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Analysis

Causes and Impacts of Deficient Liability for Climate Change Damage, and an Economic Conception for Climate Change Liability That Supports Appropriate Action: DRaCULA

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Highlights

- Liability deficiencies exist through the instrumentalisation of international law.

- This allows the climate regime to be ineffective and lose legitimacy.
- Scholarly improvements do not sufficiently address accountability and dynamics.
- A treaty based economic framing of liability has the potential to resolve these issues.
- It is a robust framework facilitating negotiations and overcomes the N-S divide.

Abstract

To gain an understanding of the issues with [environmental liability](#) attribution, both [international law](#) and the implicit liability under the [UNFCCC](#) are reviewed, and found to be ineffective. This [stems](#) from a neoliberal marginalisation of international law and tendency to externalise liability resulting in accountability gaps, which pose major challenges for the climate regime. A socially efficient [economic](#) reframing of liability into a Dynamically Relative, and Comparatively Universal Liability Attribution (DRaCULA) framework is proposed. The attribution of liability for [climate change](#) damages under DRaCULA is algebraically developed into a conceptual model, the operation of the conceptual model is discussed and together with the framework found to be robust. Through its embodiment of the dynamic challenges inherent in climate change, DRaCULA strategically facilitates the climate negotiations and provides credible solutions to stumbling blocks, including the N-S divide.

[< Previous](#)[Next >](#)

Keywords

Climate change; Liability; Negotiations; Facilitation; Economic; Accountability

1. Introduction

Numerous global figures have referred to [climate change](#) as the greatest challenge of our time. Its [economic](#) impacts are broadly accepted to be significant despite debate as to their exact scale ([Dietz et al., 2007](#)), and the difficulty of valuing some impacts. For those who will suffer from climate change, receiving compensation will be critical, and yet those responsible for causing the damage seek to avoid their liability. The distribution of those who will suffer and those who are responsible is generally split along spatial and [economic](#) lines ([Panayotou et al., 2002](#)). It should therefore not be surprising that the attribution of liability for climate change damages remains unclear.

The investigation focusses on the attribution of responsibility for climate change and the role of liability. To this end the [international law](#) for [environmental damages](#) is reviewed, and exposes the shortcomings of state responsibility. This is largely due to the instrumentalisation of international law through neoliberal and political influences ([Mason, 2008](#)).

Next, the current implicit application of liability in the operation of the United Nations Framework Convention on [Climate Change](#) (UNFCCC) and [Kyoto Protocol](#) (Kyoto) is reviewed. A number of deficits are found, including: lacking accountability, inadequate responses to the problem's dynamic nature and inappropriate governance. Although there has been some progress in assigning responsibility and obligations, the conversion into liability has been partial and therefore largely ineffective.

These deficits allow for ineffectiveness in the actions to address climate change and the consequent failing [legitimacy](#) of the climate regime. A review of scholarly work confirms these challenges and highlights that the issues and implications are not addressed in the integrated manner required, due to the intrinsic link between mitigation, adaptation and residual damage ([Hof et al., 2009](#)). Without effective governance and accountability, it is unlikely that an effective response to climate change will ensue, and it is therefore proposed that the current conception of liability be repositioned as a form of strategic facilitation.

To this end a Dynamically Relative and Comparatively Universal Liability Attribution (DRaCULA) framework is developed, which pre-structures processes and incentives to promote [collective action](#) to resolve challenges in the climate regime. The framework is an economic framing of the various actions of states that affect the damages from climate change. A state's liability is thus dynamically determined by its preservation of [carbon sinks](#) and its past and present net emissions, and also by its contribution to [sustainable development](#) through investments in adaptation and [technology transfer](#). This framework is compatible with the neoclassical structures of climate [capitalism](#), and presents an opportunity to transform climate capitalism into an effective and legitimate regime.

2. Liability and Responsibility in Context

2.1. International Law and Environmental Protection

There has been much debate on the scope and meaning of the term “liability” in [international law](#), stemming from the discourses on rules of state responsibility for unlawful acts and lawful acts respectively. This is particularly relevant to the environment and [climate change](#), as numerous harms are in fact committed through activities that are considered legally acceptable.

[Boyle \(1990\)](#) supports defining; “responsibility” being the obligations of States, and “liability” being the implications that result from a breach of these obligations. This clarifies that liability and responsibility are intrinsically linked, yet distinct. For this discussion on climate change the focus is on responsibility for causation and the liability for damage caused.

The global nature of the problem requires an examination of laws relating to state responsibility. This and the challenges of applying the principles of international law to [environmental protection](#) are discussed in [Appendix A](#). The considerable work that has been done in these fields, although constructive in a number of ways, is fundamentally undermined by a failure to address certain critical tenants. Among them, that a victim must bear the burden of proof for wrongfulness, thereby placing the “polluter pays principle” (PPP) in jeopardy; in particular, when the polluting states are rich and powerful and the states experiencing the damage are among the weakest, as is the case with climate change ([Parikh et al., 1997](#)).

All states have a responsibility of [due diligence](#) in applying an appropriate amount of care in terms of their responsibility and culpability for climate change, which although differentiated provides a clear indictment of some portion of responsibility for all states. Notwithstanding the seemingly logical extension of this responsibility into a clear attribution of liability is far more problematic. The loosely subjective way in which liability can be distorted through due diligence ([Appendix A](#)), provides little clarity or incentive for the strong actions recommended by [Stern \(2006\)](#). So, although state responsibility remains relevant, it proves largely ineffective because More [Developed Countries](#) (MDC) can implement mitigation strategies that don't deliver the needed outcomes and Less Developed Countries (LDC) have no incentive to follow development approaches that seek to improve on the [carbon](#) intensive transgressions of the past.

This appears unlikely to change as even when there is some progress in developing the concept of “international liability”, its impact has been limited to the provision of guidance. Without a significant shift in the state of affairs on legal application of objective liability ([Appendix A](#)), the international legal regime will remain mostly toothless to protect the vulnerable.

Such outcomes clearly highlight what [Mason \(2008\)](#) terms “accountability deficits”, which he attributes to: 1) the neoliberal dominance in the application of the rule-of-law giving commercial interests priority over international law; and 2) the undermining of norms and standards in international law, such as the Bush administration's “war on terror”. These foster “broader instrumentalisation of international law”, and provide incentives for the [exploitation](#) of multilateral processes to further specific interests and agendas ([Mason, 2008:22](#)). This strong influence of politics and national interests in international law, appears to severely limit its usefulness in the context of climate change. Although a state could raise a claim to an international tribunal; this is unlikely, as in the case of the Chernobyl disaster, where political aversion and legal uncertainty prevented any claims ([Voigt, 2008](#)). Consequently, [treaties](#) present the best opportunity for liability to be clarified.

2.2. The Operational Implications and Liability

The issues associated with state responsibility and international liability and the reluctance of states to address issues independently, have resulted in a move toward the use of treaties and multinational environmental agreements (MEA) as a means of addressing environmental harm. States either sidestep the issues of responsibility and liability or shift the focus from state liability to civil liability ([Brunner, 2004](#)). [Tol and Verheyen \(2004\)](#) highlight the discord between MDC and the [small island states](#) during the formulation of the [UNFCCC](#), over the mere hinting at state responsibility in the treaty.

[Brunner \(2004\)](#) argues that there is little statistical evidence that liability regimes improve environmental protection or ensure the victims of pollution are compensated, yet this is at least partly dependent on whether parties believe that penalties will be enforced. This is clearly a contentious area and will not yield simple answers. However, current actions in addressing climate change are manifestations of (some degree of) implicit responsibility. These activities can be categorised as: 1) mitigation activities, preventing the risk of damage; 2) adaptation as damage prevention; and 3) activities to compensate damage caused ([Tol and Verheyen, 2004](#)). Looking at each of these areas in turn will allow an implicit evaluation of the soft acceptance of obligations due to climate change.

