Shindell, D., Kuylentierna, J. C. I., Vignati, E., Van Dingenen, R., Amann, M., Klimont, Z., Anenberg, S. C., Muller, N., Janssens-Maenhout, G., Raes, F., Schwartz, J., Faluvegi, G., Pozzoli, L., Kupiainen, K., Höglund-Isaksson, L., Emberson, L., Streets, D., Ramanathan, V., Hicks, K., Oanh, K., Milly, G., Williams, M., Demkine, V. and Fowler, D. (2012). Simultaneously mitigating near-term climate change and improving human health and food security. *Science*, 335(6065). 183-189. DOI: [10.1126/science.1210026](https://doi.org/10.1126/science.1210026)
- Smutylo, T. (2001). *Crouching impact, hidden attribution: overcoming threats to learning in development programs*. Draft Learning Methodology Paper prepared for the Block Island Workshop on Across Portfolio Learning, 22–24 May 2001. Evaluation Unit, International Development Research Centre (IDRC), Ottawa, ON, Canada. <https://idl-bnc-idrc.dspacedirect.org/handle/10625/30908>
- Teisman, G. R. and Klijn, E-H. (2008). Complexity theory and public management. *Public Management Review*, 10(3). 287-97. DOI: [10.1080/14719030802002451](https://doi.org/10.1080/14719030802002451)
- UN Adaptation Committee (2017). Agenda Item 5(b): Methodologies for assessing adaptation needs with a view to assisting developing countries, without placing undue burden on them. Adaptation Committee (AC/2017/12), COP23, Bonn, Germany. [https://unfccc.int/files/adaptation/groups\\_committees/adaptation\\_committee/application/pdf/ac12\\_5b\\_assessing\\_needs.pdf](https://unfccc.int/files/adaptation/groups_committees/adaptation_committee/application/pdf/ac12_5b_assessing_needs.pdf)
- UNEP (2011). *Near-term Climate Protection and Clean Air Benefits: Actions for Controlling Short-Lived Forcers*. United Nations Environment Programme (UNEP), Nairobi, Kenya. <https://ccacoalition.org/en/resources/near-term-climate-protection-and-clean-air-benefits-actions-controlling-short-lived>
- UNEP/WMO (2011). *Integrated Assessment of Black Carbon and Tropospheric Ozone*. United Nations Environment Programme (UNEP), Nairobi, Kenya and World Meteorological Organization (WMO), Geneva, Switzerland. <https://www.ccacoalition.org/en/resources/integrated-assessment-black-carbon-and-tropospheric-ozone>
- van der Hel, S. and Biermann, F. (2017). The authority of science in sustainability governance: a structured comparison of six institutions engaged with Sustainable Development Goals. *Environmental Science and Policy*, 77. 211-220. DOI: [10.1016/j.envsci.2017.03.008](https://doi.org/10.1016/j.envsci.2017.03.008)
- Weible, C. M., Heikkilä, T., deLeon, P. and Sabatier, P. A. (2012). Understanding and influencing the policy process. *Policy Sciences*, 45(1). 1-21. DOI: [10.1007/s11077-011-9143-5](https://doi.org/10.1007/s11077-011-9143-5)
- Weiss, C. H. (1979). The many meanings of research utilization. *Public Administration Review*, 39(5). 426-431. DOI: [10.2307/3109916](https://doi.org/10.2307/3109916)
- Weiss, C.H. (1995). Nothing as practical as good theory: exploring theory-based evaluation for comprehensive community initiatives for children and families. In *New Approaches to Evaluating Community Initiatives: Concepts, Methods and Contexts*. Connell, J. P., Kubisch, A. C., Schorr, L. B. and Weiss, C. H. (eds). Aspen Institute, Washington, DC
- Weitz, N., Carlsen, H., Nilsson, M. and Skånberg, K. (2018). Towards systemic and contextual priority setting for implementing the 2030 Agenda. *Sustainability Science*, 13. 531-548. DOI: [10.1007/s11625-017-0470-0](https://doi.org/10.1007/s11625-017-0470-0)
- Weitz, N., Carlsen, H. and Trimmer, C. (2019). *SDG Synergies: An approach for coherent 2030 Agenda implementation*. SEI Policy Brief. Stockholm Environment Institute. <https://www.sei.org/publications/sdg-synergies-factsheet/>
- Weitz, N., Carlsen, H., Skånberg, K., Dzebo, A. and Viaud, V. (2019). *SDGs and the Environment in the EU: A Systems View to Improve Coherence*. Report Commissioned by the European Environment Agency. SEI Report. Stockholm Environment Institute <https://www.sei.org/publications/sdg-synergies-environment-eu/>
- West, S. E., Büker, P., Ahsmore, A., Njoroge, G., Welden, W., Mulhoza, C., Osano, P., Maku, J., Njoroge, P. and Apondo, W. (2020). Particulate matter pollution in an informal settlement in Nairobi: Using citizen science to make the invisible visible. *Applied Geography*, 114. DOI: [10.1016/j.apgeog.2019.102133](https://doi.org/10.1016/j.apgeog.2019.102133)
- Wilsdon, J. and Willis, R. (2004). *See-through Science: Why Public Engagement Needs to Move Upstream*. Demos, London, UK
- World Commission on Environment and Development (1987). *Our Common Future*. Oxford University Press, Oxford, UK
- Young, J. and Mendizabal, E. (2009). *Helping Researchers Become Policy Entrepreneurs: How to Develop Engagement Strategies for Evidence-Based Policy-Making*. ODI Briefing Paper. Overseas Development Institute (ODI), London, UK. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/1730.pdf>

## Annex 1. Semi-structured interview questions for the case studies

We're looking for a recent [i.e. in the last 5 years or so] piece of SEI work which you think had a significant impact.

1. What is/was the outcome you are/were aiming for?
2. Why? (i.e. "so what" – what is/was the point of bringing about that outcome?)
3. What outcome did you actually achieve?
4. What did you do to achieve that outcome? (i.e. how did you do it?)
5. Were there any unexpected outcomes?
6. Were there any negative outcomes?
7. What is it about SEI that helped in this work? ("*characteristics of SEI*")
8. What was the wider (temporal, political, social, economic, environmental) context which was important for the outcomes?
9. Was there anything particular about the form of the engagement with decision-makers and decision takers which made it successful and generate the outcome? (*Pathway*)
10. Is there anything else about this significant impact story which you think I haven't asked?
11. Are there any people in SEI or external to SEI that we can contact to this case studies

Close by asking if we can come back for more detail if required, and for URLs and other location of supporting material?

Crib list - A list of features we want to have information on but which we don't have as questions – that we need to include in the assessment – and which are linked to current knowledge – outputs and outcomes; style of engagement; etc.



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