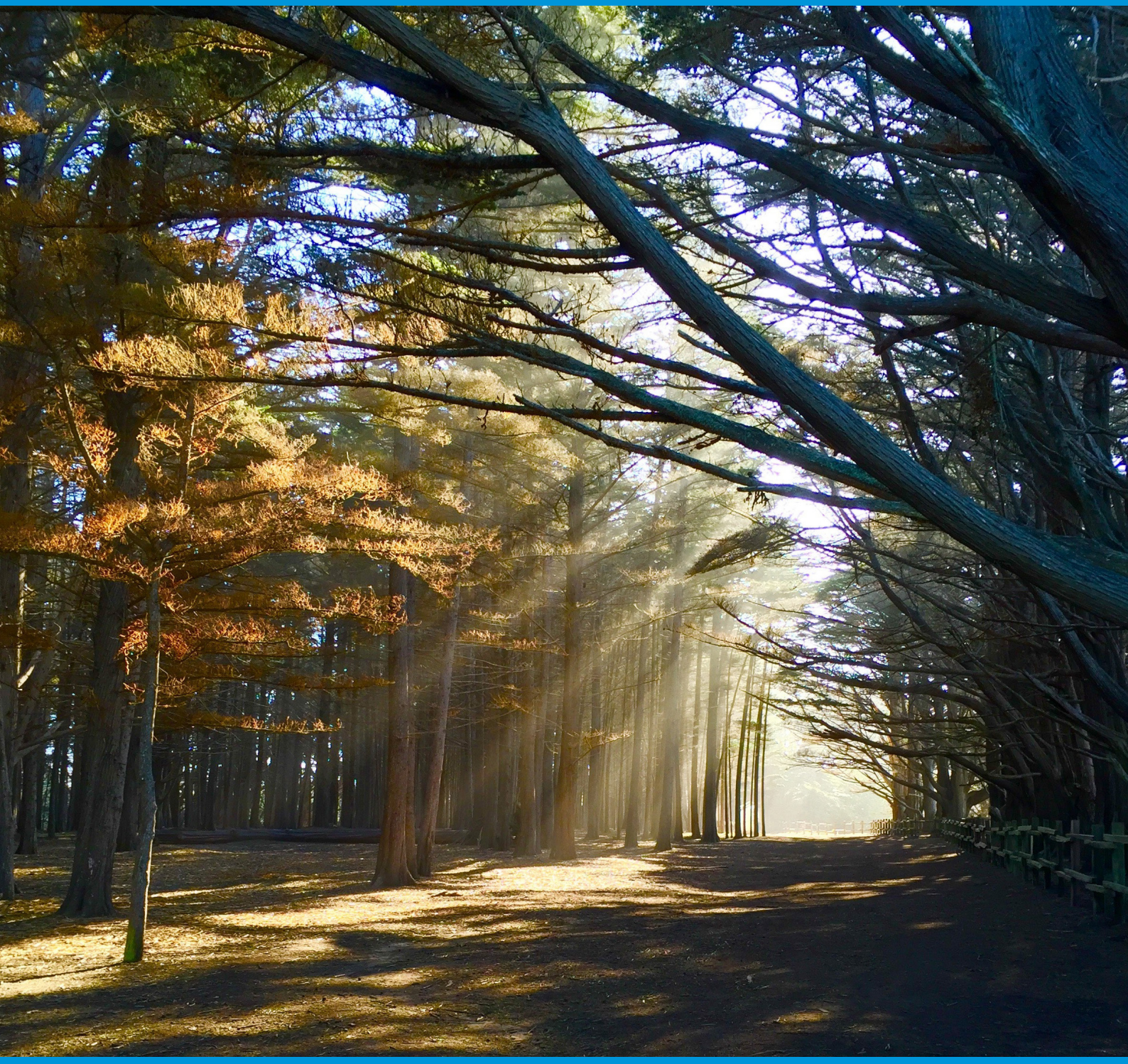
Entering the FOREST of risk:

A framework option for risk evaluation & systems thinking



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Contents

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Authors: Joseph Lewis

Design: Bea Gilbert

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About the Institution of Environmental Sciences (IES):

The IES is a visionary organisation leading debate, dissemination and promotion of environmental science and sustainability. We promote an evidence-based approach to decision and policy making.

We are devoted to championing the crucial role of environmental science in ensuring the well-being of humanity now and in the future.

Registered charity no. 277611

Contact: Institution of Environmental Sciences
6-8 Great Eastern Street
London
EC2A 3NT

T: +44 (0)20 3862 7484

E: info@the-ies.org

Executive Summary

In a world of complex systems, evaluating environmental risks can feel like walking into a dark forest. This report sets out a Framework as one potential option to help demystify the uncertainties posed by evaluating risks and opportunities, and to facilitate a systems thinking approach to making such evaluations.

Attempting to evaluate risks or opportunities involving complex natural systems can feel overwhelming, as navigating in one direction may lead to rapidly expanding considerations and consequences. Much like in the dark forest, we can quickly find ourselves lost if we do not have an effective guide. While systems thinking approaches may be able to support that endeavour, there have historically been insufficient tools to engage a systems thinking mind-set when evaluating risks specifically.

