Global Climate Adaptation Partnership

Adaptation X

Framing adaptation as transforming pathways has gained prominence and innovative, viable methodologies are being developed and tested. The foundations for adaptive pathways at the inter-spaces of decision making and climate-impacts are explored in this paper.

Adaptation to X: Mapping decision spaces between climate and development

Authors and contributors

Thomas E Downing (CEO, Global Climate Adaptation Partnership) is the lead author, seeking to draw together a decade (and more) of theoretical and practical work into a think-piece that lays out the future of adaptation (and the best practice that our senior team aspire to achieve in knowledge-led services).

This line of thinking reflects a decade (and more) of close interactions, brainstorming, reflection and learning with others. Those who are acknowledged at this stage include: David Stainforth and Fernanda Zermoglio (climate spaces spilling over as knowledge), John Colvin, Vikrom Mathur and Sukaina Bharwani (decision-oriented viewpoints), and Muriel Bonjean and Paul Watkiss (analytical approaches), and many others. The final paper is expected to involve close contributions from this extended team as co-authors.

Framing adaptation as a socio-institutional process

Imagine an empty map, a space with no features. We might take this as the initial landscape of adaptation. What would we put on the map? There is no shortage of proposals—from adapting ducks to survive floods in Bangladesh to full coupled socio-ecological transformations of resilience.

An initial starting point is to ask who provides the milestones, signage, contour mapping, naming of peaks and valleys and so forth. Climate change is widely seen as a wicked environmental problem. The stakeholders responsible for finding solutions are also the problem, each has their own framing and no single authority is able to impose a solution. Each framing reflects different viewpoints—from predicting the future to adaptive management, from community rights to ecosystem management, from information solutions by the elite to social mobilization of the vulnerable.

Against this reality of contested space, there can never be a universal map. However, we must adapt and we should be confident in the arts of wayfinding. This paper outlines emerging thinking in creating a robust and yet practicable methodology for planning adaptive futures.

Our approach is based on a conceptual framing of adaptation as a pathway of strategies and actions that comprise a continuum (Item 1). This continuum ranges from good development through to targeting actions to reduce future impacts of climate change. Based on reviews of adaptation concepts and typologies, we propose five categories as a reasonable starting point.

The baseline for climate adaptation is **Good Development** that contributes to societal goals of economic and social welfare. This is generally seen as not part of a climate adaptation regime per se, although mainstreaming integrates climate and development so the two cannot be separated.

Supporting responding to climate change is **Adaptive Capacity and Planning**, enhancing the individual and institutional competence for planning climate resilience. Such capacity is closely embedded in the development baseline of good governance and organisational management of environment, social development and economic growth. However, additional effort to address climate change is required.

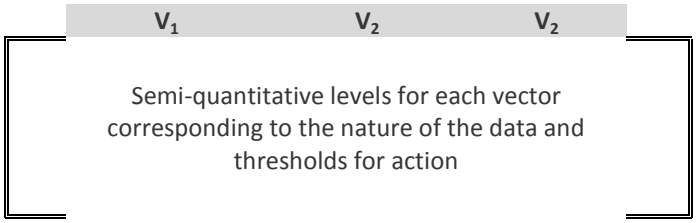
Reduced current vulnerability, especially to cope with weather-related disasters and extreme events, is an imperative at present in all countries. Better coping in the near term can be expected to have significant benefits in reduced impacts in the future. Hence, this mode of adaptation is a mix between the baseline of development and future climate adaptation.

Climate Resilience is a broad strategy to ensure climate risk does not disrupt development pathways, recognizing that future predictions of climate change impacts are highly uncertain. The focus tends to be on short-term actions, but as part of a robust strategy to achieve resilience in light of a range of potential futures. Although this mode has features of reducing current vulnerability.

The penultimate goal of climate adaptation is **Targeted Climate Change Actions.** This mode has the specific purpose of reducing specific climate change impacts—those effects that are additional to current vulnerability. Since these impacts cannot be accurately predicted or attributed to the additional effects of climate change, this mode is only justified for decisions where there is a high cost of failure if climate change is not considered.

