Policy Brief:

A Future Research Agenda for the Economics of Transformational Adaptation

August 2026

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ACCREU
Assessing Climate Change Risk in EUrope

Introduction

ACCREU (Assessing Climate Change Risk in EUrope) is a project funded by the HORIZON Europe Research and Innovation Funding Programme. The objective of the project is to develop a fully integrated framework for assessing the economic costs of climate change, and the costs and benefits of adaptation.

Co-creation

The ACCREU project is dedicated to producing research that supports evidence-based decisions and policy making. To deliver this, the project uses a co-creation approach that has actively engaged stakeholders in the project's design and research.

ACCREU's main focus has been on producing useable knowledge for decision making – often called instrumental or utilitarian co-creation. This is advanced through a knowledge brokering approach and has focused on the economic costs and benefits of adaptation, with results reported in the WP3 ACCREU policy brief.

ACCREU is also undertaking reflexive co-creation (also called critical or emergent). This approach aims to challenge existing norms and propose new ways of thinking. It uses different methods, centred around a forum which brings together different actors to debate views in an open intellectual space.

ACCREU is applying this reflexive approach to the topic of the **economics of transformational adaptation**.

Transformational adaptation

Transformational adaptation is defined by the IPCC as adaptation that changes the fundamental attributes of a social-ecological system, in anticipation of climate change and its impacts. This can be contrasted with incremental adaptation, which maintains the essence and integrity of a system or process at a given scale.

There is an increasing recognition of the need for transformational adaptation in Europe, and such action is a focus of the Adaptation Mission. The volume of academic and grey literature publications on this topic (1) is increasing. However, almost none of this literature captures the economics of transformational adaptation and this has been identified as a key gap (2).

An economic framing for transformational adaptation is critical in Europe, because welfare economics is the defining paradigm for government policy. It forms the foundation of public policy intervention and public investment management in the European Commission and national governments.

Therefore, unless a strong economic case for transformational adaptation can be made, it is unlikely to be financed and implemented at scale. Nonetheless , conventional economic appraisal and standard cost-benefit analysis may be inadequate for transformational change, acting as a barrier to such action (3).

Against this background, the ACCREU project set out to develop a research agenda on this subject, using a reflexive co-creation approach. It undertook a literature review of the topic used this to develop a co-creation protocol.

The process was centred around a **reflexive workshop** that bring different actors together to debate the subject and identify research priorities. A policy 'think piece' was produced to frame the topic and identify key discussion topics. The reflexive workshop was held in April 2026 with around forty multi-disciplinary stakeholders.

1. For example, Pelling et al., 2015; Lonsdale et al., 2015; Termeer et al., 2017; Fedele et al., 2019; CRC, 2021; Cools et al., 2025; Engbersen et al., 2025; UNFCCC, 2025.

2. See van Ginkel et al 2025

3. See Mercure et al., 2021

Framing the reflexive debate

To frame the workshop on the economics of transformational adaptation, three guiding questions were developed for debate. These were:

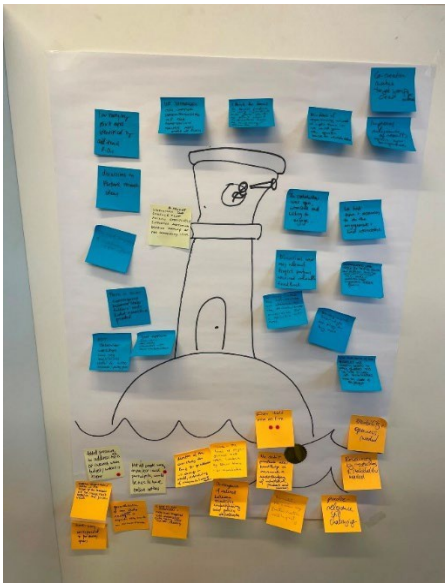
1. What is transformational adaptation and can its characteristics be captured in economics?