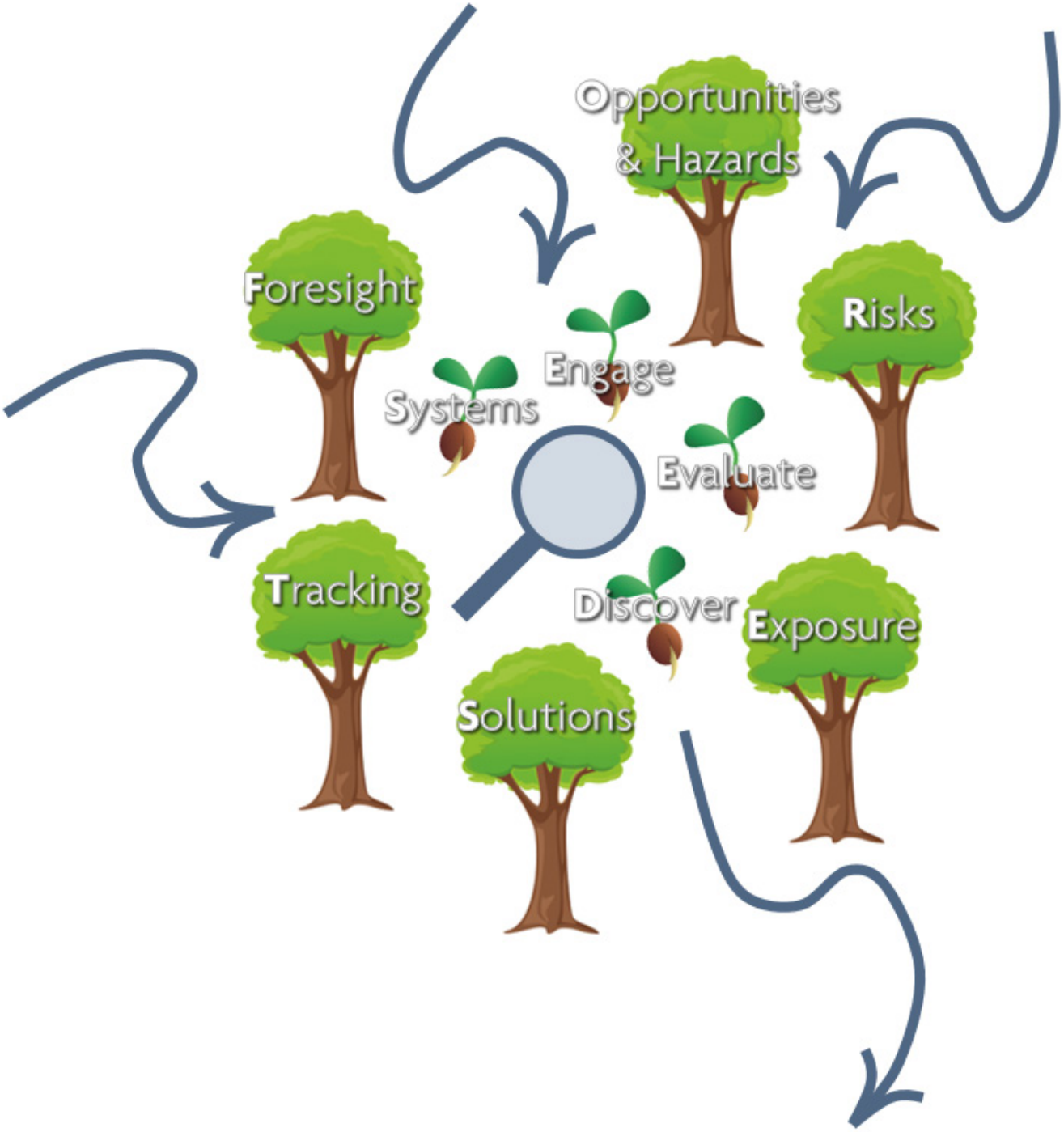
To help navigate through the dark forest that represents the complex considerations we need to manage in order to evaluate risks and opportunities from a systems perspective, the Framework provides a series of questions and sub-questions to facilitate that journey. As not all policy makers will start or end in the same places, the questions are designed to work in whichever order needed, with the potential to support evaluations either holistically or individually.

The questions cover (Q1) Foresight, (Q2) Opportunities & hazards, (Q3) Risk, (Q4) Exposure, (Q5) Solutions, and (Q6) Tracking (FOREST), providing an overview of many of the biggest barriers to interrogating systems linked to the potential for risks and opportunities. Much like mapping our journey through a forest, as we begin to break apart the complex dynamics of risk, we can find our way more easily.

Ideas that start in our mind as seeds can grow into innovative and system-changing ways to view an issue. To facilitate those ideas, the Framework also provides four reflections to support our approach: (R1) Systems, (R2) Engage, (R3) Evaluate, and (R4) Discover (SEED). Taking those reflections together, we can support the process of taking each answer to its full conclusion, growing like a seed until it flourishes in a more holistic understanding of the risks and opportunities involved.

Between those questions and reflections, the Framework in this report is an option to facilitate a systems thinking approach to evaluating risks and opportunities in some circumstances, with a view to transforming our view of risk from something overwhelming, obscure, and impenetrable into a rich resource that we benefit from exploring, encouraging us to look further than we otherwise would.

To that end, this Framework seeks to demystify the dark forest of risk, providing a map that will help some policy makers to conduct rich evaluations of risks and opportunities as they explore the forest of systems thinking, shifting the experience of risk evaluation from being a burden to being a benefit.



FOREST: a Framework Option for Risk Evaluation & Systems Thinking - graphical summary of key questions and reflections[1]

Introduction

The Institution of Environmental Sciences (IES) is a membership organisation representing nearly 6000 environmental scientists and standing up for the voice of science, scientists, and the natural world in policy. We promote and raise public awareness of environmental science by supporting professional scientists and academics.

As a professional body, the IES represents the voices of environmental professionals, sharing insights from the front lines of environmental work. We are particularly well-placed to represent a transdisciplinary approach to those insights, drawing members working in air quality, land condition, climate, nature, sustainability, water, education, and anywhere else where environmental work is underpinned by science.

As a result, the IES is uniquely positioned to examine interactions between complex natural and social systems from a scientific perspective. We are a leading voice in 'systems thinking' perspectives and transformative approaches to change.[2] Throughout our work, two linked themes regularly emerge: (1) risk and opportunities, including the concepts of systematic risk and unintended consequences or cascading policy failures, and (2) systems thinking as a potential tool to address environmental challenges.

Risk, systems, and resilience are three interlinking yet distinct concepts; risk manifests as potential situations where exposure to harm (or the potential for opportunities) is increased, resilience increases our propensity to manage those harms, and systems thinking provides a 'mindset' and a set of tools or frameworks that allow us to understand them.

As the need for precaution as a safeguard against environmental degradation increases, resilience can represent the longevity and adaptability of that safeguard, while risk can represent the threats against it. In that context, systems thinking is a key component to our ability to take precautions or ensure that precautions are effective and long-lasting.

Historically, the concept of risk has not been routinely addressed from a perspective that reflects the complex systems within which risks and opportunities often arise. In policy, systems thinking tools and approaches have become more prevalent,[3] but a systems thinking approach tailored to the nature of risk has not yet become widespread in public policy and decision-making.

This report takes a first step towards filling that gap and was developed with reference to a range of existing reports, articles, and publications from across the environmental sciences, government, and international organisations.

During the process, meetings were held with representatives of government departments and arms-length bodies working on risk, foresight, and systems thinking projects. This evidence was considered in discussion with a working group of expert members and through conversations with IES members.

Purpose and scope

Key policy makers have recognised a cross-governmental need for systems thinking approaches to decision making, particularly on environmental issues where complex natural systems are involved. This need has been met by a diversity of tools, frameworks, and approaches to facilitate systems thinking in specific contexts.[3] Despite this progress, there are not yet sufficient options available to encourage widespread adoption of systems thinking approaches to evaluating risk and the potential for opportunities.