The inter-space of useful knowledge (1)

We propose a more formal way to navigate the adaptation landscape. Or more specifically, to elicit useful information that informs decision making—the signage and milestones of adaptive pathways across a continuum of action. We construct two matrices that capture the dimensions of climate information and then of actor-decision making. The matrices follow a generic form:



Then we explore the inter-spaces between these ‘two communities’.

Landscapes of climate-impacts information

The decision focus of this approach requires an interface to climate and climate impacts information. Often, this is left rather vague—someone devising a strategy asks a climate team to review the present state-of-the-art in the analysis of trends and future scenarios. We will need a more formal knowledge engine to support real decision making.

Objective: To describe climate data in forms that guide construction of a query that translates ‘data’ into useful information given a defined Decision Space.

A reasonable matrix might have six vectors (although resolution generally collapses into one for most queries).

- Drivers of climate change. Level 1 would be current vulnerability, where the drivers of change are not a concern (the decision maker is concerned with present vulnerability and not long term, additional GHG changes. Lower, mid-range and upper bounds of GHG emissions are increasing levels of change, with a ‘top level’ option of specific reference scenarios. This progression from Level I to V relates to the nature of information required. It is not a quantitative scale of GHG forcing.

- Geographic resolution typically runs from a site (a climate station in the data) to the world. A global concern need not be generalised—planning in the coffee sector might be concerned with future conditions in far-flung regions.

- Temporal resolutions of concern are events (whether a few minutes or months) up to the long-term normal, conventionally defined as 30-year averages. Not infrequently, an actor would be concerned with more than one temporal resolution.

- Trends in climate systems seeks to capture the continuum of history. Environmental history can shape the present conditions and indicate instabilities that might lie ahead. More conventionally, forecasts of the future run from weather to Century timescales.

- Nature of climate-impacts. Simple climate-impact relationships are not uncommon, although understanding tipping elements and strange attractors in coupled socio-ecological systems is fraught with methodological challenges. Uncertainty in modelling biophysical impacts needs to be brought into the vulnerability-adaptation decision space. Social and economic processes further confound the ability to predict the future.

- Confidence in the data sets across this matrix is a key dimension for decision making. While the IPCC brought together a reasonable understanding of confidence, and applies it diligently to key conclusions, such formal ratings are rare in real-world applications.

A stylized query might be:

Actor X wishes to see a profile for [lower bound of emissions | minimum expected change with high confidence] [at a national scale for annual variables | reasonably high level of aggregation] [for a medium term planning horizon | 2020s to 2030s] [major climate variables affecting agroecological potential | multiple stressor but simple indicator] [fair confidence or higher | envelop of potential changes].

Landscapes of decision spaces

A standard typology of decision spaces remains a challenge. Although there are lots of frameworks, few are verified and proven to be helpful in real applications.

Objective: To define a Decision Space appropriate for a generic, Adaptation Space as an entry point for creating user-driven applications that provide robust strategies.

The key vectors of an actor-decision space are:

- Drivers of the decision. Most of the work at present is planning and capacity building with only weak drivers for making a decision. However, an urgent decision make be required, for instance if a major new port is being planned in an area exposed to coastal erosion and storm surges.

- Nature of the Actor. Individuals or ogranisations making a decision on their own are different from actor-networks in conflict, and informal networks present their own problems given a lack of a clear decision space.

- Stage of decision. The usual progression from awareness to an operational decision applies, with M&E or learning more broadly as a special case.

- Nature of the benefits. Avoiding expected losses from a flood is a very limited benefit, while transforming a development path to save lives in the future is far more challenging.

