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How Will We Pay for Loss and Damage?

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ABSTRACT

The devotion of a full article in the Paris Agreement to loss and damage was a major breakthrough for the world's most vulnerable nations seeing to gain support for climate impacts beyond what can be adapted to. But how will loss and damage be paid for, and who will pay it? Will ethics be part of this decision? Here we ask what are the possible means of raising predictable and adequate levels of funding to address loss and damage? Utilizing a framework developed by Marco Grasso (2009, 2010), we argue that making the ethical connections between addressing climate impacts and finance mechanisms could significantly enhance their likelihood of being adopted. We briefly review insurance mechanisms and catastrophe bonds, and then move on to six "innovative finance" approaches to funding loss and damage. We utilize six criteria in assessing them: adequacy, predictability, technical feasibility, fairness, and indirect effects, and whether each has a clear link to loss and damage. Several mechanisms for gathering funds emerged as most promising. Three of the six financial mechanisms we reviewed to raise funding involved airline transport: clearly, there is a huge opportunity to tax this sector in one form or another, in recognition of airline emissions' role in creating losses and damages in vulnerable nations from sea level rise, droughts, floods or hurricanes. Funding loss and damage response is a contentious issue that will get only more unwieldy if Parties' conceptions of loss and damage are at odds: a common definition of loss and damage needs to be agreed upon under the UNFCCC. Most immediately, to meet any equity criteria, wealthy countries should do more to support the premiums of those who cannot afford insurance.

Introduction

When mitigation falls short, people have to adapt to climate change. And when adapting is impossible, there will be losses and damages suffered, especially by the most vulnerable populations, who are unable to prepare themselves for climate impacts and recover from disasters. This much is clear, but the rise of the Loss and Damage agenda in the UN climate negotiations creates the dilemma of how to provide adequate and predictable funding to support the victims of climate change, now and in the future, as the impacts mount. The

need to raise significant amounts of funding to address harms from climate change raises major ethical challenges.

Although loss and damage initiatives have been proposed since 1991, consideration of loss and damage under the United Nations Framework Convention on Climate Change (UNFCCC) is quite recent compared to other major themes, such as mitigation and adaptation. Loss and damage first featured prominently on a Conference of the Parties (COP) agenda in 2011 at COP17 in Durban, although negotiating text devoted to loss and damage was ultimately subdivided and placed under the purview of various existing UNFCCC mechanisms, such as the Nairobi Work Programme on Impacts, Vulnerability and Adaptation.

One key paragraph, however, escaped this treatment to stand alone as COP17's Decision 7, the work programme on loss and damage, which states that Parties 'Appreciat[ed] the need to explore a range of [...] potential mechanisms, including an international mechanism, to address loss and damage, with a view to making recommendations on loss and damage [to the next COP]' (FCCC/CP/2011/9/Add.2, Decision 7/CP.17). At COP18 in Doha, although vulnerable countries urged immediate movement toward an international mechanism on loss and damage, the COP decided to 'establish, at its nineteenth session, institutional arrangements, such as an international mechanism, including functions and modalities (...) to address loss and damage' (FCCC/CP/2012/8/Add.1, Decision 3/CP.18). In 2013, at COP19 in Warsaw, vulnerable countries finally achieved a major victory when the Warsaw International Mechanism on loss and damage was created. However, there was a setback in this larger context of victory: the establishment of the WIM was placed under the Cancun Adaptation Framework, a move that undermined developing countries' efforts to clarify that loss and damage is a stand-alone issue, not a subcategory of adaptation. At COP20, held in Lima in 2014, the membership and structure of the WIM Executive Committee were approved and an initial two-year workplan to guide the committee was adopted.

The devotion of a full article in the Paris Agreement to loss and damage was another major breakthrough for the world's most vulnerable nations. Article 8 states that 'Parties should enhance understanding, action and support, including through the Warsaw International Mechanism, as appropriate, on a cooperative and facilitative basis with respect to loss and damage associated with the adverse effects of climate change' (UNFCCC, 2015a, Art. 8.3). Article 8.4 of the Paris Agreement specifies 'areas of cooperation and facilitation to enhance understanding, action, and support', including

early warning systems, emergency preparedness, slow onset events, events that may involve irreversible and permanent loss and damage, comprehensive risk assessment and management, risk insurance facilities, climate risk pooling and other insurance solutions, non-economic losses, resilience of communities, livelihoods, and ecosystems. (UNFCCC, 2015b, Art. 8.4)

But how will loss and damage be paid for, and who will pay it? Article 9 of the Paris Agreement discusses finance for many climate-related actions, but contains no mention of loss and damage. Nonetheless, article 9.4 may prove relevant to prioritizing funding loss and damage response efforts, as it singles out the world's nations with the greatest loss and damage burdens, stating,

the provision of scaled-up financial resources should ... [take] into account ... the priorities and needs of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change and have significant capacity constraints, such as the least developed countries and small island developing States (FCC/CP/2015/10/Add.1).

It says nothing of who will pay or how.

The failure of the finance article in the Paris Agreement to mention loss and damage as an area deserving funding separate from that allocated to adaptation is not reflective of the increasingly widespread understanding among Parties that loss and damage must be treated as a distinct issue area. It is important to acknowledge that defining the bounds of adaptation finance under this article will necessarily require developing a provisional definition for loss and damage finance, whether explicitly or by omission. As the UN climate regime still lacks an official, shared definition of loss and damage, proactive consideration of what loss and damage finance might be delivered under the Paris Agreement is crucial. This consideration should include officially defining many of the aspects of loss and damage listed under Article 8. In the cases of some items on that list, such as early warning systems, emergency preparedness, risk assessment and management, and resilience-building, the distinction used to categorize these aspects as actions due to loss and damage or adaptation is not clear. For other elements covered in the Article, such as permanent losses, non-economic losses, and slow onset events, it must be specified whether Parties' goals are responses post-occurrence or aversion.