This report seeks to address that gap by providing an additional option to support a systems thinking approach to considerations of risks and opportunities, drawing on the insights of the IES's expert working group to present the framework in a way that encourages adoption in the circumstances where it would be appropriate.

In particular, the group sought to ensure that the framework presented facilitated an understanding of the relationships between systems, without requiring the user to have any background knowledge. The framework seeks to achieve this by providing the user with questions to break down complex concepts and by supporting the process of breaking down long-term or systemic concepts which may otherwise be abstract to the user.

As a result, this framework may be particularly appropriate for decision makers who:

- Have limited pre-existing knowledge of – or institutional capacity to address – systems approaches, including policy risk experts who have not previously engaged in systems thinking;
- Have limited resources or adaptive capacity to create resilience, or who feel that typical approaches to risk do not identify appropriate solutions;
- Work in areas of policy where the understanding of risk is constantly evolving based on new evidence or the need to reprioritise rapidly;
- Have not historically been involved in proactive considerations around risk, or who are engaged in policy work responsible for responding to risks as they manifest.

Naturally, questions of risk (and the potential for opportunities) require some consideration of the policy context within which they occur, including availability of resources, institutional objectives, and the given organisation's appetite for risk or desire to pursue opportunities. While the framework itself does not seek to address these considerations, which will vary for different users, it may inform how decision makers approach these considerations in the future. Equally, those considerations may make a more systemic approach to addressing risk and opportunities inappropriate in some circumstances.

The scope of this framework extends only to facilitating systems approaches to risk and opportunities where this is already desirable, rather than seeking to extend the contexts within which those approaches are taken or addressing structural barriers which may currently exist.

Why risk?

What is risk?

Given its focus on practical interventions, this framework does not seek to intervene in questions about the nature of risk or how to define it on a theoretical level. The framework instead focuses on how to approach risks for those who have already defined what a risk means in their context.

For clarity, where a definition is required, it may be appropriate to consider the definition given in the Intergovernmental Panel on Climate Change (IPCC)'s Guidance for IPCC authors on the concept of risk: "The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems."[4] The definition also provides further examples in the specific context of climate change.

As the framework also seeks to identify the potential for positive opportunities or co-benefits as well as negative ones, this can be clarified by considering that where a risk would be "the potential for adverse consequences", an opportunity would be "the potential for favourable consequences". Equally, a risk could be "the potential for opportunities lost or foregone". Where another approach to defining or conceptualising risk is used – such as viewing risk as a combination of impact, likelihood, and vulnerability – this should be explicitly noted.

What is risk evaluation?

For the purposes of this report, 'risk evaluation' refers to the evaluation of risks or uncertain opportunities (particularly those associated with the environment). This extends beyond risk assessment, both in terms of process and in terms of scope: risk evaluation determines not only the nature or extent of risks and opportunities, but also their relevance and how they ought to affect decisions.

Evaluation is not a replacement process for formal or mandated risk assessments, but is a useful tool for building on risk assessments to generate strategic and systemic approaches to risks or uncertainties. In order to take a systems approach to risk, it is necessary to go beyond identifying risks in the abstract, so evaluation is a fundamental step to contextualising the role of risks and opportunities as part of a more complex system or interacting variables.

While the Framework does not instruct decision makers on the values and priorities they should use when making those evaluations, it provides a means by which the decision maker's (or their organisation's) priorities can be applied to evaluate the appropriate responses (or solutions) to the existence of the risks and opportunities being evaluated. To the extent that decision makers may also perceive, understand, or tolerate risks in different ways, the Framework also facilitates evaluations without prescribing a specific set of perceptions or understandings.

Why does risk matter?

Typically, we care about risks because doing so allows us to avoid adverse consequences. That is often enough to motivate us, but in modern policy the rationale for considering risks is even stronger. The lower our appreciation of risks and how to prepare for them, the more likely we are to face unintended consequences or to see our efforts end in policy failure.[5]

That is particularly true for environmental policy, where complex natural systems are subject to increasing degrees of risk from multiple sources. There are also significant social, economic, technical, and reputational costs associated with a failure to prepare for risks.[6] To that end, risk evaluations and assessments are not solely about the risks as they apply to policy makers, but to a range of internal objectives and external factors, many of which are interlinking or related.

Environmental risk also plays a key role in evaluating interventions that affect natural systems. The precautionary principle, which lies at the heart of environmental policy, often interacts which situations of uncertainty where risks are poorly understood or displaced by an appetite to secure uncertain benefits. More broadly, approaches to precaution against environmental harm may rely on some ability to demystify the nature of uncertain circumstances.[7]

In that context, it is important that risks and potential opportunities are properly evaluated throughout policy considerations, but especially so in environmental policy. That context also explains the importance of looking at risk through the lens of systems and the ways that they can demystify risk and improve the ways that we account for it.

Perceptions of risk

Risks can either catalyse or constrain the actions we take, with potential positive or negative consequences for environmental

outcomes.[8] Therefore, the ways that decision makers perceive risks are important. In general, there is now more data available than at any point previously, as well as greater understanding of systems and their inter-relationships, particularly at the government level.[3]

Despite that, access to information is not universal. Questions remain about what information is relevant, or how to prioritise different concerns. Even when interventions happen, often their consequences are unintuitive or require further action to achieve the desired outcomes.[9]

In that context, there are situations where value could be added to decision making processes which identify ways to unite differing perspectives on risk. Where interested parties have different goals or values, it may not be possible to reconcile all perspectives on risk, though it may be possible to better understand the reasons that different people view those risks differently.

Understandings of risk and opportunity

The way that individuals understand risk or uncertain opportunities may also be subjective, depending on their perspective, their culture and values, or their appetite for uncertainty. Different individuals may view a given course of action as riskier or less risky depending on their past experiences.[8]

Likewise, different decision makers may view the outcomes or potential for adverse or beneficial consequences associated with a particular policy decision to be too risky or completely appropriate. These understandings are often rooted in expected or historic practices which may vary across policy regimes.[10]

Ultimately, many of these considerations may be rooted in the degree of acceptance that an individual has for the existence of risk. Where individuals are willing to tolerate a higher degree of uncertainty, their understanding of risks and opportunities changes; whereas some individuals, such as businesses, may seek to minimise uncertainties and carefully manage their risks, resulting in a lower tolerability of risks or uncertain opportunities.[11]

In either case, while systems thinking approaches may be able to provide information on the existence of risks or opportunities, and may also be able to unite perspectives to some extent, final decisions about how to proceed in the presence of risk are still likely to be subject to the understanding and tolerance of a particular decision maker.

