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Designing a Funding Framework for the Slow-Onset Impacts of Climate Change: Insights from Recent Experiences with Coastal Retreat

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Abstract

Effective management of slow-onset impacts such as coastal erosion, desertification and sea level rise and their often-transformative impacts on communities and countries has remained relatively unexplored in terms of policy and finance responses. Drawing on relevant global experience, this paper investigates recent approaches to planned relocation as one possible response to climate change impacts and considers principles to inform the design of a fair and effective funding system. Relevant principles include minimizing long-term societal costs, pursuing intergenerational equity, integrating funding with broader sustainable development objectives and ensuring a high degree of transparency and accountability for the use of public funds.

Highlights

- The slow-onset impacts of climate change will require planned relocation.
- Current funding systems focus on rapid-onset impacts and disaster recovery.
- Funding for pre-emptive planned relocation is inadequate.
- Clear principles are needed for funding planned relocation.
- Long-term cost minimization and distributional fairness are critical.

Key words: slow-onset events, sea level rise, planned relocation, funding mechanisms, funding principles; managed retreat

1. Introduction

Recent projections of the impacts of climate change point to a significant increase in coastal flooding, coastal erosion and the mean sea level during the 21st century [1,2]. Even with rapid global decarbonisation by 2050, sea level rise will affect tens of millions of people in coastal regions, with substantial losses of land, livelihoods, infrastructure, community assets and cultural heritage. Indeed, in some places around the world these impacts are already evident, necessitating a range of risk-reduction initiatives and adaptation measures. In some cases, it may be cost-effective to strengthen or expand coastal protective structures or elevate vulnerable buildings. Often, however, such responses are problematic and at best provide only temporary respite. In these latter cases planned relocation (variously referred to as managed retreat and managed realignment) is increasingly seen as an important tool for policy-makers [3,4,5,6]. For low-lying atoll states and other vulnerable islands, pre-emptive relocation may represent the only credible response [7,8].

For effective implementation, pre-emptive interventions require well-designed policy frameworks and robust funding mechanisms – at both the international and national levels. Globally, funding for any pre-emptive responses to climate change remains insufficient [9], despite growing evidence of the economic benefits of ex-ante resilience building and adaptation efforts [10,11]. Nationally, comprehensive policy frameworks for climate change adaptation are slowly emerging. However, across both high and low-income countries funding for pre-emptive responses is generally ad hoc, poorly coordinated, and limited in scale and scope. Sound anticipatory governance is typically lacking. This is particularly evident in the context of managing slow-onset events.

This paper explores the funding of pre-emptive planned relocation in response to the slow onset impacts of climate change. The primary focus is on the policy challenges posed by sea level rise. For various reasons, such challenges differ from, and often exceed, those associated with rapid-onset events and post-disaster responses [12,13]. The paper briefly outlines the rationale for and the nature of planned relocation. It then explores the types of policy instruments available for funding the various costs associated with planned relocation, notes their application in different contexts, and considers some implications for policy. Finally, the paper outlines a series of principles to govern the design of funding arrangements for pre-emptive planned relocation.

Our analysis focuses on planned relocation *within* countries. Cross-border issues are not considered. Nor are the moral and legal responsibilities of high-income countries to assist low-income countries, including the issues surrounding climate-change related ‘loss and damage’ (e.g. matters of attribution, historical responsibility, liability, and inter-governmental compensation) [14,15]. Finally, the loss of statehood (e.g. due to sea level rise rendering low-lying atoll states uninhabitable) and the related need for trans-national managed retreat are not considered. While such matters are rightly receiving increasing international attention (e.g. via the Warsaw International Mechanism for Loss and Damage), they are beyond the scope of this analysis.

2. Background

Planned relocation is recognized as a possible response to rising climate risks in the Cancun Adaptation Framework under the United Nations Framework Convention for Climate Change (UNFCCC), in the Warsaw International Mechanism for Loss and Damage and the Sendai Framework for Disaster Risk Reduction. It is commonly understood as ‘state-led resettlement of populations severely exposed to climate change impacts’ [16] and includes ‘the reconstruction of communities’ infrastructure, services, housing, and livelihoods at their destination’ [17]. It differs from migration as it is a deliberate intervention, leading to relocation of assets and resettling people out of harm’s way, usually based on decisions made by public authorities rather than individuals [18,19,20,21].