The first key framing issue for debate was on 'what is transformational adaptation'? This took the perspective of the adaptation community. The aim was to discuss whether and how transformational adaptation characteristics align with economics.

2. What is the economic case for, and the economic challenges, with transformational adaptation?

The second issue reversed the discussion and took the perspective of the economic community. The key framing issue for debate was on the economic case for transformational adaptation. The focus was to discuss whether the characteristics of transformational align to, and can be assessed with, conventional economic thinking and methods, or whether more innovative approaches are needed.

3. Re-thinking adaptation economics for transformational change.



The final framing issue was to debate scenarios where more transformational adaptation might be needed, arising from major shocks or tipping points. The focus was to explore how big a climate stress or a shock might need to be to justify a step-change in economic analysis and how radical this should be, and what might be the success factors or barriers to such change.

Throughout and following these three debates, workshop participants identified potential research needs, both through group discussion as well as individual reflection. The discussion from these three session is summarised over the following pages.

1. What is transformational adaptation?

While there is a growing literature on transformation adaptation, exact definitions vary significantly and the concept is not well defined in practice. Several studies in the literature have defined the **characteristics** (also called the elements, dimensions or attributes) of transformational adaptation.

The most recent example of this approach, Biesbroek et al. (2026), used a Delphi study to agree key elements (characteristics) of transformational adaptation. This found broad agreement on 13 elements for a definition. The ACCREU analysis and workshop discussion took these elements and debated whether economic tools and approaches could capture them. A summary is presented in the table below.

Table 1. Elements that meet the minimum criteria for being included in the definition of transformational adaptation to climate risks (Biesbroek et al. 2026) and potential economic issues (source authors).

Label	Description (Biesbroek et al)	Potential role of economics / issues
Root causes	Identifies and tackles the underlying environmental, societal, economic, political and/or legal conditions that create or sustain vulnerability and risk within a certain system	Welfare economics can capture societal conditions including environmental economics. Econometric analysis can assess root causes but may be limited by data
Climate resilience	Leads systems and communities to withstand and recover from future climate impacts	Valuation of adaptation benefits already undertaken, but issue of extending to resilience (trade-off with efficiency)
Time-horizon	Includes long-term (intergenerational) needs and future climate scenarios and socioeconomic pathways	Captured in economics through time preference and discounting, but potential for declining or intergenerational discount schemes
Diversity of knowledge	Considers a diverse set of knowledges in the process, including scientific knowledge, local knowledge and Indigenous Knowledge	Reliance on quantification in economics likely to prejudice local and indigenous knowledge
Depth of change	Leads to profound change in the societal norms, values and worldviews	Values and norms currently considered through risk preferences and behavioural economics
Distributive justice	Ensures fair and equitable allocation of resources so that particularly vulnerable and marginalized communities receive support/ compensation	Can be assessed in economic analysis through distributional analysis and equity weights
Context specificity	Tailors adaptation to the unique conditions and needs of specific contexts	Framing issue on boundary and context - requiring site and context specificity for economic analysis
Multiscale	Impacts of change occur across different types of scale (e.g. trophic, spatial, jurisdictional or sectoral)	Partly captured through different analysis from micro - to macro-economic scale
Restructuring	Alters the core properties, functions or interactions within the existing social, ecological or socioecological systems	Economic analysis can look at structural change, but element extends to ecological and social elements which are challenging
Persistence	Secures long-term commitments and impacts, recognizing that these may not always be irreversible	Sustainability of intervention part of broader economic assessment, issue of irreversibility and can be addressed in some extended DMUU approaches
Maladaptation	Avoids actions that inadvertently increase vulnerability to climate impacts	Economic analysis conventionally assesses risk of perverse outcomes, but issue if too narrow as economic maladaptation only
Avoid lock-ins	Prevents long-term commitments that limit future adaptability and flexibility	Can be included through extended CBA and decision making under uncertainty
Systemic	Takes into account the interconnected nature of the system as a whole, acknowledging root causes of vulnerability within systemic structures / dynamics	Set of more systemic economic approaches, including input-output analysis, macro-economic modelling. Agent based modelling
Governance*	The institutional structures and arrangements and governance processes affecting decisions, both formal and informal	Political economy analysis, Institutional economics, Behavioural economics

* Note that governance is not included in the final element in the paper but was identified at the workshop brief as important.