2.2.1. Liability in Mitigation

[Kyoto](#) was a step change in responsibility acknowledgement for climate change, and has engendered a broad and multi-faceted discussion, which has advanced in a somewhat start-stop fashion. Most notably this has enabled differing domestic [policy approaches](#) and some cross border carbon trading, focussed on mitigation at the lowest possible cost. These are conceived as being the first stage of the carbon economy, leading to a regime of “climate capitalism” aligned with both [neoliberalism](#) and a low carbon future ([Newell and Paterson, 2009: 94](#)). This future vision is as yet unproven, in a number of areas.

The trade in [emission permits](#), relies heavily on the generation of permits through a grandfathering approach to countries' emission allowances. This is part of a system enabling [emission reduction](#) projects through Kyoto's most successful flexibility provision: the [Clean Development Mechanism](#) (CDM). Numerous scholars ([Michaelowa, 2005](#), [Carr and Rosembuj, 2007](#)) highlight a number of positive outcomes of the emerging carbon finance system, which upon review are heavily focussed on its [economic](#) efficiency and effectiveness in mobilising capital. Others take a more critical view, suggesting that improvements are needed in the way the CDM operates and the environmental integrity of the projects it creates ([Streck and Lin, 2008](#), [Voigt, 2009](#)).

The CDM promotes uptake through financial incentives, and privatises the responsibility and liability for emission reduction by placing this onus on the seller of the certified emission reduction ([Zhang, 2001](#)). Past improvements to the liability in this basic model include different arrangements when the buyer is from an Annex 1 and non-Annex 1 country ([Kerr, 1998](#)), “buyer beware liability” ([Zhang, 1999:326](#)) and combinations of preventative and punitive measures ([Zhang, 2001](#)). Problematically, these improvements can intensify private entities drive to undertake emission reducing activities in isolation. Making it questionable whether these activities (and related externalities) will lead to an overall global reduction in emissions. This is due to what is often referred to as “additionality” and “leakage”, or put another way: ineffectiveness and bad governance, respectively.

The reason additionality presents a challenge is that Kyoto seeks to balance a number of often conflicting priorities ([Voigt, 2009](#)), illustrated by Grubb's paradox: the projects that are the most cost efficient may also be the least additional ([Sugiyama and Michaelowa, 2001](#)). Since carbon credits are often used to offset emissions elsewhere, if these credits are not based on real additional reductions what follows is a net increase in emissions, undermining the perceived transparency and the [legitimacy](#) of the CDM ([Bauhr, 2009](#)). [Caney \(2010a:22\)](#) confirms this concern “The CDM, as currently constituted is not making an appropriate contribution to lowering greenhouse gas emissions.” By extension, the [social cost](#) incurred collectively increases significantly as we account for the damage caused by climate change, and the waste in resources attempting to mitigate it.

[Nordhaus \(2008\)](#) argues that emission limits provide significant incentives for evasion, more so, for instance, than domestic [tax systems](#). Cases where the CDM has been counterproductive are highlighted in the [Focus on the Global South \(2010\)](#) report on the [Philippines](#). It identifies projects where CDM funding has resulted in an erosion of existing [environmental regulation](#), which would have resulted in equivalent emission reductions without the CDM. It elaborates on how large multinationals and the government benefit from unsustainable, and climate change causing patterns of behaviour under the CDM. Issues are not limited to the CDM - in the US, despite some regional action, domestic policy is still far from what its Kyoto obligations would have required. Even among those who have ratified Kyoto, [Catton \(2009\)](#) argues that, many cruised nonchalantly toward defaulting on their Kyoto obligations.

It is therefore understandable that [Voigt \(2009\)](#) argues that unless economic efficiency is balanced by environmental integrity and [sustainable development](#), no long-term solution should be expected. Increasingly worrying, [Drew and Drew \(2010\)](#) identify parallels between the issue of additionality and the 2008 global [financial crisis](#); and call for a review of the systemic risk posed by the CDM to avoid a future crisis. This then begs the question of who is responsible and can be held liable if current mitigation efforts are unsuccessful and result in increased adaptation requirements and/or damage compensation. Some radical suggestions such as CDM discounting ([Schatz, 2008](#)) have been made, however tactical solutions cannot remedy the systemic risk and problems of lacking accountability and liability for the success or failure of mitigation efforts at a global level. The private liability measures that provide a semblance of accountability in Kyoto should therefore be viewed as an experiment in liability; and its avoidance.

2.2.2. Liability for Adaptation and Compensation

Adaptation to climate change cannot be separated from the issue of development and is of particular importance in LDC, as they currently stand to bear the brunt of the negative impacts from climate change ([Stern, 2009](#)). There are numerous shapes and scales that adaptation actions can take across financial, social and organisational spheres, interacting and operating within existing and emerging [institutional contexts](#) ([Adger et al., 2005](#)). Within this context, scholars like [Grasso \(2009\)](#) make ethical arguments to prioritise allocation of funds to the most vulnerable and least secure. Prioritisation is sensible, but the focus on the allocation of funds alone risks not delivering the adaptive capacity required.

Current funding mechanisms for adaptation can be split into two governance categories: 1) conventional funds where the [donor countries](#) exercise control over allocation, and 2) progressive funds, such as Kyoto's international Adaptation Fund ([Dellink et al., 2008](#)). A key difference in the Adaptation Fund is that [developing countries](#) have real [ownership](#) of the fund and the [decision making](#) is transparent ([Muller, 2009a](#)). Such progressive governance will enable enhancements in absorptive capacity both at a project and at a domestic policy level, which is critical ([Muller, 2009a](#)).

[Adger et al. \(2006\)](#) present a unanimous view that addressing the allocation of responsibility for the consequences of climate change is essential in the delivery of a just adaptation response. It is therefore critical that historical responsibility and recipient responsibility are appropriately addressed to ensure sufficient funding for adaptation strategies, and that the recipient has an appropriate level of absorptive capacity, such that this funding supports sustainable development. This perspective is supported by [Moyo \(2009\)](#), who argues that [development aid](#) without responsibility can be the prime cause of corruption, leading to funds being diverted away from their intended use.

Hof et al. (2009) confirm the intrinsic link between the level of mitigation, the cost of possible adaptation measures and residual damage costs. The models used by Hof et al. (2009) are subject to high uncertainty; yet even under the most optimistic scenarios of fund raising there is a significant shortfall in funding, the consequences of which would be higher costs under all climate change scenarios. As such the UNFCCC and Kyoto, although implying a sense of shared responsibility do not currently adequately address adaptation, nor the related but also independently inevitable residual damages (Tol and Verheyen, 2004). The inability to deal with damages once again points to the omission of liability, and will, as a result, lead to higher social costs.

It is very difficult to identify the correct level of investment needed in climate change adaptation as the potential damages it seeks to avoid are difficult to assess. Additionally, Northern countries have concern that acknowledgement of responsibility for adaptation costs could give rise to liability for damages (Baer et al., 2010). This status quo is likely to lead to higher costs in all scenarios at least at a social level. However, establishing liability could give rise to a market for adaptation funding with damage costs as an incentive, that would minimise costs (including damage cost), and solve the funding allocation problem for adaptation. This cost effectiveness logic is similar to that used to justify proactive actions (sprinkler installation) as a prerequisite for (fire) insurance (Baer, 2010).