Decisions about risks and opportunities

When decision makers address issues where risks and opportunities are a significant factor, their approach must overcome the challenges linked to perceptions. This can be achieved in a number of ways:

1. Consider risks and opportunities proactively, rather than passively, avoiding immediacy bias which may displace risks which occur over the long-term, and allowing risks to be considered before they becomes too embedded for adaptation;

2. Consider risks and opportunities from a holistic perspective, with reference to the complex interconnected systems they affect, at a minimum not making problems worse, and ideally maximising the potential for multiple benefits;

3. Consider risks and opportunities from an integrated perspective, developing shared understandings with other departments or stakeholders and avoiding the undue shifting of risks to affect other aspects of the biosphere which lack the capacity to sustainably manage them;

4. Identify suitable questions to uncover sufficient information to inform decisions or fill gaps in knowledge.

Facilitating this positive approach to risks and opportunities by decision makers will require different support in different contexts. Across all contexts, systems thinking will be a vital tool, though the manner in which it is delivered may require contextual alterations. In many instances, the general attitude to risk is to attempt to eliminate it, which may not always be possible or desirable. Some uncertainty may be inevitable, particularly in the long-term, though this can be mitigated with certain approaches.[12]

The other common approach to risk is to attempt to adapt or create resilience. Resilience against risk relies on the capacity for adaptation, which is often under-resourced or under-recognised, due to challenges with how risks are perceived. This can lead to unintended consequences or a failure to protect against risks.[13]

Why systems thinking?

What is systems thinking?

Systems thinking is an approach to thinking about issues that reflects the nature of the complex systems which underpin human action, society, economics, and the environment. It encompasses both a mind-set for considering issues related to complex systems as well as practical tools or approaches to intervening in those systems.[14]

There are many ways to approach 'systems thinking'. Different thinkers require different mind-sets, tools, or approaches to thinking about complex issues, and there are no 'one-size-fits-all' approaches which apply across people and across contexts.

Several classical methodologies and models exist for analysing systems, notably:

- Soft systems methodology (SSM);[15]
- Critical systems heuristics (CSH);[16]
- Viable systems model (VSM);[17]
- System dynamics (SD);[18] and
- Strategic options development and analysis (SODA).[19]

Additionally, environmental practitioners have best practice approaches to addressing risks and opportunities or considering the ways that natural systems interact with social ones to create risks or opportunities. Frameworks such as Land Contamination Risk Management (LCRM)[20] and the Source-Pathway-Receptor approach (SPR)[21] reliably provide heuristics to assess risks in the typical contexts practitioners encounter.

Where environmental professionals have less procedural responsibilities, many have adapted their own approaches to risk conceptualisation and management, as well as the pursuit of opportunities and co-benefits.

Such an approach might seek to understand the extent of vulnerability, adaptive capacity, and likely risks faced by a project or locality in the context of scientific data, models or projections, then overlay that data as a guide to where risks or opportunities may emerge and what their effects might be, with a view to identifying options for interventions in discussion with affected communities and stakeholders. These approaches could apply to the present or with a forward view to future risks and vulnerabilities.[22]

Alternatively, such an approach could identify potential impacts and their likelihood as a way to calculate risks, or could seek to conceptualise risk as the consequences of not addressing an environmental harm.

Why should we use systems thinking to address risks and opportunities?

Given the complex nature of risks and opportunities which connect to interlinking social, economic, and natural systems, as well as the subjective or contextual factors which often influence the perception of risks and opportunities, systems thinking is well-placed to demystify systems and to develop more complete understandings of how they interact.[14]

Such an approach may help to explore otherwise evasive contextual information, allowing for more accessible identification of problems, opportunities, and systems of interest where these are not already identified. Systems thinking also exposes hidden patterns and the relationships between risks, opportunities, and the systems which produce them, potentially helping to identify potential interventions which are feasible and desirable to support action.[23]

Systems thinking approaches may also facilitate more proactive and cyclical approaches to assessing risks or opportunities, facilitating change that takes place on the system level, rather than atomistic changes which are less likely to produce the intended consequences where complex dynamics may be involved.[24]

These approaches can uncover patterns or aggregating factors which contribute to risk but which may otherwise be undetectable. This is particularly relevant where seemingly unrelated risks may be caused by the same pressures or systems, or where precautionary approaches to policy may be discounted due to limitations on the scope for decision makers to assess the manner in which environmental harm can be caused by pressures aggregated across complex systems.

Where decision makers are insufficiently able to evaluate risks, opportunities, or their consequences with traditional risk assessment approaches, a systems thinking approach may be more appropriate. In that context, multiple tools that allow for systems approaches to risk and opportunity evaluation may be valuable. This framework provides one such tool which may help to evaluate risks and opportunities from a systems perspective.

A framework option for risk evaluation & systems thinking

As an option to facilitate a systems thinking approach to evaluating risks and opportunities, this framework is provided to support decision makers or groups exploring questions of risk, particularly as they relate to connected social or natural systems.

FOREST (a framework option for risk evaluation & systems thinking) asks decision makers to consider six questions, answering them while reflecting on four broad considerations. These are not intended to replace professional risk management methodologies or standards, but to supplement them and to aid in the process of evaluating risks or potential opportunities where they seem impenetrable or overly complex, ensuring that connected systems are appropriately considered.

The core questions in the framework are grouped into six themes, which together form the acronym FOREST: (Q1) Foresight, (Q2) Opportunities and hazards, (Q3) Risks, (Q4) Exposure, (Q5) Solutions, and (Q6) Tracking. The reflections are grouped into four themes, which together form the acronym SEED: (R1) Systems, (R2) Engage, (R3) Evaluate, and (R4) Discover.

In Appendix I, a template for the Framework is provided.

When considering risks from a systemic perspective, the decision maker using the Framework should seek to ask and answer these questions:

Question 1 – Foresight: What do we expect to happen, and when will it happen?

Sub-question 1a: What does scientific data suggest will happen, and when? *

Sub-question 1b: How much certainty do we have about those projections? *

Sub-question 1c: What scenarios are plausible within the constraints of that uncertainty? *

Sub-question 1d: Does our planned approach to considering this issue work in the context of this information? *

Sub-question 1e: When will new data emerge and how should we monitor it so that we can update our approach?

Question 2 – Opportunities & hazards: Is there a potential for opportunities or hazards?

Sub-question 2a: What is the extent of each opportunity or hazard? *

Sub-question 2b: What is the likelihood of each opportunity or hazard? *

Sub-question 2c: When will each opportunity or hazard happen? *

Sub-question 2d: Where will each opportunity or hazard happen? *

Sub-question 2e: Why do these opportunities and hazards matter and what is at stake?

Question 3 – Risks: How vulnerable are we to each of the hazards?

