TECHNICAL BRIEF

ON DECISION-MAKING FRAMEWORK FOR CARBON PRICING IMPLEMENTATION IN ASIA

About UNDP

UNDP's work on climate change spans more than 140 countries and involves US$3.7 billion in investments in climate change adaptation and mitigation measures since 2008. With the goal to foster ambitious progress towards resilient, zero-carbon development, UNDP has also supported implementation of the Paris Agreement on Climate Change by working with countries on achieving their climate commitments or Nationally Determined Contributions (NDCs).

About the Climate Finance Network

The Climate Finance Network team of the UNDP Bangkok Regional Hub comprises experts specializing in SDG Finance, Governance, Development Finance and Political Economy, Climate Change, Public Financial Management and Development Effectiveness.

The programme catalyzes sustainable climate related financing. It promotes self-sufficiency of development finance within country public financial management systems- both of which are keystones in achieving the goals of the 2030 Agenda.

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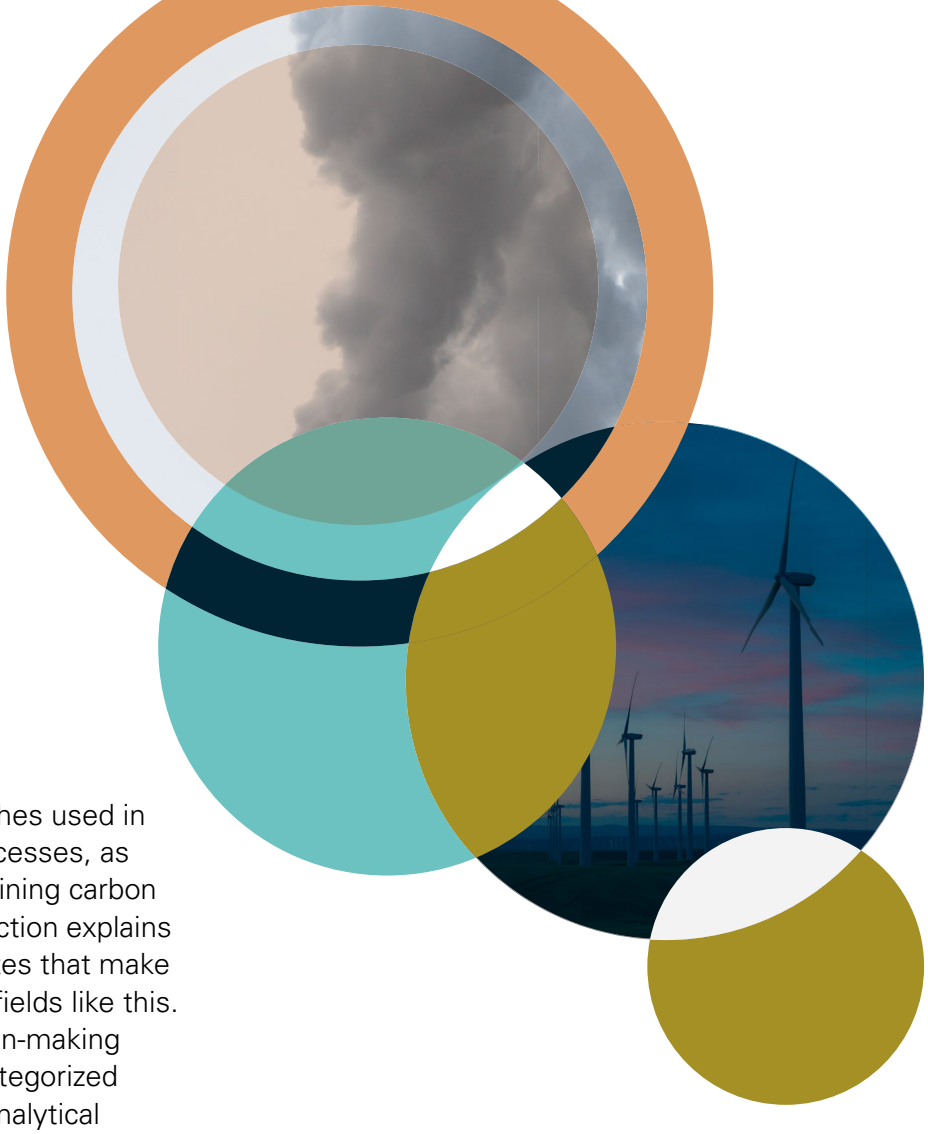


Abstract

This paper discusses approaches used in complex decision-making processes, as well as their application in defining carbon pricing strategies. The first section explains which are the intrinsic attributes that make decision making complex for fields like this. In the second section, decision-making approaches are presented, categorized according to their degree of analytical complexity and interaction. Next, examples of each of these approaches are discussed in the context of carbon pricing strategies.

The core choice here is of course the carbon pricing instrument, weighing e.g. economic and social pros and cons of different options as well as political economy considerations, impact on gross domestic products, and last but not least impact on emissions trajectories. 'Subsidiary' choices would include in which sectors to apply each instrument, or over what timeframe. This is meant to serve governments who are currently embarking on carbon pricing policies where wide-reaching decisions have to be taken, as is the case e.g. for the Indonesian MoF's recent announcement of a carbon tax.

When discussing 'decisions', the paper usually refers to decisions between instruments, the sectors in which these can be applied, or the level to be chosen of e.g. a tax. When the paper discusses 'alternatives', it means choices or options among these different instruments, sectors, or levels.

It should be noted that the authors are aware of the limits of focusing on pricing instruments alone, and that a more comprehensive view of the decisions facing policymakers in this context would include e.g. the design of relevant regulations or standards; and about the effective recycling of revenues and offsets to address distributional and other impacts.

Finally, in light of the sometimes dramatic conclusions of the recently released IPCC AR6, a more comprehensive view of the decisions facing policymakers would include those about the level of ambition in designing any instruments with which a country plans to respond to the climate change challenge.

