DEVELOPMENT CORRIDORS PARTNERSHIP

IMPACT ASSESSMENT FOR CORRIDORS: FROM INFRASTRUCTURE TO DEVELOPMENT CORRIDORS

Edited by:
Jonathan Hobbs and Diego Juffe Bignoli

2022

The Development Corridors Partnership

The Development Corridors Partnership (DCP) is a research and capacity development initiative. It is a collaboration between institutions from China, Kenya, Tanzania and the UK. The main objective is to deliver effective research and capacity-building to help improve corridor planning and management. It aims to ensure that development corridor decision-making is based on sound scientific evidence and effective use of available planning tools and procedures, to ensure that risks are avoided and opportunities exploited. The DCP comprises partners from the University of York, the University of Cambridge, London School of Economics, Sokoine University of Agriculture, the University of Nairobi, as well as the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), African Conservation Centre, the World Wide Fund for Nature (WWF), the Chinese Academy of Agricultural Sciences and the Chinese Academy of International Trade and Economic Cooperation (CAITEC).

DCP Partners:

For the purposes of this publication, DCP collaboration was extended to experts representing Netherlands Commission for Environmental Assessment, the Centre for Energy, Petroleum and Mineral Law and Policy at the University of Dundee, the University of Queensland, the Columbia Centre on Sustainable Investment, the GOBI Framework for Sustainable Infrastructure Initiative (comprising the University of Oxford, University of Central Asia and the Independent Research Institute of Mongolia), The Biodiversity Consultancy, the Wildlife Institute of India, the Endangered Wildlife Trust and Ecotecnia Ingenieros Consultores SRL.

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Foreword

In the course of a long and varied working life, I have been privileged to work with, or learn from, a stimulating panoply of individuals who are committed to contributing to the economic, social, and environmental development of all aspects of the United Nations Sustainable Development Goals.

Jon Hobbs and Diego Juffe-Bignoli are, thankfully, two of these individuals. I was delighted to learn that they had come together to produce, for the Development Corridors Partnership, a rich and stimulating collection of research reports, case studies and assessments relating to the array of efforts made under the rubric of 'development corridors'. They were determined to express the conviction that decisions made, primarily by governments, regarding the planning and building of Corridors, really must be informed by an evidence-based understanding of the consequences – positive or negative – of these decisions. And they have succeeded. But Jon Hobbs will never read these words. He was hospitalized after the bulk of the work was complete, and, to the deep sadness and regret of all who knew him, he passed away at the end of September, 2021.

Jon and Diego sought out and recruited a daunting array of researchers, scholars and stakeholders to shed light on the processes currently underlying the world of development corridors today. They certainly succeeded.

The work was initiated before the onset of the COVID-19 pandemic, and as governments turn to the formidable challenge of restoring economic vitality without further damage to the climate, it becomes even more imperative that impact assessment be understood, embraced and improved. Jon and Diego have shown us the way forward for a journey which absolutely must be embarked upon.

They would be first to recognise that the Development Corridors Partnership as a whole must be commended for showing – in many different ways and places – that, not only is the need for impact assessment clear and present, but so are the skills and commitment of researchers, scholars and stakeholders. These are to be found in an impressive coming together of universities, civil society organizations and business groups, and communities.

All are part of an outstanding initiative, funded by the UK Research and Innovation Council, and managed by the UNEP-WCMC. This initiative has been embraced by some of the best minds that have been turned to the task of ensuring that – while we attempt to bring economic and social benefits to people, in line with the United Nations Sustainable Development Goals – we do not risk significant environmental and social costs, and thus actually undermine long-term development successes.

So, I urge you to read this book, and figure out how you might improve your own contribution to the challenges ahead. Jon and Diego have set out a case. It needs to be taken up, not set aside; acted on, not just talked about. It is in your hands.

John Harker

Chair of the Development Corridors Partnership Independent Advisory Board,
Nova Scotia, Canada.

Dedicated to the memory of Jon Hobbs
who was the architect and driving force of this book

Executive Summary

Driven by increasing globalisation, the development aspirations of nations, and the need to access resources, an infrastructure boom is impacting many regions of our planet. New infrastructure projects are traversing diverse landscapes over hundreds of kilometres, often crossing international borders and penetrating into remote areas previously unaffected by industrialisation and urbanisation. These large-scale projects, mostly spanning several regions in a same country, but often linear and transnational in nature, are generically called corridors. Depending on the nature and objectives, they can be transport, infrastructure, growth, resource or economic corridors.

The rapid development of corridors globally presents environmental planning professionals with numerous challenges. **The primary need is to ensure that decisions about these developments are informed by an evidence-based understanding of their consequences – both positive and negative.** This will enable infrastructure development to meet development needs without adversely impacting ecological systems or human welfare. Improving the quality of infrastructure policies, plans, programmes and projects, by ensuring they include the necessary environmental and social scrutiny, is urgently required now - and will be for the foreseeable future. This challenge is the unifying theme of this publication.

Using insights from Africa, Asia and South America, this sourcebook compiles 24 contributed papers written in 2021, covering many facets of the opportunities and challenges presented by the rapidly growing number of infrastructure and corridor developments around the world. Prevailing planning practices are reviewed through case studies along with the efficacy of some of the available tools to conduct systematic and comprehensive impact assessments. The latter includes Strategic Environmental Impact Assessment (SEA) and Environmental Impact Assessment (EIA).

As the title suggests the underlying thesis of this publication is that, where they are justified, **there are significant benefits in ensuring that corridors that contain single purpose infrastructure developments (utility, infrastructure or transport) progress through a carefully planned sequential process of diversification and expansion to ensure the maximisation of benefits in full-blown 'development corridors'.** In this book, development corridors are therefore aspirational. They comprise areas identified as priorities for investment to catalyse economic growth and development. They should be developed with multiple stakeholders and social, economic and environmental interests and interdependencies in mind. With the integration of sustainability principles and appropriate environmental and social standards, development corridors could become true '(sustainable) development corridors'. They should be planned to maximise positive opportunities and minimise negative risks. Without this, today's short-term successes will become tomorrow's challenges and long-term human welfare and ecosystem integrity will be undermined.

Overview of contents

This book brings together a wide range of perspectives from experts, researchers, and practitioners around the world with the purpose to foster greater collaboration and increase our global understanding of corridors and their benefits and potential negative impacts. 13 of the 24 chapters are written by independent experts and researchers from Australia, Bolivia, Brazil, China, India, Kenya, Mongolia, South Africa, Tanzania, UK, and the USA. The book also includes 11 chapters containing material gathered by the Development Corridors Partnership, a programme of work led by UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and funded by the UK Government via their Global Challenges Research Fund.