2. The economic analysis of transformational adaptation

The nature of transformational adaptation means that it is unlikely to happen autonomously: it is likely to require some form of public intervention to stimulate change, and often some level of public investment. There are well established approaches in public policy for assessing the justification for such intervention and subsequent policies and projects are then assessed with economic appraisal.

However, conventional economic approaches may act as a barrier to transformational adaptation, as was found in the ACCREU adaptation case studies (see policy brief). Further, building the case for more transformational adaptation often requires extended economic approaches, and due to its characteristics and scale, this may require combinations of new and innovative methods.

These issues were debated at the workshop, with a particular focus on themes that are key for transformational adaptation, notably: systems approaches; comprehensiveness (including environment and social benefits); time preference; justice and distributional issues; decision making under uncertainty, governance and political economy issues, and macroeconomics.

Systemic. A system-based approach is a consistent theme across the literature on transformational adaptation. Economic analysis can also capture system-level analysis (for example, with interconnected modelling or macroeconomic assessment), but the quantification and economic analysis of system level adaptation is often challenging.

Comprehensiveness. The ACCREU case studies found that adaptation often involves co-benefits, in addition to reduced climate change damages. When comprehensive economic appraisal was undertaken, including these co-benefits, the economic case for adaptation was generally positive, and also the choice of options often shifted. Many of these were environmental or social benefits (non-market). This point highlights that capturing these benefits in comprehensive economic analysis is critical.

Time preference and discounting. In economic analysis, the timing of costs and benefits matters (time preference). This is routinely captured through the use of social discount rates, which assign lower weight to the future, reflecting that people (and society) generally prefer to receive goods and services now rather than later. This makes it harder to justify proactive transformational adaptation in present value terms.

There are, however, alternative discount schemes that can help to address these issues, and that may be justified for transformational adaptation. For example, it is possible to use declining discount schemes, and also even inter-generational discount schemes, which involve much lower rates reflecting the consideration of future generations. The ACCREU case studies provide examples of different discount schemes and how these influence the attractiveness of transformative adaptation.

Climate justice and distribution/ equity. A common attribute of transformational adaptation that is seen in the literature is that it should be just, involving potentially distributive justice, procedural justice and recognition.

Economic analysis routinely assesses distributional effects, and how costs and benefits accrue to different people or groups (i.e. winners and losers). Such analysis can involve a quantitative or descriptive assessment, or distributional or equity weights, which increase the values of lower income or more vulnerable households. The ACCREU case studies found that the use of distributional analysis, and especially distributional weights, does make a large difference to the adaptation options prioritised, as well as the patterns and locality of adaptation. This is linked to broader objective choices between economic efficiency versus egalitarianism.

Decision making under uncertainty. Future transformational adaptation involves deep uncertainty. Existing economic decision support tools do not work well for a lot of adaptation decisions because of this.

In response, the literature has moved towards extended cost-benefit frameworks and decision making under uncertainty for adaptation. While this evidence base and the number of applications is growing, these techniques are more applicable at the project level (rather than systemic), and they do involve considerable data, expertise, time and resources.

Governance and political economy. A common characteristic is that transformational literature often involves challenging existing power dynamics and may require the formation of new structures or systems of governance. These concepts have been translated into economics through political economy studies, which look at the interaction between politics and economics, institutional economics, which focuses on the role of institutions in decisions, and behavioural economics, which looks at how individuals and institutions make decisions in real-world contexts.

Macroeconomics. Macroeconomics is by nature much more aligned with systems and large-scale change, however, while macroeconomic analysis of the costs of inaction has progressed in recent years, adaptation remains poorly represented in these frameworks. The debate identified that there are established economic disciplines that support macroeconomic policy, which would be highly relevant for transformational adaptation. Examples include the analysis of root causes through empirical studies and econometric studies, the analysis of structural change, and the analysis of shocks.