1

ATTRIBUTES OF COMPLEX DECISIONS OVER CARBON PRICING INSTRUMENTS

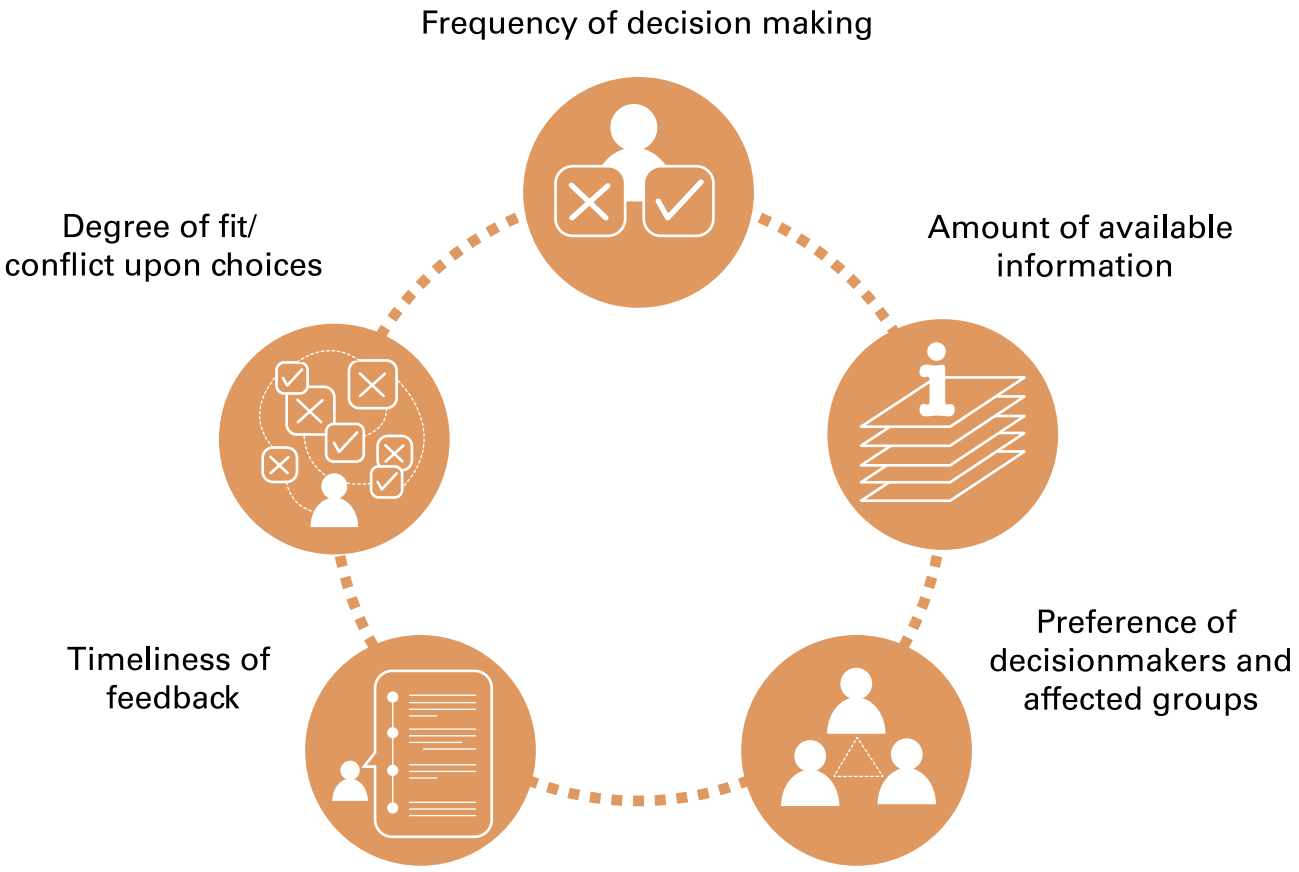
Using and implementing carbon pricing instruments is a complex task. Five attributes characteristic of the complex nature of decision making can be distinguished and applied to this field: the amount of information available, the frequency of decision making, the degree of fit or conflict between alternatives, the timeliness of feedback and the preference of decision makers and affected groups.[1]

Having all the necessary information is not always possible. This condition makes the understanding of the challenges more tedious, involves the collection of new data and, particularly in cases where the information is neither accessible nor possible to acquire, makes the use of scenarios necessary; both to be able to interpret the conditions to which the solution is being sought, and to be able to review the performance of the proposed solutions. The use of scenarios naturally leads to the use of sensitivity analysis, given the need to corroborate the relevance of the scenarios proposed. Working in this way paradoxically leads to the solution space diverging so much that there is now too much information in the solution space that requires more frequent decision making to make the solution space converge.

Additionally, when it comes to proposing alternatives, the lack of information (more precisely: lack of quality input data) plays a serious role, since it is more complex to define the solutions/alternatives at a more detailed level. Consequently, it is very easy to end up with alternatives that are either very similar or very different. In the first case, at the moment of evaluating them, it is difficult to differentiate them, and a higher level of detail is necessary, which also implies obtaining more information. In the second case, it is likely that the alternatives are so different from each other that they end up being conflictingly complementary, i.e., one alternative offers something that the other does not and vice versa and combining them may not be so easy or may reduce the performance that each one has on its own. This leads to even more decisions to be made. The timeliness of the feedback to be provided will then depend very much on how differentiable, evaluable, and appropriate the alternatives are.

[1] Richard H. Thaler and Cass R. Sunstein, Nudge: Improving Decisions about Health, Wealth, and Happiness, Nudge: Improving Decisions about Health, Wealth, and Happiness (New Haven, CT, US: Yale University Press, 2008).

In addition, decision making is a subjective activity regardless of the methodology and objectivity that may be involved in the process. This means that the decisions to be made will depend very much on the preferences of the decisionmakers and the affected groups. This may result, for example, in conflicting preferences, where the alternative preferred by the decisionmakers is not precisely the alternative preferred by the affected groups. Likewise, the decisionmakers' choice may be biased by various a priori interests.



2

ANALYTICAL COMPLEXITY VS DEGREE OF INTERACTION

In decision making processes, four main approaches can be distinguished:

- **Quantitative approaches**

  have a strong focus on models and quantitative analyses and usually represent few interactions with strategic decisionmakers.

- **Analytical-interactive approaches**

  use analytical models as starting point to foster 'strategic discussions.' They offer possibilities to provide 'strategic' room for top-level decisionmakers. Likewise, they provide transparent inclusion of stakeholder opinions.

- **Deliberative approaches**

  use little or no technical analysis and have a strong focus on exchange, deliberation, and communication between stakeholders.