The collection of papers in this sourcebook is divided into five sections. First an introductory section where we introduce some key terms and definitions that underpin this work (Chapter 1). We then explore some key principles and aspirations of corridors such as delivering the Sustainable Development Goals (Chapter 2), ensuring theory and practice align (Chapter 3), ensuring financial sustainability (Chapter 4), properly assessing environmental sensitivity (Chapter 5) respecting human rights (Chapter 6), or maximising, co-benefits (Chapter 7).

In the next three sections, we present 15 case studies from three continents: Africa, Asia, and Latin America. These case studies explore key challenges and lessons learned from specific planned, ongoing, and already implemented developments. They are presented as individual stories that readers can explore.

The final and fifth section aims to summarise lessons learned from a 4-year research and capacity building programme specifically aiming to understand the key challenges and opportunities around corridors and that has been the major driving force of this work: The Development Corridors Partnership project (DCP). DCP is a collaborative partnership across UK, Kenya, Tanzania and China, funded by the UK Research and Innovation Global Challenges Research Fund (see Chapter 23).

The book finishes with an overview of the lessons learned from the contributed papers included in this book and develops ten principles for corridor planning and delivering a meaningful and comprehensive impact assessment (Chapter 24), which we summarise here as ten key messages.

Key messages

1

Corridors must seek to achieve positive sustainability outcomes:

The mindset underwriting environmental planning of most infrastructure developments has been to mitigate negative impacts. The planning of few existing corridors is based on their role in supporting a sustainability vision for a country or region in which they are situated. Corridor developments must therefore be based on sustainability principles and support progress towards national, regional and international sustainable development goals. A true development corridor will seek to do good, as well as to mitigate negative impacts.

2

Integrated and inter-disciplinary approaches are needed:

Corridor developments are extensive, complex, multifaceted features traversing many landscapes. They can bring about significant transformational change to physical, economic, social, and cultural systems, and serve as interconnecting features. Yet engagement in corridor planning is often constrained by limited disciplinary and institutional involvement, with projects often superimposed upon communities. Corridor developments need diverse expertise and experience in their planning and management, including local stakeholder knowledge, avoiding disciplinary, institutional, or sectoral silos, that can result in policy conflicts, contradictions, and inconsistencies.

3

Corridor proponents should clearly demonstrate consideration of alternatives:

Corridor options should not be limited to a preferred proposal favoured by an elite. Corridor developments must consider all feasible alternatives (including maintenance of the status quo and no corridor development) and make the risks and opportunities of each option explicit and transparent through meaningful consultation. An important requirement in all corridor planning is to justify the need for a wide choice of options and an explanation of the potential benefits it will bring and to whom, in comparison with the alternatives. Any necessary trade-offs and how any significant potential negative impacts will be effectively managed, and opportunities created must be explained.

4

Public participation and stakeholder engagement should be at the core of corridor planning:

Corridor planning frequently fails to include meaningful participation of all stakeholders. Corridors can profoundly affect the lives and rights of indigenous peoples and local communities, potentially for generations. A common failing is that the first opportunity for local stakeholders to engage arises only after all strategic decisions have already been made and the only option remaining is for them to react negatively to a fait accompli. The meaningful engagement of all stakeholders is necessary to ensure their role is more than reactive. The way corridors are viewed by different stakeholders must be identified, understood, and addressed. Corridor developments must ensure that all interested and affected people are provided with adequate information about a proposal and have meaningful ways to engage in decision-making processes from the outset of strategic planning.

5

Mainstreaming and tiering are fundamental for corridor success:

Corridor planning requires a tiered assessment process, ensuring that environmental and social issues are considered alongside financial and technical considerations from the start of strategic planning or programme development, right though to project specifics. Conceptual corridor planning is frequently dominated by technical and financial suitability criteria with environmental, social, cultural, and human rights sensitivity issues being considered, at best, as externalities, retrospectively, once issues and problems arise. Strategic planning is important because it is when the full range of options is still open for discussion. It also establishes the parameters that will frame and implement a corridor plan or programme. Environmental and social considerations (and the interactions between them) should be considered early in strategic decision-making alongside (and to inform) technical, financial, and economic considerations.

6

An iterative process is needed:

Corridors exist in dynamic environments and need to be responsive to changing circumstances and priorities. Planning must adjust as circumstances and available information changes. The process should identify, map, and engage all interested and affected stakeholders from the earliest stage of corridor planning and throughout the planning and management of the corridor. New concerns and evidence will likely emerge as a corridor development progresses. Corridor planning frequently places undue emphasis on the production of a report (Environmental Impact Report) and its influence on the decision to proceed. The process may not be so linear in nature. It may involve many adjustments and decisions as new evidence emerges and predictions improve. A good-quality report and recommendations is necessary, but they are dependent upon a comprehensive process of ongoing dialogue and engagement with all stakeholders.

7

Corridors must ensure effective use of available tools:

Many corridor environmental impact assessments fail to meet required international standards. Corridor planning and management should make systematic and adequate use of available impact assessment procedures, methods, techniques, and tools to ensure good-quality decisions. The available procedures discussed in this publication (notably Strategic Environmental Assessment and Environmental Impact Assessment) and their associated methods, tools and techniques should be used when appropriate to help ensure that a systematic process identifies all significant potential benefits and development outcomes, and that they outweigh the costs and risks to affected people and their livelihoods and environments. The objectivity and quality of corridor decisions are dependent upon the effective use of the available tools.

8

Plan corridors with resilience and adaptability in mind:

Prevention will always be better than cure in addressing the negative impacts of corridors, and this should be the priority. However, some circumstances dictate an inevitability of negative impacts. Corridors, therefore, need to be designed to be made resilient to anticipated changes and adaptation measures may be necessary as 'coping' mechanisms or to offset unavoidable impacts, such as the impacts caused by climate change. The suitability of measures will require ongoing monitoring and adaptation as needs arise.

9

Seek impact, influence, and implementation capacity:

The decision to proceed with a corridor is ultimately the responsibility of decision makers. They are usually the representatives of all stakeholders' interests and custodians of their natural resources. Any impact assessment report must provide adequate information to ensure sufficiently good-quality decisions. If they are to be effectively implement the recommendations provided. Attempts to improve the performance of planning and associated assessment processes of corridors must tackle the ways in which outcomes are shaped by political contexts and institutional capacities. Approaches to working on assessment processes should integrate political economy analyses and institutional capacity assessment from the outset and on an ongoing basis. Resulting insights should inform the design and implementation of interventions intended to improve planning practice.