3. What if transformational adaptation needs to really scale up?

The final debate session was to explore what the implications would be of more substantial climate impacts, and the greater scale and speed of transformational adaptation needed. These might even require a re-thinking of economics. Such scenarios might arise from more significant changes that are not yet included in most economic climate modelling.

For example, the need for more major shifts might arise from a continuation or increase in the acceleration of global warming, which would require much greater and earlier levels of transformational adaptation. It could also arise from a shift towards more unprecedented extremes and a persistence of anomalies, noting the extreme events in Europe in recent years (such as the 2021 European or Valencia floods), noting this would have major issues for insurance. It might also be needed if earth-system climate tipping points or climate induced socio-economic tipping points occur, both of which would require more radical responses.

A discussion on these areas raised additional questions. For example, how big does a climate stress or shock need to be to justify a step change in transformational adaptation and economics? Further, can transformational policy shifts happen in advance of climate impacts (anticipatory), noting that to date, more major responses usually arise reactively as a response to a crisis?

A number of other areas flow from these questions. Who should pay for transformational adaptation and what should be the cost sharing mechanisms, within and across countries? At the European level, this would have major implications for solidarity. There are also lessons for these issues from historic shocks (the financial crisis or COVID-19).

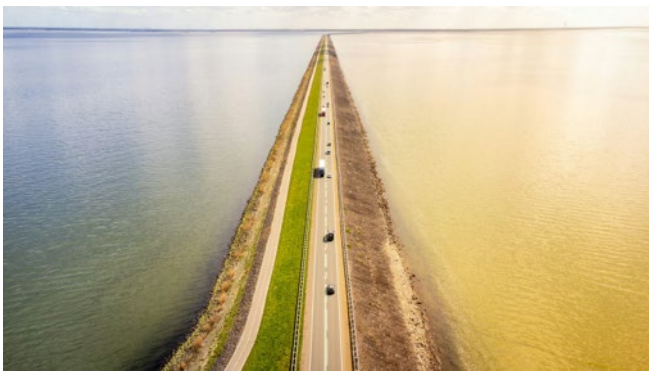


Photo by Denny Müller on Unsplash

The workshop included a visioning exercise to look to the future (to 2040), under two scenarios: one where transformational adaptation at scale had failed and one where it had succeeded.

The discussion overwhelmingly attributed the potential failure of transformational adaptation to political and structural barriers rather than technical or knowledge limitations.

It was also highlighted that in the current landscape, competing crises (war, geopolitics, AI), as well as climate denial, are likely to be far more influential than scientific issues or reasoning around climate change. There was also the issue of available finances, including public finances and fiscal pressures, being a limiting factor.

Conversely, the discussion identified that successful transformational adaptation would be more likely through a proactive, planned, deliberative approach with strong EU mandates, citizen pressure, de-politicisation, inclusive processes, and the alignment of financial and economic systems. This led to a discussion on whether transformational adaptation could be reframed defensively around national security/military benefit, or in terms of competitiveness or strategic autonomy, rather than purely in the pursuit of adaptation, i.e. looking to see where it could have benefits against other threat multipliers.

Emerging Insights from the debate

A number of recurring themes and emerging insights came up during the day. For some of these, there was a broad consensus. For others, viewpoints differed significantly, reflecting the reflexive nature of the event.

A key conclusion of the debate was that **economics is more than cost-benefit analysis**, and that project appraisal is probably the wrong arena to start thinking about transformational adaptation., There is a need to move economic analysis upstream to a more strategic level for transformational adaptation.

Further, the discussion agreed that some of the tools and approaches needed for transformational adaptation already exist within the discipline of economics.

These range from individual techniques to broad disciplines such as macroeconomies. However, these economic subdisciplines currently work in silos, and thus they are not being combined across boundaries. A combination of approaches and sub-disciplines is likely to be needed to capture the scale and nature of transformational adaptation.