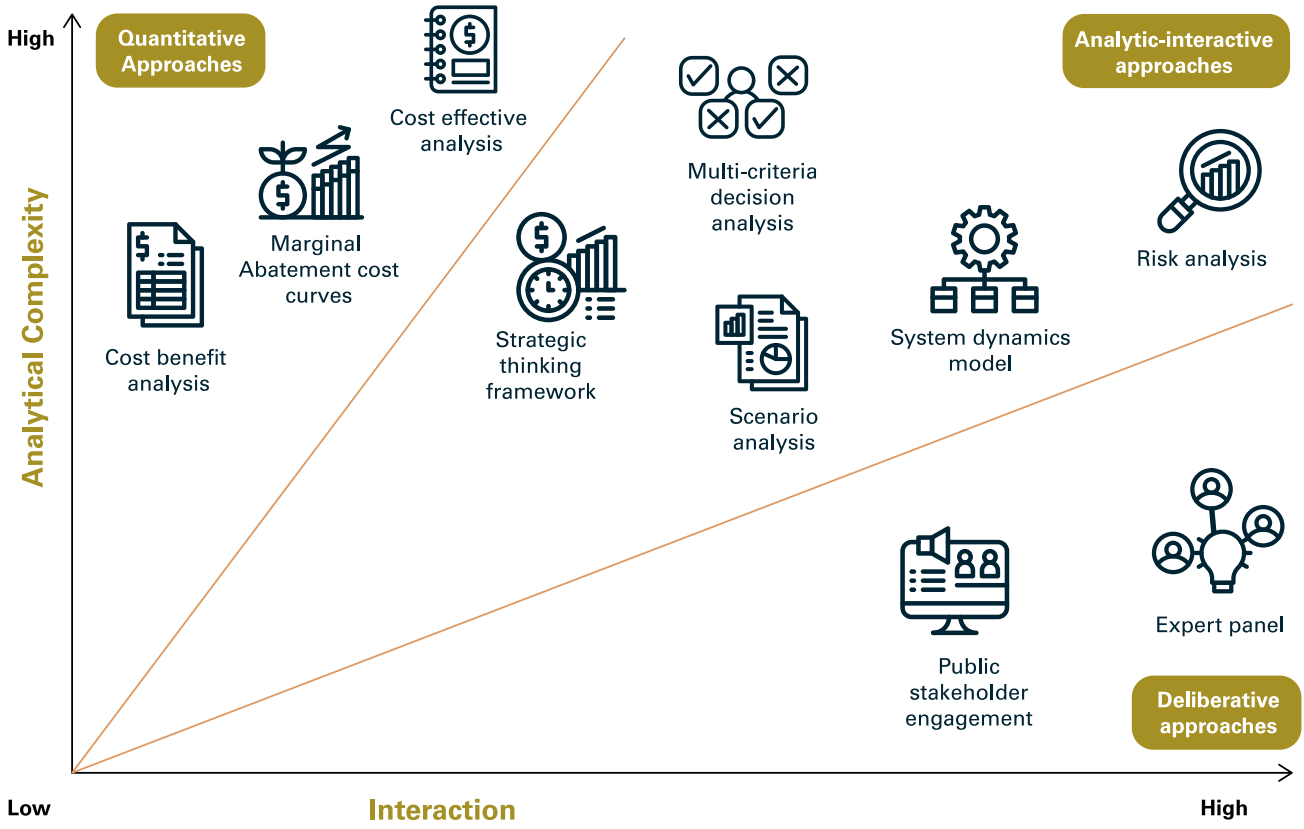
- **Ad - hoc decision making**

  is related to infrequent, low-stakes decisions, that involve both little or no use of technical analysis and few interactions between stakeholders.[2,3] As this represents no complex decision method per se, it is only mentioned here for the sake of completeness and will not be further analysed below.

The different approaches can be categorized according to their level of analytical complexity and their level of interaction between stakeholders. On the one hand, from the perspective of analytical complexity, quantitative approaches are the most complex, followed by interactive analytical approaches and deliberative approaches over carbon pricing. On the other hand, from the perspective of the level of interaction between and with stakeholders, the order is completely the opposite. Given its nature, ad hoc decision making is peculiarly lacking in analytical complexity and involves little interaction with most stakeholders.

[2] Aaron De Smet, Gerald Lackey, and Leigh M. Weiss, "Untangling Your Organization's Decision Making," McKinsey Quarterly, June 21, 2017, https://www.mckinsey.com/business-functions/organization/our-insights/untangling-your-organizations-decision-making#.

[3] Hanna Hart, "The Four C's Of Decision-Making," Forbes, May 21, 2021, https://www.forbes.com/sites/hannahart/2021/05/21/the-four-cs-of-decision-making/.


High
Quantitative Approaches
Analytic-interactive approaches
Analytical Complexity
Cost effective analysis
Multi-criteria decision analysis
Risk analysis
Marginal Abatement cost curves
Cost benefit analysis
Strategic thinking framework
System dynamics model
Scenario analysis
Expert panel
Public stakeholder engagement
Deliberative approaches
Low
Interaction
High

3

APPLYING QUANTITATIVE APPROACHES TO DECISION-MAKING OVER CARBON PRICING OPTIONS IN ASIA

In the following, we consider how each of the four approaches can be applied to decision-making over carbon pricing options in Asia; and consider one concrete example

3.1 Cost-Benefit Analysis:

Cost–Benefit Analysis (CBA) refers to the evaluation of alternatives according to their costs and benefits when each is measured in monetary terms. CBA can be used to estimate or evaluate the value against the cost of a decision, project, policy. CBA is a powerful economic tool to inform responsible decisions and help government choose policies and projects. In selecting from among several alternatives, one would choose that particular one that had the highest benefit-cost ratio.

CBA process generally includes – to specify options, decide costs and benefits, select measurement, predict the impact, monetise impact, discount future costs and benefits, compute the net present value, perform sensitivity analysis and reach a conclusion.

Application to decision-making over carbon pricing options in Asia:

CBA might be applied when looking at a proposed carbon tax / carbon finance measure. The tax / measure has cost in terms of design (ie, conceptualizing such a measure), implementation / administration (ie, actually applying such a measure), supervision (ie, enforcing such a measure and monitoring it), … but has benefits in terms of government revenue and / emissions reduction, which CBA would compare against each other[4].

[4] Ginés de Rus, Introduction to Cost-Benefit Analysis: Looking for Reasonable Shortcuts (Edward Elgar Publishing, 2010).

Pros and Cons:

Pro: CBA enjoys widespread acceptance as a methodology, and the skills to apply it are available in any country. CBA is also widely understood among stakeholders, making its implementation easier from a political economy perspective.

Con: CBA only tells us strictly the financial costs and benefits of a project, and nothing about more complex issues like broader economic, distributive or dynamic effects from the project. Using CBA also tends to aggregate all costs and benefits, making it hard to distinguish gender and social inclusion effects.

Example in the carbon pricing context in Asia: the cost of designing, administering, and enforcing complex Environmental Tax Arrangements in Indonesia (motor fuel tax, vehicle tax, …) vs direct financial benefits in terms of tax revenues. Obviously CBA would also have to be applied diligently in the current design of Indonesia's carbon tax.

Where on the globe this method has already been applied in the climate (or broader environmental) arena (Box 1):

Box 1: Cost-Benefit Analysis of Humanitarian Aid and Resilience Building in Africa

A USAID study for Kenya, Ethiopia and Somalia measured how effective humanitarian aid is in building (climate-) resilience compared to the costs it represents and the losses avoided.