Financing loss and damage, then, could have a wide range of implications—finance could flow toward knowledge and capacity building, administrative applications, or directly to approaches developed to reduce the burden of loss and damage upon affected individuals and communities. In systematically reviewing each of the approaches mentioned in the WIM ExCom's workplan, we seek to clarify the range of possibilities for funding loss and damage response in the short and medium term. Our core objective here is to address a crucial task at hand: What are some of the possible means of raising predictable and adequate levels of funding to address loss and damage? Many of the innovative mechanisms that we discuss have not yet been accepted by the global powers and therefore have not proven successful in raising sufficient funds in either mitigation or adaptation settings. Could these approaches prove successful in a context of funding efforts to address loss and damage? Utilizing a framework developed by Grasso (2009, 2010), we will argue that making the ethical connections between addressing climate impacts and finance mechanisms could significantly enhance their likelihood of being adopted.

Loss and Damage in the Context of Ongoing North-South Environmental Finance Struggles

The need to raise funds for loss and damage does not arise in a historical vacuum. Since the beginning, environmental treaties have included pledges for funding to flow from the world's wealthy to its poorer nations, but only because of demands from the developing world. Back in Stockholm at the first Conference on the Human Environment in 1972, Brazil pointed out the 'happy coincidence' that the very countries that had caused global environmental problems were the same ones who had the resources to pay for their resolution (Edwards & Roberts, 2015). Developing nations feared from the beginning that funding for environmental initiatives would be siphoned off of their hard-earned development assistance, which they were counting on for schools, hospitals, roads, and airports (Hicks, Parks, Roberts, & Tierney, 2010). Worse, they feared that internationally funded environmental efforts would restrain their ability to exploit the very resources they relied upon for the national development drives they planned to pull themselves out of poverty. Therefore, environmental aid was called the 'Earth Increment', and at Rio in 1992 the UN Framework Convention on Climate

Change saw developed nations promising to deliver 'new and additional' funding to help developing nations address climate change.

The best-funded treaty was the 1987 Montreal Protocol on Ozone Depletion, which included excellent mechanisms to raise funding fairly from the major developed nations and to distribute it to developing nations in order to support their transition away from the use of freon (chlorofluorocarbons) and other ozone-depleting chemicals (Gareau, 2013). Nations like India were given extra time to comply with lowered limits on emissions of these gases. Billions of dollars flowed through dedicated funds at the Global Environment Facility, and mechanisms were in place to track the funding flows and the compliance of nations. The rich nations could see why they needed to help these nations avoid a massive CFC cooled industrial boom, and assure that financial promises were met.

Likewise it is somewhat easier for wealthy nations to see why they need to fund developing nations reduce their emissions than it is for them to see why they need to help them adapt to climate impacts. That is, adaptation is seen as a local problem, but mitigation a global public good (Ciplet, Roberts, & Khan, 2013, 2015; Khan & Roberts, 2013). Adaptation also faced a series of problems in gaining acceptance, such as the concern by some environmentalists that taking on adaptation efforts was akin to giving up on mitigation (Khan & Roberts, 2013). Developing nations likewise are split on whether to focus on adaptation, and the mechanism was delayed for nearly a decade (Khan, 2013).

Loss and damage raises similar issues to adaptation, since it needs to be made clear to wealthy nation residents, negotiators, and politicians why they need to address the impacts their behavior is having on people a half a world away. Atiq Rahmin of the Bangladesh Centre for Advanced Studies once said in a negotiating hall that if the wealthy nations didn't stop the warming, 'we will walk with our wet feet into your living rooms' (Athanasiou & Baer, 2002; Roberts & Parks, 2006). Unfortunately, this is not possible, and the world's most vulnerable people and nations are both politically and economically weak and often very distant from those responsible for driving the bulk of human-caused climate change.

Do rich nations have a moral obligation to pay poorer nations for the loss and damage they sustain from climate change? Weikmans (in press) highlights the fact that the feeling of injustice and the 'duty' of developed countries to act to assist vulnerable countries are very high in the discourses that consider the drivers of climate risks to be *external* to developing countries (as is the case with most debates on loss and damage). Most discourses on loss and damage consider climate risks to be produced almost exclusively by high levels of anthropogenic climate change (which are mainly seen as rich, high-emitting countries' responsibility). On the contrary, *internal* factors (such as 'bad' policies or institutions in developing countries, which can be seen as developing countries' responsibility) are generally considered as minor drivers in the production of losses and damages. This could be linked to the fact that most discourses on loss and damage tend to consider long timescale, associated with very high levels of climate change (Weikmans, in press).

This ethical case is the one made by some key religious actors and philosophers, such as statements by Interfaith Power and Light and Pope Francis' June 2015 encyclical *Laudato Si* (Pope, 2015). Fourie, Schuppert, and Wallimann-Helmer (2015) argue that the WIM approach to Loss and Damage should have compensatory justice as its main concern, and its three aspects of corrective liability, remedial responsibility, and fair remedy (p. 473). This is a thorny issue, and raises the issue of whether contributions to paying for Loss and Damage should be assessed based on consequentialist or non-consequentialist approaches (Dellink et al.,

2009). That is, should countries most responsible for climate change be most liable, or those who have the most capacity to pay (or some combination of the two)?

