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Beyond maladaptation: structural barriers to successful adaptation

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ABSTRACT

Around the world adaptation projects are being implemented, with the hope of essentially climate proofing communities. While there is an abundance of failed adaptation schemes in developing and developed countries alike, there has been little scholarship on this problem. Through interviews with twenty-two climate change adaptation practitioners, we identify four structural challenges that contribute to maladaptation: the focus on technological fixes versus holistic approaches; the difficulty of distinguishing between adaptation and development; the problem of quantifying non-quantifiable variables; and the existence of competing problems given that failure to mainstream climate change adaptation. Addressing these maladaptation dynamics is necessary to enhance successful adaptation processes.

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Introduction

In 2018, climate-related disasters cost the United States approximately 91 billion dollars (NOAA National Centers for Environmental Information (NCEI) 2020). For middle-income and less-developed countries, economic losses are even higher, especially in relation to their national gross domestic products. For instance, Cyclone Winston, which was a category 5 storm, caused losses and damages that totaled approximately 31% of Fiji's gross domestic product (World Bank 2016). There is no indication that climate change is being curbed. Contrarily, it is projected that climatic impacts are going to worsen as countries fail to significantly reduce greenhouse gas emissions (IPCC 2018, 2021). Consequently, the damages associated with climatic disasters are expected to become more costly, which is stimulating efforts to develop and implement adaptation planning.

Until recently, climate change policy has primarily focused on mitigation efforts, with scholars detailing the importance of monitoring and reducing pollution, especially greenhouse gas emissions. Policymakers were reluctant to discuss adaptation for fear that it would detract from mitigation efforts, especially those targeting major polluters (Ciplet, Roberts, and Khan 2013). However, failure to effectively address the drivers of climate change has made adaptation a global priority, as nations are forced to contend with its consequences (Dolsak and Prakash 2018). The 2015 Paris Accord advanced the need for adaptation through the United Nations Framework Convention on Climate Change (UNFCCC) by stressing that adaptation is equally as important as mitigation (Magnan and

Ribera 2016; Emma et al. 2018). It also established an international goal to enhance adaptive capacity, particularly in developing countries. Adaptation research subsequently followed suit and has grown substantially. For instance, Sietsma et al. (2021) find that between 2009 and 2019, adaptation research increased by 20.6% per year. Yet knowledge and assessment of projects are still limited (Callaghan, Minx, and Forster 2020; Sietsma et al. 2021). Given the recent emergence of adaptation efforts, it is understandable that there are significant gaps in this area of inquiry, particularly regarding the effectiveness of adaptation projects (Sietsma et al. 2021; Singh et al. 2021). A systematic framework for studying adaptation has not been developed, which complicates efforts to address *maladaptation* (Ford and Berrang-Ford 2016).

There tends to be an assumption that adaptation projects lead to positive outcomes. However, this is not always the case. Recent Intergovernmental Panel on Climate Change (IPCC) reports indicate that adaptation can have undesirable outcomes and that there is an increasing prevalence of maladaptation, making it all the more important to study adaptation itself (Magnan et al. 2016). Given the diversity of adaptation projects in distinct countries and specific locations, there are numerous pathways and outcomes that emerge from these efforts. Within the extant literature focused on adaptation, there is a positivity bias. Both natural and social scientists tend to confine their studies to cases with positive adaptation outcomes (Juhola et al. 2016). While useful insights arise from such cases, it is also necessary to examine maladaptation situations in

order to gain a broader understanding of processes and conditions that influence adaptation projects. Knowledge from such research can help improve future adaptation developments (Magnan 2014).

Scholars have called for such investigation in order to minimize the risk of maladaptation (see Barnett and O'Neill 2010; Juhola et al. 2016; Magnan et al. 2016; Schipper 2020). Taking an *ex ante* approach to address maladaptation can lead to more effective climate change adaptation learning models that will better identify what processes work, which do not work, and for whom do they work (Faulkner, Ayers, and Huq 2015; Juhola et al. 2016). As Schipper (2020) notes, 'the challenge with studying and understanding adaptation [and maladaptation] is that it is a *process* as much as it is an *outcome*.' With this recognition in mind, there is a growing body of literature that draws attention to adaptation processes over outcome. Furthermore, policy experts criticize the *progress* of adaptation research, noting that increases in quantity do not address quality concerns (Sietsma et al. 2021).