Dietz et al. (2007) find a strong downward bias on the damage estimates of other scholars, which intensifies the argument that there is a strong case for incurring costs now to reduce the risk of damages from climate change. Such critical assessments have been instrumental in motivating action on climate change, yet valuations are still not linked to the process of deciding the nature and scale of actions to be taken. The emergence of liability should play a facilitating role in the ongoing debate among scholars discussed by Dietz et al. (2007) on the valuation of damages, and determination of risk, and risk aversion. It is uncanny that for all the talk of “climate capitalism”, action on climate change progresses similarly to a planned economy, where goods and activities are allocated based on political determinations rather than linking the good (in this case, risk and damage aversion) directly to the market, so that it can be priced there. Thus, liability for residual damages continue to be conveniently externalised, and as a result adaptation faces a similar accountability deficit to mitigation. Many may argue that this indicates a need to move away from positivist approaches of dealing with climate change. It would however be well advised to first seek to complete the (currently one sided – all carrot and no stick) contract with climate capitalism, clearly defining the implications of successful operation as well as those for failure. A meaningful value, for climate change risk and damage aversion, will only emerge, when the liability (and costs) for failure have been attributed. Such market pricing measures will provide the necessary incentive to ensure the impact of climate change damages are effectively minimised.

2.2.3. Operational Problems, Regime Legitimacy and the N-S Divide

Drawing insight from the review of the current operationalisation of liability, the shortcomings can be summarised as: 1) inadequate accounting for the total [value at risk](#) when determining policy measures; 2) the lack of mechanisms to address the dynamic nature of the problem; and 3) lacking governance and incentive structures to avoid lock-in to ineffective or inefficient pathways. These issues and their consequences are contributing to a growing critique of key aspects of the current climate regime and as a result challenging the legitimacy of the current UNFCCC and post-Kyoto trajectory.

In a review of carbon trading [Caney \(2010a:22\)](#) finds that for carbon trading to be ethical it must learn lessons from past [emission trading](#) schemes and not undermine incentives for investing in [clean technology](#). In addition, it must ensure that the CDM is radically reformed to not reward emission increases nor undermine other mitigation efforts, alternatively reject the CDM altogether. This moral perspective is expanded upon by a [Friends of the Earth \(2009\)](#) special report, which identifies six issues endemic with carbon trading. There are however, a number of modalities under which “climate capitalism” may develop in its use of low carbon technologies to address climate change, while managing the legitimacy challenges that will be posed by relying on global finance as an enabler ([Newell and Paterson, 2009:96](#)). Considering these perspectives jointly, it follows that the regime's legitimacy cannot be maintained without a reassertion and focus on environmental integrity, and hence a significant shift away from capitalism's liability externalising tendencies.

The ongoing political impasse between northern and southern delegations within the UNFCCC remains the biggest and most important barrier to moving forward decisively on climate change. This divide is framed around MDC responsibility for historical emissions, leading to current GHG concentrations and LDC potential future responsibility for ongoing GHG emissions. What cannot be agreed is what constitutes a just, [fair](#) and feasible attribution of responsibility and costs, the resolution of which is crucial to any regime. As a result of the unclear attribution of liability, states are able to continue exploiting the regimes processes for special interests, leaving a regime design that is too political and not sufficiently defined by the dimensions of the problem. Fortunately, scholars have been very active in proposing improvements to the attribution of responsibility.

2.2.4. Developments in Responsibility Attribution

A common principle affirmed in attempts to legally progress attribution in an international context is the principle of common but differentiated responsibility (CDR) as brought forward in both the Rio declaration and the UNFCCC ([Caney, 2010b](#)). However, there is diversity in how CDR is envisioned by scholars. These ensuing policy choices, such as which principles and climate change indicators to use, have a far greater impact on outcomes than scientific choices ([den Elzen et al., 2005](#)).

The progress of a number of scholars is covered in [Appendix D](#), yet despite their significant progress, there remains a failure to

addresses the deficits in accountability and governance and the attribution of liability for damages.

2.3. The Need for a New Approach

That so many have worked together since forming the UNFCCC to address climate change attests that all participants accept some responsibility for shaping the solution. It is the degree of responsibility that is problematic; consequently, our actions remain partial while the costs are complete. By analogy: the world behaves as if it is “partially-pregnant”. Such behaviour does not alter the objective reality nor the path of causality, and hence responsibility and accountability must arise. Where negotiation has not succeeded so far, collective objectivity must arise, as the evasion and externalisation of liability for the impacts of climate change on the vulnerable cannot be defended, and will lead to higher costs for all in the long run.

Much financial wealth has been created by profit maximising organisations, who legitimately limit their liability and externalise risk, it is therefore no wonder that liability has become an averted and negatively perceived concept. Yet given the aspirations of climate capitalism and growing [prevalence](#) of socially conscious [business models](#), a longer term perspective is needed for capitalist thinking to retain its legitimacy within the climate regime. Relying on the patchwork of current operational capacities, and legal framings of liability for climate change, that avoid confronting the whole issue will not only waste resources, it will also amplify the consequent liability.

In essence it is a problem of perception. Which can be addressed by refreshing how liability is viewed from: a set of complex rules that punishes individuals, to a principle of community interest here to protect everyone.

3. The Dynamically Relative, and Comparatively Universal Liability Attribution (DRaCULA) Framework

The proposal is to reframe liability as a unifying framework to facilitate action and rehabilitate climate [capitalism](#). Within the framework each country's liability is based on its past and ongoing contributions to [climate change](#), with adjustments through investments in adaptation and mitigation via [technology transfer](#) that support [sustainable development](#). The improved attribution of liability is achieved through incentives based on the potential pareto improvement of linking the actions that affect damages to their [economic](#) implications, with the intention of minimising the global [social cost](#) of climate change.

Early work in applying economic principles to liability found that classical forms of the negligence rule were more efficient than the comparative negligence rule; these findings fell apart under [imperfect information](#) (Prather Brown, 1973). More recent work has found that all forms of the negligence rule are efficient under perfect information, but that under partial information and uncertainty the

comparative negligence rule is superior (Cooter and Ulen, 1986, Rubinfeld, 1987). The comparative perspective is justified in terms of fairness and the support of a number of philosophical traditions; however, this is only applicable with reference to parties who are “symmetrically situated in their ability to take precaution” (Cooter and Ulen, 1986:1100).

Hence the most efficient way of attributing liability for climate change with its high informational uncertainty is by comparing the negligence intrinsic in the actions of the involved parties. The key caveat is that in the case of MDC and LDC vastly different capacities exist, and as a result the framework must directly support adjustments to compensate for symmetrical discrepancies. This supports the ethical perspective brought forward by Caney (2010c) that any regime needs to take account of both the PPP and the APP; these perspectives provide the first parts of the framework underpinning the conceptual model.