The study uses Household Economy Analysis (HEA) to model the potential impact of different response scenarios. HEA as a method focuses on determining how shocks may affect a given population, based on how people in different socio-economic circumstances get the food and money they need to survive and prosper, and the options available to them in times of crisis.a[1]

[1] Laura Swift, "Household Economy Analysis," Common Approaches (Save the Children, 2018), https://www.heacod.org/fr-fr/Published%20Reports/Household%20Economy%20Analysis_Package21032018.pdf.

54 livelihood zones with a total of about 15 million people were modelled in the three countries combined. The analysis provides an estimate of the total costs of implementing four different scenarios over 15 years in these zones:[2]

- Late humanitarian response: including response costs and losses associated with humanitarian response that arrive after negative coping strategies have been deployed and prices of food and other items have already begun to destabilize.
- Early humanitarian response: including the costs of response, as well as the reduction in humanitarian need and avoided losses.
- Safety net: adding a transfer to the early response, meaning an increase in income provided to the poorest, equivalent to the country's existing safety net transfer.
- Resilience Building: including an increase in household income due to the result of resilience building programs.

Total net costs with benefits include the costs of humanitarian aid, development program investment costs, increased income and avoided losses. The figure below shows the total net costs with estimated benefits for the four scenarios.

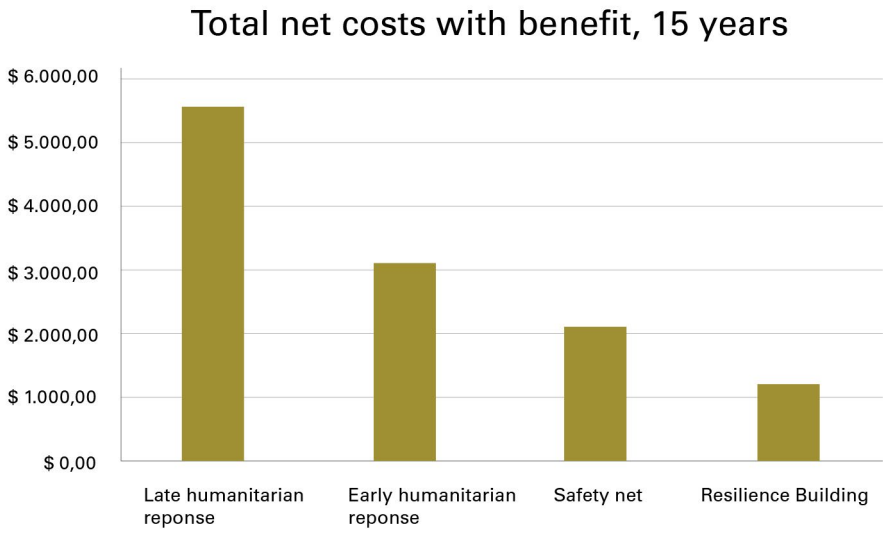


Figure 1: Total net costs with benefits over 15 years for the four scenarios modelled. Adapted from Courtenay Cabot Venton, "Economics of Resilience to Drought" (USAID, 2018).

The benefits have been defined as avoided humanitarian aid costs plus avoided losses. When comparing the costs of investments against these benefits, the ratio of benefits to costs ranges between 2.3 and 3.3. The results also indicate that donors could save about 30% of the costs involved in humanitarian aid if more proactive, preventive, and early responses are put in place, rather than corrective measures. Thus, investing in resilience would make communities more able to withstand the effects of climate shocks, while allowing for better allocation of resources to other areas or other needs. [3]

[2] At a discount rate of 10% to estimate the net present cost of each scenario.

[3] Courtenay Cabot Venton, "Economics of Resilience to Drought" (USAID, 2018).

3.2 Cost-Effectiveness Analysis:

Cost-Effectiveness Analysis (CEA) is a form of economic analysis that compares the relative costs and outcomes (effects) of different courses of action. CEA is distinct from CBA which assigns a monetary value to the measure of effect. One cannot compare alternatives with different goals nor can one make an overall determination of whether a policy or program is worthwhile in an absolute sense.

Application to decision-making over carbon pricing options in Asia:

CEA might be applied when looking at a proposed carbon tax/ carbon finance measure. The tax / measure has cost in terms of design, implementation / administration, supervision, … but also has benefits in terms effectiveness that cannot be quantified, such as certain health benefits that are hard to quantify (e.g. quality of life effects).[5]

Pros and Cons:

Pros: CEA augments cost-benefit analyses by 'effectiveness' where the benefits of the project are hard to establish in monetary terms.

Cons: There are persistent controversies around the right methods for quantifying effectiveness.

Example in the carbon pricing context in Asia: the cost of designing, administering, and enforcing complex Environmental Tax Arrangements in Indonesia (motor fuel tax, vehicle tax, …) vs indirect financial benefits in terms of reduced health costs from respiratory diseases.

Where on the globe this method has already been applied in the climate (or broader environmental) arena (Box 2):

[5] Henry M. Levin and Patrick J. McEwan, Cost-Effectiveness Analysis: Methods and Applications (SAGE, 2000).

Box 2: Environmental cost-effectiveness analysis in intertemporal natural resource policy: Evaluation of selective fishing gear

For most decisions involving natural resources, it is difficult to measure the results of a particular policy in monetary units. This is also the case with the development of a new policy for recovery plans for several endangered fish species in the North Sea. The main problem in this fishery is bycatch that must be discarded.

Therefore, policymakers evaluate different mesh sizes for nets used by fishing trawlers that have a less negative impact on the bycatch. Previous studies have shown that two different gear types used in trawl fisheries can improve bycatch stock size and composition:

1. 90-mm codend with a 120 mm mesh panel and
2. 90-mm codend with 35 mm between bars and 80 mm between bars in different sections of the net.

The policy should consider the following:

1. stock biomass that exceeds current levels (and if so, whether a longer time horizon should be considered, perhaps infinity or a future equilibrium, e.g., ten years)
2. improved composition of age classes in a stand
3. an improvement in the biomass of several stocks.

By conducting a CEA, policymakers can identify the best mesh size among alternatives that achieve the objective at the lowest cost. The result of applying CEA to conservation measures in fisheries is a cost-benefit ratio that is a measure of the cost per physical (non-monetary) unit change in the fish stock of concern (referred to as impact). Thus, CEA has the advantage of measuring the impact of a policy alternative.

Because it significantly reduces harvests for most of the species of concern, resulting in large net negative benefits, the analysis concludes that 35/80mm may be as good or more cost-effective a means of improving bycatch biomass than the 120 mm mesh panel gear, depending on how impacts (i.e., intangible benefits) are defined.

