Framework for evaluating system-wide and sector-specific adaptation actions

Key Messages

- The framework presented in this paper aims to support the broadening of adaptation actions from a on-going focus on sector specific actions (e.g. infrastructures) to more system-wide actions (budgets, strategies, learning).
- The costs and benefits of system-wide actions are more difficult as their impact tends to be more indirect than sector-specific adaptation. The framework is based on the concept of adaptive capacity to support their better consideration in economic analysis.
- Three steps are proposed for evaluating system-wide adaptation: assessing adaptive capacity, appraising system-wide actions, and deciding on best action(s) to implement.

Context

Following the definition of UKCIP (2007) and IPCC (2014a), sector-specific actions are related to Delivering Adaptation Actions (DAA), e.g. coastal defences, flood defences, irrigation planning, reforestation, resource quotas. System-wide actions are related to Building Adaptive Capacity (BAC) actions, e.g. budget revisions, disaster response strategies, early warning systems, education, regulatory frameworks, tax reforms. It is the potential for under-representing the value of system-wide actions in the adaptation discourse that motivated the preparation of the decision-making framework presented in this Insight.

Policy and methodological developments

The structure of the conceptual framework builds upon the recent applications of benefit-cost frameworks to adaptation actions developed by Leary (1999), Ranger et al. (2010), and Willows and Connell (2003). In this framework, a decision maker is faced with a set of feasible adaptation actions in a given period. This set is determined by the adaptive capacity in that period. Adaptive capacity itself follows a dynamic process that depends upon the both endogenous and exogenous factors. Endogenous factors are those controlled by the decision maker i.e. system-wide actions implemented by the decision maker. Exogenous factors are those not under the decision maker’s control e.g. natural disasters that damage adaptive capacity.

The key steps in assessing system-wide adaptation are presented in the figure below. There are described in the next three sections.

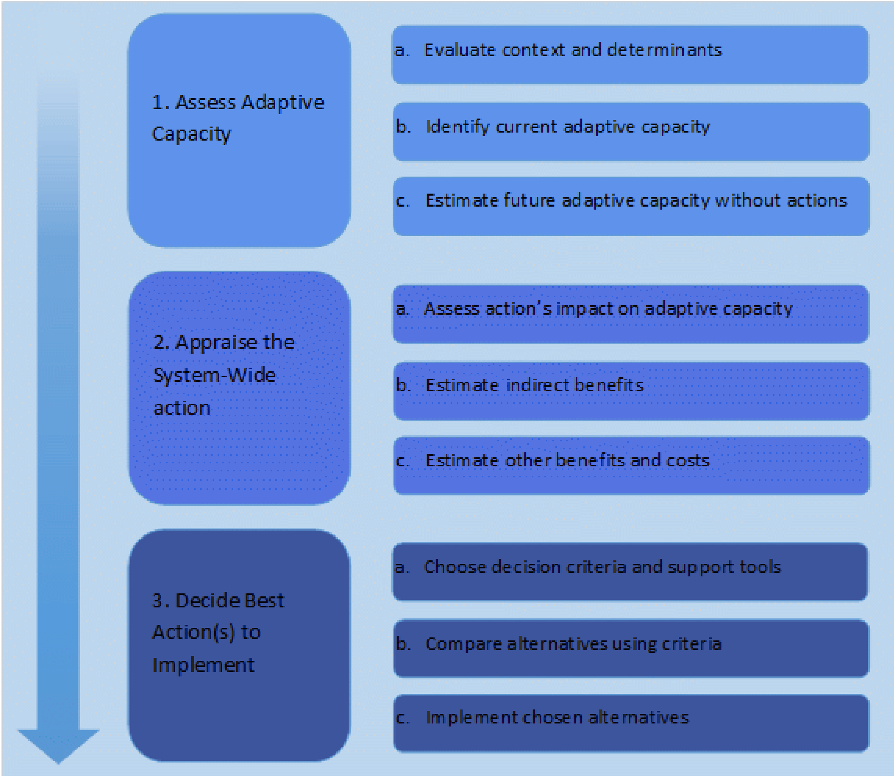

Figure 1: Three step process for evaluating a system-wide action relative to alternative adaptation actions.

1. Assessing adaptation capacity

Adaptive capacity must be assessed in order to determine how the system-wide action might affect it. Therefore, the resources and constraints of current adaptive capacity need to be evaluated (IPCC, 2014b). In addition, the processes by which adaptive capacity is determined need to be understood (Adger and Vincent, 2005). This will help the decision maker understand how their actions influence adaptive capacity, and in turn how they can target climate drivers. However, adaptive capacity is not an observable variable. As a result, proxies for adaptive capacity and climate risk vulnerability have traditionally been developed. However, these indices measure the outcomes of adaptive capacity in terms of vulnerabilities, and not adaptive capacity itself. Therefore, there are some limitations in using indices for the assessment of adaptive capacity in this framework.