The pieces in this special issue usefully attend to the agency of vulnerable peoples and their loss of self-determination, and to the UNFCCC technical paper on Loss and Damage and how this topic is (too narrowly) being conceptualized. However, this paper adds to these analyses a discussion of how to actually raise the funds for loss and damage. To do so requires attention not only to these past efforts to essentially browbeat north governments to pay for climate adaptation out of their national treasuries, but also the likelihood of acceptance of new streams of funding through insurance and 'innovative mechanisms'.

In one of the few forays into the concrete assessment of financing options by ethical criteria, Marco Grasso (2009, 2010) has laid out 'fairness and equity criteria' of different sources and allocation of funding for adaptation to climate impacts. Grasso argues that doing so can inform the efforts to actually raise these crucial funds. That is, people are likely to be more willing to pay taxes if they understand the fairness principles by which one's burden of payment is derived. Grasso applies John Rawls' Theory of Justice as Fairness and Amartya Sen' capability approach to the negotiation processes, to raising of adaptation resources, and to the allocation of those resources. We are focused here only on the fair sharing of the burden of paying for loss and damage, so we assess each potential funding source only by the second of these: how the funding is raised and whether it's done so fairly. Is the rate at which a country or individual must pay into a Loss and Damage fund directly tied to their actions harming the global climate system (one's responsibility)? Or is it based upon our 'ability to pay' (capabilities)?

One can go further with these ethical analyses to assess whether there is a direct connection between the way funding is raised and the actual damage that nation (or group of people being taxed) can be seen as doing to vulnerable people. For example, placing a small levy on international air travel arguably taxes exactly the behavior causing an intensification of hurricanes and the sea level rise that is threatening small low-lying island populations. Such a proposal is assessed below. For ethical analysis, this discussion falls entirely under the heading of distributive justice, in particular whether funding is raised from those with the greatest responsibility. We turn next to some concrete mechanisms—like the air travel levy—that have been proposed.

What are the Mechanisms for Paying for Loss and Damage?

In Action Area 7 of its initial two-year workplan, the Executive Committee of the Warsaw International Mechanism (the WIM ExCom) announced its intention to research and disseminate information regarding a range of financial tools that 'address the risks of loss and damage'. The WIM ExCom's list of funding instruments to investigate includes 'comprehensive risk management capacity with risk pooling and transfer; catastrophe risk insurance; contingency finance; climate-themed bonds and their certification; catastrophe bonds; and financing approaches to making development climate resilient' (FCCC/SB/2014/4). Our main focus in this paper is the raising of funds from 'innovative sources' to cover the major costs of addressing Loss and Damage, but we summarize briefly here our analysis of these financing mechanisms, which we discuss more fully elsewhere (Gewirtzman et al., n.d.).

Each of these approaches raises issues of justice and equity, in who would pay for them and whether they would help countries facing permanent loss and damage from climate impacts. For example with insurance, there is a large gap in penetration across the globe that generally mirrors international wealth disparities: in poor countries, on average only 2% of total losses due to weather-related events are insured, while insurance penetration in the US and EU for certain weather-related events (like hailstorms) exceeds 60% (Hoeppe, 2016). Insurance may not be an appropriate solution for ongoing, slow onset events that all but guarantee substantial financial losses, such as sea level rise or desertification, or for disasters that occur with very high frequency, such as recurrent flooding (Munich Climate Insurance Initiative, 2012). Contributions by developed countries to insurance pools have thus far been ad hoc, however, and most of the burden of financing insurance schemes is still borne by developing countries. In an attempt to make insurance approaches align with the principle that countries should pay according to how much of the problem of climate change they caused and how wealthy they are now,¹ some actors have suggested that polluters shoulder the development and operating costs of insurance approaches. For example, an Alliance of Small Island States proposal to the Ad Hoc Working Group on Long-term Cooperative Action suggested that contributions from developed countries fund insurance in countries that 'lack the financial means to adapt to the adverse effects of climate change and the capacity to manage financial risks from the direct impacts of climate change' (Alliance of Small Island States, 2012).

Catastrophe risk insurance is defined as insurance coverage for low-probability, high-cost disasters, and can include meso- and micro-insurance, or coverage for individuals and communities (Hoeppe, 2016; Warner et al., 2009). Unlike risk pooling more generally, catastrophe risk insurance coverage necessitates high-quality (and potentially expensive) catastrophe risk models. Additionally, as with other types of risk transfer, catastrophe risk insurance may only have limited effectiveness in addressing loss and damage, as it also cannot provide for slow onset or high-frequency events.

Contingency finances are commonly included on top of strictly necessary funds, in case of cost overruns or unforeseen circumstances (European Commission, 1998). Some localities and institutions have adapted this approach to prepare for unpredictable climate-related disasters, setting aside funds to finance contingency plans for emergency situations and integrating this finance with other aspects of comprehensive risk management. Setting aside funds for pre-planned uses during emergencies allows localities to distribute funds earlier in the course of disasters, and thereby provide vulnerable households assistance 'at the crucial time of shock, before they resort to livelihood-eroding coping mechanisms' (Makaudze, 2012). During climate-related disasters, contingency finance can also be used to extend existing low-level resource coverage to benefit a larger number of people. For example, Ethiopia's Productive Safety Net Program continually provides basic aid to the chronically food insecure, but includes contingency funds that permits it to scale up coverage to include the temporarily food insecure during shocks that damage agricultural productivity (Makaudze, 2012). The reliability of contingency finance has been debatable. First, uncertainty in types, frequencies, and intensities of climate disasters provides a challenge in determining the size of an adequate contingency funds reserve. Second, it remains to be seen whether the private sector or the public sector will be better suited to provide contingency financing. In particular, while private sector funding mechanisms could cover distinct climate events, such as a floods, public sector funding mechanisms are generally better poised to address the scope and scale of the broader systemic risks associated with climate change (Molk, 2015).