10

Evolve from Infrastructure to Development Corridors:

The prospects for linear infrastructure projects to evolve into comprehensive development corridors are often left to chance and spontaneity. Infrastructure projects are often developed in isolation and in an incremental way. For infrastructure projects to progress and become true development corridors, the transition must be systematically sequenced into planning from the start. Assessments must include consideration of potential induced, secondary, synergistic, transboundary, and cumulative impacts likely to result from the corridor development. The progression from infrastructure to development corridors must be based on a systematic, comprehensive, and integrated assessment of the potential positive environmental, social and economic opportunities and the rigorous avoidance or management of negative impacts.

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Accounting for Sustainable Development Co-benefits: Insights from Local Experiences with Climate Resilience Interventions

Swenja Surminski, Viktor Roezer and Sophie Dicker

Grantham Research Institute, London School of Economics and Political Science, London, UK

This chapter is based on work conducted by the three authors at the Grantham Research Institute in 2021

ABSTRACT

Every investment decision shapes outcomes in the real world, and can have numerous non-intentional, positive or negative wider economic, social and environmental impacts. Particularly during the current COVID-19 pandemic, it is essential that investments are made responsibly, without harming the economy, the environment or our communities. Recovery from this crisis should mark the beginning of a global transformation to strong, sustainable, inclusive and resilient economic development and growth.

If we are to overcome poverty, make progress on the Sustainable Development Goals (SDGs) and manage the immense risks of climate change, it is wise to choose a path out of the depression by focusing on investment in sustainable economies and activities of the future, not only in man-made physical capital (traditional tangible assets and infrastructure), but also in natural, human and social capital. There is convincing evidence that a recovery which embodies the principles of sustainability can be stronger and faster than alternatives, as also shown by recent assessments underpinning the 'building back better' and green recovery arguments for a post-COVID-19 stimulus programmes (Hepburn, *et al.* 2020).

At the core of the SDG concept is the recognition that an intervention – be that an investment, policy, plan, programme or project – can have a wide range of co-benefits (and co-costs) that often fail to be recognized when undertaking ex ante appraisals or evaluation. This can be in the form of public health co-benefits of green spaces, or education and employment co-benefits arising from better transport routes. The terms co-benefits and co-costs emphasize the idea of additional, sometimes overlooked or unintended, benefits and costs of a particular project in any sector. As such, some investments might be undervalued because the potential indirect benefits to the community were not included in the appraisal, while in other cases wider environmental or social costs may be ignored or not identified.

From an SDG perspective the recognition of co-benefits and co-costs helps embed a holistic perspective across social, environmental and economy dimensions. Indeed, this is the underpinning principle of sustainable development, including for large-scale infrastructure investments, such as through China's Belt and Road Initiative, or as part of the African development corridors, which offer significant opportunities to support SDG strategies across different countries (Adshead et al. 2019).

However, recognizing and accounting for these during the appraisal-planning and evaluation stage of investments or projects is often challenging (Tanner et al. 2015; Vorhies and Wilkinson 2016; Fung and Hellgeson 2017). This underpins the importance of interdisciplinary and holistic planning for projects such as the development corridors that have emerged across many parts of the developing world. Research from the Development Corridors Partnership, led by the UN Environment Programme World Conservation Monitoring Centre, shows that development corridors can produce a range of large-scale social, political, economic and environmental benefits, as well as trade-offs, generating very uneven impacts and often excluding vulnerable populations, threatening the SDG pledge to "leave no one behind" (Lesutis 2019; Gannon et al. 2020). This raises questions for those investing in these development corridors, as well as for those who are responsible for implementation and delivery at national and local level (Schindler and Kanai 2019).

7.1 The concept of co-benefits

Conceptual overviews and taxonomies of co-benefits (see, for example, Ürge-Vorsatz *et al*. 2014; Mayrhofer and Gupta 2016) show that there are widespread definitions of the concept of co-benefits and quantification is often lacking.

Multiple approaches have existed to determine the magnitude and sources of co-benefits within appraisal methods such as cost–benefit analysis (CBA) or Multi Criteria Analysis (MCA). Some examples are computable general equilibrium modelling, such as a simulation method focused on the macro-economy, econometrics, economic modelling or science-based models, among others. These can be data- and computing-intense, and not all are feasible for applications by practitioners. Indeed, the failure of CBA to successfully quantify all impacts has given rise to the development of further appraisal tools such as Environmental Impact Assessment.

Particularly for large-scale projects – such as corridors – that span across geographic boundaries and involve international funders, implementing agencies, national governments and private sector, the recognition of co-benefits and co-costs is often lacking. As analysis of the Lamu Port South Sudan and Ethiopia transport corridor (LAPSSET) in Kenya shows (Dexter 2018), there was little formal integration of the environmental, social and economic co-benefits and co-costs in the official CBA, which only captured the conventional costs and benefits associated with the projects. Instead, wider economic, environmental and social aspects were considered in separate impact assessments, but not integrated into the formal appraisal. Thus, concerns such as local resistance to mandatory land rights changes, the environmental implications of the corridor for fishers' (Enns 2017), and the economy-wide implications of oil price fluctuations (Browne 2015) were not considered at the formal project appraisal.

Overall, the utilisation of any co-benefit assessment depends on data availability and on agreed metrics. Over the last few years, a range of alternative approaches to identifying environmental and socioeconomic co-benefits have emerged to supplement the conventional impact assessments (Olsen *et al*. 2015). In an effort to formalize this, the United Nations Framework Convention on Climate Change Clean Development Mechanism (CDM) Sustainable Development Co-benefits metric was devised, to highlight the co-benefits of CDM projects (United Nations Framework Convention on Climate Change 2018), offering a qualitative assessment that loosely captures these co-benefits and provides an approximate magnitude. This may be efficient and particularly sensible for local-level and small-scale projects, but is likely to face acceptability challenges in the context of large-scale investments, including major infrastructure. Lack of data and clear accounting standards is an issue. There are, however, also tools and methods that can help overcome this, as the case of climate resilience shows.

The ability to collect primary data in case of field work, especially in behavioural economics, where data is not necessarily taken at face value, but instead different pathways for co-benefits can be uncovered by non-market contributors to co-benefits. Examples include the Co-benefits Evaluation Tool for Municipal Solid Waste by the United Nations University, which uses a life cycle assessment approach to consider the environmental impacts associated with climate change, air pollution and wastewater. The Nationally Appropriate Mitigation Action (NAMA) Sustainable Development Evaluation tool allows users to evaluate the sustainable development performance indicators and sustainable development results achieved over the lifetime of the NAMA.