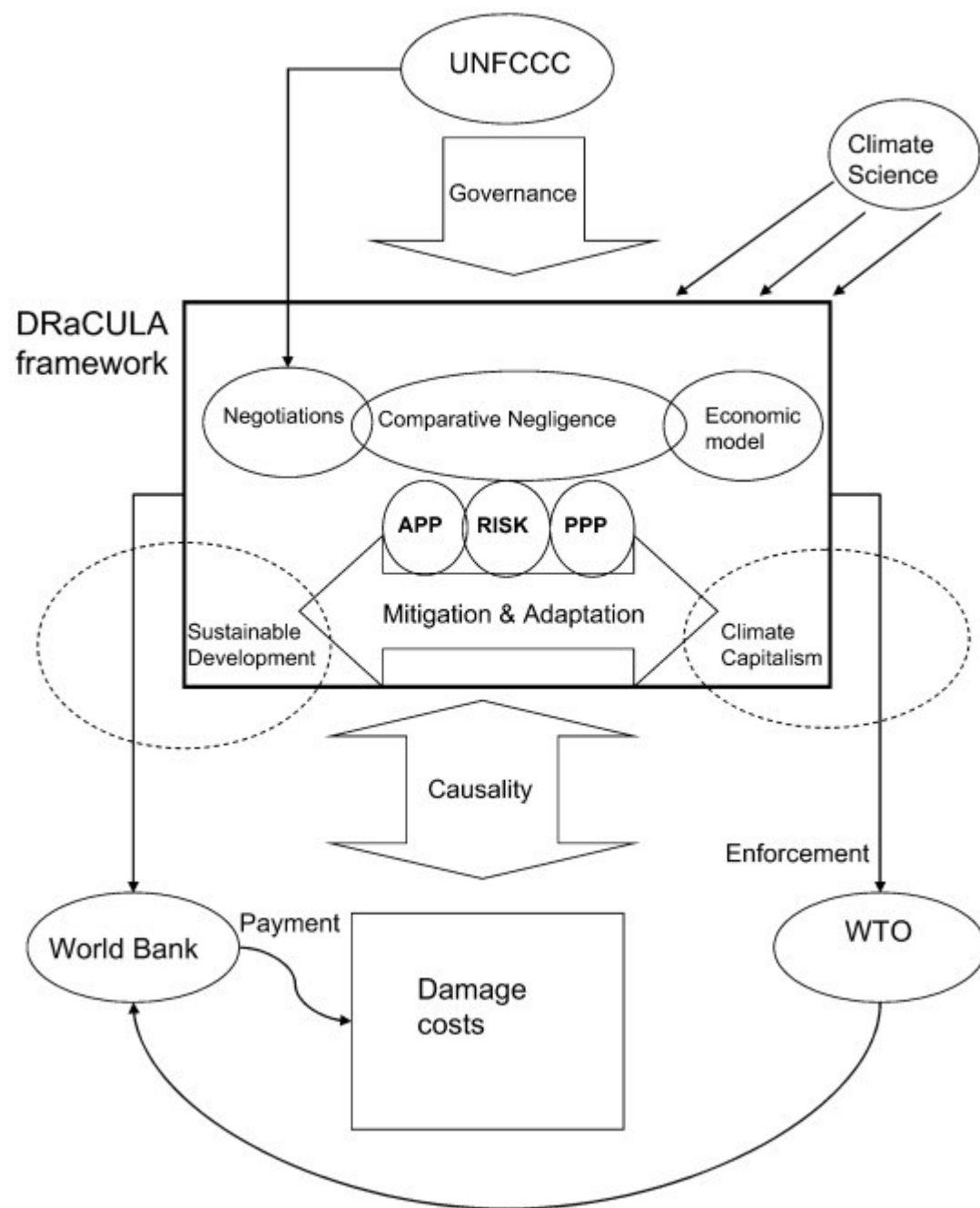
Next the framework must embody the insight, empirically tested by Hof et al. (2009), that mitigation, adaptation and residual damages all are intrinsically and dynamically linked. Therefore, a socially optimal solution to addressing climate change can only be achieved by directly addressing these aspects. This is achieved by designing the conceptual model primarily for the attribution of liability, so that it effectively supports a Dynamically Relative, and Comparatively Universal Liability Attribution (DRaCULA) framework where the relative capacities and actions of all states, are structured to incentivise collective action. In so doing it makes the intrinsic qualities of the issues that exist for and between participants of the climate regime clearer. Thereby mapping the mechanics of the climate change dilemma, in a holistic manner and pointing to the necessary modifications for effective operation.

The framework thus plays a significant role in the strategic facilitation of the climate change negotiations, assisting in the resolution of issues and stumbling blocks that impede progress and accelerating regime building and institutionalising norms. This pre-structuring of systemic (regime and institutional) components can have far reaching impacts, improving: problem solving, process characteristics, knowledge distribution and transparency (Sjostedt and Penetrante, 2013a, Sjostedt and Penetrante, 2013b) across all stumbling block areas in the negotiations. This does not eliminate the need for other forms of strategic facilitation as highlighted by Sjostedt and Penetrante, 2013a, Sjostedt and Penetrante, 2013b, rather it is integral to them, for example addressing discrepancies between the capacities of MDC and LDC.

The assessment of damage due to climate change is a highly contentious and challenging area (Dietz et al., 2007), and requires ongoing work. The determination of damage value is therefore not dealt with here, but will be assumed to have been assessed to a sufficient degree of accuracy. Achieving this accuracy is likely to be akin to a ‘chicken and egg’ dilemma, therefore, it is reasonable to assume, that allowing liability to arise may be *necessary* commit all parties to the sufficiently accurate assessment of values at risk,

through markets or other means. Any baseline assessment should exist only for a limited time period, as it is likely that the process and parameters for assessment of damage will evolve. Actors with a high proportion of liability will also collaborate effectively, as valuations are likely to increase over time, for a number of reasons, including: i) the world is likely to be wealthier and therefore damages higher in the future, ii) the public is likely to be more knowledgeable and accepting of the impacts/consequences of climate change in the future, and iii) there is currently strong downward bias on valuations ([Dietz et al., 2007](#)).

Although additional work is needed on institutional compatibility, the DRaCULA framework could be implemented within a [treaty](#) and applied as an overlay over the existing [UNFCCC](#) arrangements. Initially it could be governed by the UNFCCC secretariat, [payments](#) could be arbitrated through the World Bank, and sanctions and enforcement could be managed through specific agreements with the [World Trade Organisation](#) (WTO) to impose commensurable [tariffs](#). This could result in benefits and operational improvements to all [international organisations](#) involved. A visualisation of the DRaCULA and its contextual framing are presented in [Fig. 1](#).



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Fig. 1. The DRaCULA framework in context.

The logical and [arithmetic](#) operation of the framework is developed algebraically in [Appendix B](#), where the key Eqs. (B1), (B6), (B7) are developed. These form the basis of the conceptual model, the definitions of the equations terms' are found in [Table 1](#).

$$P_{D1} = F_{CL1} \times D_T \quad (B1)$$

$$RB = (\sum E_R) + E_H - (\sum E_{CS}) + \theta (\sum (W_A C_A)_{+-} + \sum (W_T C_T)_{+-}) \quad (B6)$$

$$F_{CL1} = \frac{RB_{c1}}{\sum_{cX}^2 RB} \quad (B7)$$

Table 1. Description of equation terms.

P_{D1}	Payment for Damages
F_{CL1}	Factor of Comparative Liability
D_T	Damage Total
RB	Responsibility Balance
E_R	Recent Emissions
E_H	Historical Emissions
E_{CS}	Emissions stored in Carbon Sinks
W_A	Adaptation Weighting coefficient
W_T	Technology Transfer Weighting coefficient
C_A	Capital invested in Adaptation

C_T	Capital invested in Technology Transfer
θ	Emission Adjustment Factor

3.1. Unpacking the Rationale and Operation of the Framework

Eq. (B6) summarises the operational aspects of the conceptual model in terms of responsibility balance. This is likely to be the focal point of negotiations, where the detailed function of the terms will be decided, possibly building on the practises already accepted by the UNFCCC. The model is however likely to result in the reforming of a number of practises as a result of its holistic accounting of emissions. The model is structured to address climate change efficiently (positivist) while supporting sustainable development, and is thereby equity enhancing. However, the model does not make determinations on equity or justice itself, and if needed these should be applied through negotiations of the variable terms. Although the functioning of the model is characterised in terms of the current regime, it is regime agnostic.

Increases in the effectiveness of the climate regime are dependent on the benefits that actors see for themselves (Andresen, 2013). These benefits are often normative themselves, however the political and economic legitimacy of the climate regime critically depends on its processes leading to effective outcomes, hence positivist ‘machinery’ enabling robust governance should underpin such systems. At the centre of the framework's positive operation are the balancing effects of the emission and investment focussed terms.