Catastrophe (CAT) bonds are high-yield debt instruments that transfer specified risks from the bond issuer to an investor in order to provide the bond issuer funds if a catastrophe strikes (Lebens, 2013). CAT bonds have a specific set of attached conditions stating that if the bond issuer suffers from a certain pre-defined disaster, the issuer's obligation to pay interest and/or repay the principal to investors is either deferred or completely forgiven. CAT bonds may be issued by insurers to protect themselves from financial ruin should disaster strike, or by countries to ensure sufficient financing for disaster response. The main shortfall of CAT bonds is that they cover only sudden catastrophes, not slow onset events and they tend to come with stricter terms and conditions than traditional insurance (Lebens, 2013). Since the premiums to pay for these insurance tools are largely paid for by payments from poor nations themselves, they do not support Grasso's Equity criterion. But they do target the vulnerable, and they are clearly feasible in the post-Paris political setting.

Innovative Finance Tools: What has Been Proposed?

In this section, we provide a brief review of six major tools that have been proposed at various points over the past dozen years to raise funding for climate change actions in developing countries (see also High Level Advisory Group on Climate Financing, 2010; Müller, 2008; Pauw, Klein, Vellinga, & Biermann, 2016; van Drunen, 2009), and we set out to assess each tool using six criteria.

Under the first of these criteria, *adequacy*, we consider various estimates for revenues that each mechanism could gather. Once we collected estimates for each of the six mechanisms considered below, we found that three mechanisms are likely to raise over \$25 billion per year, two are likely to raise less than \$10 billion per year, and one is predicted to raise anywhere from \$5 to 35 billion per year. It is important to note that a mechanism's position among others examined here should not be considered a testament to its adequacy outside of our analysis, as projections of future loss and damage costs suggest that no single mechanism we considered in isolation can be seen as adequate to support all necessary response efforts (See Hope, 2009; United Nations Office for Disaster Risk Reduction, 2015 for yearly cost estimates that dwarf \$25 billion).

Second, we assess the *predictability*, which we understand to encompass immediate dependability and long-term sustainability, of each instrument, gauging whether each would generate roughly the same amount of funding each year without problematic fluctuations based on relevant factors, such as the price of oil or participation in carbon markets. Predictability can be interpreted as allowing countries to know that funds will be available in the future; therefore, funds must remain constant or increase over time for a mechanism to be called predictable (see Pauw et al., 2016).

Third, we consider each approach's *technical feasibility*, evaluating the effort that would be needed to gather funds under each mechanism. This criterion appraises whether collection infrastructure is already in place or would need to be built and assesses the complexity of gathering funds, considering, for example, whether funds could be collected at relatively few sources upstream versus by taxing all purchasers of a product. Fourth, we consider the *fairness* of each funding mechanism. This criterion considers whether the financial burden of a mechanism falls on those who caused or are causing climate change, or on poor and vulnerable peoples who have contributed little to the problem. This criterion best expresses Grasso's Equity criterion. Fifth, we take stock of some of the likely *indirect effects* of each

Mechanism	Adequacy	Predictability/Sustain- ability	Technical feasibility	Fairness:	Indirect effects	Clear link to loss and damage?
Financial transaction tax	Estimates range from \$5 to \$35 billion/year	High	Some feasibility issues: Designing and administrating a worldwide-coordi- nated FTT would be challenging	Somewhat fair: Burden falls on wealthy banks and traders, who are not necessarily the largest polluters, instead of the poor and vulnerable	Could reduce volatility in currency and security markets, other impacts uncertain	Conceptually discon- nected from L&D: Does not suggest compensation or liability
International Airline Passenger Levy (IAPAL)	\$5–10 fee per interna- tional flight would raise about \$5–10 billion/ year	High: Airline travel is increasing and the fee unlikely to affect ticket purchases	High feasibility: Identical to existing solidarity levy; relatively few companies would collect	Fair: Much international airline travel is by wealthy individuals, burden does not fall on the poor and vulnerable	No observed effects; concerns it might reduce tourism in poor nations are apparently not supported	Strong link to L&D: aviation fuel a significant and growing source of emissions
Solidarity levy	Currently raises \$200 million/year; global levy could raise about \$5–10 billion/year or more, but model is voluntary	Somewhat predictable: Airline travel is increasing but would require national opt-in	High feasibility: System already operational in France and seven other countries	Fair: Much international airline travel is by wealthy individuals, burden does not fall on the poor and vulnerable	No observed effects; universal application would reduce chance of distorting travel decisions	Strong link to L&D: aviation fuel a significant and growing source of emissions
Bunker fuels levy	Tax of \$25–30/ton CO2 would raise \$25 billion per year by 2020	Predictable, then unpredictable: if successful, could disincentivize fossil fuel use and revenues would fall	Some feasibility issues: few companies from which to collect, but possibility of avoidance	Fair: burden falls on polluters, not the poor and vulnerable	May incentivize fuel-saving measures like efficiency	Strong link to L&D: aviation fuel a significant and growing source of emissions
Fossil fuel majors carbon levy	A starting levy of US\$ 2 per tonne of CO2 could yield US\$ 50 billion per year	Predictable, then unpredictable: if successful, could disincentivize fossil fuel use and revenues would fall	Participation and coordination needs pose a challenge	Fair: burden falls on polluters, not the poor and vulnerable	May incentivize shift away from fossil fuels	Strong link to L&D: The idea was developed with loss and damage in mind; based in concept of compensa- tory justice
Global carbon pricing	US\$ 40–50 billion based on a US\$ 2 per tonne lev	Predictable, then unpredictable: if successful, could disincentivize fossil fuel use and revenues would fall	Broad-based participa- tion required to prevent leakage; would require large-scale administra- tive management	Fair: burden falls mostly on polluters, not the poor and vulnerable	May incentivize shift away from fossil fuels	Strong link to L&D: recognizes liability of emitters