7.2 Insights from climate resilience: integrating co-benefit appraisal into planning and decision-making processes

In the context of climate mitigation and adaptation, the concept of co-benefits has been playing an important role for strengthening the case for investment and action. Many benefits of emission reduction projects are long-term and global in nature (Hamilton, Brahmbatt and Liu 2017). However, there are also more immediate and locally felt benefits, such as improved air quality, which is the co-benefit most often referred to in the literature, as per a review by Karlsson, Alfredsson and Westling (2020) of 239 peer-reviewed articles covering co-benefits. Likewise, within the resilience literature, many benefits of resilience projects that protect against uncertain shocks will only materialize if a disaster happens (Surminski and Tanner 2016). However, in both cases, recognition of the wider co-benefits of these projects can make the business case for their implementation to become more palatable, as other immediately tangible benefits also occur because of their implementation.

This follows the view that climate change policies and interventions can be used to target multiple (non-climate) objectives, such as human health and energy security (Intergovernmental Panel on Climate Change 2014; Von Stechow 2015). To quantify co-benefits, Von Stechow (2015) adopts an economic model in which co-benefits are the marginal impact of a policy on an objective, where the social planner's aim is maximizing social welfare by choosing the best policies (optimization of marginal welfare). This approach of optimizing marginal welfare can be adopted in multiple objective/multiple-impact frameworks. After a revision of quantitative assessments of co-benefits in the literature, they find that potential co-benefits account for 53 per cent (e.g. from renewable wind farms) to 350 per cent (e.g. from thermal insulation) of direct benefits.

On the adaptation side, decision makers still undervalue investment in resilience due to its political unattractiveness and unclear monetization, even though evidence shows that strengthening resilience is hugely cost-effective and can generate multiple benefits. The idea of resilience has been promoted for a long time. In terms of global commitments, this is well established in the Sendai Framework for Disaster Risk Reduction 2015–2030, the SDGs and the Paris Agreement on climate change. Yet different disciplines apply different concepts when assessing resilience – from robustness to bouncing back and bouncing forward in the face of shocks. A commonly used definition is the one provided by the United Nations Office for Disaster Risk Reduction: "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" Importantly, resilience needs a holistic understanding of risks and risk drivers, taking into account how risks interact and what this means for the aims and ambitions of individuals, companies or countries. But, for many, particularly in the investment community and for policymakers, there is a need to assign monetary values to any co-benefits or co-costs (Surminski and Szoenyi 2019). This creates challenges, as not all impacts of policy or interventions can be assigned monetary values, but overcoming this quantification gap is widely seen as a key barrier for more investment in adaptation and resilience (Dicker et al. 2021).

Resilience can also have a transformational aspect when we consider future climate risks and how to reduce and prepare for these. In that context, we consider resilience as a holistic strategy to help communities move ahead in a sustainable way; that is, by pursuing social,

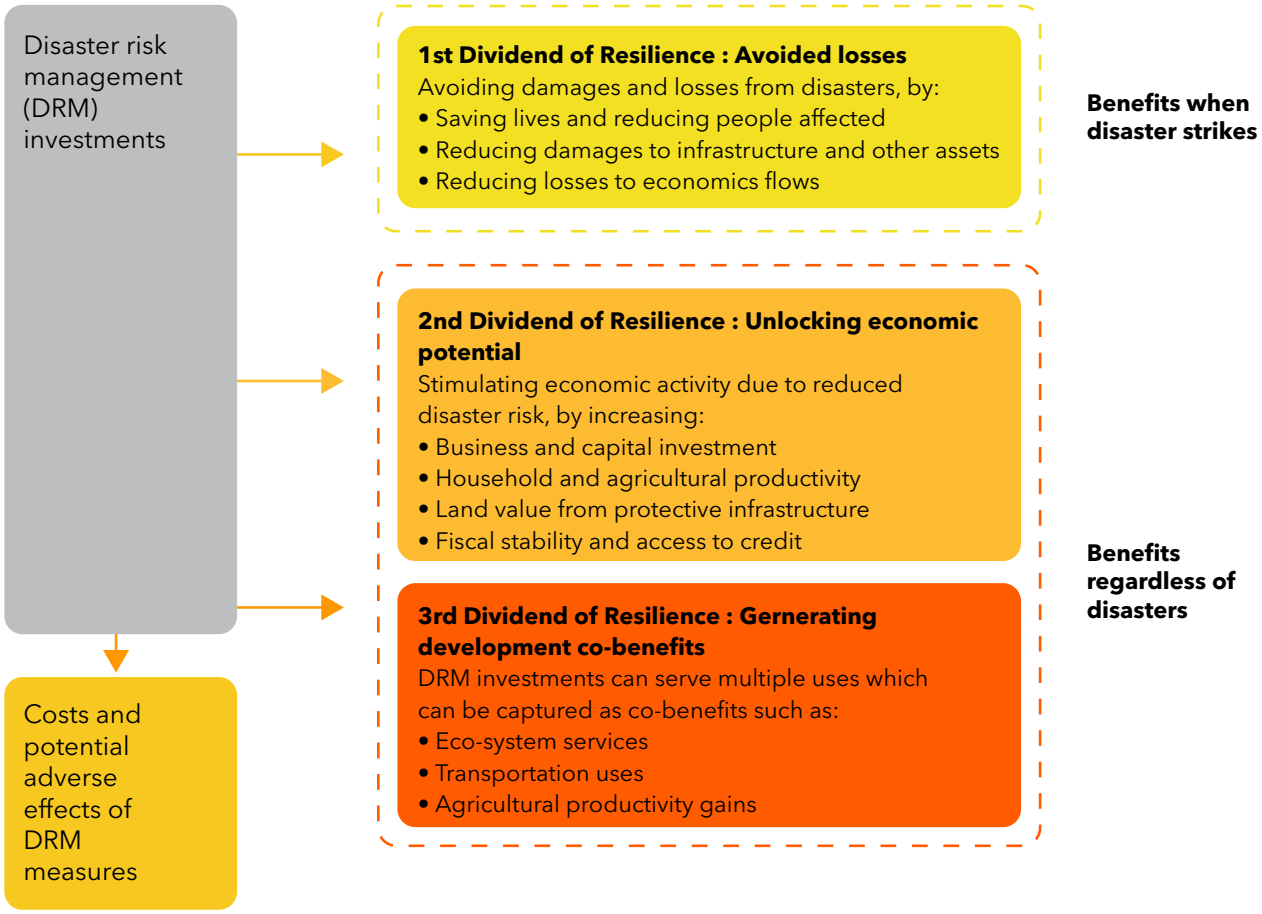
ecological and economic development goals, while managing the risk of climate change over time in a way that mutually reinforces these goals.