However, this gear may not be used because it has a high net negative benefit that can have significant and severe impacts on fishing vessels.

However, the analysis provides a new insight that the same impact can be achieved at a lower cost if the net is introduced to a portion of the fleets, if scaling is possible. This suggestion is interesting and has previously not been considered by policymakers.[1]

[1] Lone Grønbæk Kronbak, Niels Vestergaard,Environmental cost-effectiveness analysis in intertemporal natural resource policy: Evaluation of selective fishing gear,Journal of Environmental Management, Volume 131, 2013, Pages 270-279, ISSN 0301-4797, https://doi.org/10.1016/j.jenvman.2013.09.035.

3.3 Marginal Abatement Cost Curve:

Marginal Abatement Cost Curve (MACC) is a tool that provides a succinct visualization of various emission reduction options or measures organized by a single metric: the economic cost of emission reductions.

MACCs are divided into discrete "blocks," with each block representing an individual option or a set of similar carbon reduction options. The width of each block represents the potential emissions abatement that the option may offer in a given year, compared to business as usual. The height of each block represents the average net cost of reducing one ton of CO2eq (carbon dioxide equivalent) by that option during that year.

Usually, the blocks are placed in such a way that the lowest cost measures, which may represent a net cost savings (negative $/tCO2eq), are shown first on the left, while the next highest cost measures are placed on the right.[6,7]

Application to decision-making over carbon pricing options in Asia:

MACCs are useful for informing decisions on carbon emission reduction opportunities by comparing a wide range of measures from various sectors in equivalent terms. Accordingly, MAC curves serve as an initial framework and identification of where abatement opportunities are potentially greatest and most cost-effective in achieving modest reductions in the short to medium term. In this sense, MAC curves are a good starting point for further discussion and analysis, with consideration of other relevant dimensions and appropriate policy options to leverage the potential of each measure.[8]

Pros and Cons:

Pros: the MACC allows for a comparison between different sectors through the use of a single metric.

Cons: the MACC fails to capture interactions between measures and across sectors.

Example in the carbon pricing context in Asia: in the context of various countries carbon pricing plans, MACC would allow to identify the marginal costs of different abatement options in each sector and thereby allow companies in that sector to meet emissions reductions effectively.

Where on the globe this method has already been applied in the climate (or broader environmental) arena (Box 3):

6 Climate Works Australia, "How to Read a Marginal Abatement Cost Curve," ClimateWorks, Resource Hub, accessed November 2, 2021, https://www.climateworksaustralia.org/resource/how-to-read-a-marginal-abatement-cost-curve/.

7 Kevin Tempest, "Understanding Carbon Reduction: Marginal Abatement Cost Curves," Plan Washington, January 13, 2016, https://planwashington.org/blog/archive/understanding-carbon-reduction-marginal-abatement-cost-curves/.

8 Evolved Energy Research, "Marginal Abatement Cost Curves for U.S. Net-Zero Energy Systems: A Systems Approach" (Environmental Defense Fund, August 2021), https://www.edf.org/sites/default/files/documents/MACC_2.0%20report_Evolved_EDF.pdf.

Box 3: MACC for Romania's Low Carbon Growth Strategy

Romania's national program for the integration of climate change mitigation and adaptation measures for attaining the Europe 2020 Strategy was implemented jointly by the World Bank and the Romanian Ministry of Environment and Climate Change.

Component C of this program was focused on the development of an analytical and knowledge base on low carbon green growth for policy simulations and decision making. Within component C, an analysis of mitigation opportunities using MACCs was conducted for selected key sectors based on sectoral analysis and modelling, namely power supply, energy efficiency, transport, agriculture, and forestry.

The analysis using the MACC showed that the implementation of green actions in all sectors would reduce the country's emissions by 38 Mt CO2 eq by 2050, an equivalent of 23% reduction compared to the baseline. The most beneficial opportunities are in the energy efficiency sector, which combine both high abatement potential and mostly negative costs (savings). In addition, measures associated with energy supply offer the most abatement, but with low to mid-range costs.[1]

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[1] Ministry of Environment, Waters and Forests and The World Bank, "Marginal Abatement Cost Curve Analysis," Dissemination Note, Romania: Toward a Low Carbon and Climate Resilient Economy, March 30, 2015, https://openknowledge.worldbank.org/bitstream/handle/10986/24065/Romania000Towa00cost0curve0analysis.pdf?sequence=1&isAllowed=y.

4

APPLYING ANALYTIC-INTERACTIVE APPROACHES TO DECISION-MAKING OVER CARBON PRICING OPTIONS IN ASIA

4.1 Cost-Benefit Analysis:

The purpose of a risk analysis is to provide information to help make better decisions in an uncertain world. The risk analysis process mainly includes risks identification, and modelling/analysing the risk problems and making appropriate decisions. There are various software tools and models can be used – spreadsheets, influence diagrams, event trees, decision trees, fault trees, and discrete event simulation. The calculation methods include calculating moments, exact algebraic solutions, numerical approximations, Monte carlo simulation, etc.

Pros and Cons:

Pros: climate change risk assessment is one of the most important tools in making decisions regarding climate change.

Cons: the relevant data e.g. on climate change impacts and associated risks sometimes not available at highly detailed geographic or temporal scale.

Application to decision-making over carbon market options in Asia:

This would cover e.g.

- Gauging the risk of mitigation inaction: e.g. if certain sectors of the economy do not engage in mitigation planning today, they may be severely 'punished' by future international mitigation regimes, or may lessen their ability to export their products to markets where GHG emissions intensity strongly features in consumers' purchasing choices (aided e.g. by labelling systems).
- The double dividends between certain types of mitigation action with lowering climate impact risk. E.g. enhancing forests as carbon sinks (which is a mitigation action) can also be an adaptation action (e.g. for erosion control, or (mangroves).[9]

Example: Fiji REDD+ to enhance national forest-based carbon balance by supporting and strengthening initiatives that address delivers of forest-based carbon emissions

[9] David Vose, Risk Analysis: A Quantitative Guide (John Wiley & Sons, 2008).

and encourage drivers of forest-based carbon sinks. Combine with strengthening role of forests in climate impact risk management (see e.g., Agrawal et al 2003 on role of mangroves in Fiji in protecting against coastal erosion and storm surge damages).

Where on the globe this method has already been applied in the climate (or broader environmental) arena (Box 4):

Box 4: UK's Climate Change Risk Assessment

The UK Climate Change Committee annually publishes the UK's Climate Change Risk Assessment (CCRA). The aim of this analysis is to provide a tool for assessing the relative importance of the different risks posed by climate change to the UK and to provide an anchor point for the government's national adaptation program (NAP).