Table 1. Summary assessment of proposed innovative funding mechanisms for loss and damage.

funding mechanism on other economic sectors and industries. Finally, we assess whether each instrument has a *clear link to loss and damage*, considering whether it sanctions actors or activities that played a role in causing climate-related losses and damages (Table 1).

Financial Transaction Tax (FTT)

A Financial Transaction Tax is a small levy placed on monetary transactions or trades of financial instruments but it has the potential to generate substantial revenues. A number of developed and developing countries have already implemented FTTs at the domestic level to generate funds for government use (Williams, 2015). While the funding gathered by an FTT would likely be at the discretion of the countries' governments subject to the tax, an FTT could provide a large boost to funding loss and damage.

There are advantages to imposing an FTT. First, in terms of adequacy, the UN High-Level Advisory Group on Climate Change Financing (AGF) expects that an FTT could raise about US\$ 7–16 billion in revenue globally per year (Oxfam, 2012). Second, funding from an FTT would be highly predictable, provided the revenues are earmarked. Third, use of an FTT is technically feasible, given such taxes' implementation in numerous domestic markets, in both developed countries and developing countries (Oxfam, 2012). Fourth, an FTT is expected to slow the rate of speculation in currency and security markets, reducing market volatility. Fifth, since the FTT is conceptually distinct from loss and damage, this could make it more politically acceptable to developed countries given the explicit exclusion of liability and compensation in relation to Article 8 of the Paris Agreement (UNFCCC, 2015a, p. 51). Since it is in part a tax on investors and currency traders, the FTT arguably meets Grasso's equity principle of falling on those most responsible for global warming and the losses and damages it creates. To the extent that consumer goods are subject to an FTT in their importation and in their production, the tax will also create costs for transnational corporations.

In addition to the benefits of an FTT, there are disadvantages too. Despite the success in domestic financial markets, there are obstacles when implementing an FTT at the global level. Some countries may be unwilling to impose such a tax or may not be logistically prepared to administer the tax. As an example, talks for imposing an FTT in the EU have dragged on since 2011, due to disagreements between member countries (Reuters, 2016). Although a global tax will likely invite discord among countries, agreement on coordinated tax implementation by major Parties such as the EU and US could encourage wide cooperation (Burman et al., 2015).

International Airline Passenger Levy (IAPAL)

Fees on airline passengers collected to finance adaptation efforts in developing countries have been suggested by several, and the IAPAL scheme was officially proposed to the UNFCCC in 2008 by Maldives on behalf of the 48-country Least Developed Countries (LDC) group of nations. Originally proposed by Müller and Hepburn of the Oxford Institute for Energy Studies (2006), the IAPAL would involve a modest flat fee of US\$ 5–10 (depending on class of travel) on international airline tickets, and this fee would be paid directly into the Adaptation Fund of the Kyoto Protocol (see also Müller, 2006). Two reviews for the LDCs were supported by the International Institute for Environment and Development (IIED) (Baker, 2011; Chambwera, Njewa, & Loga, n.d.). An airline passenger levy seems to apply nicely to

loss and damage, since air travel releases greenhouse gases directly into the atmosphere (at a particularly damaging altitude). The original IAPAL proposed that collected funds go directly into the Adaptation Fund of the UNFCCC. Channeling potential IAPAL revenues to an International Risk Insurance Pooling Facility or an UNFCCC 'Loss and Damage Fund' would similarly avert involvement of national policy-makers making decisions on revenue allocation. The technical feasibility of the IAPAL is supported by that of the Solidarity Levy.

Solidarity Levy

In 2006, France imposed a levy on passengers departing from French airports, ranging from EUR 1 to 40, depending on the class of service and destination. Unlike the proposed IAPAL, this Solidarity Levy is not a universal tax that produces revenue to be allocated by a single global actor. Instead, it is levied domestically by participating countries. Nine countries, both developed and developing, have implemented the air ticket levy, such as Cameroon, France, and Madagascar. Each nation decides the amount of its own levy and agrees to allocate funds collected to support a common cause. Currently, the revenue from the Solidarity Levy supports UNITAID, an international drug purchase facility that combats malaria, tuberculosis, and HIV/AIDS in developing countries. As of 2007, total revenue from this levy was approximately EUR 180 million per year from France alone and about EUR 22 million annually from seven other participating countries (Brookings Institution, 2007).

Advantages of the Solidarity Levy for climate Losses and Damages include its feasibility and clear link to loss and damage. The development and implementation of the program shows that in willing countries, it is relatively easy to implement the levy in addition to existing airline taxes and fees. National sovereignty is preserved, since the program is voluntary and does not require universal adoption, because it is not a global tax. The program explicitly includes opportunities for countries to adjust their participation as economic conditions change.