A stylized query might be:

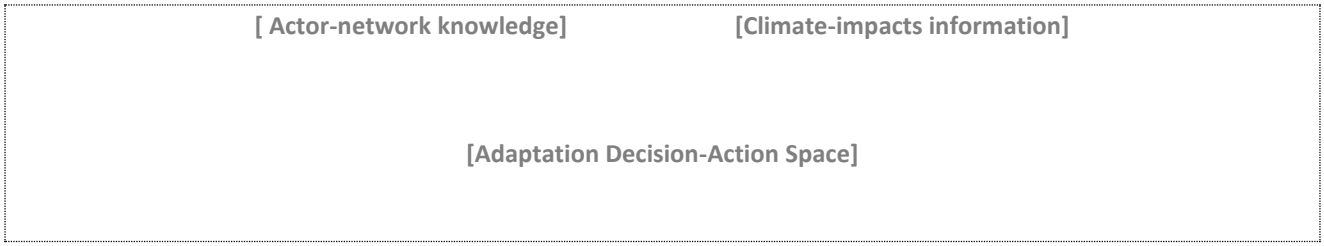
[Actor X is an individual in a climate change unit | collective management in the lead agency] and has been requested to: [prepare a plan | part of normal government mainstreaming of development planning] that will include [strategies

for sectoral management | including new policies and an investment framework] as a contribution to [the government's revised medium term vision| scenarios for 2030 and pathways to reach them]. The plan is concerned with a full spectrum of benefits and beneficiaries [all levels are part of government conerns | economic losses to lives saved].

The inter-space of useful knowledge

These two communities need to be connected in order to usefully define the Adaptation Decision-Action Space. An Actor seeks information on climate and climate change impacts in order to make a decision leading Action. Note that there are additional linkages before action is produced—we suggest some ways forward in the conclusion.

Item 1. Actor-Decision-Action Space



The first proposition regarding the inter-space is widely held although the implications rarely fully developed:

- No single framework, methodology or analytical device is adequate to cover the entire Actor-Decision-Action Space.

While that seems obvious, and is a consequence of the wicked framing as well, the world of vulnerability and adaptation is replete with one-stop-shops and proprietary, black-box methodologies. The most famous example is perhaps the UNEP/GEF Economics of Climate Adaptation project (2009-10). The lead consultants, McKinsey and Company, sought to stamp cost-benefit analysis as a complete framework under the aegis of Total Climate Risk and essentially copying the marginal abatement cost curves that are widely used in evaluating mitigation options. At a local level, protocols and checklists imply that a single sheet will cover the decision needs of all actors.[1] Or, visit one of the web sites that promise a full risk assessment for any user (you can even get a lite version). Or try to find a user-orientation in any of the proliferating vulnerability maps.[2]

A second proposition is quite different—it asserts that this space is not unknowable or indeed alien territory for decision makers:

- Narratives of real decision spaces can capture the most relevant dimensions of actor-networks and climate-impacts information in a practical analysis of the value of information in making decisions.

Our work in this area uses the well-established technique in agile software engineering of use cases. Adaptation Use Cases describe the Actor, their context and decision needs, and then provides a means to judge whether the information provided is likely to lead to a successful outcome for that Actor, or conversely fails to either help the

[1] The Economics of Climate Adaptation project produced a final report in 2010. The project was reviewed by T Downing for UNEP in 2013.

[2] In contrast, our work for the African Development Bank is specifically designed for one decision environment (their task managers) with different scorecards for each sector given their typical project. This project forced us to work through many of the concepts set out here, in particular use cases.

Actor make a decision or indeed leads to a worse decision than if that information had not been used (one mode of maladaptation). We have a growing library of such use cases.

A further proposition follows:

- A formal description of the Actor-Decision-Action Space will assist analysts and practitioners to make better adaptation decisions.

This is the ultimate aim of this paper—to describe the foundations for a formal representation of adaptation decision making as socio-institutional processes. At this stage, we can only outline the initial framework and starting point. Ideally, we would begin to capture the pace of change and timing of decision making in dynamic pathways. A daunting challenge.