In the conceptual framework, current adaptive capacity is defined as the set of feasible adaptation actions. Therefore, identifying current adaptive capacity requires the decision maker to understand which actions are feasible. As the name suggests, feasibility studies may be carried out to identify the current set of feasible adaptation actions. For example, the financial limitations posed by budgetary constraints could indicate whether an action is feasible or not. If the decision maker is aware of boundary for feasible adaptation actions, then they can implicitly determine current adaptive capacity. However, it is recognised that using feasibility studies to determine every feasible adaptation action may be resource intensive, given the potential number of actions. Therefore, feasible studies could target particular determinants of adaptive capacity, rather than adaptive capacity as a whole.

The determinants of adaptive capacity need to be assessed in order to understand the limits of current adaptive capacity and how adaptive capacity might change. It is also important to understand the interaction between these determinants, as highlighted by Tol and Yohe (2002, 2007) as well as exogenous factors on adaptive capacity.

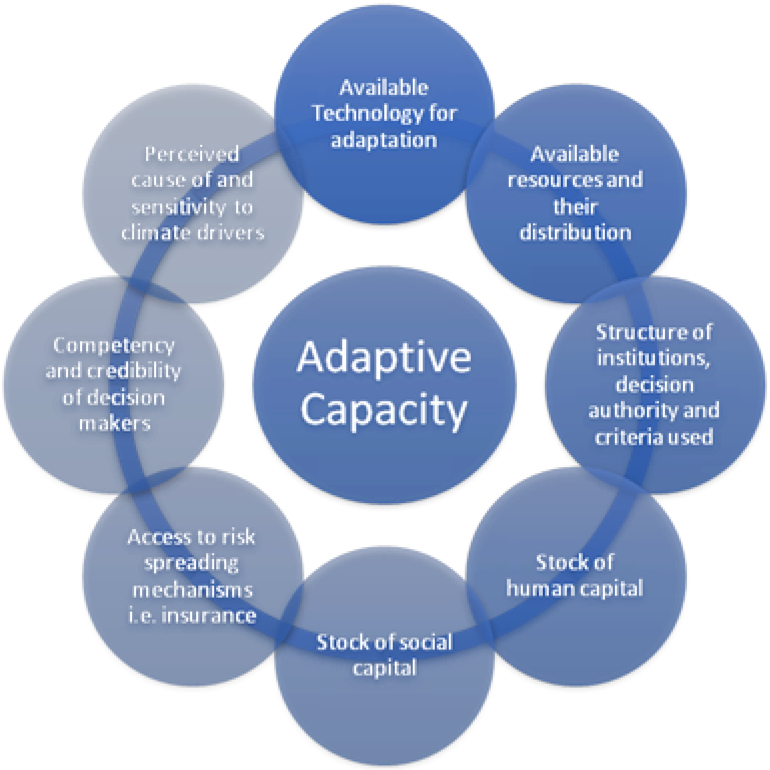

Figure 2: Possible determinants of adaptive capacity. Source: (Tol and Yohe, 2002)

2. Appraising system-wide actions

Once current and expected future adaptive capacity has been assessed, the next step is to appraise the system-wide action. This step looks to determine the benefits and costs associated with the system-wide action. However, there are several factors that make the analysis of the benefits and costs uncertain. These are:

1. The change in adaptive capacity attributed to the system-wide action;
2. The possible future climate and non-climate pathway; and,
3. The appropriate valuation techniques for the benefits and costs.

Factors 1 and 2 become increasingly uncertain for adaptation actions with longer time horizons. In addition, the complexity of human and natural systems makes it hard to assess these two factors. Factor 3 depends on whether market or nonmarket valuation techniques are appropriate to use, and what type of discount rates should be used.

Conceptually, the value chain attributed to the original system-wide action (a_1) (i.e. impact on adaptive capacity) will depend upon the type of adaptation actions it facilitates:

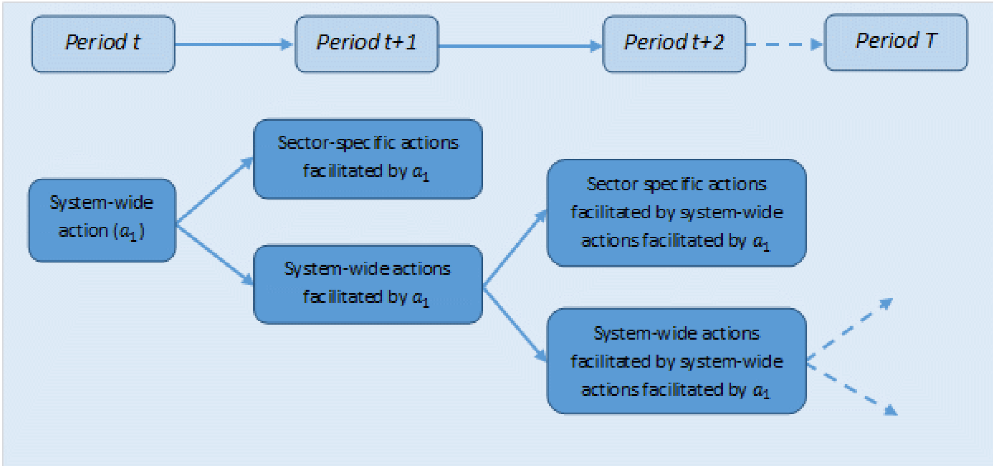

Figure 3: Adaptation actions facilitated by the system-wide adaptation action.