In this article, we focus solely on processes that contribute to maladaptation. We begin with a brief overview of maladaptation as a conceptual framework, focusing on the trajectory of the terminology and where the literature stands to date. Using data from twenty-two semi-structured interviews conducted with climate change practitioners, we identify four structural challenges that contribute to maladaptation: the focus on technological fixes versus holistic approaches; the difficulty of distinguishing between adaptation and development; the problem of quantifying non-quantifiable variables; and the existence of competing problems given that failure to mainstream climate change adaptation. Altogether these challenges affect the adaptation lifecycle from conceptualization to implementation to evaluation, leading to divergent outcomes.

As we highlight in the next section, there are limited studies that focus specifically on maladaptation, and even less that structurally analyze it (see Barnett and O'Neill 2010). Most research on this subject is dominated by in-depth case studies that are unique to a specific location (see Antwi-Agyei et al. 2018; Neset et al. 2019; Work et al. 2019). This creates challenges for generating comparisons across time and space. While context is critical to understanding specific maladaptive outcomes, it is also useful to examine broader, common themes as identified by adaptation practitioners in order to develop a systematic framework for adaptation.

Maladaptation overview

Despite the fact that maladaptation is of increasing concern for adaptation planners, the concept remains theoretically underdeveloped (William et al. 2020).

Most research on the subject, as it relates to climate change, is limited to presenting a definition or an example of an isolated maladaptive outcome.¹ To date, the definitional ambiguity of what defines a maladaptive outcome has stifled a rich understanding of the concept. Additionally, the temporal and spatial dimensions associated with adaptation complicates what constitutes a maladaptive outcome (Adger, Arnell, and Tompkins 2005). For example, climate-related migration is a relatively common adaptive response to drought in rural-farming communities throughout South East Asia. Such migration can also lead to labor shortages and loss of skills in rural spaces, becoming maladaptive over time for specific locations (Jacobson et al. 2019).

In an effort to create more clarity, Barnett and O'Neill (2010) developed five distinct maladaptive pathways, which planners can use to evaluate the successes and/or failures of adaptation decisions. These pathways include: an increase in greenhouse gas emissions, disproportionately burdening the most vulnerable, high opportunity costs, reducing incentives to adapt, and path dependency. This framework is novel in providing a clearer conceptualization of what constitutes maladaptation. Nevertheless, research is needed to specifically identify what conditions lead to these maladaptive pathways and outcomes. Furthermore, there remains some tension, given that the meaning of maladaptation remains in flux, as is evident in definitional shifts in IPCC reports.

The IPCC first defined maladaptation in its Third Assessment Report (IPCC 2001, 378) as 'any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead.' The IPCC conveyed an important message by incorporating maladaptation into its report, indicating that adaptation efforts have the potential to do more harm than good. In using this terminology, the IPCC distinguishes maladaptation from an *unsuccessful* adaptation project that did not meet its objective. It also highlighted that a range of outcomes were possible, suggesting a closer examination was necessary.

By the Fifth Assessment Report, the IPCC (2014, 837) expanded its definition of maladaptation to include a temporal dimension, 'actions that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, *now or in the future*.' This was followed by an emphasis on intentionality: 'Maladaptation arises not only from inadvertent badly planned adaptation actions, but also from *deliberate decisions* where wider considerations place greater emphasis on short-term outcomes ahead of longer-term threats,' or that discount, or fail to consider, the full range of interactions arising from the planned actions. This definitional shift

addresses the ‘elephant in the room’ by emphasizing that too often decisions about the environment *deliberately* sacrifice environmental quality for economic gain (Anderson and Bows 2012; Foster and Clark 2020). This caveat adds an element of accountability for decision-makers. It also broadens the conception of maladaptation to include negative outcomes that are either intentional or unintentional, as far as the consequences related to environmental conditions, inequalities, risks, and vulnerabilities. While it recognizes maladaptation as a real outcome, it does not provide any framework on how to avoid such a situation. We address these concerns below.