3.1.1. Emissions Focussed Terms

The Recent Emissions E_R term represents the net emissions of all GHGs from various emitting, capture, or scrubbing activities of a state. The starting date for calculating recent emissions, must be negotiated, and coincides with the end of the historical emission period. This raises the important theme of policy choices within the framework. Given their importance, as highlighted by den Elzen et al. (2005), and their potential political motivations or implications, the framework supports negotiation of these parameters and stipulates two requirements. Firstly, that the indicator used to attribute responsibility be cumulative emissions with historical concentrations of emissions treated as a constant; and secondly, that as far as practically possible, accuracy and completeness be the focus in evaluating GHG contributions. The rationale for this is: 1) measuring emission contributions is subject to the least uncertainty and since its causal link to temperature change and potential damages is robust (den Elzen et al., 2005); and 2) as the compensation for damages is based on strict liability, this attribution has to be as accurate as possible (although likely to be a dynamic evolving standard) to ensure the credibility and legitimacy of the framework. The trade-off between completeness and reliability raised by Dellink

et al. (2008) can be assumed to be dealt with by the moderating impact that the negotiation of an agreement will have on potential unreliability. States with less capacity to engage in negotiations will either seek to form a coalition or their capacities will need be augmented through facilitation to ensure a fair outcome (Sjostedt and Penetrante, 2013a, Sjostedt and Penetrante, 2013b), this would be required under all modalities, although would be less efficient without the framework's pre-structuring benefits. Therefore (assuming a levelled playing field) as unreliable outcomes could potentially affect any state, we can expect that states will seek to minimise their down side but will likely settle on parameters that distribute the risks fairly.

Within the model, recent emission reductions produce the double impact of reduced comparative and overall liability; however, states' reductions that are discovered to be subject to leakage or double counting should have their liability readjusted. To avoid strategic behaviour: 1) only liability increases should be adjusted, this also aligns with the precautionary principle; and 2) such calculation "errors" should incur a carbon interest rate on adjustments significantly higher than the cost of capital and a further adjustment to ensure no benefits arise from changes in the carbon value. This capability will ease the improvement of emission reduction mechanisms, such as Muller's (2009b) proposal for differentiated application of additionality in the CDM, as DRaCULA will provide a higher level of governance. Where long term permanence of storage is a concern, the ability to operationalise long-term liability is critical to the viability of enabling technologies (Bode and Jung, 2006). As such the ability to readjust responsibility would future proof the framework for potential future technologies such as carbon capture and sequestration.

Emissions stored in Carbon Sinks E_{CS} play a key role in reducing the risk associated with a very significant source of emissions and must be included in the balancing of responsibility. Despite the significant issues with measurement and verification of carbon sequestered in LULUCF projects (Dutschke, 2002), there is a great urgency to operationalise these projects, brought into focus for forestry by the Eliasch Review (2008), which identifies the significant costs of inaction on deforestation and the scale of support needed to address it. DRaCULA also provides the flexibility via readjustment necessary to support Dutschke's (2002) permit leasing conception of the temporary nature of carbon sequestration in LULUCF type projects. This term provides initial balancing potential for certain LDC allowing them to immediately leverage these resources on a low emission development trajectory. Thus, it provides for the rapid potential operationalisation and improved governance for a mechanism that will reduce the liability of all parties.

The Historical Emission constant E_H , is a value that must be negotiated for each country as a once off adjustment for all emissions emitted prior to the commencement of E_R contributions. According to Weisbach (2009) this once-off 'payment' for past harm causing acts is the only workable solution. It should be determined by considering historical contributions as well as more normative perspectives such as moral responsibility and APP (Muller et al., 2011). It is expected that MDC will bear the majority of this burden and

commence the regime with the majority of the liability. This significant burden at the starting point is necessary for the establishment of the PPP and is the basis of the incentive for MDC to actively engage in technology transfer and adaptation investment in LDC. This is, in turn, necessary to get LDC to all accept responsibility for sustainable development and increasing responsibility for their own emissions.

3.1.2. Investment Focussed Terms

The formulation of the Responsibility Adjustment (RA) terms for adaptation and technology transfer ([Appendix B](#)) and their weightings $W_A C_A$ and $W_T C_T$ respectively, will likely be considered in parallel with E_H , as their interaction will initially set the international institutional boundaries within which comparative liability will evolve. These parameters are state-specific and based on current capabilities and capacities. There are many issues with technology transfer at present, including the commercial, funding, absorptive capacity, governance and [intellectual property rights](#) arrangements ([Mandal, 2009](#)). [Giddens \(2009:220\)](#) highlights this by saying “rules governing [knowledge transfer](#) and investment...will be more important than universal accords”. There is a critical two-sided rule applied in DRaCULA that operationalises CDR for knowledge transfer and adaptation investments. Firstly, on the MDC side bearing differentiated responsibility based on the APP, in part by investing and supporting the augmentation of capacity in LDC and as a result reducing their liability (compensation for past emissions). Secondly on the LDC side to take on their responsibility in ensuring that the investments made are those that can be absorbed by the country and thus contribute toward sustainable development, thereby increasing their responsibility to develop in a proportionately less emissions intensive manner.

This balancing effect of the RA terms, are a positivist treatment of adjustments to responsibility and operationalise accountability for investments made. Accountability for effective outcomes is required for both sides of RA : effectiveness of the investment or technology transfer (outflow value) and the responsibility for these assets and [skills](#) to be effectively applied (inflow value). Outflows will reduce a particular amount of liability for the investor (e.g. renewable generation), and increase the *relative* liability of all other parties to the framework (likely offset, by lower overall liability). Following a similar logic, inflows (e.g. renewable generation, displacing carbon intensive generation) enable the receiver to accept more liability (as their cumulative emissions will be reduced); this will also have the effect of reducing the *relative* liability of all other parties to the framework. These balancing flows and impacts are needed to have a bounded and balanced system of accounting. With the normative and ethical considerations inherent in climate change operationalised (investment wise) through the values of the relevant weighted coefficients.

This two-way flow of responsibility provides an effective facilitation mechanism to assist in resolving the N-S divide, bridging the North's

forward-looking conception of fairness and justice and the South's backward-looking conception ([Penetrante, 2013:251](#)).

This holistic conception of responsibility seeks to align with broader shifts in governance, such as those identified by [Muller \(2009a\)](#) as emerging within the UNFCCC Adaptation Fund by the severing of donor control. This should lead to both proper accounting, and the right kind projects gaining investment.

3.2. Robustness of the Framework

This approach to climate change and liability may give rise to various challenges. Some potential conceptual challenges are reviewed in [Appendix C](#). The [robustness](#) of the approach is further assessed by considering it under the following four lenses: 1) the conceptual formulation, 2) practicability of the approach, 3) realistic potential for success, and 4) building on and improving current arrangements.

Conceptually the approach maintains environmental integrity through the operationalisation of the PPP and the precautionary principle. It is aligned to key issues in the climate change negotiations through the application of comparative negligence, the APP and the dynamic and adaptive nature of the framework integrating uncertainties and supporting 'immeasurability' in its operation. In a simulation using [cooperative game theory](#), [Eyckmans and Tulkens \(2003\)](#) found that the necessary conditions for world cooperation on climate change do exist; through the relative distribution of the differential [surplus](#) gained from cooperation (potential pareto improvement). Their findings are compatible with DRaCULA as the proportional allocation of the surplus was based on marginal climate change damage costs in a [dynamic model](#) that considers multiple regions.