Sub-question 3a: Who and what are likely to be affected by the hazards? *

Sub-question 3b: How are they likely to be affected, and why are they likely to be affected in that way?

Sub-question 3c: Does that exposure differ in different places?

Sub-question 3d: Will that exposure differ at different times?

Sub-question 3e: Do any of the hazards interact with each other, and if one of these hazards took place, would it increase the likelihood of other hazards taking place? *

Sub-question 3f: Are any of these hazards caused in the same ways, or are they likely to happen at the same time as other hazards?

Question 4 – Exposure: What would it look like to be resilient to those hazards?

Sub-question 4a: If the hazard took place, what would be necessary to reduce or prevent any negative consequences, or to make it easier to recover from them?

Sub-question 4b: What possible options could create resilience (with reference to any case studies where resilience already exists)? *

Sub-question 4c: Would any of the options for resilience create the potential for other benefits? *

Sub-question 4d: Would any of the options for resilience require us to make trade-offs? *

Sub-question 4e: Are any of the options for resilience affected by the potential hazards we identified? *

Question 5 – Solutions: How can we intervene to create change?

Sub-question 5a: Is an intervention desirable and what consequences do we desire? *

Sub-question 5b: What possible interventions could we make (or what controls could we impose)?

Sub-question 5c: Would the interventions lead to the consequences we desire? *

Sub-question 5d: How will the systems involved react to the intervention, and are they sufficiently transformed to prevent the problem reoccurring?

Sub-question 5e: Will the interventions create new problems, or shift the existing problem somewhere else?

Sub-question 5f: Are the interventions feasible (with reference to resources, capacity, urgency, and political and social considerations)?

Sub-question 5g: Are the interventions desirable, and if they require trade-offs, are we willing to make those trade-offs? *

Sub-question 5h: Do the interventions have the potential to lead to co-benefits, and how should we value those benefits?

Sub-question 5i: Taking all of these considerations into account holistically, what are the potential costs and benefits of each potential intervention?

Sub-question 5j: Which feasible and desirable intervention should we prioritise, and what options should we fall back on if our first intervention is unsuccessful?

Question 6 – Tracking: How can we monitor and evaluate success?

Sub-question 6a:
Are the risks manageable through intervention in the short-term or will they require long-term governance?

Sub-question 6b: What is our objective and what does a successful outcome look like? *

Sub-question 6c: How can we measure that outcome and what indicators should we use?

Sub-question 6d: Are our interventions having the desired effect (as we regularly monitor against the chosen indicators)?

Sub-question 6e: How can we adapt our approach to make it more successful?

* For further guidance on how to approach these questions, see 'Guidance for specific questions and reflections'.

When considering each question, the decision maker using the Framework should seek to reflect on these considerations:

Reflection 1 – Systems: Consider systems and their interactions

Sub-reflection 1a: What system are we addressing, what parts or processes are in the system, how do they interact with each other, and what are the boundaries of that system? *

Sub-reflection 1b: What other natural systems are linked to the system?

Sub-reflection 1c: How are these systems linked and what does an intervention in one do to the other?

Sub-reflection 1d: What social and economic systems are linked to these natural systems, and how could they react to interventions?

Reflection 2 – Engage: Take a cooperative approach to understanding the risks

Sub-reflection 2a: Who else will be affected by the question we are asking? *

Sub-reflection 2b: How do the stakeholders interpret this question and its answer? *

Sub-reflection 2c: Does their perspective differ from ours? *

Sub-reflection 2d: Do their priorities and assessments differ from ours? *

Sub-reflection 2e: Is it possible to unite these perspectives or do we need to make a trade-off between them? *

Reflection 3 – Evaluate: Reflect on the process and whether it is working

Sub-reflection 3a: Has the context changed since we last evaluated our approach?

Sub-reflection 3b: Is the framework giving us useful information?

Sub-reflection 3c: Is the framework making it easier or more difficult to understand the situation?

Sub-reflection 3d: Is the framework and the process we are using legitimate for making decisions? *

Sub-reflection 3e: Are there other approaches or tools which would be more appropriate?

Reflection 4 – Discover: Locate the information you need to inform your answers

Sub-reflection 4a: Do we have the information we need to answer this question? *

Sub-reflection 4b: Where can we find the information, data, or evidence we need?

Sub-reflection 4c: What limitations are there on our ability to find the information, data, or evidence we need? *

Sub-reflection 4d: What trusted sources could give us more information?

Sub-reflection 4e: What contacts or networks could we use to find out more?

Sub-reflection 4f: If we cannot find more information, how will that change our approach?

* For further guidance on how to approach these reflections, see ‘Guidance for specific questions and reflections’.

Guidance for using the Framework

How should the Framework be used?

The six questions comprising the Framework do not need to be followed in a linear order and can be taken independently or together depending on the needs of the risk evaluation being conducted. While answering those questions, the four reflections provide opportunities to safeguard against answers that do not sufficiently approach the question from a systems perspective.

As a simple rule, the decision maker using the Framework should not only answer the questions provided, but also ask themselves why the answers are true, which is likely to support a broader understanding.

Those questions can either be used as an independent process for evaluating risk or to supplement existing processes. For example, an organisation that already employs deep evaluations of risk in terms of the potential for, and nature of, hazards and opportunities, may nonetheless benefit from using question 3 to deepen its understanding of vulnerability. An organisation with a full risk evaluation process may nonetheless benefit from using the Framework's reflections to examine whether the process is producing the intended results.

Regardless of where the Framework adds value to risk and opportunity evaluation processes, it should be engaged in an iterative manner in collaboration with other relevant organisations, avoiding an approach to risk that becomes limited by the time or perspective from which it was considered.

Using the reflections

Answering the questions provided in the Framework in isolation may not be sufficient to address risk from a systemic and systematic perspective. To take a systems approach to risk evaluation, the reflections provided in the Framework are essential to answering questions in a way that generates a more complete perspective and incorporates other perspectives, both of which are essential to developing an awareness of the systems involved and how they affect the evaluation of risks.

Crucially, employing the Framework requires an approach rooted in systemic awareness, particularly the understanding that many of the risks and opportunities being considered are linked to cycles, unintuitive effects, or unintended consequences of actions elsewhere in the system.[25]

This requires the decision maker using the Framework to be willing to depart from preconceptions about what the answers are likely to be, discovering a broader awareness of the system by exploring how systems interact, how other perspectives can inform our own, how we can find information to answer questions, and how the process we use is shaping our answers.

To that end, the reflections in the Framework are an important tool for approaching each question in a manner that promote systemic awareness. In many instances, answers to the reflections will remain the same throughout the process, though the decision maker should continue to evaluate them where relevant, particularly as a question requires a different perspective to be applied.