Methodology

We conducted twenty-two semi-structured interviews with climate change practitioners in the private sector, international bilateral organizations, and international development agencies who work in the climate change adaptation field in the United States, Colombia, Bangladesh, Kenya, Caribbean Islands, and various Europe countries.² All interviewees have expertise in climate change adaptation. Expertise, in this study, is defined as someone who has been working on climate change adaptation for more than five years and has worked on at least one adaptation effort through a local institution. We selected individuals with a diversity of professional backgrounds (i.e., climate insurance, resilience, disaster risk, and capacity development) and geographical context. Research that includes practitioners allows for the sharing of knowledge and unique insights given the distinct roles and agendas associated with the execution of projects (Sietsma et al. 2021).

Interviewees were selected in two primary ways. First, we conducted a search of organizations that focus on climate change adaptation, and identified individuals who worked on climate change adaptation within these organizations. Second, we employed snowball sampling to identify practitioners who work outside of the United States. Between these two approaches, we were able to interview practitioners with expertise in climate change adaptation, who also worked in different geographical locations. Interviews were conducted in English and recorded with consent from the interviewee. Linguistic barriers are a limitation to this research. Importantly, three interviewees indicated that linguistic barriers are also a limitation to adaptation research in general. With English as the lingua franca of global science, non-English scientific knowledge, in spite of its relevance, is often omitted from such assessments and discussions (Tatsuyo, Juan, and William 2016; Sietsma et al. 2021). Language barriers, and in some cases biases towards non-English climate change adaptation research, restrict the range of knowledge that is

available for practitioners and policymakers. Interestingly, we see parallels between the limitations in our methodology as well as within our general analysis of climate change mal/adaptation.

Guided by our research focus to understand adaptation as a holistic process, our interviews examined three schematic areas: the considerations that inform adaptation projects, the implementation process, and the evaluation of projects. In the first area, we investigated how adaptation was defined and how the goals of the project were outlined. In the second area, we documented the logistics of the projects including barriers and operations regarding implementation. In the third area, we explored the evaluation protocols that were used for specific projects as well as individual perspectives on the process as a whole.

Interview questions were designed to allow interviewees to be reflective regarding the adaptation projects on which they had worked. Interviews lasted from sixty to ninety minutes. Transcriptions were made of all interviews. We then coded each interview, looking for themes that emerged across responses. Cross validation was achieved through multiple researchers analyzing and coding the data independently. Themes were then compared to identify areas of convergence. Important patterns regarding the structural barriers associated with adaptation projects became apparent, revealing systemic challenges. Our data is strengthened through the diversity of professional backgrounds of our interviewees, in which themes regarding maladaptive practices and barriers to adaptation emerged across sector, location, and scale. These data, rather than focusing exclusively on project outcomes, illuminate useful insights regarding the structure and processes associated with adaptation, providing information that can be used to assess the adaptation lifecycle.

Given the nature of the organizational and financial structure of adaptation projects, our interviewees were only involved in one or two aspects of adaptation projects (e.g., conceptualization, implementation, or evaluation). Thus, in each interview, depending on the expertise of practitioners, one or two stages for projects were thoroughly discussed. The approach here builds on the experience of adaptation practitioners. However, the lack of involvement of any individuals throughout the whole project process illustrates a major drawback to the way in which adaptation projects are structured and developed. With the conceptualization, implementation, and evaluation components of adaptation partitioned out, it undermines coordinated execution and a holistic understanding of the project lifecycle from beginning to end. In what follows, we present four major themes that we deduced from our interviews, illuminating particular questions and challenges that affect adaptation projects and contribute to maladaptation.

Critical questions and challenges that influence adaptation and maladaptation

Adaptation is an endeavor in which both the implementation and benefits exist at the local level. It is, therefore, appropriate to pay attention to the particularities of the context. However, adaptation governance and bilateral funding are more often than not situated at the national and international levels. Following the lead of Eriksen et al. (2021), we scale up our assessment of adaptation in order to gain an understanding of the general dynamics and context in which projects are situated. Simply put, national and international climate change adaptation interventions are shaping climate change adaptation efforts on the ground. In interviews, practitioners consistently noted that adaptation projects are constrained by narrow conceptions and short-sighted goals, undermining the comprehensive engagements that are necessary for long-term success. Here we focus on the major themes related to such constraints.