As a policy instrument planned relocation is challenging. It requires significant community buy-in, acceptance and planning to ensure that it puts those at risk on new and more sustainable development paths. Further, it raises serious political challenges and can trigger wider societal implications, such as the loss of traditions or cultural heritage [22,23] and opposition among those being relocated [24]. However, given current climate-risk trends, significant planned relocation is inevitable. As such the global, national and local governance implications of relocating people have received increased attention in international climate change policy debates [17,25], but clear policy guidance around funding arrangements remains wanting. For example, although in some countries there are policies, including in some cases legal arrangements that govern planned

relocation – as highlighted in Table 1 –many of the key funding issues, such as who should pay for the various costs associated with relocation, have not been properly resolved.

Table 1: Examples of policies, including legal arrangements, for relocation

Embankment and Drainage Act,1952 regulates land acquisition by the Water Development Board [26]	Bangladesh
Law No. 2016-1087 for reclaiming biodiversity, nature and landscapes: ecological compensation bonds; fund for the Prevention of Major Natural Risks (created in 1995 under the Natural Disaster Compensation Scheme) pays for resettlement after repeated flooding [26]	France
Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013 includes provisions for resettlement of persons residing in areas affected by natural calamities [27]	India
The New Zealand Coastal Policy Statement (NZCPS) 2010, guides local authorities in their day-to-day management of the coastal environment and Policy 25 under the policy includes provision for managed retreat by relocations [28]	New Zealand
The Building and Planning Act (SFS 2010:900) – regulates the compensation mechanism for damage and compulsory purchase by government; appeal mechanism for municipal government decisions [26]	Sweden
Disaster Recovery Reform Act 2018 has incorporated relocation into its national hazard mitigation strategy [26]	USA

In particular, the majority of existing laws and funding mechanisms center around sudden-onset disasters, with few extending to slow-onset events, such as sea-level rise and protracted droughts [29,30]. Bangladesh, for instance, has no provision within the existing legislative framework to address slow-onset events such as sea level rise and non-economic loss and damages [31]. Given the increasing vulnerability of many countries to climate-related slow-onset risks, not least many small island developing states and low-income nations, developing new policy frameworks to manage such risks is critically important [32].

3. Funding instruments for planned relocation

To analyze funding instruments, it is important to distinguish between two aspects: who pays and how the financing is structured. Drawing on available studies and different examples globally, we examine the nature of funding instruments for planned relocation. Table 2 indicates the many contexts where relocation is occurring and the different types of funding mechanisms that have been applied. It also highlights the use of a variety of tools ranging from federal funds based on public taxes, contingency funds, insurance instruments to international aid and grants and trust funds.

Table 2: Examples of existing instruments and mechanisms for financing relocation

Types of funding instruments and mechanisms	Source of Funding	Examples of application (country, hazard)
<ul style="list-style-type: none"> • Dedicated Tax 	<ul style="list-style-type: none"> • Taxpayers 	<ul style="list-style-type: none"> • City of Fargo, North Dakota, USA used flood control sales tax to acquire 200 properties for flood control [33]
<ul style="list-style-type: none"> • Utility Fees 	<ul style="list-style-type: none"> • Utility users (water, electricity etc) 	<ul style="list-style-type: none"> • City of Charlotte, North Carolina, USA utilizes Storm Water Services fees to fund buyouts [34]
<ul style="list-style-type: none"> • Relocation incentives 	<ul style="list-style-type: none"> • Taxpayers subsidizing homeowners 	<ul style="list-style-type: none"> • New York State’s buyout plan pays owners an additional 5% percent over the pre-storm assessment if they relocate within the same county [35]