What can the Framework do and what are its limitations?

Systems thinking mind-sets and techniques should be viewed in the context of the full set of options available to policy makers. Some may be more useful than others for given policy makers or contexts, so none should be prescribed without examination of the subjective circumstances of the policy question being addressed. No single tool or approach is universal and will work for all decision makers in all scenarios.

This Framework provides one option, which may help a decision maker to ask the right questions and think about risks and opportunities in a simpler way, without compromising the integrity of the process or missing out on potential considerations. Equally, other tools or approaches may be better suited in some circumstances. This is a framework for considering systemic approaches to risks and opportunities, not a guide to acting on them. Different solutions to risk will require subjective decisions to be made about what trade-offs to make and what to prioritise.[26]

Likewise, this Framework may supplement formal approaches to risk, such as ISO standards or other industry regulations,[27] but is not a replacement for them. When adhering strictly to certain standards, it may be necessary to shift focus slightly from the sub-questions identified by the Framework in order to better align with existing procedures. In such circumstances, the Framework provides the additional value of identifying where standard procedures produce blind spots, but does not compromise the necessary adherence to those procedures.

There may also be circumstances where a traditional risk management approach is insufficient to fully address the presence of risks or the potential for opportunities. 'Wicked issues' like climate change may require an approach based on risk governance, where the goal is to govern the potential for risks and their consequences, rather than managing each individually.[28]

Template for using the Framework

Recognising the time and capacity restrictions on many policy makers, a template worksheet is provided in Annex I to support initial usage of the framework. Policy makers who have more experience using the framework may be better placed to use their own methods or to take an approach which makes better use of diagrams, mind maps, or other devices.

These additional approaches may be useful in certain contexts, but are not necessary, nor is the template in Annex I. Policy makers should use the Framework as a guide where it is helpful to facilitating decision making, rather than a prescriptive process which must be followed in a linear fashion.

Guidance for specific questions and reflections

This section outlines guidance for specific questions in the Framework where answering the questions may not be immediately accessible to all decision makers. Later in 2023, a case study will be provided to demonstrate the application of the Framework to a given scenario.

Sub-questions 1a, 1b, & 1c:

Naturally, as in most foresight work, there is a degree to which uncertainty about future events must be acknowledged, even where data is available to predict or model future pathways.[29] These challenges can be overcome (even where data is limited) through systems thinking approaches and futures thinking approaches such as scenario mapping, exploring the plausibility of different uncertainties, and by acknowledging that some areas of uncertainty are inherent to the question of examining what is likely to happen in the future.

In all cases, while data gaps may be a limiting factor on the extent to which this question can be answered, they should not preclude the ability to comment on what available data does indicate, such that the question can be answered to an appropriate level of certainty for the purposes of continuing with the Framework. Reflection 4 provides further means of finding data and evidence where necessary.

Sub-question 1d:

Where it is not immediately clear whether the planned approach to evaluating risk (whether utilising the Framework or other tools for risk assessment and evaluation) will be appropriate in the context of the answers to sub-questions 1a, 1b, and 1c, suitable approaches may be able to offer further information, such as stress-testing, wind-tunnelling,[30] and scenario analysis.[31] Equally, these tools may be appropriate reflective tools to establish whether or not planned interventions are likely to fit with the scenarios established in answering question 1.

Sub-questions 2a, 2b, 2c, & 2d:

These question may best be answered with reference to traditional approaches to risk assessment, which should be sufficient to establish the extent of opportunities or hazards in most scenarios. The subsequent sub-questions apply that understanding to the context of complex systems.

Frameworks such as the Source-Pathway-Receptor approach[21] (or specialist frameworks such as Land Contamination Risk Management[20]) can reliably provide heuristics to assess the extent of a particular hazard and risk registers often facilitate a sufficient understanding of how a hazard could manifest to proceed with the Framework. For more extensive evaluations where the extent of a hazard or opportunity may be more complex, it may be appropriate to employ techniques such as those standardised by the BSI[32] and ISO.[27]

Where possible, these should align with the decision maker's organisational requirements and legal obligations. These questions are likely to be the best place to integrate such requirements where they are mandated.

Sub-question 3a:

While considering who and what are likely to be affected, specific systems thinking approaches may be appropriate to facilitate answers to this question. Soft Systems Methodology provides techniques such as CATWOE[33] or BATWOVE[34] which can be effective means of identifying the elements of a system, including stakeholders (or customers, beneficiaries, and victims) associated with a particular system or intervention.

As in question 2, traditional approaches to risk may be able to support answers to this question, particularly the Source-Pathway-Receptor approach.[21] It may also be valuable to consider why individuals or groups are likely to be affected by the hazard or opportunity, as this is likely to improve broader understanding of the risks and opportunities involved. This also plays an important role in identifying other groups or individuals who are equally affected by the same causes and drivers, providing a more complete answer to this question.

Sub-question 3e:

Where it is not immediately clear where one hazard is likely to interact with another, or how the potential for adverse or beneficial consequences interact within a given system, systems thinking approaches may be able to support a more complete understanding of the interactions between hazards and their causes. Modelling through approaches such as System Dynamics approaches[18] may offer alternative approaches to mapping complex interactions between hazards that may be linked by intermediary systems or connected in unintuitive ways.

Sub-questions 4b, 4c, 4d, & 4e:

The IPCC defines resilience as "a system's ability to anticipate, reduce, accommodate, and recover from disruptions in a timely, efficient, and fair manner."[35] In this context, resilience concerns the disposition of individuals, groups, or systems to risks or opportunities.

Where it is not immediately clear how resilience can be evaluated for the purposes of these questions, resilience to risk can be considered in multiple dimensions: firstly, the ability to resist or prevent negative change or hazards where desirable; secondly, the ability to return to positive (or past) circumstances in the aftermath of negative change or hazards; and thirdly, the ability to move on to preferable circumstances in the aftermath of negative change or hazards.

Similarly, resilience in the face of opportunities could be considered to be: firstly, the ability to seize or capitalise on positive change or benefits where desirable; secondly, the ability to maintain other benefits (or co-benefits of past circumstances) in the aftermath of positive change or opportunities; and thirdly, the inherent ability of a system to improve circumstances as a result of change as it occurs (and the broader context of anti-fragility).[36]

As with question 3, it may also be valuable to consider why individuals, groups, or systems are likely to be vulnerable or resilient, either inherently or in the context of specific interventions. In many instances, redisposition to vulnerability or resilience is likely to be affected by past policy considerations, so it may be necessary to establish the causes of vulnerability and how they link to other systems affected by risk.