Technological fixes versus holistic approaches

Interviewees indicated that technological approaches and solutions dominate adaptation projects, limiting the understanding, scope, and tactics employed. Too often the guiding logic is that climate change and its negative consequences are technical problems that can be resolved through the proper application of scientific knowledge, engineering, infrastructure, and technology (Ausubel 1996; Paul, Lovins, and Hunter Lovins 1999). In this perspective, adaptation is conceived as a means to protect people and property from external threats, such as sea level rise, storm surges, and drought, through technological fixes (Nightingale et al. 2020). For example, seawalls are constructed as a defense to protect property from rising sea levels often at the expense of the coastal ecosystem to acclimate to changing conditions (Betzold and Ibrahim Mohamed 2017). Under such technologically optimistic approaches, adaptation equals technological fixes. Funding is thus directed toward supporting such projects, given the assumption that solutions are readily available.

Throughout interviews, practitioners criticized technical and engineering adaptation projects, stressing that they were often irreversible and incapable of acclimating to the unpredictability of coupled human-natural systems. This adds to the notion that such projects already had a narrow conception and absence of accounting for social, cultural, and political factors (Barnett and O'Neill 2010). Interviewees emphasized the need to move beyond technological conceptions towards more transformational changes, to adequately incorporate the social and political relations that are necessary components within adaptation projects.

Reflecting on this issue, one practitioner who consulted with many bilateral organizations and African governments on large-scale infrastructural projects remarked:

What it [i.e., an infrastructural project as a technical fix] ignores and what it doesn't take into account is you are not just adapting to the physical impact of climate but you're adapting a societal system. You're adapting a governance system that has to deal with the changes that will lead to [the] predictions, sort of forecast impact.

Practitioners noted that too often adaptation projects focused on simply resisting the forces of nature through creating technological buffer or protective systems. They indicated that all projects are situated within and influenced by social, political, cultural, and economic relations. Hence, practitioners emphasized that more holistic approaches are needed within adaptation projects, in order to account for a variety of risks, adverse outcomes, and unintended consequences that arise for a number of reasons, such as existing social hierarchies. For example, a practitioner working in Bangladesh discussed an adaptation developed in response to a shifting monsoon season:

Our adaptation approach was to make available more fresh water and we did it in terms of just copying nature. You bring back canals. If you dig out those canals you actually can create more fresh water storage and it also has a social dimension. Those canals are a story of elite capture. Local elites were the one who took the illegal leads or just occupied them for their own personal use.

We gathered the community, we help them to raise their voice and to [make] demand[s] to the local government. They take back what you call common property [because] common property is supposed to be used by common for all the people for the commons, not by elites. I mean through one simple intervention you're addressing a lot of issues altogether.

The story of the canals highlights the social and political relations embedded in adaptation projects. At first, this adaptation project was simply concerned with increasing fresh water through technological means. This contributed to maladaptation, as the local elites co-opted the benefits of the project, which increased the vulnerability of farmers, as their access and rights to water were threatened. Paralleling development interventions, elite capture is an ongoing concern in which more powerful local actors – community leaders, political elites, and state officials – uphold existing power structures through processes of enclosure, exclusion, and encroachment (Sovacool 2018). Elite capture is detrimental to the efficacy of adaptation projects, and has the potential to exacerbate social vulnerability for already marginalized communities (Eriksen et al. 2021; Sovacool 2018). Fortunately, in this case in Bangladesh, the practitioner

identified the unintended consequences and helped develop a holistic approach to account for the larger social-political context, which included governance, water rights, and subsequently longer-term goals.

Along a similar vein, practitioners noted the importance of adaptation projects focusing on engaging with and enhancing the integrity and options of the communities that are affected by changing climate conditions. A marine scientist, for instance, who worked on a local retreat project in Ventura, California, highlighted an alternative approach, which he deemed successful because it aligned with the values of the community:

There was a sense of movement to it that we were pulling back from this hazardous area and we were restoring resources in a way to provide both more natural shoreline values and public access. And so, I think people have grasped onto that as a success, so the inherent, or implicit, in their evaluation is that *success means that you are not building a seawall, or trying to fight the inevitable, you are adapting to it in a way that makes sense for these other things we care about.*

In this case, the adaptation project was rooted within the community, and coordinated to address community values. Both of these practitioners pointed to how climate change was simply one lens of adaptation, which could not be confined to the constraints of technological approaches. For them, these adaptation projects illuminated how a single intervention leads to an array of options for contending with potential changes associated with climate change that are both political and social in nature.

Adaptation and/or development?