As such, achieving resilience is not just a matter of selecting one strategy; for example, in the context of flooding, by building a dyke. True resilience can only be achieved through a strategy that employs financial, human, natural, physical and social capitals. One example is climate change, where we know that today's decisions will determine tomorrow's risks. A lack of regard for future risk can lead to expensive lock-ins.

However, for policymakers or investors, the old adage that prevention is better than cure does not always hold water; preventative measures aimed at reducing risks or avoiding damages tend to be seen as a cost, with uncertain or distant benefits, and they often lose out to actions or interventions with more immediate and more visible results. This has caused a major imbalance in funding, with significantly more spent on recovery and repair than on climate adaptation and increasing resilience (Surminski and Tanner 2016).

As a result, the European Union's Science for Disaster Risk Management report in 2017 recommended that "presenting evidence of additional dividends to policymakers and investors could provide a narrative reconciling short- and long-term objectives. This will improve the acceptability and feasibility of DRM investments, enhancing the business case for investment in prevention and mitigation" (Poljanšek et al. 2017). Recognizing and quantifying those wider benefits in the context of policies, investments and interventions can thus help to strengthen the case for investing in adaptation, as demonstrated by the Global Commission on Adaptation's Flagship report (2019). This builds on the notion that climate resilience can generate several dividends and achieve separate objectives simultaneously. Fung and Helgeson (2017) define the resilience dividend as "the net benefit (or cost) that accrues, from investments aimed at increasing resilience, in the absence of a disruptive incident over the planning horizon". Here, the main objective is maximizing co-benefits from projects that are initially financed to achieve a certain resilience objective that tackles a problem, whether in infrastructure, energy, agriculture, water supply and many more. The end goal for measuring and exploring the resilience dividend is to make co-benefits (e.g. increased jobs and enhanced reliability of an infrastructure system) of resilience planning tangible. This idea was based on existing literature around measuring co-benefits for several types of projects in multiple sectors that yield indirect benefits, whether the main outcome was building resilience or not. The Triple Resilience Dividend concept, developed through a collaboration between Overseas Development Institute, the World Bank and the London School of Economics, and currently developed further with International Institute for Applied Systems Analysis and partners in the Flood Resilience Alliance and applied by the GCA in the context of adaptation, provides a holistic framework for assessing the direct and indirect benefits and costs of climate resilience measures. At its core are three dividends (Fig. 7.1).

Figure 7.1 Triple Disaster Resilience Dividends framework

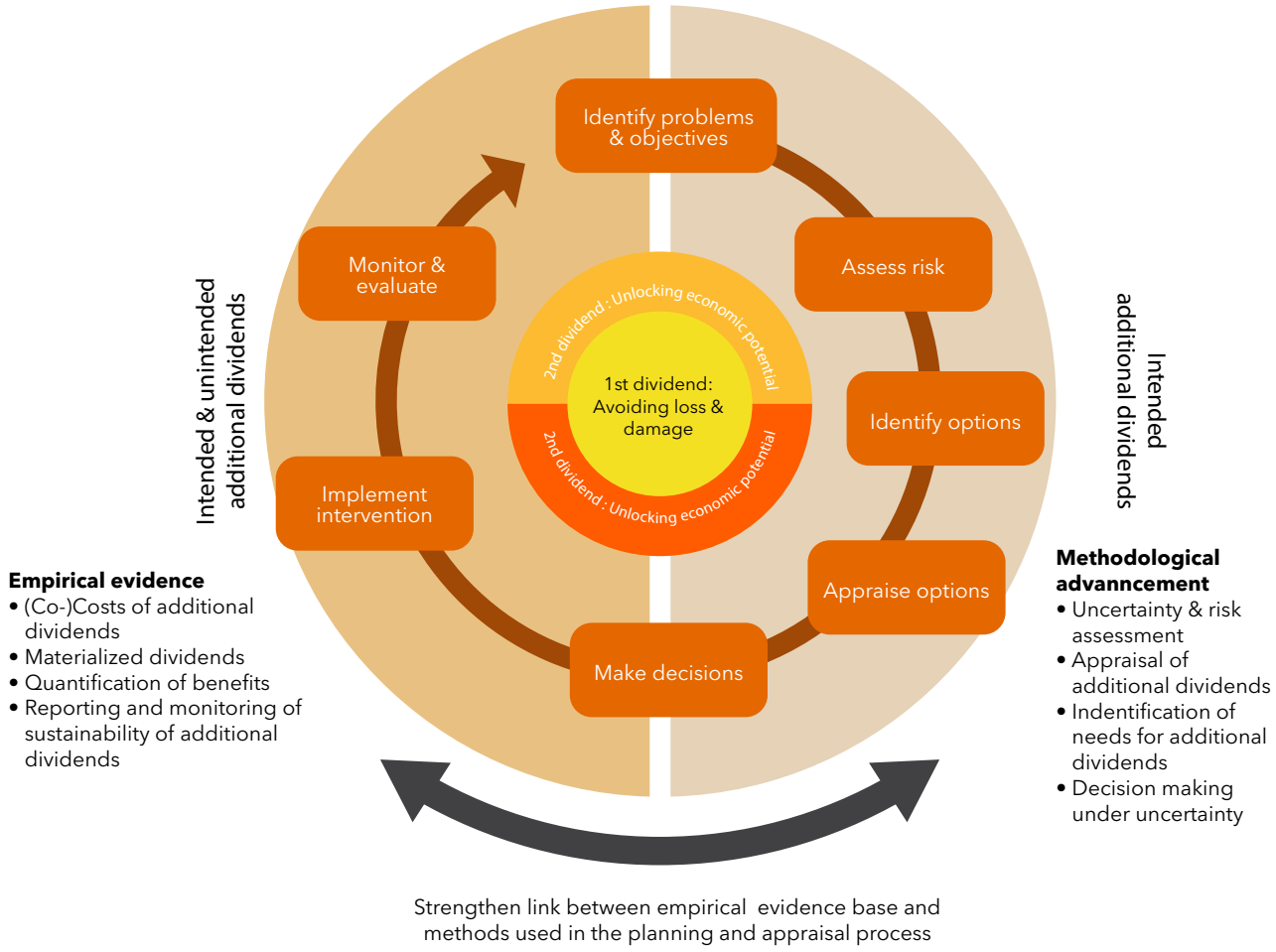


Source: Surminski and Tanner (2016).