<ul style="list-style-type: none"> • Government emergency assistance funds 	<ul style="list-style-type: none"> • Taxpayers 	<ul style="list-style-type: none"> • The US Federal Emergency Management Agency (FEMA) has funded the acquisition of more than 40,000 properties through buyout programs [4] • Japan resettled 21,000 residents following the 2011 earthquake [36] • US FEMA’s Pre-Disaster Mitigation Grant Program received \$222 million between 2011 – 2014, which also supported relocation for Isles de Jean Charles, Louisiana [37]; three Alaskan communities of Kivalina, Newtok, and Shishmaref that have voted to relocate [38] • UK Defra pilot provided £11 million for the ‘rollback’ of 15 local communities in the face of coastal erosion [39] • The Dutch government’s ‘Room for the River’ program supported resettlement of households [40] • The Fiji government contributed more than US\$345,000 for the relocation of Vunidogoloa affecting over 100 households • The Panamanian government relocated the community of Gardi Sugdub, at risk of coastal inundation, including 300 homes rebuild in new locations • The government of Kiribati bought land in Fiji for a potential resettlement site for AUD\$9.3 million • The government of Papua New Guinea’s resettled 1,700 residents of Cateret Island
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		<ul style="list-style-type: none"> • The state of Odisha in India has relocated around 700 families from risk of sea level rise and coastal flooding under Resettlement and Rehabilitation policy 2016 [41] • The government of Vietnam has been relocating households since the 1990s from the flood prone areas under ‘Living with the Floods programme’ [17]
<ul style="list-style-type: none"> • International Aid and grants 	<ul style="list-style-type: none"> • International donors (via taxpayers in donor countries) 	<ul style="list-style-type: none"> • Tamil Nadu received international aid to support relocations following the 2004 major typhoon [42] • Guatemala received aid for rebuilding 19 municipalities in Sololá, which required the relocation of some communities, at a total cost of US\$92.7 million [43] • The Philippines received international aid following Typhoon Haiyan which was also used to support relocation of some households [44] • Mozambique received international funding following 2007 floods, which was also used to support relocation of households [5]
<ul style="list-style-type: none"> • Trust Fund 	<ul style="list-style-type: none"> • Levy payers 	<ul style="list-style-type: none"> • Fiji set up a relocation trust fund with a portion taken from the country’s Environment and Climate Adaptation levy, contributing approximately \$5 million/year [45]
<ul style="list-style-type: none"> • Borrowing/bonds 	<ul style="list-style-type: none"> • Donor tax payers provide capital: local tax payers and 	<ul style="list-style-type: none"> • Subsidies and low-cost loans and mortgages for communities in Kamgar Putala, India to resettle outside of flood risk area [46]

	homeowners need to repay loans	<ul style="list-style-type: none"> • Argentina, in partnership with the World Bank, lent funds for assisted self-construction program to relocate homes in chronic flood areas [43] • Sao Paulo received loans from the Inter-American Development Bank for relocating homes in chronic flooding areas [43]
<ul style="list-style-type: none"> • Insurance-linked 	<ul style="list-style-type: none"> • Those paying for insurers or taxpayers (depending on structure of the insurance mechanism) 	<ul style="list-style-type: none"> • New Zealand has funded buyouts after the Christchurch earthquakes via the Natural Disaster Fund operated by EQC [29] • French catastrophe insurance – The Major Natural Risk Prevention Fund (Fonds de Prévention des Risques Naturels Majeurs - FPRNM) or Barnier Fund – can be used for natural hazard risk reduction, including buyouts in certain circumstances [47] • A similar approach has been proposed for other countries whereby a surcharge on property and casualty insurance would be paid into a fund for buy-outs and relocation [48]
<ul style="list-style-type: none"> • Community housing savings groups 	<ul style="list-style-type: none"> • Local communities 	<ul style="list-style-type: none"> • Communities form savings groups to assist with relocation, for example in Pune, India; Panama; Fiji [40,47]

4. Findings

Our review of existing instruments and mechanisms for financing planned relocation highlights several important features.