Similar to the ambiguity of the term maladaptation, there has been little consensus regarding what constitutes adaptation (Emma et al. 2018). Considering the larger context, one practitioner noted, 'there's no organization that can impose worldwide and across all sectors a single definition of adaptation resilience or any other concept that you might want to use.' As a result, all interviewees operated from a conceptualization of adaptation that was either unique to their organizations or, for convenience, used the one adopted by the IPCC. Given the variation and ambiguity of adaptation, it is difficult to delineate adaptation measures from development interventions (Singh et al. 2021).

Among practitioners, there are divergent opinions regarding the degree to which development should be part of adaptation. Most suggested that divorcing climate change adaptation from socioeconomic progress is artificial (Benney 2018). As one interviewee proposed, 'it's a vice versa relationship. Unless you improve the condition of the people, the pressure on the ecosystem

will be higher. So, one system will influence another.' Others also referenced the correlation between climate change and poverty, seeing this as the impetus to address the two simultaneously. From this perspective, climate change adaptation is closely related to, if not synonymous with, sustainable development.

Nevertheless, addressing development and adaptation concerns is more complicated. Oftentimes, development projects prioritize short-term goals and have narrow parameters for what is being considered (Goldman 2001). The implications of climate change, however, are vast and play out in complex ways (Benney 2018). Funding agencies increasingly try to draw varying distinctions between development and adaptation, which influences the strategies employed by organizations. Needing financial support for projects, some practitioners indicated that their organizations had refined how they articulate and distinguish between the two, while putting forward a clear climate rationale. For example, a practitioner stated:

Our main concern for our [development organization] is that a lot of things are being sold as adaptation which are actually development measures with a green end. Basically, somebody said oh yeah, yeah, yeah that's adaptation because we are so at risk of climate change just to get funding from dedicated climate funds.

Similarly, a representative from a bilateral donor agency argued that:

[Our agency] has been trying to get people out of poverty. And so, we need not to lose sight of that particular overarching goal when we are trying to put into place things, which are related to scientific things like climate change. Yes, we want to do climate change adaptation but at the end of the day the purpose of this really is to get people better public services and better incomes I think we should just . . . we should not try to play cognitive dissonance at the beginning and spend so much time trying to write around the poverty issue when really, the poverty issue is at its core.

Climate change and its consequences have shifted what some funding agencies are looking to support. Given the lack of consensus regarding a universal definition of adaptation, many organizations are adjusting their existing framework or the description of projects to account for such concerns, as it provides an opportunity to secure needed funds. This approach to adaptation is criticized for really being a form of development aimed at reducing the impacts of climate change (Eriksen et al. 2015). Nevertheless, it highlights the tension between development and adaptation, as far as their relationship, different agendas, timeframes, outcomes, and evaluations. These efforts fall short in addressing the linkages between climate vulnerability and inadequate access to social, economic, and human resources (Ayers and Dodman 2010; Eriksen et al. 2015).

How to quantify non-quantifiable variables?

A key challenge to adaptation planners is how to quantify non-quantifiable variables such as resiliency, justice, and equity. Most funding agencies impose generalizable metrics to assess effectiveness (Singh et al. 2021). Practitioners described the structure of these mechanisms as ‘accountability’ reports that identify how funds were allocated across projects. These reporting mechanisms perpetuate technocratic solutions, as we described above, for their ‘tangible’ and ‘quantifiable solutions.’ Additionally, such outcome reporting fails to address the necessary social and political dimensions of adaptation. As one practitioner stated in response to the contemporary evaluation processes, ‘Tick boxes in terms of evaluation lead to meaningless outcomes, versus transformational approaches less focused on how the money is spent and more upon the systemic adaptation.’ To date, according to interviewees, funding agencies mandated outcome reports confine practitioners to a narrow conceptualization of adaptation that contributes to the development of short-sighted projects focused on incremental change.