The most common motivation and most basic rationale for disaster risk management is the first dividend: avoiding loss and saving lives. However, it is a metric that is hard to measure because of the uncertainty around predicting the timing and magnitude of a future event – this applies to both public health crises and natural disasters. The second dividend – boosting economic potential – occurs because improving resilience reduces the background risk of disaster and can increase economic potential at both the household level and, more broadly, at the macro-economic level. In addition, there can be broader sustainable development co-benefits (third dividend). Investment in resilience can yield other benefits, for example, in the form of wider environmental impacts of ecosystem restoration or reforestation, transport structures and agricultural systems. For example, flood embankments can also support road networks, and safe sea-port shelters can double as a fishery logistics service centres. Nature-based solutions in particular offer many advantages, including the fact that healthy ecosystems can regenerate; they are self-sufficient and do not need external energy supplies; they help to maintain biodiversity; they can bring tourism benefits; and they do not lose their performance capacity over time.

Applying the wider perspective on benefits and costs requires a strong tool set to help identify, quantify and monitor these for project appraisal, investment decisions and other interventions, as well as a recognition of experiences and qualitative assessments at the local level (Mechler and Hochrainer-Stigler 2019). Rözer et al. (2021) consider this in the context of decision-making processes, as shown in Fig 7.2. They argue that the need for holistic appraisals and recognition of the wide range of co-benefits and co-costs is key.

Figure 7.2 Empirical Process.



Source: Roezer et.al. 2021

7.3 Examples of co-benefit appraisals in projects relevant for the development corridor context

This section offers brief summaries of case studies where co-benefits have been appraised, to illustrate different types of applications and local experiences, as well as observed challenges. All cases have the primary aim of supporting adaptation to climate change and increasing resilience to the impacts of climate change effects. In addition, there are a range of environmental, social and economic co-benefits that have been realized, and in some cases quantified.

7.3.1 Devolved climate finance in Kenya's arid and semi-arid regions and assessment of social co-benefits

7.3.1.1 Context

The Adaptation ('Ada') Consortium (made up of the Kenya Meteorological Department, the UK Met Office, Christian Aid, International Institute for Environment and Development and in-county partners) built on pilots to develop

the County Climate Change Fund (CCCF) – a devolved climate finance mechanism. The mechanism comprises a fund to finance climate action, adaptation planning committees at county and ward levels, climate information and resilience planning tools, and a monitoring and evaluation (M&E) mechanism. It is designed to both channel climate financing to county-level governments, and to empower local communities by strengthening their participation in the use and management of those funds. Communities focused initial investments mostly on water infrastructure, such as water pans, earth and sand dams, boreholes, shallow wells and rock catchments.

Social co-benefits include the following:

- Advancing gender equality. At the community level, the CCCF mechanism has resulted in greater engagement among women and young people in planning processes. This has been supported by training and capacity-building through local committees, as well as establishing processes and procedures to ensure the views of all community groups are appropriately represented. For example, where women's views are not reflected strongly enough in plans, women-only meetings are held to address this imbalance (Bonaya and Rugano 2018). Anecdotal evidence suggests that the CCCF mechanism may be "helping change communities' attitudes towards women and supporting women and youth to become more visible and active within communities" (Crick et al. 2019) – with some women taking on leadership roles in their communities (both within local committees and more broadly) and discussing issues of community development with men where they were not previously (Bonaya and Rugano 2018; Crick et al. 2019).
- Increased community participation. It has been reported that "community consultations have become more participatory and communities have strengthened their political voice, increasingly holding county planning departments to account" (Crick et al. 2019). This is driving transparency and accountability in governance processes. This is supported by strengthened vertical links between community, ward and county levels, with greater interaction (including greater consultation of ward-level representatives), improved relations, and learning supported between different levels. Findings from household surveys suggest that standards in the way investments had been implemented had been improved as a result of increased public participation and scrutiny (Crick et al. 2019). Moreover, the CCCF mechanism has been cited by county officials to highlight the "value of participatory planning in generating effective and efficient public goods investments that represent value for money" (Crick et al. 2019).
- Education. The reduction in time spent collecting water is noted to be supporting children in their schoolwork, with anecdotal evidence of increased time at school for both girls and boys, and increased support at home – with noted educational benefits. It has been noted that girls in particular have more time to spend on their schoolwork, as a result of reduced water collection responsibilities (Bonaya and Rugano, 2018).
- Increased social cohesion/reduced conflict. Other benefits reported anecdotally include greater social cohesion and fewer conflicts within households (including reports of decreases in domestic violence) and communities, as well as between neighbouring villages.

7.3.2 Heat Action Plan in Ahmedabad, India and social co-benefits

7.3.2.1 Context

In Ahmedabad, a coalition of academic, municipal, health and environmental groups partnered to address heat-induced health impacts, led by the Indian Institute of Public Health, Gandhinagar; the Natural Resources Defence Council; and Ahmedabad Municipal Corporation (AMC). The coalition developed a Heat Action Plan (HAP), a framework for the implementation, coordination and evaluation of a strategy, the HAP outlined immediate and longer-term activities to increase preparedness, information sharing and response coordination.

Social co-benefits include the following:

- Capacity built to address other public health threats. Research to inform iterations of the HAP, and the relationships it developed, have also led to work to protect health in new areas. For example, research undertaken with traffic police in 2016 as part of the HAP highlighted the risk to workers' health of traffic pollutants (Kirbyshire and Paul 2017). The city now has an Air Information and Response Plan to fight air pollution, modelled on the HAP process. The Air Information and Response Plan promotes inter-agency coordination, public awareness and capacity-building among medical professionals. This provides a clear example of the capacity built in local government institutions through the HAP, including in planning and evaluation. One evaluation found that the HAP "built interest in the evaluation and feedback process within several government agencies" (Indian Institute of Public Health Gandhinagar, Natural Resources Defense Council, Rollins School of Public Health of Emory University, Icahn School of Medicine at Mount Sinai 2015).