The practicability of implementing the framework faces many of the challenges that exist in implementing any inclusive and complex multi-national agreement. The framework's alignment to many of the central climate change and negotiation issues, with strong incentives for reducing risk and impact from climate change, supports the strategic facilitation of climate change negotiations through pre-structuring. Therefore, investments in its implementation will improve the robustness and effectiveness of the climate negotiation's regime building activities. The approach is also sufficiently flexible to allow it to operate as an overlay to current institutional arrangements with various potential linkages with other international organisations such as the WTO in its implementation. This has many potential additional positive effects to the [negotiation process](#) such as the broadening of the Europeanisation effect through international bargaining, as highlighted by [Bhatti et al. \(2011\)](#). This flexibility also extends to the ability to adapt to potential changes to the climate regime (e.g. [emission permits](#) to taxes). The implementation of the conceptual model will be non-trivial and requires further work. In particular, it would be beneficial to test the viability of the conceptual model under different scenarios, by developing a model that could test its operation with sample data. In this next phase of [modelling](#), it would be advisable to apply a Global Sensitivity and

[Uncertainty Analysis](#) (GSUA) to the model, as outlined by scholars such as [Saltelli et al. \(2008\)](#). Which will improve operational understanding and management of the implementation aspects of the framework. Despite there being much to do, to realise the framework, the effort in doing so is unlikely to be additional to efforts under other approaches to regime building.

The degree to which the framework will realise success is dependent on its ability to ensure participation, which is largely about having the right incentives in place and achieving an ideological balance. As highlighted by [Michaelowa and Michaelowa \(2012\)](#) a country will shift its strategy (climate policy) and/or compromise if it has something to lose by not doing so. The strong collaborative and competitive incentives that exist in the framework are likely to penalise latecomers to the agreement, which will drive participation. Ideologically the framework supports normative views through the negotiation of key parameters, is positivist in its compatibility with neoclassical approaches and environmentally sound based on the primacy of its outcome focus: to address climate change. The compromise enhances this frameworks adoptability.

The framework acts as a unifying mechanism in a fragmented climate regime. It draws from the work of leading scholars from different fields; it balances a neoclassical approach to operation with key aspects of the Green Development Rights (GDR) framework ([Baer et al., 2010](#)) on responsibility sharing and capacity transfer. It also seeks a more effective and synergistic governance architecture through the creation of a market for avoidance of climate change damage and associated risk. This in turn also addresses many of the negative impacts and costs from the intentional promotion of conflictive and cooperative governance fragmentation by certain actors ([Biermann et al., 2009](#)). Improved governance is necessary as the economic benefits under the framework would be orders of magnitude greater than what is currently being mobilised to combat climate change, despite that number being significantly lower than the liability exposure from climate change itself.

Finally and most critically it has the potential to gain the participation of actors who in the past have been obstructive of the process; specifically because of the significant economic benefits to participation.

4. Conclusion

[International law](#) is unlikely to play a role in liability for [climate change](#) damages unless its principles find a way into a climate change [treaty](#). [UNFCCC](#) mitigation efforts have “experimented” with the implicit operationalisation of liability, although the bias against explicit liability in the current formulation of climate [capitalism](#) has sought to avoid it formally when shaping policy. This is undermining the environmental integrity of mitigation actions and calling into question the [legitimacy](#) of the current regime. Despite the law's

ineffectiveness in attributing liability, its legal principles still point clearly to the correct application of rules and have informed the formulation of DRaCULA.

Adaptation has gained increasing focus, and as a result so has the topic of damages, and the interconnectedness of climate change areas. The empirical strengthening of the links between mitigation, adaptation, residual damage, responsibility and liability, confirm that piecemeal approaches in responding to climate change must be refuted. The implication is that a mechanism is needed that considers all these aspects in an integrated manner that ensures accountability and effective outcomes.

Looking at the climate regime from a macro perspective, numerous deficiencies are evident, including gaps in accountability resulting in failed accounting for [value at risk](#), inadequate handling of the problem's dynamic nature and insufficient governance to prevent lock-in to ineffective trajectories. The degree to which liability arises increasingly provides incentives for these issues to be addressed. In addition, it is evident that the regime is strongly defined by existing power structures and not enough by the nature of the problem. This leads to an instrumentalisation of the regime for national interests, and contributes to entrenching the N-S divide, and other stumbling blocks that will require strategic facilitation to yield adequate solutions.

Confirming this crisis in climate change, scholars have proposed improvements, none of which address the lack of a cohesive form of high-level accountability for delivering reductions in risk and damage. This provides an opportunity to reframe liability as an incentive mechanism to minimise the [social cost](#) of damages and thereby act as a unifying framework, pre-structuring key [negotiation processes](#) and principles to facilitate effective outcomes. The acronym DRaCULA describes such a framework which entrenches the PPP, the APP and the risk associated with climate change, and thereby a degree of the [precautionary principle](#). This framework is socially efficient under the uncertainty of climate change by using a standard of comparative negligence in attributing liability and providing both collaborative and competitive incentives for states to act in a positive manner; and together with the operationalisation of an emergent conception of CDR provides a credible solution to the N-S divide.

The DRaCULA framework's operation is positivist in formulation, which represents the aggregation of various actions that states take to alter their contribution to causing climate change damages. It however integrates normative positions through the weightings (coefficients) that can be applied to various terms in the model. The emission-focussed terms deal with responsibility for past emissions, ongoing emissions and the preservation of [carbon sinks](#). These terms are likely to assign the majority of liability to MDC at the start, as well ensuring that LDC take responsibility for developing along non-emission intensive paths. The liability can be expected to balance out as adjustments are made through investment based terms. Investment can take the form of adaptation and [technology transfer](#) that

support [sustainable development](#), where incoming investment potentially increases liability and outgoing investment potentially reduces liability. DRaCULA does not eliminate the need for complex negotiations or ongoing rigorous work within each domain; rather it strategically facilitates the negotiations, improves their efficiency and supports regime building.

The framework could be operationalised through existing [international organisations](#), with the UNFCCC governing its progress and the World Bank and WTO providing transactional and enforcement functions, respectively. This area will require further research, as will the empirical testing (modelling) of the conceptual model, and ongoing work is needed in the assessment of damages. The success of this model is dependent on the damage valuations being as inclusive and robust as possible - this will be no easy task. This said the framework itself provides incentives for minimisation of damage and thereby the value of any marginal error in damage valuation.

The DRaCULA framework provides an effective response to the issues currently facing the climate regime and is flexible to changes in regime design. It is likely to succeed where other approaches have found difficulty, by ensuring all parties have an interest in participation, through collaborative and competitive incentives, while contributing to the strategic facilitation of the negotiations. The environmental underpinnings on which the framework is based mirrors the dynamic and multifaceted nature of the climate change problem. It also takes account of the often conflicting neoclassical and ethical concerns, designed therefore to be structurally positive while effectively integrating normative attributes from negotiation; addressing both perspectives. Together with the correct application of the appropriate negligence rule under information uncertainty and using a simple and logical conceptual model developed for implementation, DRaCULA presents a robust approach and operable framework that can lead to appropriate action. DRaCULA therefore provides a legitimate pathway for efficient macro level climate governance and [collective action](#). Applying DRaCULA will require a reshaping of climate capitalism away from its externalising tendencies and toward a just handling of liability, those actors who are still averse to such reshaping, should carefully consider the possible alternatives.

The lack of a clear and comprehensive liability regime not only divides the signatories of the UNFCCC, it is also now emerging as the underlying cause of a very serious threat to the climate regime's legitimacy. As the limits of the climate system are increasingly breached, it is not only necessary but highly beneficial to all that clear and complete sharing of the liability for the outcomes be agreed.

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Appendix A. Climate Change and International Environmental Law

A.1. State Responsibility in Treaty and Customary Law

State responsibility arises when there is a breach of the terms of a [treaty](#) or of one of the rules of customary law; it has the aims of 1) supporting primary rules in treaties and customary law which aim to prevent damages; and 2) secondary rules providing restitution or [compensation for damages](#) ([Voigt, 2008](#)). [Voigt \(2008\)](#) highlights that treaty law is the main source of obligations under international [environmental law](#), although often it still relies on the provisions within customary law both in terms of primary and secondary obligations.