Evaluation models that quantify outcomes become particularly problematic as they relate to issues of justice and equity. A major concern over the last several decades is the unequal distribution of vulnerability and risk in relation to global climate change. The Global North is primarily responsible for the historic release of global greenhouse gas emissions. The Global South disproportionately experiences the consequences of climate change, which is only exacerbated by scarce economic resources and political marginalization (IPCC 2018; Roberts and Parks 2007). Given global inequalities, adaptation projects are often conceived as a way to help rectify or address some of these concerns. In fact, it is mandated that adaptation proposals explicitly address social equity. However, practitioners pointed out that unfortunately concerns regarding justice and equity are often treated as ‘lip service’ as budgets are considered. For example, one interviewee mentioned how gender is addressed in such plans:

And, you know, the Green Climate Fund has very specific requirements in terms of gender dimensions. But then when you look at the project documents and you read what they implement And you think that’s pretty light? And you think okay, you’re telling everybody that you’re super strict on the gender criteria, but you do let some people get away with very . . . wobbly justifications.

In other words, it is stressed that gender inequality will be addressed, but there are no specific plans or real content on this issue that are enforced.

Practitioners noted that the challenge in assessing equity variables such as gender equality is not due to apathy, but an inability to statistically capture this measure in a meaningful way during the evaluative process. As another interviewee pointed out, this has created the challenge of quantifying the non-quantifiable, ‘it is quite difficult to determine statistically that some community is better able to adapt to climate change after a four-year project. What are the types of quantifiable indicators you’re going to be able to use if it’s quite difficult? And so, we often don’t.’ These concerns create a challenge as far as how to record and document outcomes, so in the process of prioritizing the spending of funds, addressing these issues is often sacrificed or given low priority, even if the language of the project stresses these outcomes.

Proper accountability for such measures relies on aggregate qualitative data that accompanies quantitative analyses. While the solution is simple, conducting proper evaluations is costly and labor intensive. Thus, tradeoffs are made, as far as how to spend budget funds. As one practitioner explained: ‘Three thousand dollars will maybe pay for one consultant to fly to your capital city. He might get per-diems for two days to speak to a few people. And that’s going to be your evaluation.’ Because of monetary considerations, evaluations that can adequately identify the efficacy of projects are not built into the budget. By default, what cannot be counted is not accounted for. In other circumstances, it may just be falsified as a practitioner who works with a funding agency stated, ‘You can’t claim with any authority that your outcome is resilient. And so, you’re basically just making it up. We’ve seen that, repeatedly.’ This challenge fosters a lack of real assessment in adaptation projects, which narrows the range of issues considered and further contributes to maladaptation.

Competing problems and mainstreaming adaptation

Given the vast consequences of climate change, practitioners emphasized the importance of embedding adaptation planning into municipal resources. In this, adaptation must be mainstreamed to actually yield positive results or to accomplish its goals. Unfortunately, short-term interests and narrow conceptions of what is at stake hinder adaptation projects. Interviewees remarked how the failure to mainstream adaptation as an essential action at all levels of society and governance limits the capacity and scope of their efforts.

There are many competing issues and problems that different nations are confronting. Consequentially, when it comes to prioritizing concerns, climate change falls low on the list, as a practitioner working in South Africa stated, ‘Climate change just isn’t the priority. It’s

about putting food on the table. You have to make the link between climate change and people's daily worries.' Another practitioner echoed this sentiment,

Off the top of my head, I think the biggest challenge in adaptation is simply to convince people of the need to do it. But for some reason it has never reached the top of the priority list and in developing countries, I can sort of understand it because you know, why worry about where your food comes from in 20 years' time.

These statements follow a widely circulating assumption – environmental concern is confined to more affluent communities and countries. At the same time, there was variation in how practitioners conceived of these situations. For instance, a practitioner who worked with a bilateral donor agency problematized such an assumption, pointing out:

The community is very near the sea, and there is often going to be hurricanes. There have been hurricanes for the previous 500 years, so these communities may have already started thinking about adaptation, they just didn't call it climate change adaptation. They were just talking about trying to survive the hurricane.

In this context, the community is aware and concerned about environmental conditions and the consequences associated with climate change. The people just used different language. When this situation is not recognized, it is possible to misrepresent people's understandings and their actions, therefore missing efforts of resiliency and preparation at the local level.

On the municipal level, adaptation becomes a matter of making investments in long-term projects. With competing problems, obtaining commitments is difficult. In many ways, adaptation involves preparing for an uncertain future. Practitioners cited this issue as a major challenge, as far as convincing municipalities to invest in precautionary measures associated with adaptation. One interviewee stated, 'Already it's like we want you to spend X number of dollars to prepare for a risk that you may not have experienced yet. It's hard enough to get people to buy into that.' The challenge becomes more pervasive when there are competing interests and climate change is not part of the overall planning process, as another practitioner explained:

So my point is that, you know, if you go to a city where only 10 percent of the roads are even paved in the first place and you tell the local government, hey, you know what should really be your first concern is climate change adaptation. And they say, yeah but I don't even have any paved roads. I have no map of where my roads are to begin with, so why are you coming to me with this climate change adaptation thing? I just want to get, you know, 2 percent more roads paved this year.