The change in adaptive capacity attributed to the system-wide action may be difficult to identify. This is because exogenous factors cloud the process by which adaptive capacity changes. This is a problem as it makes it hard to define the indirect benefits associated with system-wide actions). Decision maker should first evaluate how these exogenous factors are expected to impact adaptive capacity.

Following on from this, the decision maker should assess how the system-wide is expected to change adaptive capacity in light of these benchmark exogenous changes. If changes in adaptive capacity aren't deterministic, multiple scenario analysis may help the decision maker conjecture different possible changes in adaptive capacity related to exogenous factors (Ranger et al., 2010; Willows and Connell, 2003). From these benchmark scenarios, the impact of the system-wide action on adaptive capacity could be assessed. For example under SSP4, which stipulates that inequality dominates the future socioeconomic pathway, the decision maker may infer that adaptive capacity is expected to decrease (IIASA, 2012). In this pathway, the effectiveness of the system-wide action at building adaptive capacity may be constrained. Therefore, the decision maker needs to estimate how the system-wide action will impact adaptive capacity in light of the possible future pathways.

In addition, the future climate and non-climate pathway may be uncertain. This is a problem because the benefits and costs associated with an adaptation action are contingent on the realised future pathway. For example, the benefits of flood defences may be contingent on whether a high average rainfall or low average rainfall pathway is realised. Therefore, the decision maker may need to account for the benefits and costs in multiple future pathways using robust procedures.

3. Deciding on best action(s) to implement

Once the alternative adaptation actions have been formally evaluated, the final step handles the decision making process. The appropriate process to follow will depend on the decision making context e.g. risk or uncertainty. A clear decision making process will provide a strong platform for the comparison of alternative adaptation actions. In economic terms, this comparison can be based on the use of a number of economic criteria and assessment tools.

Decision criteria need to be distinguished from decision support tools. Decision criteria are the benchmark from which to evaluate the adaptation actions. The criteria used depend on the decision maker's objectives, preferences and context. For example, when the outcomes of alternative actions are directly comparable, a decision criterion with a single parameter can be used, e.g. expected utility or value. However, when the outcomes aren't comparable, a multiple criteria approach should be used (Willows and Connell, 2003). In contrast, decision support tools relate to the actual methods used to evaluate the actions. For example, the decision maker could use a combination of quantitative and qualitative analysis to reach conclusions about which adaptation actions best meet the chosen criteria. Therefore, decision support tools are the techniques used to assess adaptation actions relative to the decision criteria, such as cost-benefit analysis or real-option analysis.

Traditional support tools focus on decision making under risk, and follow optimisation procedures. However, because probabilistic climate information may be limited or unreliable, traditional optimisation procedures might not be relevant (Dessai and Hulme, 2004). Therefore, alternative robust tools for decision making under uncertainty may be applicable. The appropriate decision support tools used to compare alternative adaptation actions to the decision criteria is context specific. The ECONADAPT Policy-Led Framework provides a useful step-wise approach to selected the right assessment tools.

Once the chosen adaptation actions have been implemented, it is recommended that periodical monitoring and evaluation takes place (Ranger et al., 2010). This will inform the decision maker about the success or failure of an adaptation action. As a result, they may be able to correct any problems with the current implemented actions and learn about improving future adaptation actions.

Main implications and recommendations

Adaptation actions target climate drivers, by attempting to reduce vulnerability to climate risks and acting on climatic opportunities. The two categories of adaptation actions, sector-specific and system-wide, achieve these goals by different means; sector-specific actions directly target climate drivers, whereas system-wide actions indirectly target climate drivers. The framework provides a process that decision makers can follow in order to make reliable comparisons between these types of adaptation actions. It is hoped that this process will improve the representation of system-wide actions in the adaptation discourse.

The framework formally distinguishes between system-wide and sector-specific actions, and proposes to evaluate the indirect benefits associated with system-wide actions by assessing how they change adaptive capacity. In addition, the framework accounts for the problem of additionality for both system-wide and sector-specific actions. By categorising the benefits and costs of adaptation actions into groups relating to both climate and non-climate drivers, decision makers can identify how different objectives are targeted by adaptation actions.

An application of the framework to the system-wide action of developing new climate change scenarios, and their impact on the decision maker's adaptation actions in response to flood risks is provided in the ECONADAPT report: Framework for the evaluation of system-wide adaptation actions relative to sector-sepcific adaptation actions. By accounting for the indirect benefits that the new scenarios provide, the evaluation shows how system-wide actions can be more reliably compared to alternative adaptation actions. As a result, the possibility of maladaptation is reduced.

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Further Information
Framework for the evaluation of system-wide adaptation actions relative to sector-sepcific adaptation actions (D2.1) [pdf]
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