At the same time, there was a discussion that not everything can be tackled using conventional economic approaches. In particular, there were some participants who argued that the current economic paradigms are themselves a root cause of the problem and act as a barrier to transformational adaptation.

This debate highlighted the need for a broader research agenda, not just focusing on tools or methods, but also broader framing issues and paradigms that are capable of dealing with the emergence of new sectors, or the reconfigurations of regions, which clearly go beyond marginal change.

Running across the day, there was a call for an **improved empirical knowledge base** to support transformational adaptation. This could draw on historical analogues and what works (and well as what does not).

Finally, there were divergent views on how fast and at what scale transformational adaptation should move, and what level and rate of political and economic change is needed.

While there was no consensus, an interesting theme that emerged, and that seemed to have widespread support across participants, for **radical transformational adaptation that is implemented incrementally**.

A research agenda for the economics of transformational adaptation

Based on the reflexive workshop and participant feedback, a research agenda has been produced. The agenda is broken down into a key research topics, reflecting key themes from the workshop.

Defining the use of economics for analysing transformation / economics of societal change

The most obvious priority to start with is research to frame and define the role of economics in transformational adaptation. Some early work on this was developed after the workshop (see Figure 1, later).

However, the workshop also highlighted that economics should be integrated much earlier into the transformation adaptation policy cycle, rather than being used for project appraisal later. Reflecting this, there is research needed to frame the upstream economics of transformational adaptation.

This framing includes the justification for intervention (including the market failures involved), as well as the nature of intervention. It would also be useful to develop a broader economic narrative for transformational adaptation, including its wider benefits.

Research Priorities:

- Mapping and analysis of the role of the economic methods to assess transformational adaptation, and consideration of how these could be combined rather than working in silos.
- Developing the upstream economic justification for transformational adaptation and the role for policy intervention, including analysis of market failures: developing a broader narrative including how to adapt entire economies and the benefits of doing so.

Improving the evidence on the economics of transformational adaptation: what works?

A common theme across the day was that there was insufficient current evidence on what works (and what does not).

Participants identified the need for research on ex-post, evidence-based analysis to ground transformational adaptation in observed reality. This could include historical case analysis (within the climate context, but also beyond to non-climate), with good and bad examples. This would provide a counterweight to the more abstract conceptual debates.

There will also be a need to establish research methods and protocols for future evaluation (ex post) for transformational adaptation. This would also include research into the measurement and indicators for transformational adaptation

Research Priorities:

- Conducting review work to identify and assess ex-post, evidence-based analysis of transformation (within and beyond the climate context) and assess why progress was slow or fast, and identify enablers and success factors, including institutional conditions.
- Developing evaluation methods for transformational adaptation, including potential applicability of different methods.
- Developing transformational adaptation metrics and indicators, for measuring progress, including economically relevant aspects.

Understanding how preferences inform the attractiveness of transformational adaptation

The workshop discussion identified that current choices in many areas are generally accepted without question. However, system level change involves elicitation of preferences in contexts that go well beyond those in incremental adaptation and beyond areas which are familiar to people currently. There are therefore a set of research priorities to identify preferences. This includes time preferences including long-term and intergenerational aspects (and associated discount schemes), as well as climate justice and distributional preferences (including intra-generational equity).

These issues are part of broader societal preferences on transformational change, which require research on societies willingness to pay for transformational adaptation costs and/or its willingness to accept residual impacts (after adaptation). Once these preferences are understood, they can be used in policy. This might tim to maintain current objective-based approaches, whether these are based on economic efficiency or acceptable levels of risk, but could also extend to new framings, such as resilience objective that accepts higher levels of redundancy. Research can support these choices, and could also consider aspects of adaptive management, i.e., the trade-offs and benefits associated with greater flexibility, robustness and recovery capacity.

Finally, there is a set of policy questions and research needed on the cost sharing mechanisms that are used, and whether costs are shared equally across society (e.g., with taxation) or whether those who benefit should pay.