This statement captures the difficult predicaments, decisions, and contradictions that influence adaptation projects. It elucidates two challenges associated with mainstreaming climate change. One is convincing municipalities to invest in adaptation when other priorities take precedent. The second is lack of access to data at the granular level that makes adaptation planning even feasible. Without the will and the data, adaptation planning falls by the wayside, as more visible concerns are present.

Discussion and conclusion

While further research is needed regarding maladaptation, important contributions have arisen since the inception of the concept in the IPCC policy sphere. Most notably, Barnett and O'Neill (2010), in an effort to overcome the ambiguity of the term, provide concrete examples of maladaptation. They present five examples of maladaptation as an outcome, which can be used by policymakers in assessing project outcomes. While there are important lessons that can be gleaned from outcome-oriented studies, Juhola et al. (2016) stress the need to develop a more *ex ante* approach to *avoid* maladaptation. Thus, in our research, we sought to identify some of the major conditions, circumstances, and processes that structurally contribute to maladaptation.

Based on our interviews with practitioners, there were four major challenges: technological fixes versus holistic approaches; distinguishing between adaptation and development; the problem of quantifying non-quantifiable variables; and the existence of competing problems given that failure to mainstream climate change adaptation. Our twenty-two interviewees had diverse professional backgrounds with one commonality, they were all climate adaptation experts. All interviewees were able to provide insights regarding how local adaptation projects were structurally shaped by national and international interventions. All of them were able to speak to the conceptualization, implementation, and evaluation of adaptation projects, but only worked in one specific realm. We identify this as a drawback, not to our methodology, but to the overall adaptation process. The adaptation process is often fragmented in a way that prevents an adequate feedback loop and a comprehensive assessment.

The identified challenges exist within the larger organization of projects and affect the adaptation lifecycle as a whole, from conceptualization to implementation to evaluation. In this, they highlight specific structural characteristics associated with adaptation projects that foster a commitment to

short-term goals that often increase risks, ignore the broader range of sociocultural relations, and create adverse outcomes. Importantly, these challenges are not mutually exclusive and they can interact and influence each other. Likewise, they are recognized by practitioners as conditions that contribute to maladaptive outcomes and undermine the transformational changes that are needed in order to make climate change adaptation successful (Alexandre, Schipper, and Duvat 2020).

Climate adaptation is frequently negotiated in relation to development. This blurred and contradictory distinction, especially in regard to funding opportunities, influences how projects are conceived, what projects are undertaken, and which projects are seen as outside of the scope of climate change. At the same time, development concerns are more mainstream than climate adaptation projects, particularly in regard to planning. Thus, many countries and cities end up making trade-offs between adaptation and development. This generally privileges short-term interests and goals versus pursuing changes to address threats that emerge over longer periods of time. Such trade-offs can lead to a complete neglect of adaptive planning within development considerations, as was the case with the initial drafting of the Millennium Development Goals. This predicament continues to be the case in most global and municipal spheres. Ayers and Dodman (2010) substantiate this finding by emphasizing that international frameworks that focus on adaptation without development are conceived simply as adaptation to *climate change*. Such projects and depictions tend to ignore the underlying developmental factors that increase vulnerability such as absolute poverty. Instead, it encourages technology-based solutions to climate problems, which can be measured, such as the construction of seawalls, dams, and irrigation systems. Ironically, these technological fixes have a high propensity for maladaptation, creating an array of adverse outcomes. Thus, it is paramount to recognize that climate adaptation policies should shape social planning and development, in order to account for the broader, more holistic, context, and to foster environmental justice and the conditions for long-term sustainability.

Many of the challenges discussed above are driven by the donor landscape of climate change adaptation. The projects that are undertaken and the mandated outcome reporting are externally imposed onto developing countries by adaptation funding agencies, most of which are from developed countries (Annah et al. 2020). Consequently, these top-down project-based adaptations that are shaped by donors are often ill-equipped to address complex social-economic-political contexts, which

include cultural traditions, community values, and distinct needs, that shape the implementation and outcomes of adaptation projects. A mismatch and lack of coordination between local needs and international approaches helps generate maladaptive outcomes.