Determining state responsibility when a prohibited act is committed has generally been a straightforward matter. Complications arise, however when someone experiences harm from acts that are lawful. An example in the case of [climate change](#) is where damages are inflicted as the result of 'business as usual' (BAU) activities. [Taylor \(1998\)](#) cites numerous sources that pose significant doctrinal challenges to the [payment](#) of compensation for activities that are not unlawful. These challenges are overcome by a stipulation made by the President of the International Court of [Justice](#) ([Higgins, 1994](#)), who ruled that it is the allowing of harm to occur that is wrongful.

This "no harm rule" has its foundations in the principle of states being good neighbours to each other, and is highlighted in the 1972 Stockholm declaration and 1992 Rio declaration as well as forming the basis of the [UNFCCC](#) and [Kyoto](#); it further also contains an obligation to prevent foreseeable harm or minimise risk ([Tol and Verheyen, 2004](#)). The limitation on damages needing to be "significant" for the harm to require prevention is overcome in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (and developments since then), which clearly puts climate change within the scope of this rule ([Voigt, 2008](#)). In addition to significant damage, it is also necessary to prove a causal link to the state whose activities caused the damage; if this can be done, one can say that responsibility for the damages arises for the relevant state.

This however does not mean that the state is necessarily liable for the damages. It is first necessary to prove the state did not fulfil its obligation in regard to duty of control by acting without [due diligence](#) or not applying an appropriate standard of care, which are defined by a state's capacities and its context ([Voigt, 2008](#)). [Voigt \(2008\)](#) specifies a series of three common elements used to evaluate the standard of care under due diligence: 1) opportunity to act – a state should take all necessary measures to prevent significant damages, regardless of uncertainty and in such a manner that can be dynamically modified to take account of change and new information; 2) foreseeability – sufficient for a state to be able to envision the general consequences of an act or omission; 3) proportionate measures – states have a duty to act in proportion to their capacities and level of development, and furthermore they have a customary law duty to

reach equitable solutions. There is no standard template that can be applied to determining a standard of care, although there seems to be an implied sense of “doing one's best”.

A.2. The International Law Commission and Strict Liability

Following a different tack the [International Law](#) Commission (ILC) developed a topic on acts not prohibited by international law. During this process and despite general support for strict liabilities shifting of responsibility to the polluter, as well as the support of a number of scholars and some legal precedent, customary international law was found to be in favour of the application of due diligence. ([Boyle, 1990](#), [Taylor, 1998](#)). Scholars have both praised and condemned the developments made by the ILC, with [Taylor \(1998\)](#) and [Boyle \(1990\)](#) highlighting a number of them particularly on the doctrinal front. Both indicate a need for greater [codification](#) within treaty or customary law and recognise the importance of the subject in terms of past and current environmental issues such as Chernobyl and climate change.

[Boyle \(1990:23\)](#) presses on the need to clarify the circumstances under which states should be liable for damages “without the lack of due diligence”, either based on general principle or under strict dictates. The opportunities for this are in fact significant, as [Brownlie \(1983: 38-44 cited in Boyle, 1990:15\)](#) points to the opportunity for a stricter approach to liability enabled through the concept of objective responsibility based purely on proving causality. This would point to objective liability as a possibility for addressing climate change, and would shift the focus to establishing causation. The work of the [IPCC](#) in establishing a link between [greenhouse gases](#) (GHG) and the [radiative forcing](#) that causes climate change is sufficient for GHG contribution to result in specific responsibility arising ([Tol and Verheyen, 2004](#)).

This does not answer the degree of causal impact that is attributed, what indicators should be used in their calculation nor how these should be converted into a proportion of responsibility. These and other difficulties muted the draft articles on the “Prevention of Trans-boundary Harm from Hazardous Activities” adopted by the ILC in 2001. This became known as “international liability”, the impact of which has been moderated to guidance on rules for the prevention of environmental harm; hence the [polluter pays principle](#) (PPP) is still not clearly established in customary law and the burden of proof remains with the victim of damages ([Tol and Verheyen, 2004](#)).

Appendix B. Conceptually Modelling the Attribution of Liability for Climate Change

The conceptual model is premised on all states collectively accepting liability for damages from [climate change](#). In effect applying strict liability globally within the framework, via a [treaty](#) and thereby entrenching the PPP and creating a market for the aversion of climate

change risk. Factors affecting the degree of contribution are negotiated in relative terms similarly to current [UNFCCC](#) practise, however, with capacity and universal responsibility as underlying concepts, thereby entrenching the ability to pay principle (APP) and the responsibility for minimising emissions in development. With this basis, the comparative liability of the various states can be developed based on their balance of responsibilities. The choice and number of actions will affect a state's comparative liability, and in some cases will reduce the overall damage liability shared by all states. Thus, the model has both collaborative and competitive incentives, encouraging a wide range of actors to participate. This will be driven by the net gains likely to accrue to early participants as damage cost valuations are likely to increase over time and from the greater relative share of potential pareto improvement available. The structure of the conceptual model can be simplified to: the addition of past actions (constant); to various future actions (independent variables); equating to the damage (dependent variable). This intentionally belies the complexity intrinsic in the calculation of the various terms, this macro perspective isolates the various terms to allow for independent handling of the uncertainties and risk necessary to enable best practise within each domain.

Deriving the model starts with the intention of calculating the liability of country 1 in the [payment](#) it owes for damages incurred. The Payment for Damages (P_D) for which a country is liable is equal to the product of the Factor of Comparative Liability (F_{CL}) and the Damage Total (D_T) attributable to climate change.

$$P_{D1} = F_{CL1} \times D_T \quad (B1)$$

It is therefore F_{CL} that determines the extent of liability of a specific state and is the comparative term sought.

In deriving this term, it is important to take account of both emission based contributions to the damage, as well as capital investments that help in dealing with the damage. The emission-based components change based on changes to emission output and [carbon](#) sink protection with a historical term initially placing most of the burden with historical polluters. The capital-based components adjust the responsibilities gradually, as the capability and capacity of states' increases through adaptation and [technology transfer](#).

The Emission-based Contributions (EC) portion of the conceptual model are comprised of the sum of Recent Emissions (E_R) added to the negotiated Historical Emission responsibility constant (E_H) and the deduction of Emissions stored in Carbon Sinks (E_{CS}) from activities such as [Land Use](#), Land Use Change and Forestry (LULUCF) sequestration projects.

$$EC = (\sum E_R) + E_H - (\sum E_{CS}) \quad (B2)$$

The Responsibility Adjustment contribution (RA) is comprised of Adaptation Capital investments (C_A) and Technology transfer Capital investments (C_T). Each of these terms is weighted by a coefficient (W_A) and (W_T), respectively, which can be negotiated based on development priorities. The RA is then converted into Emission Adjustment (EA) units that are commensurable with EC by multiplying it with Theta (θ), which is a term that can be linked back to the carbon price or other value balancing mechanism. Both funding states and receiving states would incur adjustments, with outward capital flow carrying a negative sign (responsibility reducing) and inward capital flow carrying a positive sign (responsibility increasing).

$$RA = \sum(W_A C_A) + \sum(W_T C_T) \quad (B3)$$

$$EA = \theta(RA) \quad (B4)$$

The Responsibility Balance (RB) is then simply the sum of EC and EA .

$$RB = EC + EA_{+-} \quad (B5)$$

Alternatively, by substituting Eqs. (B2), (B3) and (B4) into (B5)

$$RB = (\sum E_R) + E_H - (\sum E_{CS}) + \theta(\sum(W_A C_A)_{+-} + \sum(W_T C_T)_{+-}) \quad (B6)$$

From here F_{CL1} is easily calculated as the ratio of the RB of country 1 to the sum of the RB of all other countries.

$$F_{CL1} = \frac{RB_{c1}}{\sum_{c \neq 1} RB} \quad (B7)$$

This can then be substituted back into Eq. (B1) to determine P_{D1} .