A formal representation of vulnerability was developed over a decade ago.[3] In a similar way, we suggest a formal nomenclature for adaptation decision making is required. The multiple attributes (vectors in the meta-metrices above) are required for the representation of Actor-Knowledge Networks and Climate-Impacts Information. The nomenclature should facilitate the representation of a particular decision space as Actor-Action-Outcome (perhaps using semantic web technology). A specific instance of the decision space should be separate from the stylized model. Each operator in the nomenclature should correspond to established theory, and the sequence should be informed by a Theory of Change. Representing snapshots of time (usually with a subscript, t) needs to be expanded with the drivers of change.[4]

At this stage we do not propose such a nomenclature. Before proceeding, we believe further prototyping of the value of information in making adaptation decision is required. As such, we propose a vastly expanded library of Adaptation Use Cases and verifying their applications in real decision contexts. This stylized body of grounded theory would then inform further analytical development.

Exploring the adaptation space

Let's look at some possible uses of this approach. First, we define a state in the Actor-Decision Action Space as the description of the actor-knowledge network and climate-impact information matrices.

ADAS (State A) = $\int$ {[AKN], [CII]}

Where AKN and CII represent the values of the vectors in the two matrices.

A typical State might be planning for a national strategy. Shown in the cells below as N, the actors are formally constituted but in conflict, responsible for an overall policy but looking forward to strategies too, and anticipating a wide range of impacts but avoiding the most uncertain consequences. The resulting 'fit' for the climate space suggests that external forcing is not relevant (they do not have a formal integrated assessment model that links to mitigation planning), the scale is mostly national and forward looking beyond the current conditions but not driven by longer term scenarios. The table below shows this mapping, or more formally:

State A = $\int$ {[$D_{1\text{-}3}$, $A_{4\text{-}5}$, $S_{2\text{-}3}$ $B_{1\text{-}2}$], [D_1, $S_{1\text{-}3}$, $T_{1\text{-}2,}$ $I_{1\text{-}3}$ $C_{1\text{-}3}$]}

A similar exploration for a community based adaptation project is shown below. The matrix looks quite different, with a more operational focus to community planning. We assume most of the planning will be implemented by

[3] There are several such schemes—none have been widely adopted, although there is continuing work along these lines in recent EC projects. Many assessments continue to use outdated definitions of vulnerability (such as the hold-over from the IPCC's second assessment report) or fail to represent vulnerability in a way that can be verified.

[4] Hopefully this does not lead into the complexity of Hamiltonian matrices.

households, although informal networks are relevant. The climate side looks similar, that is their interests are similar to national planners although with more emphasis on the near term conditions that they face.

The two examples are illustrative. However, they suggest one important finding. The useful information provided to a decision process—taking account of uncertainty and confidence—depends on the interactions of the two matrices. Neither is sufficient on its own to define what is good-enough/fit for purpose.

Item 2. Combined matrix for national planning

Drivers	Actor	Stage	Benefit		Drivers	Scale	Trend	Impacts	Confidence
n			N		C	c	C	c	c
N		n	N			C	c	C	C
N		N				c		c	c
	N								
	n								

Item 3. Combined matrix for community based adaptation

Drivers	Actor	Stage	Benefit		Drivers	Scale	Trend	Impacts	Confidence
C	C		c		n				N
c								N	N
c			C		N	N	N	n	n
		C							
	c								

Wayfinding: Scanning the future landscape

The argument we have established above sits between the imperative for action and the inability to read the whole of the future landscape of adaptation. The approach rests on the ability to understand actors in this landscape, while going further to shape the ways in which knowledge about future climate change and impacts might be useful (converting data into actor-knowledge). Various social, economic and institutional theories inform this practicable approach (a short guide to this literature follows). And lastly, above we suggest there is a need for formal descriptions of this landscape.

There is no shortage of tools for evaluating adaptation, whether strategic (e.g., Strategic Environmental Assessment), options (e.g., multi-criteria assessment as proposed in the NAPAs), or operational (e.g., various handbooks and guidelines). A recurrent gap in 'wayfinding' on adaptation is a critical faculty to choose the most appropriate methodology, and consequent approaches, methods and tools. This choice is often shown as between classic, rational, optimizing models and participatory learning cycles; however the tools and choices are somewhat more diverse than this.

While this paper is not a complete guide to the toolbox, we highlight two methods that illustrate the issues.