The Solidarity Levy also has some disadvantages, however. Given that the levy is relatively modest and voluntary, its adequacy is of concern. Although the French Solidarity Levy has successfully delivered approximately US\$ 200 million annually to UNITAID, this amount is not enough to finance loss and damage response efforts. The solidarity levy would have to be implemented more widely to ensure adequacy. However, the levy could run into difficulties of political feasibility if there are efforts to extend its base across reluctant nations. Although the levy is not intended to be large enough to alter passenger behavior, some have argued that 'another increment' of tax on air travel 'could reduce a country's competitiveness at the margin' (Brookings Institution, 2007). Only universal application of a levy would render this concern irrelevant. It is a dilemma that every effort to make the solidarity levy more flexible to avoid resistance and gain wider adoption will potentially lower its reliability and adequacy.

Bunker Fuels Levy

Transportation of cargo by container or bulk transport ships across the world's oceans and skies is skyrocketing as production and consumption systems become more globalized. International aviation and maritime shipping is estimated to account for 3–4% of all carbon emissions, and these emissions are projected to increase by 150–250% by 2050 (Oxfam,

2012). There are currently no regulations or taxes on these emissions, and 'bunker fuels' used in shipping are largely untaxed. The International Monetary Fund (IMF) estimated that a tax on airplane and ship fuels of US\$ 30/ tonne of CO2 would have raised about US\$ 25 billion in 2014, from advanced economies only (Darby, 2016; Farid et al., 2016). In the report, the IMF concludes that a bunker fuels tax should be 'front and center' in raising funds for climate action (Farid et al., 2016).

Air and ship fuels are not currently taxed, and were not explicitly addressed in the 2015 Paris Agreement. There is a need for international coordination, and the sectors are overseen globally by the International Civil Aviation Organization (ICAO) and International Maritime Organization (IMO), both of which have considered bunker fuels levies previously. However, the ICAO points to the existence of 'treaties and bilateral air service agreements limiting fuel taxes'. The IMF report concludes that eliminating those barriers 'should be manageable' (Farid et al., 2016, p. 29). On the criteria of adequacy, predictability, and feasibility, bunker fuels levies are promising. However, there is likely to be political resistance from very organized sectors, and risk of avoidance of the levies by firms attempting to purchase fuels in locations without taxation. The link of transportation emissions to the impacts of climate and loss and damage is clear. We conclude that bunker fuels levies align well with Grasso's Equity principle. And indirectly, the levy may incentivize fuel-saving measures like efficiency.

Fossil Fuel Majors Carbon Levy

The concept of a fossil fuel majors levy linked to loss and damage finance provision is based on the 2013 Carbon Majors Study, which found that just 90 companies were responsible for 63% of anthropogenic greenhouse gas emissions (Heede, 2014). The organization advancing the concept of a carbon majors levy, the Climate Justice Programme (CJP), has proposed that a global fossil fuel extraction levy be imposed on large oil, coal, and gas producers. While an earlier report called for a one-time payment and ongoing taxes for the 90 companies implicated in the Carbon Majors Study, the expanded and revised report states that the one-time payment and ongoing taxes would be extended to the broader category of big oil, coal, and gas producers to 'establish a level playing field and capture all relevant emissions in the scheme' (Richards & Boom, 2014). The CJP has suggested that revenues from the levy be funneled directly into a 'loss and damage mechanism', whether through a Loss and Damage Window in the Green Climate Fund or a specific finance stream that may be developed as part of the WIM under the UNFCCC. This ongoing funding stream would be supplemented by an initial one-time payment from each company based on historical emissions, as well as additional funds from Annex I (developed) countries.

While a national and sub-national fossil fuel levy has been imposed for extraction of nonrenewable resources, an international extraction levy, however, has never been employed. Richards and Boom (2014) argue that a starting fossil fuel majors levy of US\$ 2/ tonne of CO2 could yield US\$ 50 billion annually. The levy may additionally increase the cost of fossil fuels enough to incentivize greater use of renewable energy, and the authors note that the levy will incentivize phasing out fossil fuels (Richards & Boom, 2014). If extraction rates are reduced, however, the income stream may also falter. The potential feasibility of participation and coordination poses a challenge to establishing the levy—states may be unwilling or unable to engage and coordinate the implementation of such a levy based on their national

situations. Perhaps major transnationals will restructure their firms and locations of revenue reporting to avoid this taxation.

An attractive advantage to this approach is its principle of compensatory justice. The levy targets those most responsible for emissions and therefore also for loss and damage arising from climate impacts. There are advantages and disadvantages to bypassing state aid while still relying on nations' participation and compliance. For example, states would still have to adopt a regulatory framework to facilitate the collection of funds but would not themselves receive any revenue. However, this new source of finance for loss and damage would not add an additional burden to states' existing mitigation and adaptation funding obligations.

Global Carbon Tax

A worldwide system of carbon pricing could raise funds for loss and damage in the form of either a tax or auction revenues generated from trading schemes, such as the EU Emissions Trading System (EU ETS). Levied on the carbon content of fossil fuels rather than on energy content, a carbon tax would raise funds that could be applied to financing loss and damage while simultaneously promoting substitution of cleaner energy sources. Such a tax could raise funds to support loss and damage programs regardless of their profitability; thus, it is an attractive option for funding mitigation and adaptation initiatives as well.