- Education. The HAP has allowed schools to continue to provide uninterrupted access to education during some periods of extreme heat, with an informant noting a "remarkable reduction" in those missing school during heatwaves. However, this is limited, and the 2019 iteration of the HAP advises school closures on days where temperatures reach 45˚C or above (Ahmedabad Municipal Corporation 2019).
- Women's employment. Painting roofing on low-income housing with white reflective paint has allowed women, who are more likely than men to work from home (in roles such as sewing), to remain indoors and continue working, where they were unable to previously in comparable heat.
- Knowledge-building. The HAP has created greater awareness of the impacts of extreme heat and climate change, with acknowledgement and action from a range of actors who previously did not recognize the risk. Drawing attention to the role of climate change in the occurrence of extreme heat has also encouraged greater focus on carbon emissions and mitigation measures, by raising the profile of climate change more broadly among the population. One informant noted that solar panels have seen a significant increase in uptake over recent years, including as a revenue stream. The AMC is planning to install solar panels on AMC buildings, as well as planting 500,000 trees annually between 2020 and 2025 (Natural Resources Defense Council 2020).
- Highlighting vulnerabilities. The plan has also highlighted other existing vulnerabilities in Ahmedabad. The focus on protecting slum communities from heatwaves, for example, further highlighted the specific vulnerabilities of those in low-income housing without access to water or electricity.

7.3.3 Ecosystem-based adaptation in Thua Thien Hue province, Vietnam

7.3.3.1 Context

As part of a disaster risk reduction (DRR) and research project by the Global Resilience Partnership, ecosystem-based adaptation (EbA) measures have been planned and implemented in the Giang Lagoon, Bu Lu river delta and Hue City (Bubeck *et al*. 2019). The region suffers from flooding caused by the river, sea and from heavy rainfall, mainly during monsoon season. Between 1975 and 2005, 40 flood events were recorded in the region (Bubeck *et al*. 2012). At the same time, the province highly depends on ecosystem services of the surrounding water bodies, including 100,000 people directly relying on the lagoon as fishing grounds and for their water supply (Van Tuyen, Armitage and Marschke 2010). In the United Nations Educational, Scientific and Cultural Organization (UNESCO)-listed Hue City, the local ponds act as retention areas in case of heavy rainfall events, while at the same time are important for local tourism and recreation. Population growth and rapid urban expansion has led to a fast disappearance of natural areas, putting additional pressure on available ecosystem services, while at the same time increasing the exposure to flooding. Apart from that, a gender gap between men and women was identified as one key issue of the communities' flood resilience. As the main caregivers in the community, to both the elderly and children, women have limited mobility in case of a flood disaster and also fewer opportunities to build up savings for a fast financial recovery.

Social co-benefits include the following:

- The implemented EbA measures generated a number of social co-benefits. Restoring the ponds in Hue City improved the recreational value, offering areas for recreation improving physical and psychological well-being of the local population. Creating attractive spaces for local communities to meet it promotes neighbourhood activities

and social cohesion. As the measures were developed and planned with the active involvement of the local women's union, increased participation and engagement by local women helped to promote gender equality.

Economic co-benefits include the following:

» Both planting of mangroves and urban pond restoration come with considerable economic co-benefits. A willingness to pay for analysis of both national and international tourists resulted in a positive benefit–cost ratio of 34 from the increased attractiveness to tourists of the UNESCO World Heritage Site, Hué. Planting mangroves is expected to lead to an increase in fisheries and seafood, stimulating the vital maritime economy in the region. Based on an expected increase in seafood production, a positive benefit–cost ratio of 2.3 was estimated.

Environmental co-benefits

» By planting mangroves along the river banks of Bu Lu river and in the Giang Langoon, not only is wave energy reduced, stopping coastal erosion and reducing the risk of flooding, but planting mangroves also comes with additional environmental co-benefits. This includes new habitats and breeding grounds for many terrestrial and aquatic species and improved water quality, as mangroves act as a natural water filter by absorbing heavy metals and other toxic substances. As a global environmental co-benefit, the planted mangroves absorb carbon dioxide and reduce the greenhouse gas concentration in the atmosphere. The urban pond restoration in Hue City contributes to a regulation of the urban microclimate by absorbing excess heat during hot days and, due to healthier vegetation, local air quality has improved.

7.3.4 Bio-dykes in Bardia and Kailali districts, Nepal

7.3.4.1 Context

The Bardia and Kailali districts lie in north western Nepal, on the border with India. The two communities in Bardia and Kailali consist of 135 and 60 households, respectively. In both cases, the main livelihood of community members is agriculture, which is also the key source of their food security. The majority of the agricultural land is highly susceptible to regular flooding of tributaries of the Karnali river during the monsoon season, destroying crops, putting livestock at risk and leaving sand deposits. Both communities have a low standard of living. As part of the Nepal Flood Resilience project the non-governmental organization Practical Action has supported the construction of bio-dykes to reduce bank erosion and loss of agricultural land during flooding, as well as to save lives and properties. Faced with more frequent and intense climate-induced disasters, bio-dykes have emerged as a DRR intervention that can be well integrated into local plans and community-led programmes across the different geographic areas in Nepal. Bio-dykes are a bio-engineering solution that can control bank erosion and control flood risk by mediating the water flow through a combination of vegetation and structural measures. The vegetation controls the erosion of an embankment built from locally available material such as sand, rocks and soil. In the initial stage, sand bags are used to control erosion while the biological measures gradually become more effective when plants mature and their roots start to stabilize the soil. For the vegetation, local grass, shrub and tree species are used. Bio-dykes with a length of 220m and 1,500m were built in the two communities coordinated by the Local Disaster Management Committee.

Social co-benefits include the following:

» As a direct social co-benefit, the better protection of livelihoods through a protection of agricultural land from the bio-dykes out-migration from the community

could be stopped, as community members are not forced to find other sources of income outside the community.

» Additionally, community members reported the new knowledge and skills that they acquired during planning, building and maintaining of the bio-dykes as a positive social co-benefit.

Economic co-benefits include the following:

» The bio-dykes increased fodder production for livestock in two ways. As the agricultural land is better protected, yields are more stable as they do not get destroyed by floods during the monsoon season. In addition, the vegetation growing on the bio-dykes can use as an additional source of fodder increasing the productivity of livestock.

Environmental co-benefits include the following:

» The vegetation growing on the bio-dykes not only helps stabilize the construction of the dyke through their roots and prevent bank erosion, but it also created new wildlife habitats for local species. With sustainable use of the vegetation growing on the bio-dykes, carbon dioxide is sequestrated, reducing the greenhouse gas concentration in the atmosphere.

7.4 Conclusions

The ex-ante recognition of co-benefits and co-costs can have significant implications for the design of investments, policies and government interventions, such as corridors. This can be a significant contribution to ensuring utility corridors transition into true development corridors. As highlighted by Dexter (2018), their omission has led to a myopic view of the potential benefits of corridors, hence misrepresenting their true value, either with a positive or negative bias. Unequivocally, this can lead to suboptimal decision-making, when incomplete impact appraisals are used to allocate funding and attract investment, or comply with investor conditionality rules.