4.1 Dominance of public funding

Current evidence on the implications of using different financial instruments for planned relocation is rather limited. We find that the major source of financing often comes from the national and federal level – for example, in the US via FEMA [49] or in Vietnam via the ‘Living with Floods’ programme [17]. In addition, international aid and development assistance have been important sources of relocation funding for many low and middle-income countries [42,43,44]. Planned relocation in such cases has included funding from multilateral organizations. For example, after Typhoon Haiyan in the Philippines, government and international donors constructed resettlement sites to accommodate displaced communities. In other cases, responsibilities for funding relocation rest with sub-national government. In India, for example, the state government of Odisha (an eastern coastal state) has funded the relocation and resettlement of around 700 households from several coastal villages in response to sea level rise [41]. The responsibility for implementing planned relocations, however, tends to be more decentralized. It is therefore important to ensure that funding flows effectively to those tasked with implementation of planned relocation. This is a key challenge and will require a clear understanding of local needs and requirements [50].

4.2 Re-active rather than pro-active

Like most adaptation financing which is currently biased towards remedial actions over preventive actions – for example, by mobilizing tax revenues after a disaster has occurred [51]– the major focus of most cases of planned relocation has been on ex-post spending rather than pre-emptive investment. Our review of cases reveals that most current funding instruments are designed for post-disaster contexts in response to significant losses from rapid-onset disasters – indeed, most require a clear declaration of disaster for funding to become available and do not sufficiently take into account the issue of planned relocation in the context of slow-onset events [52,53]. Such arrangements are inconsistent with the predictability and durability of funding required for a well-designed and strategically planned pre-emptive relocation [50]. This situation reflects the tendency for climate change adaptation and disaster risk reduction to be covered by separate funding

mechanisms rather than integrated arrangements. More predictable longer-term funding approaches are also essential to avoid the challenge of waning donor interest unless there is a focusing event to respond to. Experiences show that the international community and humanitarian agencies still tend to shy away from taking a ‘long-term view’ [50]. Donor guidelines as well as policy frameworks will need to change if the long-term costs of adaptation, including planned relocation, are to be minimized and if there is to be adequate investment in building resilience.

4.3 Use of New and emerging financing instruments

In addition to the traditional financing options of federal funding and international assistance, there have been many emerging cases of testing new financing instruments through private markets and using debt instruments [29,45,47].

4.3.1 Green Bonds

There are several financing options that have the potential to facilitate pre-emptive planned relocation by creating investment opportunities through new forms of borrowing via bonds [54,55]. To date, the majority of bond instruments have been used for climate change mitigation [55]. But there is also a case for employing green bonds to finance adaptation projects [54], including planned relocation. For example, the Massachusetts Green Bond initiative covers land acquisition, but is not currently used for buy-outs of existing properties [56]. The Environmental Defense Fund’s Environmental Impact Bond has the potential to be utilized for planned relocation [57], and New York State is in the process of implementing a US\$3 billion Resilience Bond, of which US\$250 million will be earmarked for buyouts [58]. While there are contrasting views on the relative merits of debt instruments and fiscal measures for adaptation financing, [59,60,61], combinations of different instruments may represent an efficient solution in some situations [62,63,64,65].

4.3.2 Trust Funds and Mitigation Credits

Multi-donor trust funds and mitigation credits have recently been tested to provide adaptation finance, including planned relocation. For example, the Northeast US Regional Planning Association has called for a Resilience Trust Fund [66] to support relocations. Similarly, Use of Conservation Mitigation Credits, with credits being available to buy and sell to fund relocation

and ecosystem restoration, involve monetizing the indirect economic benefits of returning developed land to marshland or green spaces. In particular contexts this can drive increased tourism and recreation and other ecosystem services, as explored in the East Sussex Coast in the United Kingdom. Here, relocation is an investment as well as a cost, generating economic, social and environmental benefits through enhanced ecosystem services. Importantly, bonds and credits still require repayment, usually by governments. In other words, while the source of capital is the private sector, the cost of capital will have to be met by the public sector.