Sub-questions 5a, 5c, & 5g:
Where possible, broad perspectives should be utilised when considering whether intervention is desirable, what kind of interventions would be desirable, and whether trade-offs are suitable. These considerations should be made with reference to principles of equity, the potential for marginalisation, inequality, or power imbalances, as well as broader principles of environmental justice[37] and sustainable development.[38]

Sub-questions 5d, 5e, 5f, 5g, and 5h will establish in more detail how opportunities and risks are likely to be distributed towards different groups, geographies, and systems, though these factors should also be somewhat considered while answering the question of whether intervention is appropriate in the first instance.

Beyond the immediate social value of approaching this question from a broad range of perspectives, such perspectives are also important to ensure appropriate systemic awareness before intervening, particularly as trade-offs may have unintended consequences on the broader systems involved.

Sub-question 6b:
In many cases, objectives will be determined by a decision maker's organisational context or wider governance arrangements. Where further support is required for the establishment of objectives and to determine what successful outcomes look like, systems thinking approaches provide several tools which may be appropriate.

For example, theoretical comparisons between the current and desired state of a system can help to visualise what changes are desired and to express objectives for change. In such an approach, a simple analysis of how the current approach differs from the ideal one can facilitate specific objectives or desired practical improvements.[39] Alternatively, techniques such as rich pictures, used in Soft Systems Methodology for establishing perspectives on a given situation, may be appropriate means of identifying priorities and how they ought to manifest in a given system.

Where objectives are part of existing frameworks or regulations, systems thinking also provides techniques for re-evaluating our approach in the context of existing commitments, such as the 'drifting goals' archetype[40] which may support the development of a clear vision that works in the context of competing priorities and trade-offs or identifying and factoring-in the 'limits to success' that can intervene in the fulfilment of an objective.[41]

As with question 5, broad perspectives should be utilised when deciding what should constitute a successful outcome. For theoretical comparisons or the use of rich pictures, this could be facilitated through group work. For more traditional approaches, stakeholder mapping and consultation may be appropriate means of engaging a wider range of perspectives.

Sub-reflection 1a:
Some decision makers may already have clearly defined understandings of the system they are seeking to evaluate, its parts and processes, how they interact, and how the boundaries of the system are defined (even if these understandings are not explicitly identified as definitions of a system). For example, Natural England provides the following definition of what it considers to be 'nature':

"Nature encompasses natural beauty, wildlife and the geology that underpins landscape character. It includes habitats on which our most precious species depend. Nature also includes our historic and cultural connections with nature - through art and literature - and other opportunities we have to connect with the environment. Nature also provides us with clean air and water and the ability to capture carbon and create resilience to climate change.

Our understanding of nature covers the whole natural world on earth and at sea and encompasses the natural environment in our towns and cities as well as the countryside."[42]

Where these predefined organisational understandings do not exist, it will be necessary to employ some form of systems thinking techniques, tools, or approaches to apply this reflection. Different approaches may be appropriate in different contexts, so decision makers should employ those which are most relevant to their situation. In many cases, organisations may have standard systems thinking approaches which they employ to address the systems of relevance to their context, such as the UK Government Office for Science's Systems Thinking Toolkit.[3]

Other approaches may include:

- Using Critical Systems Heuristics to establish the boundaries of a given system and how it should be theoretically limited and defined, for example: if a decision maker dealing with agriculture was applying sub-reflection 1a, they may use Critical Systems Heuristics to identify what 'the agricultural system' means for the purposes of the risk evaluation, allowing them to clearly identify what they plan to consider and what they will omit;[16]

- Using a Viable Systems Model to establish the basic functioning of a system, particularly an organisation or network that is affected by a risk, an opportunity, or an intervention, for example: if a decision maker was seeking to establish the resilience of an organisation or community to a particular hazard, they may use a Viable Systems Model to identify the adaptive capacity of that organisation or community;[17]

- Using techniques from Soft Systems Methodology to identify the key features of a system and how it should be defined, for example: if a decision maker working on the energy system was seeking to establish how that system operates, they may develop a root definition[43] to concisely describe the system and all its key elements, potentially in the form of 'a system to {do what} by {how it is done and who is involved} in order to achieve {its goal} limited by {constraints}',[44] which could be supported by systems maps to provide a richer overview of the elements of the energy system;[45]

- Using systems archetypes to outline particularly important relationships between elements of a system, for example: if a decision maker dealing with biodiversity was seeking to establish the extent of harm associated with the hazard of marine ecosystems declining in quality due to climate change, they may use a Causal Loop Diagram to review how that hazard could interact with other hazards or opportunities, or they could create a more complex digital model of the dynamic relationships associated with decision making processes linked to climate change, supported by Policy Structure Diagrams or other modelling tools.[40]

Depending on the context and the availability of resources, decision makers should make judgments about the correct approach to identifying the relevant aspects of the system necessary to inform the questions they are answering, which will vary between contexts.

Sub-reflections 2a, 2b, 2c, 2d, & 2e:
These reflections encourage the decision maker to take a cooperative approach to understanding the questions asked by the Framework. This cooperative approach to understanding the risks, opportunities, and how they interact with wider systems is a crucial element of taking a systems thinking approach and is the prerequisite for the rich understanding at the core of risk evaluation.

Despite the importance of those perspectives in understanding the issues, this should not be seen as a requirement that all actions taken by decision makers must be governed by the community at large. Often, there will be established procedures for decision making as well as practical limitations on the extent of participation in the decision making process.

Ultimately, the decision maker using the Framework may be responsible for making a decision and it may not be possible to include all perspectives on what actions should be taken when doing so. Often there will be direct trade-offs between different stakeholders or groups of stakeholders. Decision makers should reflect on equitable ways to resolve these challenges within their organisational constraints. Regardless, the limits on cooperative approaches to decision making should not prevent a cooperative approach to seeking to understand these issues and different perspectives associated with them.

Systems thinking techniques are often well-suited to being utilised in participatory approaches. For example, when engaging stakeholders to establish different perspectives on how individuals or groups might be affected by a given hazard or opportunity (such as to answer sub-question 3b), one approach might be to ask stakeholders to produce simple conceptual models of how they would expect the hazard to operate in theory, then to compare the models to each other and the perspective of the decision maker, enriching the perspective that underpins the answer.[25]

Sub-reflection 3d:
Most decision makers engaging with the Framework will have established procedures for how they operate and may be legitimised by specific mandates. Where this is not immediately applicable, it may be useful to ensure that the legitimacy of processes is given consideration. The legitimacy of the process may also be affected by the credibility of both the process and those in control of it, which may be informed by reflection 2 and reflection 4.