From the field of climate resilience, we learn that a holistic approach is important for avoiding silo thinking. We are facing complex challenges and will only succeed if we understand how we can cope with interconnected and compounding risks. Importantly, this also needs to move beyond the traditional view of relying on hard engineering and infrastructure solutions only. Human, social and natural capital are hugely important for building resilience, but are often overlooked when designing risk strategies. This aligns well with the holistic scope of sustainable development, where co-benefits can also strengthen the case for investments in favour of those projects and policies that deliver economic, social and environmental benefits.

Evidence of these co-benefits can be drawn from a mixture of studies, M&E documents and discussions with stakeholders. However, the case studies used in this chapter show that there are significant limitations in the evidence base for the benefits that accrue from adaptation processes, across breadth, robustness and type of evidence. Indeed, much of the evidence gathered is anecdotal, reflecting that the evidence of co-benefits is not likely to have been a key consideration when the adaptation process was initiated. This may be related to the availability (or lack thereof) of funding for holistic M&E activities, how these activities were framed, and the types of benefits that were being considered for measurement. Challenges in evidence availability appeared greater in some contexts, for instance, from adaptation processes in Least Developed Countries and Small Island Developing States.

This is also visible for many of the development corridor projects. As Gannon (2020) shows implementation and ownership of SDG achievement through development corridors remains varied and fragmented (Gannon 2020). And the analysis of LAPSSET shows that the integration of the environmental, social and economic co-impacts were omitted from the CBA, despite the theoretical necessity of their inclusion. However, even the simplistic environmental and social impacts identified in the current LAPSSET reports (LAPSSET 2021) could be converted into an aggregate performance measure to help better indicate the co-impacts of the project (DCP policy brief 2021).

The case studies shown are themselves still relatively new and emerging examples of potential adaptation successes, recognizing that the full returns from investment in adaptation will only become evident in the long term, particularly for large-scale infrastructure projects such as the development corridors. As such, it will be critical to continue to invest in ongoing M&E activities into the future for pioneering adaptation processes such as those highlighted by the paper. Nonetheless, action to increase financing for adaptation does not depend solely on further rigorous documentation of the impacts of adaptation financing and the two areas should be focused on simultaneously. Existing technical analysis, although limited, is sufficient to continue to build the profile of the benefits to be gained through a rapid scaling up of adaptation financing.

Decision-making frameworks for financing adaptation should recognize and value a diverse range of possible benefits that may result from adaptation processes. However, those tasked with appraisals and decision-making need to acknowledge that maximizing monetary co-benefits might not be the best option in case the co-benefits do not meet the community's needs and priorities, and are therefore lacking local buy-in. In the case of CBA this means that the co-benefits that are included in a CBA analysis need a careful and critical evaluation from all stakeholders to avoid solutions that might have a high BCR but low acceptance by beneficiaries.

Furthermore, there is the challenge of creating significant search costs when attempting to assess all possible co-benefits and co-costs in detail. In response, the approach recommended by the UK's Green Book (Her Majesty's Treasury 2018) is to not conduct economic analysis of benefits and costs if it is disproportionate to do so. Given that the values of some wider co-impacts may be relatively miniscule compared with the central costs and benefits of the project, it can be justifiable to exclude them from a full appraisal if their inclusion is unlikely to alter the conclusions of the CBA or MCA. In Vietnam, a survey among local decision makers showed knowledge gaps regarding the wider co-benefits of ecosystem-based adaptation and revealed a mismatch between the adaptation strategy of the national government highlighting the importance of co-benefits and the overall reluctance and scepticism of local decision makers towards considering and implementing measures with a high number of co-benefits but a lacking track record in avoiding losses and damages. Overall, the case studies show the need for robust, long-term, bottom-up and open-ended planning, as well as M&E for these adaptation interventions.

However, there are often major obstacles in terms of lack of trust and experience with co-benefits when convincing local decision makers to include additional co-benefits in appraisals. This can lead to a negative feedback loop, in which lacking the M&E of co-benefits of previous projects means that crucial evidence is missing to inform decisions on co-benefits in future projects. However, the case studies also show that the perceived usefulness of co-benefits by decision makers and their communities play a major role in securing local buy-in and acceptance of the proposed measures. Especially in cases in which the value of additional co-benefits of a measure is compared against its main goal. In the case of the bio-dykes in Nepal, buy-in by the local community could not be achieved for these measures, despite the large number of co-benefits, as concerns by the community about the lower efficacy of bio-dykes in avoiding loss and damage compared with concrete flood walls outweighed the perceived usefulness of the additional co-benefits from bio-dykes. In the Nepal case, local decision makers were not in favour of bio-dykes as a DRR measure due to concerns that their efficacy in reducing loss and damage is lower than concrete flood walls. The additional co-benefits of bio-dykes in comparison with concrete flood walls were valued as lower in comparison with the increased risk of not reaching adequate flood protection levels. Similarly to the case study in Vietnam, this revealed a contrast between national-level strategies, which encourage nature-based solutions and solutions with a high number of co-benefits, and the focus on avoiding loss and damage by local decision makers. This suggests that without significant community engagement, there is a danger of a mismatch with co-benefits suggested by funders and those that reflect actual local needs. The selection of case studies reflects the current landscape of adaptation activity, in which narratives of adaptation recognized as successful often fail to target – or hear the voices of – the communities that are poorest and most vulnerable to climate change, despite the fact that there is extensive and innovative adaptation activity taking place in these communities.

Comparing adaption case studies between developing and developed countries, it appears that in developing countries, governance and funding structures are, at least on paper, often more supportive in including co-benefits, due the immediate development needs alongside the need for disaster risk reduction and adaptation. In developed countries, institutional silos are more prevalent and considering additional co-benefits is often seen as a weak point in project proposals, as co-benefits often require co-funding from separate funding sources.

Decision-making frameworks for financing adaptation should recognize and value a diverse range of possible benefits that may result from adaptation processes. However, those tasked with appraisals and decision-making need to acknowledge that maximizing monetary co-benefits might not be the best option in case the co-benefits do not meet the community's needs, and are therefore lacking local buy-in. In the case of CBA this means that the co-benefits that are included in a CBA analysis need careful and critical evaluation by all stakeholders to avoid solutions that might have a high benefit–cost ratio but low acceptance by beneficiaries.

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