4.3.3 Insurance Mechanisms

Use of insurance mechanisms at the individual as well as sovereign level have been argued to be potentially beneficial in financing relocations after disaster occurs [67]. Although still emerging, there are a few examples of financing planned relocations through insurance-linked instruments such as in the case of French catastrophe insurance which funds buyouts in certain circumstances [47]. While potentially important and useful, insurance mechanisms have yet to be used to finance pre-emptive planned relocations. To what extent this may be possible in the future remains to be seen.

4.3.4 Dedicated Climate Funds

Internationally, the Adaptation Fund could support planned relocation. Created by the Kyoto Protocol's Clean Development Mechanism (CDM) and funded by a 2% levy on the Certified Emission Reductions program under the CDM, nearly US\$800 million has been allocated to adaptation projects in low-income countries thus far. However, this has not yet included planned relocation. Similarly, the Green Climate Fund could support planned relocation. However, accessibility and timeliness can pose barriers, particularly for low income countries [52].

5. Guiding principles for funding planned relocation

Drawing on the examples and brief assessment in sections 2 and 3, we turn now to consider the principles that should guide the funding of planned relocation. Three preliminary matters deserve emphasis.

First, funding issues, especially those surrounding the sharing of major economic and social costs, are inherently controversial— both ethically and politically. Climate change adaptation is no exception. The relevant literature contains numerous principles for the design of funding mechanisms and cost-sharing arrangements [68,69,70,71,72,73]. Some of these are widely

supported, such as the principles of ‘equity’ and ‘common but differentiated responsibilities and respective capabilities’, as enunciated in Article 3 of the United Nations Framework Convention on Climate Change. But high-level principles like distributional equity are invariably open to different interpretations. They can also be prioritized, weighted, traded-off, and applied in multiple ways. Hence, their policy implications vary depending on the philosophical lens adopted. This applies both internationally (e.g. regarding the conflicting views over the responsibilities of high-income countries for climate-related loss and damage in low-income countries [74] and domestically (e.g. regarding divergent ideas about the respective responsibilities of central and sub-national governments and the appropriate balance of public and private funding) [75].

Second, regardless of the principles recommended, funding frameworks for planned relocation are bound to be influenced by each country’s policy context, notably its constitutional and institutional arrangements, political culture, legal traditions, financial resources, insurance coverage and provisions, and geography [76,77]. Above all, funding issues will reflect the nature of the prevailing ‘social contract’ between citizens and the state. This includes basic human rights considerations of relocated persons [32], the respective rights and responsibilities of citizenship and long-standing approaches to risk-pooling and burden-sharing [76]. For instance, countries vary markedly in their funding arrangements for, and policy responses to, natural disasters. Some emphasize the principle of *social solidarity*, resulting in many disaster-related costs being socialized via the state. By contrast, others emphasize the principle of *mutuality* based on risk-pooling through (mostly) private insurance arrangements [74,79]. These differences significantly affect the nature and extent of any public compensation for disaster-related property losses: in some cases, public compensation is commonplace; in others it is rare. Equally, some countries, like New Zealand, have a tradition of pre-funding large projected future costs (e.g. those associated with population ageing or damaging earthquakes) while others do not. Such practices will affect how governments around the world fund adaptation, including planned relocation. At the same time, policy frameworks evolve as circumstances change. Countries also learn from each other. Over time, therefore, a degree of policy convergence regarding adaptation funding is probable, certainly among countries with broadly equivalent fiscal resources living standards and political traditions.

Third, however planned relocation is funded, government decision-making on planned relocations must be properly integrated and coordinated with decisions on closely related adaptation measures (e.g. the funding of protective structures and other resilience investments), as well as wider budgetary matters, such as expenditure on infrastructure, social services, and the construction of residential housing and community facilities [80]. This implies the need for sound anticipatory governance, robust mechanisms for spatial planning and infrastructure investment, and a clear understanding of the adaptation responsibilities of the different tiers of government. Given the risks, complexities and political challenges [81] posed by pre-emptive and large-scale relocations in the face of sea level rise (e.g. repositioning of entire coastal towns and suburbs), new planning processes, public institutions, and decision-making arrangements may well be needed.