Research Priorities

- Analysis of differing objectives and trade-offs for transformational adaptation with surveys to understand societal preferences.
- Review of discounting, including intergenerational schemes, and surveys to understanding time preferences for transformational adaptation.
- Review of distributional/equity weights (and other approaches) and surveys to understand intra-generational preferences.
- Review of other preferences that are important in transformational adaptation.

Improving microeconomic tools and methods

The workshop concluded that transformational adaptation is likely to require extended cost-benefit analysis as a minimum. This would require some extensions to current microeconomic tools and approaches. Some of these are just good practice, e.g., the inclusion of societal costs and benefits (including non-market).

Other aspects might include some research to extend current methods, e.g., with distributional weights and alternative discount schemes. There is also more applied research needed to better integrate decision making under uncertainty into current guidance and practice.

The consensus at the workshop was for extending rather than discarding CBA. Nonetheless, there were calls for research to test additional criterion to explicitly value resilience or justice.

Alongside this, there were research priorities identified for enhanced use of other techniques or tools, such as storylines, visioning or narratives, and how to combine these with more traditional economic analysis.

Research Priorities

- Developing an extended cost-benefit analysis framework for transformational adaptation, extending current approaches.
- Considering new criterion (in addition to economic efficiency) such as for resilience.
- Developing complementary techniques (storylines, visioning, narratives) that can be used in economic analysis.

Developing macroeconomic tool and methods

Transformational adaptation is likely to involve structural changes to the economy that alter patterns of production, labour, trade, finance, and investment. It is therefore likely to involve restructuring.

There is a general research priority to include adaptation in the suite of existing climate models (IAMs and CGEs). and this extends to transformational adaptation. However, there is also a broader set of research priorities to assess what happens to growth, employment and the public finances under climate change, and the benefits of transformational adaptation in addressing these impacts. This could build on more traditional macroeconomic analysis and could form the basis for assessing the macroeconomics of transformational adaptation.

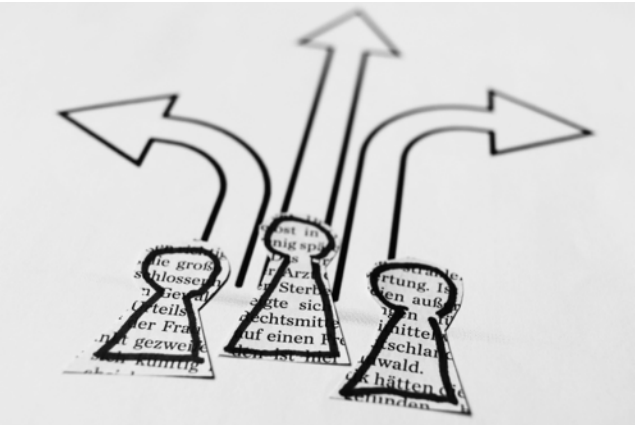
This research could include analysis of structural change, dynamic modelling (investment, capital turnover, adjustment costs) and short-run vs long-run responses. Such analysis would help understand timing and sequencing of policy interventions, as well as additional macroeconomic research on patterns of adjustment in labour markets and trade

Research Priorities

- Extending the analysis of adaptation in macroeconomic climate modelling (CGE and IAMs) to start considering transformational adaptation.
- Testing existing macroeconomic analysis methods and tools (structural analysis, dynamic models) on transformational adaptation.

Advancing political economy, institutional and behavioural economics

A consistent theme of the day was on policy and governance, as current economic models tend to have insufficient focus on the institutional and political conditions that determine whether adaptation happens. These aspects can be researched with a suite of approaches, which include political economy analysis and network mapping. It also includes institutional economics to look at the large-scale change and transaction costs associated with transformational adaptation. This research should also extend to behavioural economics to explore what influences real world change.



There was also a concern that climate-economic models are not absorbing enough of what other disciplines already know and a research need was identified to consider on communication, awareness raising and even lobbying to enhance the uptake of research results.