Based on the actors' viewpoints, a starting point is to anchor the range of options in a typology that matches their own construction of the decision space. That is, start with their frameworks and 'add' climate adaptation. Unfortunately, we tend to see many frameworks that are based on the reverse—an assumption that climate risks define the decision space and actors are expected to take up the recommendations (usually of an external expert). The table below shows four levels in a typology and an illustration for urban disaster risk management.

Item 4. Typology of adaptation responses

Typology for planning adaptation	Illustration for urban disaster risk management
Purpose: The visions and goals of lead actors in the area of concern	**Planning functions:** ❑ Protect the lives and welfare of citizens ❑ Build capacity across institutions to promote and regulate development and spatial planning. ❑ Develop and implement good practise in public and private investment in infrastructure, buildings and services
Strategy: Climate-adaptation related strategies that reduce current vulnerability and prepare for future risks (and opportunities)	**Priority areas:** ❑ Policy review, strategic evaluation and leadership ❑ Identify, assess and monitor disaster risks and enhance early warning ❑ Use knowledge, innovation and education to build a culture of safety and resilience at all levels ❑ Screen all new investments in the defined hazard zones for climate resilience
Action: Project-level requirements to fulfill the strategy	**Activities:** ❑ Define hazard planning zones for spatial planning ❑ Implement a climate screening service within municipal planning systems
Technology: The specific methods, tools and technologies that implement the action	**Detailed options:** ❑ Map hazard area using USGS standards ❑ Use a scorecard and options builder in developing the climate screening service rather than a full probabilistic risk model (due to lack of data)

The appraisal of options (usually strategies and actions) needs to fit within the actors' decision space, while avoiding well-known pitfalls of adaptation decision making (such as the lack of a singular metric of benefit, high uncertainty, path-dependence, conflicting values among stakeholders, and representation of the vulnerable). Our approach, initially implemented in the Climate Safeguards System for the African Development Bank, involves two stages:

- Filters that are required for the option to be considered. These are pass/fail criteria, such as 'option would increase the vulnerability of women and children'.
- Multi-attribute analysis of each option on some 30 attributes (including effectiveness, costs and benefits, synergies and co-benefits with other development objectives, equity, and suitability).

For each attribute, four levels capture a progression:

- **Level 1:** Minimum expected to be in a short list, should be easily achieved by most options
- **Level 2:** Existing good practice, widely seen as a priority
- **Level 3:** Enhances capacity over the coming five years
- **Level 4:** Transforms practice into a sustained effort and widespread resilience

This appraisal scheme avoids the pitfall of assuming one stakeholder (or an expert) has the authority or competence to decide on which options are 'best'. It results in a rich description of 'good' options and leaves to the stakeholders

to make judgments, for instance as to the relative merits of low-cost vs. high-reward options, or continuing 'good development' through established practices vs. seeking innovation that changes the development pathway.

A sense of wayfinding—navigating futures of uncertainty and transforming adaptation pathways—might require several further methodological developments:

- Snapshots of the current state (think of a GPS reporting coordinates) is not adequate without locating that position in a pathway. Approaches such as semantic triples (actor-action-outcome) are being pioneered in weADAPT (and indeed in many search engines).

- Each moment in adapting pathways represents a field of change beyond the static metrics of an option (whether a cost-benefit presumption or a profile of attributes as above). Rethinking the benefits of adaptation from an orientation of transformation might reveal useful approaches to measuring progress.

- Readiness for action is a more becoming metric than 'vulnerability' (the outcome of the past) or adaptive capacity (as a status-indicator). However, existing work on readiness is simplistic, relying on re-packaging static indicators rather than capturing the dynamics of cross-scale actor-networks and path-dependence.

A short guide to the literature

While the literature on climate adaptation is booming, there continues to be a relative paucity of practical evaluation of real decision making. The viewpoints and wayfinding above draw upon a wide range of material, without trying to cite every reference at this stage. This section provides our insight into the key lines of thinking.