In the third cycle of the UK CCRA (CCRA3) emphasis has been placed on estimating the economic and social value of risks and opportunities of climate change in monetary terms. A common metric (GBP) is used to compare impacts within and between different sectors (natural environment, infrastructure, health, communities and built environment; business and industry; international). Thus, all relevant costs and benefits that influence the welfare and well-being of the population are included, such as cultural, environmental, health, social care, justice and security effects.

The analysis showed that a relevant number of known climate hazards have a very high aggregate economic cost (in £ billions per year), even by mid-century. The greatest risks are associated with flooding due to overflowing rivers, surface water and sea level rise. Also included as major risks are the impact of heat on health, wellbeing and energy demand for cooling. In addition, it was found that there is a clear difference in the economic cost associated with 4°C versus 2°C future.[1]

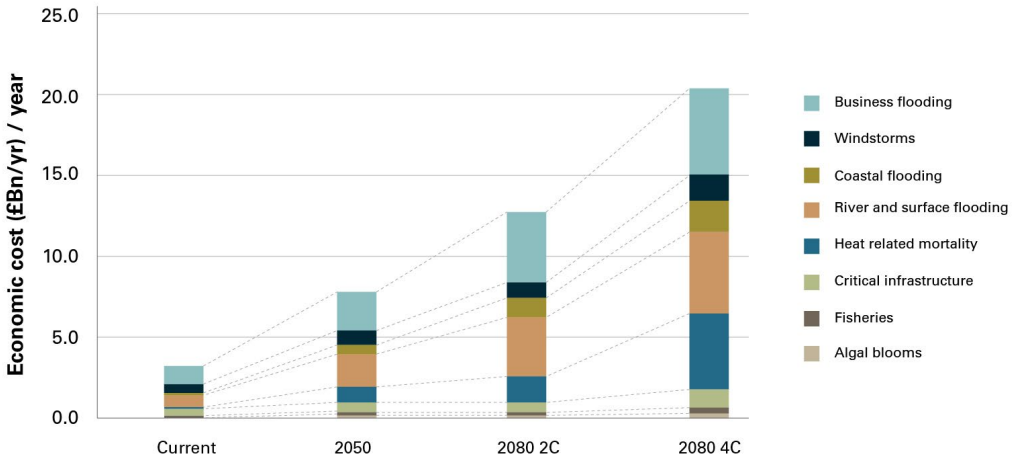

Figure 2: Annual economic costs of climate change in the UK (£ Billion) for selected risks. From Paul Watkiss et. al., Monetary Valuation of Risks and Opportunities in CCRA3, (Paul Watkiss Associates, 2021)

[1] Paul Watkiss et. al., Monetary Valuation of Risks and Opportunities in CCRA3, (Paul Watkiss Associates, 2021)

4.2 System Dynamics Modelling:

System Dynamics is a computer-aided approach for strategy and policy design. It uses simulation modelling based on feedback systems theory and is an analytical approach that complements systems thinking. It applies to dynamic problems arising in complex social, managerial, economic, or ecological systems — literally any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality.

Pros and Cons:

Pros: System Dynamics is one of the best tools to introduce dynamic effects of decisions / interactions between decisions.

Cons: System Dynamics remains a little known tool, with few experts worldwide and some of the relevant software (e.g. 'Vensim') still a little rudimentary from user friendliness perspective. This makes policy decisions based on System Dynamics arguments poorly understood among the wider population, and thus hard to implement from a political economy perspective.

Application to decision-making over carbon market options in Asia:

A key consideration here would be to choose the various carbon tax / carbon finance instruments in a way that they are reinforcing and not balancing.[10] In reinforcing instruments, an investment in one ultimately also leads to greater effect from another instrument. In balancing instruments, an investment in one leads to a lesser effect from another instrument.

Example: The greater the application of VERRA 's VCS in Cambodia, the greater the credibility of the emissions reduction projects that are certified against the VCS rules…which in turn increases the demand for VCS-certified emissions reduction projects.

Where on the globe this method has already been applied in the climate (or broader environmental) arena:

India - The Bhakra Beas Management Board (BBMB) in Northern India manages the recurring droughts and floods of the North Indian States. In order to effectively manage and supply water, the BBMB used a Real-Time Decision Support System, which dynamic information to receive up-to-date information on the state of water to inform their decisions on water management and allocation.[11]

Global – (Box 5).

[10] Donella H. Meadows, Thinking in Systems: A Primer (Chelsea Green Publishing, 2008).

[11] DHI Group: "Improving Water Management in North India: Using a real-time DSS to support sound water management decisions" (DHI, 2014)

Box 5: Climate Modelling for Decision Support

At the global level, officials and policymakers that are party to the UNFCC use a System Dynamics Model called C-ROADS (Climate Rapid Overview and Decision Support).[1] The development of C-ROADS was based on the recognition that negotiators and policymakers lack the capability to assess the impact of greenhouse gas (GHG) emissions reduction proposals offered by the parties on warming and the climate.

The climate is a complex dynamical system driven by multiple feedback processes, accumulations, time delays and nonlinearities, but research shows poor understanding of these processes is widespread, even among highly educated people with strong technical backgrounds. Existing climate models are opaque to policymakers and too slow to be effective either in the fast-paced context of policy making or as learning environments to help improve people's understanding of climate dynamics. C-ROADS fills this gap by providing a transparent, intuitive policy simulation model that provides policymakers, negotiators, educators, businesses, the media, and the public with the ability to explore, for themselves, the likely consequences of GHG emissions policies. The model runs on an ordinary laptop in seconds, offers an intuitive interface and has been carefully grounded in the best available science.

[1] John Sterman et al, "Management flight simulators to support climate negotiations." Environmental Model 44 (2013), 122 – 135.

Multi-Criteria Decision Analysis:

Multiple-criteria decision analysis (MCDA) or multiple-criteria decision-making (MCDM) is concerned with structuring and solving decision and planning problems involving multiple criteria. It explicitly evaluates multiple conflicting criteria in decision. Typically, there does not exist a unique optimal solution for such problems and it is necessary to use decision-makers' preferences to differentiate between solutions. Various methods and software are developed for different areas.

Pros and Cons:

Pros: MCDA is a highly effective tool at 'breaking down' complex decisions.

Cons: to be used effectively, MCDA requires a moderator.

Application to decision-making over carbon market options in Asia:

Structure complex decisions of mitigation actions and carbon finance instruments by enabling decision-makers to weigh and rank relevant criteria.[12] For instance, when engaging in fossil fuel subsidy removal, criteria to be weighed and ranked include short-term negative economic effects on certain sectors of the economy and certain groups in society; the amount of public backlash that is to be expected; or the amount of funding freed up to the government from the subsidy removal for other purposes.