Research Priorities

- Application of political economy approaches to transformational adaptation, including institutional and behavioural economics.
- Mainstreaming of transformational adaptation into longer-term economic development planning and policy.
- A greater focus on interdisciplinary research to avoid siloed approaches and encourage systemic and integrated analysis (economics and other).
- Analysis of how to maximise research impact, including communication, awareness raising and influencing.

Analysing the financing of transformational adaptation and the role of the private sector

An interesting topic that emerged during the day was the issue of financing and funding of transformational adaptation. Adaptation investments, and especially transformational ones, are often in public goods, involve non-market sectors or have non-market benefits, and it is difficult to realise commercial returns from them.

This means even when adaptation makes sense from a societal perspective, it will still be challenging to implement, especially for transformational adaptation because of its typically longer life-times and greater complexity.

This means that transformational adaptation will have major fiscal implications and be have consequences for the public finances. In turn, this may require different approaches to financing, i.e., that go beyond conventional approaches, considering different financing sources and instruments as well as complementary risk layering approaches.

This leads to research needs on policy instruments and incentives for transformational adaptation, including those that can mobilise private, as well as changing real economy behaviour. It will also involve new analysis to develop the business case for transformational adaptation.

Research Priorities

- Analysis of the potential impacts of climate change on the public finances, and the fiscal benefits of transformational adaptation.
- Analysis of potential financing sources, instrument and models for transformational adaptation, including more transformative finance (including private sector), and including the business case for action.

Opening up a discussion on the economics of catastrophic climate change and adaptation

Transformational adaptation may be needed at great scale, or needed earlier, due to fundamental societal changes induced by the catastrophic consequences of climate change, for example, as a result of accelerated warming or climate tipping points. This leads in turn to a set of further research topics, which range from improved analysis through to potential seismic shifts in current approaches and thinking. This could include radical solutions that are implemented incrementally.

First, it was recognised that further research is needed to assess adaptation to cascading and compounding risks, and interconnected, cross-sectoral and cross-crisis risks. This includes the links to other crises (planetary boundaries, housing, safety, AI, geopolitics).

Second is a research need to assess the wider benefits of transformational adaptation, beyond risk reduction, to include benefits of competitiveness, strategic autonomy, defence, etc.

Third, it would be useful to advance some economic research into the potential effects of accelerated warming, as well as climate and socio-economic tipping points, and the implications for transformational adaptation (including costs, benefits and rates of change).

This could also include positive tipping points that could trigger systemic change toward resilience.

Fourth, while views differed, several participants identified the need to explore different models of capitalism in relation to catastrophic risk and transformational adaptation. Whilst current economic models offers important strengths — innovation, investment, and resource allocation — they also lead to market failures, short-term incentives, and unequal outcomes. Resilience economics, as well as post growth economics, shifts the focus from maximising short-term efficiency to maintaining the long-term capacity of social, economic, and ecological systems, though research also need to better understand the trade-offs involved with these approaches.

Research Priorities

- Improving analysis of adaptation to cascading and interconnected risks.
- Analysis of the linkages between adaptation and other crisis, and development of the wider resilience and security benefits of transformational adaptation.
- Analysis of the implications for transformational adaptation from accelerated warming and tipping points (climate and socio-economic).
- Exploration of post-growth, post-capitalist or ecological economics for their ability to support transformational adaptation under catastrophic scenarios.

ACCREU

State-of-the-art and research priorities for transformational adaptation economics

To capture the discussion from the reflexive workshop and help bring together the identified research priorities, a framework was developed. This is shown in the Figure below. The framework shows a spectrum that goes from incremental adaptation and conventional economics on the left (in green) to transformational adaptation and extended economic methods on the right (in blue).

The first session of the day debated the elements of transformational adaptation – shown at the top of the figure. The second session of the day debated the economics of transformational adaptation – shown at the bottom. The figure then links these domains together.