To support this reflection, decision makers might ask if their process is transparent, fair, understandable, based on appropriate authority and expertise, and whether or not a wider set of stakeholders would consider it to meet those criteria. These considerations should be made with reference to relevant principles of environmental justice[37] and sustainable development.[38]

Sub-reflection 4a:
For this reflection, it may be necessary to distinguish between three categories of information: the information we already have in support of the question, the information we currently lack but may be able to obtain, and the information that we will not be able to obtain, either because it does not exist or is inaccessible (see sub-reflection 4c).

As with sub-question 1a, for the latter category it will be necessary to acknowledge that there is a degree to which uncertainty and gaps in data are unavoidable, but to proceed on the basis of the information that is available. Decision makers may also benefit from considering the implications of those inherent gaps in data and how they may affect the risk evaluation as a whole.

This may require the decision maker to approach the risk evaluation from the perspective of identifying different interventions and approaches which apply depending on how a given risk or situation develops, remaining agile in the face of potential areas of uncertainty.

One such approach is to provide 'plural and conditional' advice, offering the different reasonable interpretations of a given issue and the explicit ramifications of each alternate interpretation for the advice (or in this case the answer to the question being considered).[12] In most cases where such data gaps or uncertainties exist, this will reflect the nature of the variety of pathways necessary for an appropriate degree of foresight.

Sub-reflection 4c:

When applying this reflection it may be necessary to assess the cost of accessing certain information, as it may require new data collection or access to information that is not in the public domain or wider organisational reach of the decision maker. There are also likely to be costs associated with using new information even where it is already accessible, as the most significant barrier to utilising information is likely to be the cost in time associated with a wide review of relevant information. Ultimately, the decision maker will need to exercise judgment about how much information is required to sufficiently answer the question.

The decision maker may also benefit from considering other non-financial barriers to accessing information such as the availability of relevant expertise or networks. These considerations can be supported by sub-reflections 4d and 4e.

Where it is necessary to determine whether the value of information is more important than the costs associated with overcoming the barriers to accessing it, a cost-benefit analysis[46] may be an appropriate tool.

What next?

Even with the aid of a systems thinking mind-set and the support of tools such as this Framework, evaluations of complex risk may still feel like exploring a dark forest. The first step is to learn how to navigate between the trees, even if it is never completely possible to peel away the shadows from the paths.

The Framework provided in this report is one option to improve the extent to which evaluations of risk are made with full consideration of the systems involved, particularly in the environmental context. As an option, it has the potential to improve both our understanding of risk, but also our understanding of the need for further thought in this area.

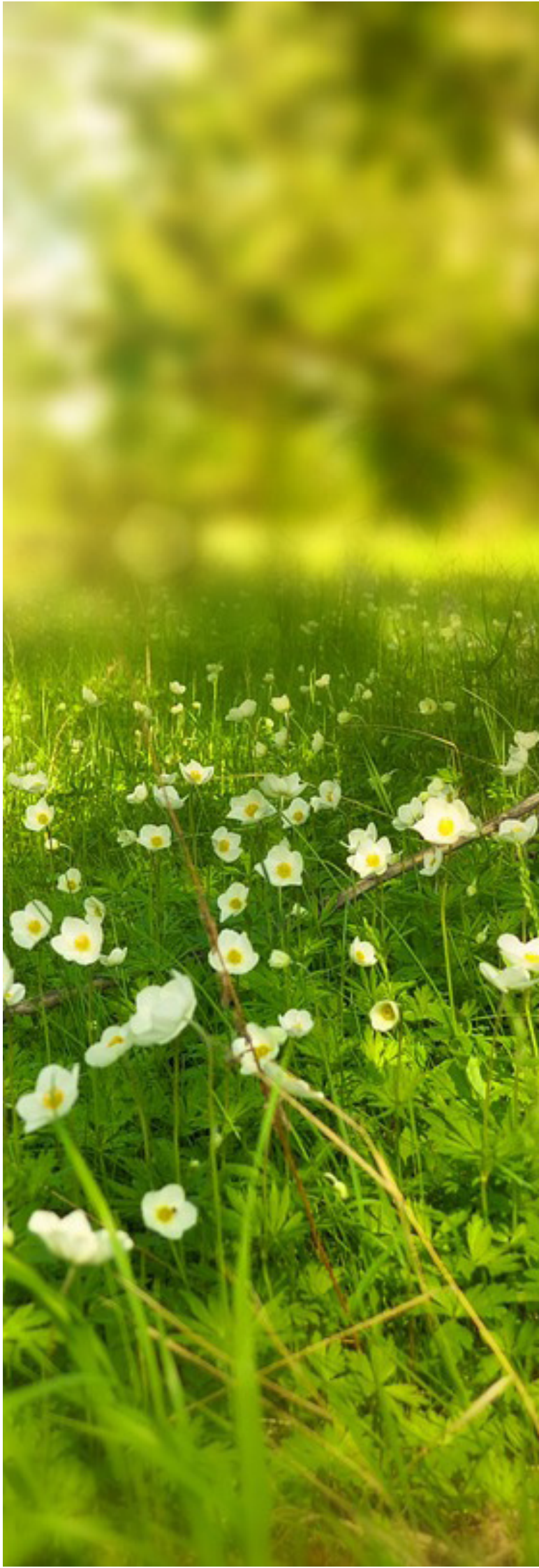
Ultimately, it is only one option and our understanding of complex systems may rely on different options in different contexts, so this Framework is not a solution to all policy problems posed during the evaluation of risks and opportunities. One significant step for further action will be to adapt this Framework to suit the nuanced scenarios where it is not a suitable option for risk evaluation, including where adherence to specific industry standards means trading-off important considerations.

In many instances, more work will need to be done before systems thinking approaches to risk governance and management are able to become more widespread. While writing this report, the IES has deliberately chosen not to make additional policy recommendations, which may vary significantly based on policy regimes, the context of specific government departments, and the needs of particular decision makers.

As a result, there is an ongoing need for further discussion on how to effectively facilitate systems thinking approaches in the context of risk and opportunity management, as well as alternative frameworks for systems thinking approaches to risk and opportunities, which may be necessary in certain situations.

Our understanding of risk is constantly evolving in line with emerging data and the expansion of knowledge relating to social, economic, and natural systems. As those understandings develop further, risk and opportunity evaluation from the perspective of systems will require further examination.

Future work will need to expand beyond the Framework outlined here to continue developing our approach to addressing complex environmental challenges. Even if evaluating risk from a systems perspective continues to seem like exploring a dark forest, we can still hope to recognise that forest for the rich and beneficial resources that it can provide.



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Institution of Environmental Sciences
6-8 Great Eastern Street | London
EC2A 3NT
+44 (0)20 3862 7484

info@the-ies.org
www.the-ies.org

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