Example: weigh and rank decision criteria between cap and trade vs carbon tax (cap-and-trade provides more certainty about amount of emissions reductions but little certainty about emission, as these are set by emissions trading market; carbon tax provides certainty about price but little about emissions reductions and is easier to implement).

Where on the globe this method has already been applied in the climate (or broader environmental) arena (Box 6):

Box 6: Multicriteria Analysis for Identification of Flood Vulnerable Areas in Nigeria

Floods represent a special type of natural disaster, due to the high costs associated with property damage, social and economic disruption in communities, as well as deaths and injuries resulting from natural disasters. In particular flooding due to river overflows has become an increasing natural hazard. In light of this, the need has arisen to identify and evaluate the determinants of the flood vulnerability of an area, in order to be able to make relevant decisions at the planning and management level. This also implies that techniques capable of covering the complexity of the issue have to be implemented.

In this context, a study conducted by the University of Nottingham and University Putra Malaysia investigated the application of multi-criteria evaluation in conjunction with GIS applications to analyse the flood vulnerability structure. The study used spatial multi-criteria evaluation techniques, pairwise comparison by analytical hierarchy process, AHP, and ranking method in order to determine the flood vulnerable areas in the Hadejia-Jama'are river basin in Nigeria. The main output of the study was a composite map showing the river basin areas categorized according to their vulnerability into low, medium, or high vulnerability zones.[1]

[1] Noordin Ahmad et al., "Multicriteria analysis for flood vulnerable areas in Hadejia-Jama'are River basin, Nigeria" European Journal of Scientific Research no. 42 (2010).

[12] Jyrki Wallenius et al., "Multiple Criteria Decision Making, Multiattribute Utility Theory: Recent Accomplishments and What Lies Ahead," Management Science 54, no. 7 (2008): 1336–49.

5

APPLYING DELIBERATIVE APPROACHES (STAKEHOLDER ENGAGEMENTS) TO DECISION-MAKING OVER CARBON PRICING OPTIONS IN ASIA

Pros and Cons:

Pros: deliberative approaches do not require prior training and no data, and are hence comparatively economics. They are inclusive by design, making it preferable over analytically complex (and less widely understood) decision mechanisms from a political economy perspective. Moreover, deliberative approaches are core in including gender and social inclusion considerations in decision making.

Cons: deliberative approaches have a very limited analytical basis.

Application to decision-making over carbon market options in Asia:

When deciding on introducing carbon pricing in principle, decision makes should gauge the size of various costs of inaction, and highlight these. For instance, where economic distortions from fossil fuel subsidies are strong, decisionmakers could quantify the burden in government spending from current fossil fuel subsidy levels, and the exact negative results for other areas the government would need to fund (e.g. quantify how many schools and hospitals could be built after phase-out of fossil fuel subsidy). Another example would be the innovation disincentives from the status quo, with distorted pricing mechanisms from fossil fuel subsidies hampering forward-looking investments like renewables).

Example: in case of Indonesia LPG subsidy removal, LPG subsidy was instead used for direct cash transfer. When negotiating with groups that are to be negatively affected by subsidy removal, negotiate with these stakeholders' temporary measures that help these groups adapt.[13,14]

Where on the globe this method has already been applied in the climate (or broader environmental) arena (Box 7):

[13] Patrik Söderholm, "The Deliberative Approach in Environmental Valuation," Journal of Economic Issues 35, no. 2 (June 1, 2001): 487–95, https://doi.org/10.1080/00213624.2001.11506383.

[14] Le Anh Nguyen Long, Megan Foster, and Gwen Arnold, "The Impact of Stakeholder Engagement on Local Policy Decision Making," Policy Sciences 52, no. 4 (December 1, 2019): 549–71, https://doi.org/10.1007/s11077-019-09357-z.

Box 7: Deliberative Agenda for Water Governance in the Mekong Region

The Mekong region is much more than the Mekong River and its basin. This region is a social, geographical, and historical construct comprising the territories and nations of Myanmar, Thailand, Laos, Cambodia, Vietnam, and the Chinese province of Yunnan. It is seen as a place abundant in natural resources, such as water, forests, biodiversity, minerals, and energy sources, which have enormous potential for wealth creation and well-being. However, the suitability of various development approaches is always debated among the different parties involved, arguing their lack of sustainability over time. Thus, throughout the region, the need for dialogue and negotiation involves much diplomacy and advocacy among multiple and varied stakeholders.

In this context, a study by the Australian National University and Charles Darwin University (Australia) describes the considerations and processes relevant to managing and reforming water governance in the Mekong region. Based on this, it then proposes a deliberative governance agenda based on constructive engagement through the promotion of inclusive and deliberative processes that emphasize different perspectives, critical analysis, social learnings, and institution-building while respecting risks, accounting for risks, recognizing responsibilities and fairly distributing rewards. It is envisioned that the implementation of this agenda will increase the likelihood of important development decisions around water resources being made as a result of negotiated and informed processes.[1]

[1] John Dore, "An agenda for deliberative water governance arenas in the Mekong", Water Policy (Oxford 2014)

Relevant data to be used for this could of the kind shown in the table below. The table shows the post-tax subsidies allocated in the three countries: Indonesia Fiji and Cambodia. The post-tax subsidy is the sum of the pre-tax subsidy, the tax subsidy, and monetary value of externalities not levied on consumers. The pre-tax subsidy is the difference between the price consumers pay and the cost of supplying the fossil fuel product. Indonesia and Fiji have allocated heavy fuel subsidies in the past which have accounted for large portions of the countries' GDP; 12.95 and 10.02, respectively. This is in stark contrast to Cambodia despite having a lower per capita income than both Indonesia and Fiji.

Post-tax Subsidies in 2017 [1] (Billion USD)			
	Indonesia	Fiji	Cambodia
Petroleum	89.57	0.08	-
Coal	23.13	0.27	0.30
Natural Gas	4.96	0.14	0.14
Electricity	13.87	-	-
Total (Billions USD)	131.52	0.49	0.44
Nominal GDP	1015.41	4.89	22.09
Post-tax Subsidies as a percent of GDP	12.95	10.02	1.98

6

CONCLUSION

To conclude, we consider for each of the approaches being analyzed here

- their respective prerequisites for implementations.
- what domestic capacity is likely available in-country.

It is important to note that our analysis of decision methods is agnostic of specific objectives a government might be pursuing in its carbon pricing efforts, but instead provides a broad range of available tools. If a government wants to use a specific lense for its analysis of carbon pricing choices, a particular subset of methods might be advisable. E.g., government entities wishing to look in particular at distributional impact of carbon pricing will get very limited insights from cost-benefits analysis, but more from methods discussed that can model broader (distributional) ramifications of the new policy, such as System Dynamics. Such a particular focus might also have to draw on specific additional methods for the focal area (e.g. for distributional issues this might include Social Accounting Matrices, Computable General Equilibrium Models, or even Microsimulation Models for comprehensive analysis of distributional effects at the micro level).