On the left (in yellow) are areas where existing economic approaches can already support transformational adaptation analysis.

In the centre (in orange) are areas where economic methods and tools have been developed but require further research application or development.

Finally, on the right (in red) are areas where primary research and further debate is needed.

These research priorities are being taken forward through the dissemination of the results and discussions with research commissioners.

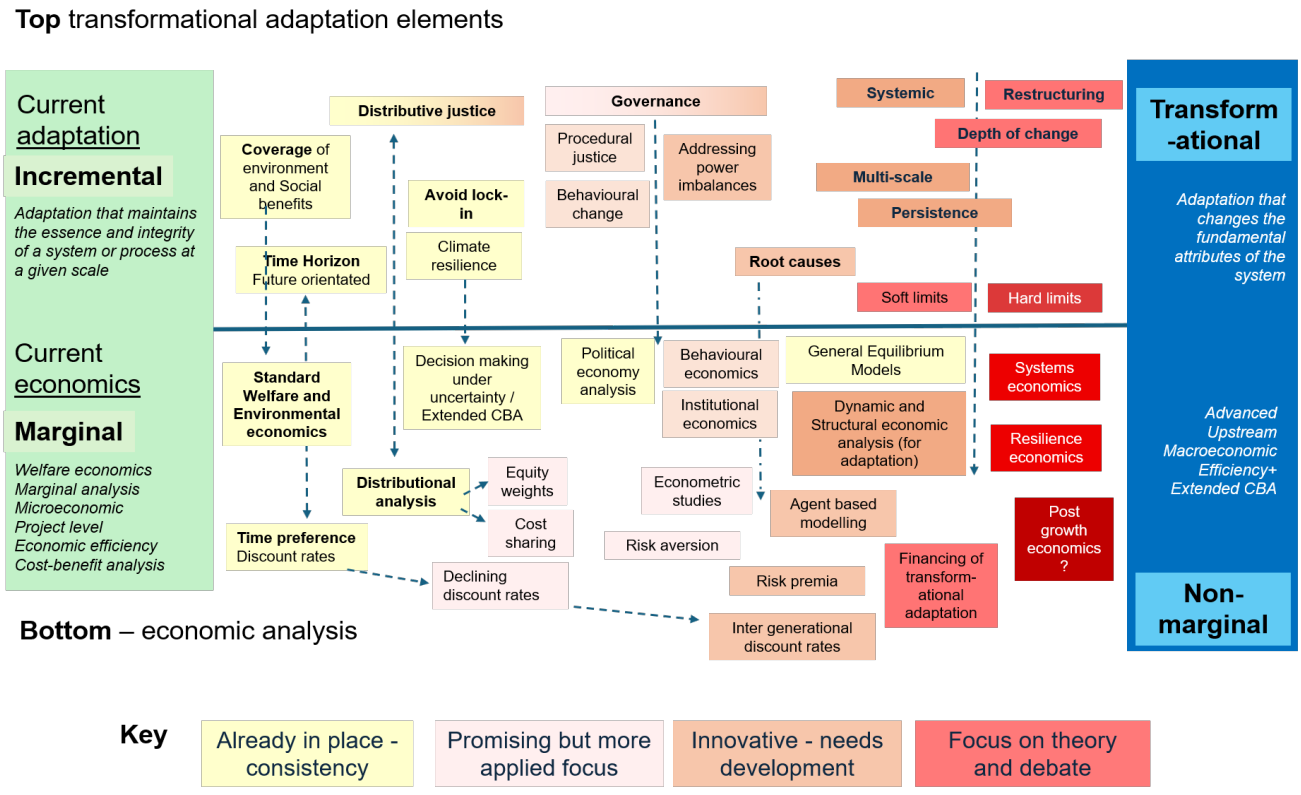


Figure1: Framework and mapping of research on the economics of transformational adaptation. Source authors.

The **ACCREU** project is co-ordinated by Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (FONDAZIONE CMCC), Italy.

To find out more about the project, please visit https://www.accreu.eu/

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