Appendix C. Potential Conceptual Challenges

Necessity of using liability - [Dellink et al. \(2008\)](#) argue that given the uncertainty of using liability to sue for damages, and the urgency of progress, using the concept of historical responsibility will be more expedient.

It may be more expedient as this is the pathway that the climate regime is already following. However, responsibility will not drive the level of action needed to effectively address [climate change](#) as failures in real [emission reductions](#) and shortfalls in adaptation funding

show. Chernobyl clearly shows the aversion states' have to legal claims, and yet this provides a key motivator for the framework. As Voigt (2008:22) clearly puts it: "State responsibility cannot replace the need for stronger environmental regulation". Hence, the reframing of liability as a unifying concept is essential, to avoid urgency leading to further ineffectiveness.

Equations and objectivity in assigning obligations -Weisbach (2009:29) has argued against the "objective scientific method of determining treaty obligations" and Caney (2010c:222) states that "no such simple formula is available" to determine who should bear the costs of climate change. The views are grounded in the significant complexity of the historical and capacity issues involved, and argue for resolution in hard negotiations and hybrid multifaceted solutions.

DRaCULA in fact draws inspiration from these arguments. As such it proposes the structuring and codification of an objective set of principles drawn from scholars within the field into a system that aligns states with diverse interests and agendas in a solution-orientated manner. In effect manifesting itself as a form of strategic facilitation within the negotiations, through its pre-structuring of regime components to address climate change issues. This is able to function effectively because DRaCULA is socially efficient and therefore provides the greatest potential for agreement through potential pareto improvement. It therefore does not remove the need for negotiations or for a vast number of complex agreements and complex formulas in the final balancing of obligations and liability.

A market for future damages will result in unethical discounting - As damage liability will be greater in the future, the value of avoiding those damages in present terms will be subject to discounting. Such discounting is unethical (Stern, 2006) and may result in lower than anticipated investment in the present, leading to inefficient outcomes.

It is more likely that in fact a market for the avoidance of future damages will emerge, however, should such a market emerge, the potential impact of such discounting is moderated in three important ways. Firstly, actions to reduce liability not only reduce the exposure to payment for damages in the far future, but also for the present and near future too. Therefore, investments in reducing liability today have a compounding return. Secondly, the incentive to act early will drive participation in the market, the economies of scale that will result will reduce the cost of mitigation and adaptation thereby greatly reducing the potential for damages (avoiding damages is of higher ethical merit than appropriate compensation for damage). Lastly as peoples' attitudes change and become more accepting of the causes and impacts of climate change, the valuation of damages is likely to increase relative to early valuations, any such discounting will hence be moderated.

You cannot expose countries to such great financial uncertainty and risk - As the damage from climate will have a broad range, the

potential liability facing countries could swing dramatically, having “unacceptable” impacts on the economy and peoples' welfare.

These negative impacts are merely a reflection of the damage that has in fact already been caused, and unjustly delivered via the climate system to comparatively innocent victims. Such impacts should therefore be seen as self-inflicted. If a country does not want to be exposed to these risks, there are numerous actions under DRaCULA that can be followed to minimise this impact.

Exclusion of equity makes it ethically devoid - Equity and [justice](#) arguments can be made about the lack of a mechanism to drive convergence of per capita emissions to a globally balanced level.

Firstly, the merits or importance of converging to a globally equitable level of per capita emissions is not within the scope of this discussion. Secondly, and despite this the framework will make some contribution toward normalisation of per capita emissions through its strong support for [sustainable development](#). Furthermore, the objective of the framework was first and foremost focussed on environmental integrity with support for normative aspects through the negotiated attributes. Hence through the strategic facilitation and inclusion of liability for damages that DRaCULA provides parties, they are better off than under the current climate regime. Further equity enhancements should be sought through other forms of strategic facilitation within the negotiations and discussed by [Sjostedt and Penetrante \(2013b\)](#).

Empirical evidence against liability regimes - There is some scholarly work that refutes many of the environmental benefits claimed by liability regimes and questions the cost associated with negotiation of such regimes ([Brunnee, 2004](#)).

[Brunnee \(2004\)](#) does, however, acknowledge that there are successful regimes, which have been tailored to specific [environmental concerns](#), and that there is evidence that suggests the failure of other liability regimes is due to the lack of strong enforcement. Further the DRaCULA framework will result in many other benefits from the role it will play in strategically facilitating the negotiations

Some states won't participate – Without broad participation, the countries that do join the treaty will be disproportionately burdened, and will revert to non-compliance.

DRaCULA provides numerous incentives that support [collective action](#), states are likely to participate if there are benefits to participation. As costs to address liability are likely to be lower early on, when damage valuations are lowest there is no incentive for non-participation. Furthermore, based on the Lac Lanoux arbitration, there exists a customary law obligation for states to “consult and reach equitable solutions” ([Voigt, 2008:14](#)). Should states be in breach of this obligation, it may be possible to exert pressure on

dissenting states, particularly if the majority of states reach agreement. It is likely that most states will participate as they either are in possession of significant sinks that will have value in the process, or have very low historical liability or will not want to miss out on gains to trade (or be uncompetitive - WTO tariffs) from the massive market for adaptation and mitigation technologies that will emerge.

Appendix D. Scholarly Advances in Responsibility

[Panayotou et al. \(2002\)](#) propose an approach where efficiency and equity are dealt with on the basis of differential net damages: transfers from those who contribute more to the problem than they suffer, to those who experience the inverse. This approach is in fact well suited to liability, as it is based on damage burden rather than on responsibility as a proxy. [Verheyen \(2005\)](#) lists numerous potential difficulties with its implementation, which do not invalidate its principles. A similar but simpler option has been proposed by [Parikh et al. \(1997\)](#) where transfers are made from MDC to LDC through international institutions, based on an equity rationale that MDC have contributed more than their 'share' of emissions. This establishes the PPP as a key component; it is however, insufficient for a workable solution despite the attractiveness of its apparent simplicity ([Caney, 2010c](#), [Caney, 2010b](#)).

Work done by [Muller et al. \(2011\)](#) advances the conception of historical responsibility, initially proposed by the Brazilian delegation in the [Kyoto](#) negotiations, as not only being reliant on the contribution but also based on the capacity for action. This view is supported by [Caney \(2010c\)](#), who concludes with the need to draw from the PPP and the ability to pay principle (APP). In his analysis, he identifies responsibilities for the wealthy to play a leading role and for the poor to avoid developing along an emission intensive trajectory if other paths are open to them. [Caney \(2010b\)](#) suggests that the principle of CDR should not only be applied between states, as it is currently legally being formulated, but between individuals within states, e.g. the wealthy within LDC. The operability of such morally rigorous perspectives may be called into question, particularly given the already complex nature of negotiations and the potential significant additional costs.

These costs may be particularly daunting given that [Dellink et al. \(2008\)](#) point to the need to review the contributions of countries to [climate change](#) regularly and adjust their responsibility as a result. As the costs of climate change grow over time so will the contentiousness of the negotiations, and it is not difficult to imagine scenarios where obstruction leaves the entire regime ineffective. A [dynamic response](#) is in fact a legal necessity, as [due diligence](#) in the case of climate change is determined by a dynamic standard of care ([Voigt, 2008](#)). Introducing dynamic solutions to deal with the dynamic challenges is therefore imperative. In recognising this need [Catton \(2009:5637\)](#) conceptualises a "bill-splitting dynamic [carbon cap](#)" which is designed around the dynamic nature of the problem.

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