6.1 Cost-Benefit Analysis or Cost-Effectiveness Analysis:

Requires quality cost data, monetized benefit data (e.g. government revenues) in the case of CBA, and non-monetized effectiveness data (such as reduction in carbon emissions) in the case of cost-effectiveness analysis.

As these are widely used approaches, domestic capacity is likely already in place in all countries.

6.2 Risk Analysis:

Requires risk data, and strong quantitative and computing skills for advanced, complex quantitative risk assessment models (e.g., Monte Carlo Simulations)

At least basic skills likely available in country, as e.g., projects with international donors invariably require risk analysis.

6.3

System Dynamics:

Requires basic understanding of System Dynamics, and associated software like Vensim. Ultimately, each of the components of the System Dynamics model will have to filled with data that can indicate the magnitude of the effect of that element (e.g., how strongly one type of carbon market instrument may reinforce another).

Relevant skills very unlikely to be currently available in most of the countries being considered here as System Dynamics is a fairly rare modelling technique mostly applied in a handful of universities and research centers around the world.

6.4

Multi-criteria decision analysis:

Requires data on the carbon market options each country wants to consider, and data on factors influencing the choice among these (e.g., the weight decision makers put on factors influencing the choices among these instruments).

Relevant skills unlikely to be available in country but can relatively easily be brought in by an external facilitator.

6.5

Deliberative Approaches (Stakeholder Engagements):

Requires appropriate representation of relevant stakeholder groups, and a context in which these can meaningfully participate in such Stakeholder Engagement (e.g., by being capacitated on the topics under discussion). Relevant skills very likely to be available in-country in all countries.

7

ANNEX: SUMMARY TABLE

	Quantitative Approach	Pros	Cons	Application
1	**Cost Benefit Analysis (CBA)** Evaluation of alternatives according to their costs and benefits when each is measured in monetary terms. CBA can be used to estimate or evaluate the value against the cost of a decision, project, policy.	• Wide-spread acceptance as a methodology. • Skills available in any country. • Implementation easier from a political economy perspective.	• Only considers strictly financial costs and benefits. • Challenging to quantify non-market goods and complex impacts like economic, distributive or dynamic effects; tends to aggregate all costs and benefits, making it hard to distinguish gender and social inclusion effects. • Does not factor in risk-levels.	• CBA might be applied when looking at a proposed carbon tax / carbon finance measure. • Evaluate cost of designing, administering, and enforcing complex Environmental Tax arrangements in Indonesia (motor fuel tax, vehicle tax, …) vs direct financial benefits in terms of tax revenues.

2	**Cost-Effectiveness Analysis (CEA)** Economic analysis that compares the relative costs and outcomes (effects) of different courses of action. CEA is distinct from CBA which assigns a monetary value to the measure of effect. Cost effectiveness analysis is often considered to be most appropriate when a target has been agreed to and the issue is how to ensure the target is met at least total cost.	• Augments cost-benefit analyses by 'effectiveness' where benefits are hard to establish in monetary terms.	• Controversies around quantification of effectiveness (levelized cost of carbon vs other methods).	• Cost of designing, administering, and enforcing complex Environmental Tax Arrangements in Indonesia (motor fuel tax, vehicle tax, …) vs indirect financial benefits in terms of reduced health costs from respiratory diseases. • Cost effectiveness should not stand above other, more core objectives of carbon market objectives (e.g. amount of abatement).
3	**Marginal Abatement Cost Curve** Succinct visualization of various emission reduction options or measures organized by a single metric: the economic cost of emissions reductions.	• Comparison between different sectors, use of a single metric.	• Failure to capture interactions between measures and across sectors.	• Inform decisions on carbon emission reduction opportunities by comparing wide range of measures from various actors in equivalent terms.

	Analytic-Interactive Approaches	Pros	Cons	Application
4	**Risk Analysis** The purpose of a risk analysis is to provide information to help make better decisions in an uncertain world. The risk analysis process mainly includes risks identification, and modelling/ analysing the risk problems and making appropriate decisions. There are various software tools and models can be used – spreadsheets, influence diagrams, event trees, decision trees, fault trees, and discrete event simulation. The calculation methods include calculating moments, exact algebraic solutions, numerical approximations, Monte carlo simulation, etc.	• Climate change risk one of the most important tools in making decisions regarding climate change.	• Relevant data e.g. on climate change sometimes not available at highly detailed geographic or temporal scale.	• Gauging the risk of mitigation inaction: e.g. if certain sectors of the economy do not engage in mitigation planning today, they may be severely 'punished' by future international mitigation regimes (strong risk of stranded assets, ie fossil fuel reserves that are not usable if decarbonization targets are met), or may lessen their ability to export their products to markets where GHG emissions intensity strongly features in consumers' purchasing choices (aided e.g. by labelling systems). • The double dividends between certain types of mitigation action with lowering climate impact risk. E.g. enhancing forests as carbon sinks (which is a mitigation action) can also be an adaptation action (e.g. for erosion control, or (mangroves).

5	**System Dynamics** Computer-aided approach for strategy and policy design, using simulation modelling based on feedback sstems theory. Applies to any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality.	• One of the best tools to introduce dynamic effects of decisions / interactions between decisions.	• Little known tool, with few experts worldwide and software that is still rudimentary from UX perspective.	• Choose carbon pricing instruments in a way that they are reinforcing and not balancing.
6	**Multi-Criteria Decision Analysis** Concerned with structuring and solving decision and planning problems involving multiple criteria. Typically there does not exist a unique optimal solution for such problems and it is necessary to use decision-makers' preferences to differentiate between solutions.	• Highly effective tool at 'breaking down' complex decisions.	• To be used effectively, requires a moderator.	• Structure complex decisions on mitigation actions and carbon pricing by enabling decision makers to weigh and rank relevant criteria.
7	**Deliberative Approaches / Stakeholder Engagements** A range of interactive, non-analytical approaches inclusive of the relevant stakeholders engaged in or affected by a decision.	• Does not require prior data. • Inclusive by design	• Limited analytical basis.	• When negotiating with groups that are to be negatively affected by an aspect of carbon pricing, negotiate with these stakeholders the temporary measures that help these groups adapt.

UNDP is the leading United Nations organization fighting to end the injustice of poverty, inequality, and climate change. Working with our broad network of experts and partners in 170 countries, we help nations to build integrated, lasting solutions for people and planet.

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