Revenues from a global carbon tax would be highly scalable and would vary according to taxation rates, coverage, and market responses. One estimate by the Swiss Government, based on a levy of US\$ 2/ tonne of CO_2 emissions, projected revenues of US\$ 40–50 billion annually (Anderson, 2010). Proposals for local taxes are many times that level, so substantial revenues are possible. One factor confounding revenue estimation is leakage, wherein emissions reductions in highly taxed jurisdictions are negated by emissions increases in low or non-taxing regions. Another is that revenues would progressively decline if the tax were successful in shifting consumption away from fossil fuels, thereby gradually downsizing the market being taxed. The former issue can be mitigated by ensuring true global coverage with the tax. The latter may be inevitable, but revenues could still be substantial in the short run, and could be placed in trust or rotating loan funds to finance future needs.

Establishing true global coverage is not easy. A global tax would require worldwide consent, but many countries would inevitably resist the proposal. It would also require the establishment of an entity with the authority and capacity to implement the tax, and the costs of enforcement and compliance would be significant. Moreover, as the tax would be based on current consumption rather than historical responsibility, it may be contentious or unpopular among developing countries. However, the net outcome would be strongly positive for all countries of the world, and the tax could be progressive, with developed countries paying greater rates to be redistributed among developing countries and defray costs. This supports the equity principle, but could lead to leakage.

Some Other Tools

Some other innovative finance tools have attracted significant attention in the past but have all but disappeared in the discourse since. This is the case with the issuance of additional Special Drawing Rights (SDRs), a reserve asset created by the IMF, that was suggested in

December 2009 to finance a global climate fund. The idea was subsequently adopted by the IMF's then-Managing Director Dominique Strauss-Kahn during a panel session at the 2010 Davos World Economic Forum (IMF, 2010), but its details were apparently never further developed by the IMF. The idea was discussed by ActionAid (2010), which suggested several options for how SDRs could be used to finance climate action in developing countries.

The idea of a tax on banks that could partially finance climate activities in developing countries was proposed by some observers after the 2007–2008 international financial crisis, with limited echoes since (Craeynest & Doig, 2010). Another proposal was the potential levy on carbon market mechanisms. The idea was either to increase the tax percentage on the Clean Development Mechanism (CDM), or to apply a tax to other carbon market mechanisms. These options were discussed at COP14 in Poznan in 2008, but were opposed by many developed countries (Craeynest & Doig, 2010). In addition, since the near-collapse of the CDM market, the funding from the levy has almost dried up, and the Adaptation Fund now mainly depends on voluntary contributions from developed countries.

Discussion and Conclusion

We have reviewed a range of proposals on the collection of funding and how they supported efforts in addressing loss and damage in developing countries. In this section, we summarize the most salient parts of this overview and look ahead to pragmatic steps that might be taken in the short and medium term. In doing so, we acknowledge that given inadequate science on the scale of likely future disasters, limited ability to predict the scope of irreparable damage these disasters will cause, and the lack of a political definition of what 'counts' as loss and damage, these points are extremely preliminary. It is also outside of the scope of this paper to determine how funding, once collected using innovative financial mechanisms, should actually be *allocated*, equitably and effectively. Rather, we seek here to assess which funding streams seem most feasible and align with Grasso's equity principle, and suggest steps toward development of a lasting financial mechanism to support loss and damage response efforts.

As shown by Barrett (2013) in the context of adaptation, financial resources from those countries responsible for climate change provided to vulnerable countries effectively address some climate justice concerns. Adaptation finance offers a means to address climate change as a justice issue, but only when directed toward the most vulnerable and only for the communities that benefit from adaptation funding (Barrett, 2013). Similarly, there are a number of viable ways to effectively use funds gathered by the mechanisms above to support efforts to address loss and damage. First, risk transfer approaches, including risk pooling, catastrophe risk insurance, and catastrophe bonds, are clearly politically and technically feasible, as they are already used in some form in many developed and developing countries. Funds gathered for loss and damage response could go toward subsidies for risk insurance premiums in vulnerable nations in order to lower the financial burden governments, enterprises, and individuals face when purchasing insurance. Without such external financial support, private insurance remains largely unaffordable for households and small or medium-sized enterprises in highly exposed countries, where insurers face steep start-up and transaction costs. Substantial education on the use of insurance mechanisms will be required. Further, for the world's most vulnerable nations' governments, 'opportunity costs of private risk-financing instruments can be prohibitively high in terms of meeting other human needs' (Munich Climate Insurance Initiative, 2012, p. 12). In other words, governments may be unwilling to invest precious funds in risk insurance or set money aside as contingency finance in anticipation of a disaster that is not certain to occur, as this might diminish their capacity to meet already-present human needs. Alternatively, financial support aiming to enable the purchase of risk insurance could take the form of direct funding that targets government administrative costs, thereby minimizing distortion of loss prevention incentives, capital support for local insurers designed to lower premiums, or funding for risk reduction measures that would allow insurers to offer reduced premiums (Munich Climate Insurance Initiative, 2012, pp. 8–10).

Another important use for funding gathered for loss and damage response is support for capacity building in vulnerable nations (Hoffmeister et al., 2016). Especially as more information on risk transfer, risk pooling, and other risk management tools is made available in coming years, as mandated by the Paris decision text, it will prove crucial to build governments' capacities to understand and optimally utilize data to develop effective risk reduction and loss and damage response measures.