Climate change adaptation operates within an economic, environmental, political, and ethical framework (Neset et al. 2019). After much work and struggle, justice is now seen as a necessary component of climate policies. In fact, there is an ethical obligation for adaptation to be used as an avenue to enhance equity and rectify the unequal distributional burdens of climate change. Practitioners noted that this is an important accomplishment, but there remain distinct challenges. Equity is not readily reducible to a quantitative measure. Assessing equity requires qualitative instruments, which involve time and money, leading to additional trade-offs in how to spend limited monies. Thus, interviewees indicated that addressing equity has been difficult, given that evaluations prioritize a quantitative value. They stressed that without proper evaluations, particularly focused on justice, it is difficult to ascertain whether or not adaptation projects are shifting vulnerabilities to other groups. As a result, serious consideration of equity and justice are often dropped from adaptation projects as they progress.

There is much to learn from case studies of successful adaptation projects, however, we must also consider maladaptation and the structural factors that contribute to such outcomes. Such work is all the more important, as highlighted in the IPCC reports that have identified maladaptation as a serious concern that is undermining climate efforts. Thus, identifying the structural challenges that influence climate adaptation projects and that contribute to maladaptation outcomes is vital to making changes that can improve future actions.

Our research identified distinct structural challenges that are common to adaptation projects around the world. Reconceptualizing adaptation, in order to address these challenges and to better account for social-environmental relations, will require a radical transformation in the way we perceive adaptation. At the heart of the solution is a broader understanding and more holistic approach to what it means to expand adaptive capacity. Adaptation projects must consider the complex interactions between social, economic, and political systems. They must devote more resources and ongoing attention to addressing equity, deeming it an essential goal. It is necessary to mainstream climate adaptation, but this must be done in a way that redefines what development is and who it serves. In other words, it is necessary to

pursue projects that prioritize meeting human needs in sustainable ways, rather than serving short-term interests, such as profits (Daly 2005; Longo et al. 2016).

Additionally, we must be honest about the various limitations of adaptation, given the uncertainties of climate change and the dynamics of social-environmental systems, especially in light of the ongoing failure of nations to pursue mitigation. As a result, predictive outcomes are difficult to pinpoint. Nevertheless, such considerations and changes can help minimize the development of maladaptation. After all, we are not protecting a single highway from sea level rise, a lone coastal village against rising storm surges, or ensuring food security for one remote farming community during a seasonal drought. We are adapting to a fundamentally different set of living conditions. We are reconciling with the fact that we are increasingly living in an uncertain world.

It is worth highlighting that several practitioners emphasized the need for reflection to coordinate and improve adaptation processes. Given the urgency and consequences associated with climate change, this is all the more important, especially given the massive investment of time and money. Without proper planning and assessments, poorly coordinated projects can increase inequities and environmental vulnerabilities. A practitioner working for a global development program emphasized the importance of promoting a learning culture and strengthening the collaboration between universities and the policy sphere: '[Universities are] a community that's grounded in developing evidence,' which should help inform and assess policies. With this research, we can promote the learning culture by focusing on the conditions that generate divergent outcomes, versus the outcomes themselves. These findings highlight the underlying drivers of maladaptive outcomes. At the root of the problem are structural mechanisms forcing adaptation projects to operate within narrow parameters with short-term goals. Practitioners struggle within these constraints, trying to redirect projects and accomplish larger goals, despite the compromises that are made. This broader understanding that takes into account the political and economic context is crucial to promoting a learning culture without fear of individual repercussions such as the withholding of funds, threat of unemployment, and stigmatization. While we may have a long way to go, before we effectively avoid maladaptation altogether, working to address the challenges of adaptation offers greater possibility for future success.

Notes

1. The term maladaptation has traditionally been used in the context of evolutionary biology. In 2001, the IPCC introduced the term in relation to climate change (Magnan et al. 2016).
2. In accordance with IRB standards the names of practitioners and organizations they work with are anonymized. IRB approval was received by all authors' institutions University of Utah (IRB #00122248) and University of Maine (#2019-4-16).

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