With these preliminary considerations in mind, the funding of planned relocation should be informed by at least five high-level principles:

1. Minimizing long-term societal costs;
2. Ensuring intergenerational and intragenerational equity;
3. Enabling those directly affected to get on with their lives with minimal disruption and uncertainty;
4. Integrating the funding of planned relocations with national strategies for sustainable development and societal resilience; and
5. Ensuring a high degree of transparency and accountability for the allocation of public funds.

We briefly explain these principles below and note some of their policy implications.

5.1 Minimizing long-term societal costs

The principle of long-term cost minimization should be at the heart of all adaptation decision-making [77,82]. ‘Long-term’ in this context means at least a century. Importantly, too, the goal should apply to all societal costs, not merely those borne by the state.

Clearly, implementing this principle poses challenges for policymakers. Complications include the inevitable uncertainties surrounding the timing and scale of climate change impacts, difficulties

assessing the precise costs and benefits of adaptation options, disagreements over the appropriate discount rate to apply in cost-benefit analyses, and uncertainties over the timeframes required to plan and implement pre-emptive relocations. Nevertheless, this principle has several significant implications for policymaking, including:

- Implementing policy measures to minimize moral hazard, for example through encouraging risk-related insurance premiums and imposing stringent restrictions on residential development in at-risk coastal areas or on flood plains (e.g. via zoning and other spatial planning mechanisms);
- Ensuring that vulnerable communities are relocated *prior* to serious coastal erosion or flooding, thereby minimising property damage;
- Ensuring that all new settlements are established in safe locations in order to avoid multiple retreats;
- Minimizing disorderly and unmanageable migration, both internally and across national borders; and
- Avoiding expenditure on new or reinforced protective structures where the expected cost-effectiveness is low.

Meeting these objectives will not be easy. Suitable locations to relocate communities may be difficult to find. Property developers typically resist new planning restrictions. Where available insurance usually does not send price signals, and where risk-rated premiums are charged this poses equity issues. Furthermore, if protective structures are largely publicly funded while public compensation for property losses from climate impacts is limited or unavailable, governments will face public pressure to favor protection over relocation. Avoiding asymmetrical funding arrangements which bias policy decisions towards expensive options is imperative.

5.2 Distributional equity

As noted earlier, the principle of distributional equity (fairness or social justice) is open to differing interpretations. Much depends on how various egalitarian and non-egalitarian considerations are weighted and applied [83,84]. Egalitarian considerations include meeting citizens' basic needs, such as adequate food, clothing and shelter; non-egalitarian considerations include giving people

what they deserve (e.g. based on their contribution, skills or effort) and making sure that those who cause particular harms contribute proportionately to their repair or rectification.

Pre-emptive planned relocation raises numerous equity issues [70,73]. Understandably, those relating to housing warrant a particular focus. The Universal Declaration of Human Rights and related international agreements highlight a global concern that all citizens should be adequately housed. Hence, if governments require their citizens to relocate pre-emptively from vulnerable coastal settlements, they are obliged to ensure that alternative accommodation is available and affordable. How this goal is best achieved will depend on the circumstances. But it is likely to require one or more of the following policy responses: publicly funded buyouts of at-risk properties in accordance with legally-mandated criteria; the construction of housing and related infrastructure in safe locations; the provision of targeted housing subsidies for those with limited financial means; and targeted subsidies for removal expenses.

Intergenerational equity considerations are also important [84,85]. Recent generations of humanity are largely responsible for the adaptation costs that future generations will bear. Accordingly, a plausible argument can be advanced that current generations should contribute to these future costs. An obvious way to implement this principle would be for nations to establish sovereign wealth funds with part or all of their income drawn from taxing greenhouse gas emissions or selling emissions credits (i.e. where trading schemes exist). In this way, part of the cost of planned relocation, as well as other adaptation measures, could be pre-funded. But while desirable, pre-funding arrangements are difficult to implement politically.