Frameworks abound. We also are guilty of thinking new boxes and arrows explain reality. To a large extent, this paper seeks to go beyond the 'framing' debates and provide practical insight and tools for moving forward. Downing (die Erde) and Downing et al. (NeWater) capture much of his early thinking about viewpoints related to food security and vulnerability. We appreciate the thought behind the new framing of climate adaptation in the IPCC's report on extreme events (SREx) and in particular the inclusion of transformation—reflecting an intense negotiation among the 'two communiities'. Individual efforts often seem to be rearranging deck chairs although they all capture some elements of both theory and experience.[5]

Framing adaptation as change is emerging. A renewed interest in change-making is evident, not least in monitoring and evaluation, Theory of Change, and dynamic drivers of learning cycles. However, there is little consensus on what are real drivers of climate resilience. McKinsey asserted more cost-benefit analyses would solve most decision issues, while the World Bank has been notable for showing that roads are the engine of development in Africa.

Decision making is the focus of our approach. The progression from static vulnerability to dynamic adaptation-action spaces is a move from environmental assessment to decision making. The IPCC AR4 showcased the Act-Learn-Act again model, which is more broadly the realm of adaptive management.

Actors act in networks. The institutional literature in some senses starts with Ostrom's grammar of institutions and notions of decision spaces. Actor-network theory has a much longer tradition (and fertile ground for debate). Cultural theory, social learning, sociology of scientific knowledge and other schools of thought are relevant.

5 Recent articles on urban adaptation cover some of this ground. Stephen Tyler & Marcus Moench (2012): A framework for urban climate resilience, Climate and Development, 4:4, 311-326. http://dx.doi.org/10.1080/17565529.2012.745389. Anna Brown, Ashvin Dayal and Cristina Rumbaitis Del Rio (2012): From practice to theory: emerging lessons from Asia for building urban climate change resilience. Environment and Urbanization 2012 24: 531. DOI: 10.1177/0956247812456490. Jo da Silva, Sam Kernaghan & Andrés Luque (2012): A systems approach to meeting the challenges of urban climate change. International Journal of Urban Sustainable Development, Volume 4, Issue 2, 2012, pages 125-145. DOI:10.1080/19463138.2012.718279

Climate applications have their own logic. The climate adaptation literature has some fruitful insight, although much is very practical and not particularly well informed by social theory. Various stocktaking exercises rarely lead to better approaches.[6] Most inventories of adaptation options proliferate methods that are inadequate to the challenges of being both practical and transforming.[7]

Social entrepreneurs challenge the search for solutions. The grounding experience of people seeking solutions may well be the place to look for innovation.

[6] ProVia is the latest attempt to create a unitary guideline on vulnerability-impacts-adaptation methods. It moves well beyond the former notion of generic steps, using decision trees to construct representative research processes.

[7] For instance, the Kenya climate action plan has a long list of 'good things to do' but with little sense of timing, pathways or realistic requirements for investment decisions.

Item 5. Matric of actor-knowledge network and climate-impacts information

Actor-knowledge network				**Climate-impacts information**					
Drivers	**Actors**	**Stage**	**Benefits**	**Drivers**	**Geographic resolution**	**Temporal resolution**	**Trend**	**Impacts**	**Confidence**
Mainstreaming and planning	Individuals	Awareness	Avoided economic losses	Current vulnerability	Station	Event	Historical normal	Single variable	High, well established
Reorganisation	Collectives	Policy	Investment streams	Lower bound of emissions	Catchment	Month	Current expectation	Multi-stressor	Good, consensus
New window of opportunity	Parties of consensus	Project investment	Livelihoods	Middle range of trend	Country	Season to year	Medium term planning horizon	Complex causal chain	Fair, bounded
Post-disaster response	Parties in conflict	Operations	Health and welfare	Upper bound	Continent	Decade	Middle- to end of Century	Complex feedbacks	Poor, disputed
Urgent action required	Informal networks	Monitoring and evaluation	Lives saved	Explicit reference scenario	World	30-year normal	Beyond 2100	Tipping elements	Low, unknown