In the course of our review, several mechanisms for gathering funds emerged as most promising. Three of the six financial mechanisms we reviewed to raise funding involved airline transport: clearly, there is a huge opportunity to tax this sector in one form or another, in recognition of airline emissions' role in creating loss and damage in vulnerable nations. In addition, a tax that is small relative to the total price of airline tickets can raise significant funding without distorting consumer decisions or competitiveness within the industry. The IMF statement in early 2016 is positive evidence of the momentum for such an approach, but leadership from the International Civil Aviation Organization (ICAO) appears to be necessary. If needed, a more piecemeal approach could be taken in expanding the French-led effort to assess a modest Solidarity Levy on passenger travel. The Solidarity Levy approach has been tested and proven, was not too cumbersome to implement, and did not depress airline travel in any observable way. However, such a levy alone cannot raise enough revenue for loss and damage response in vulnerable nations. Rather, a passenger levy that is broadly assessed—applying at least to international flights originating or arriving in developed countries—could raise substantial new and additional finance and clearly meets equity criteria, given who are most able to fly (the world's most wealthy inhabitants).

Much greater attention should be paid to the pressing question of how funding raised can support efforts to address loss and damage from slow onset, high-certainty events, such as sea level rise and desertification. None of the items listed in Action Area 7 for financially supporting loss and damage response were devised with the intention of application to slow onset events: most listed instruments release funds only if triggered by sudden, unpredictable disasters. Therefore, investigation into how finance for loss and damage can be leveraged to support response to such slow onset events is urgently necessary. Furthermore, as climate change intensifies and the occurrence of now-unpredictable disasters becomes increasingly definite, mechanisms founded on the uncertainty of disaster occurrence will become increasingly unviable. Therefore, it is crucial to consider channels for funding raised for loss and damage support besides risk transfer, catastrophe bonds, and contingency finance.

Non-economic loss and damage, such as loss of life, livelihoods, territory, culture, habitats, or species, should be considered as an element of any formulation of support for loss and damage response (Serdeczny et al., 2016). Non-economic loss and damage, by definition,

cannot be straightforwardly compensated by insurance payouts or government disaster response funds. However, because it occurs in concert with losses and damages that *can* be so compensated, such as destruction of infrastructure, non-economic loss and damage must be made a part of relevant discussions. Furthermore, poor citizens of vulnerable countries may suffer severe non-economic loss and damage in the aftermath of disasters and will not benefit from insurance schemes, as they do not own property to insure. Means to facilitate inclusion of non-economic loss and damage in a potential loss and damage financing system, such as systematic evaluation, should be considered.

Crucially, a common definition of loss and damage should be agreed upon under the UNFCCC in order to advance discussions of loss and damage finance. Funding loss and damage response is a contentious issue that will get only more unwieldy if Parties' conceptions of loss and damage are at odds. Putting off the complex process of agreeing upon a common definition will inevitably create misunderstandings and difficulties later, as more severe loss and damage grows more common, countries' individual loss and damage response programs develop, and international coordination on loss and damage is more essential than ever before. It should also be understood that discussions of adaptation finance that proceed without explicitly defining loss and damage comment on its definition by omission. Drawing the boundaries of what is considered adaptation necessarily will make a distinction between adaptation and loss and damage. A more focused effort should be made to define loss and damage in its own right.

The private sector certainly has an important role to play in financing loss and damage response, especially in risk transfer approaches. However, it must be ensured that developed countries' support for loss and damage response does not continue to almost solely take the form of one-time contributions to insurance schemes, as such grants present a boon to the private sector while keeping the bulk of the financial burden associated with risk insurance on vulnerable country governments. Most fundamentally to meet any equity criteria, wealthy countries should do more to support the premiums of those who cannot afford insurance. Their contributions should be sustained and predictable instead of ad hoc, and must increase steadily as climate change intensifies. This is precisely why advancing the adoption of innovative funding mechanisms reviewed above are so important. Furthermore, it must be understood that contributions to insurance schemes do not constitute sufficient delivery of support for efforts to address loss and damage. Developed countries should engage in diverse means of financing loss and damage response, perhaps beginning with insurance subsidies, but also by reporting on their initiatives, sharing relevant information, building capacities, and exploring means to support responses to slow onset events and non-economic loss and damage.

A major gap remains between the amount of funding needed to support response to loss and damage and the amount of funding currently available. Most climate finance currently goes to mitigation efforts, rather than to adaptation (AdaptationWatch, 2015; Climate Policy Initiative, 2015), let alone to efforts to address loss and damage. To raise funding for loss and damage response, it must be emphasized that loss and damage is an issue distinct from adaptation that is in serious need of adequate financial support and that virtually none currently exists. In addition, there must be accountability and efficiency at all levels of fundraising, including sourcing, allocation, disbursement, contracting, implementation, and evaluation.

Finally, if these outstanding issues with financing loss and damage response were resolved, a key question would still remain: *who* will be funded? Should insurance schemes be designed to serve supranational regions, nations, subnational regions, states, cities, groups of businesses and households, or individuals? How should funding be allocated between insurance pools, other international institutions, and nations, communities, and individuals themselves? As efforts to raise sufficient funding for loss and damage response and utilize these funds effectively proceed in coming years, Parties will inevitably have to address these complex questions at length.

Note

 The idea that countries should act to avoid dangerous climate change on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities' has been the bedrock ethical foundation of the 1992 UN Framework Convention on Climate Change and arguably all the negotiations since then (United Nations, 1992). The convention made quite explicit what that meant: 'Accordingly, the developed country Parties should take the lead ...'.

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