5.3 Minimizing societal disruption and uncertainty

Most planned relocations are likely to be socially disruptive and political fraught. A key policy goal, therefore, must be to minimize such disruption by enabling those most directly affected to get on with their lives with the least possible stress, delays and uncertainty [71,73]. Such a goal has obvious implications for public policy. For instance, planning processes need to be well-designed with appropriate opportunities for public participation and the reliance on the best available evidence. Equally, there must be effective coordination and cooperation across the different levels of government. From a funding perspective, citizens will need to be fully informed

about their entitlements to public assistance, and such assistance must be provided in a timely and accurate manner. The evidence from US property buyouts [82,86] suggests that co-funding arrangements involving two or more tiers of government can result in citizens being at the mercy of the least well-resourced public authority. Accordingly, any co-funding arrangements must mitigate this risk. Ideally, too, funding frameworks should be stable over time to ensure consistency and fairness. This, in turn, implies the desirability of securing cross-party support for the proposed arrangements. The same applies to relocation funded through development aid: stability, certainty and longevity of funds to support relocation is important.

5.4 Integrating adaptation funding with wider national strategies

Ideally, planned relocation should not be regarded as a last resort or as indicative of policy failure. Rather, it should be viewed as a *strategic* policy response to the impacts of climate change – one that is prudent, legitimate, empowering, and purposeful. Siders et al. (2019, p.761) [80] argue, for instance, that relocation should be fully integrated into each country’s ‘long-term development goals’ and applied in a manner that is ‘innovative, evidence-based, and context-specific’. In so doing, planned relocation should be reconceptualized as ‘as set of tools used to achieve societal goals’, such as greater fairness, sustainability, resilience, and community revitalization. This means viewing planned relocation as a means to accomplish multiple public purposes. Accordingly, funding frameworks should be designed with these wider purposes in mind.

5.5 Transparency and accountability

Finally, to secure and maintain public trust and confidence in the funding arrangements for pre-emptive managed retreat, a high degree of transparency and political accountability is imperative. This will require careful monitoring, accurate and regular reporting, periodic independent assessments, and a willingness of policymakers to adapt their policy arrangements as new evidence emerges or circumstances change.

6. Implications for public funding

Plainly, the five principles enunciated here do not resolve all the policy trade-offs and funding dilemmas raised by the need for planned relocation. In particular, they leave open two critical issues: the appropriate balance of public and private funding; and the best mix of funding tools,

including market and non-market mechanisms. Nevertheless, if coastal communities are to be relocated proactively and at a significant scale, and if implementation is to be strategic, equitable, timely, and competent, adequate funding will be pivotal. One way or another, substantial public funding seems unavoidable. In the context of least developed countries this appears obvious, but lack of clarity on availability and reliability of international funds poses a key challenge for ex-ante planning. For countries with strong traditions of social solidarity and collective risk-pooling, significant public compensation for property loss and damages will doubtless form a core component of the funding framework, as is already the case in some jurisdictions. But even if such compensation is capped in various ways, the burden on future taxpayers is bound to grow markedly over the coming century, especially for countries with numerous vulnerable coastal settlements. Robust planning to accommodate these long-term fiscal impacts will be imperative. Where politically feasible, the option of pre-funding some of the expected costs warrants consideration.

6. Conclusion

Climate change is generating not only severe rapid-onset events but also significant slow-onset impacts. As highlighted in this paper, the focus of policy and finance in most high and low-income countries thus far has been on the former rather than the latter. Yet the slow onset impacts of climate change, and especially those resulting from sea level rise, require concerted and pre-emptive policy responses. Numerous coastal settlements will need relocation over the coming century and beyond. But undertaking such relocations in a planned, pro-active and equitable manner will require substantial resources and a range of well-designed funding instruments – some long-established, others relatively novel. This paper has highlighted how governments in various high-income and low-income countries have begun experimenting with different funding arrangements and has proposed a series of principles to guide future policy developments. While some of the costs associated with planned relocation can and should be met from private sources, other costs – not least any compensatory arrangements for property losses – will almost certainly require public funding. Concerted efforts at all levels of governance – international, national and sub-national – are needed to develop cost-effective, equitable and politically sustainable funding solutions.

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