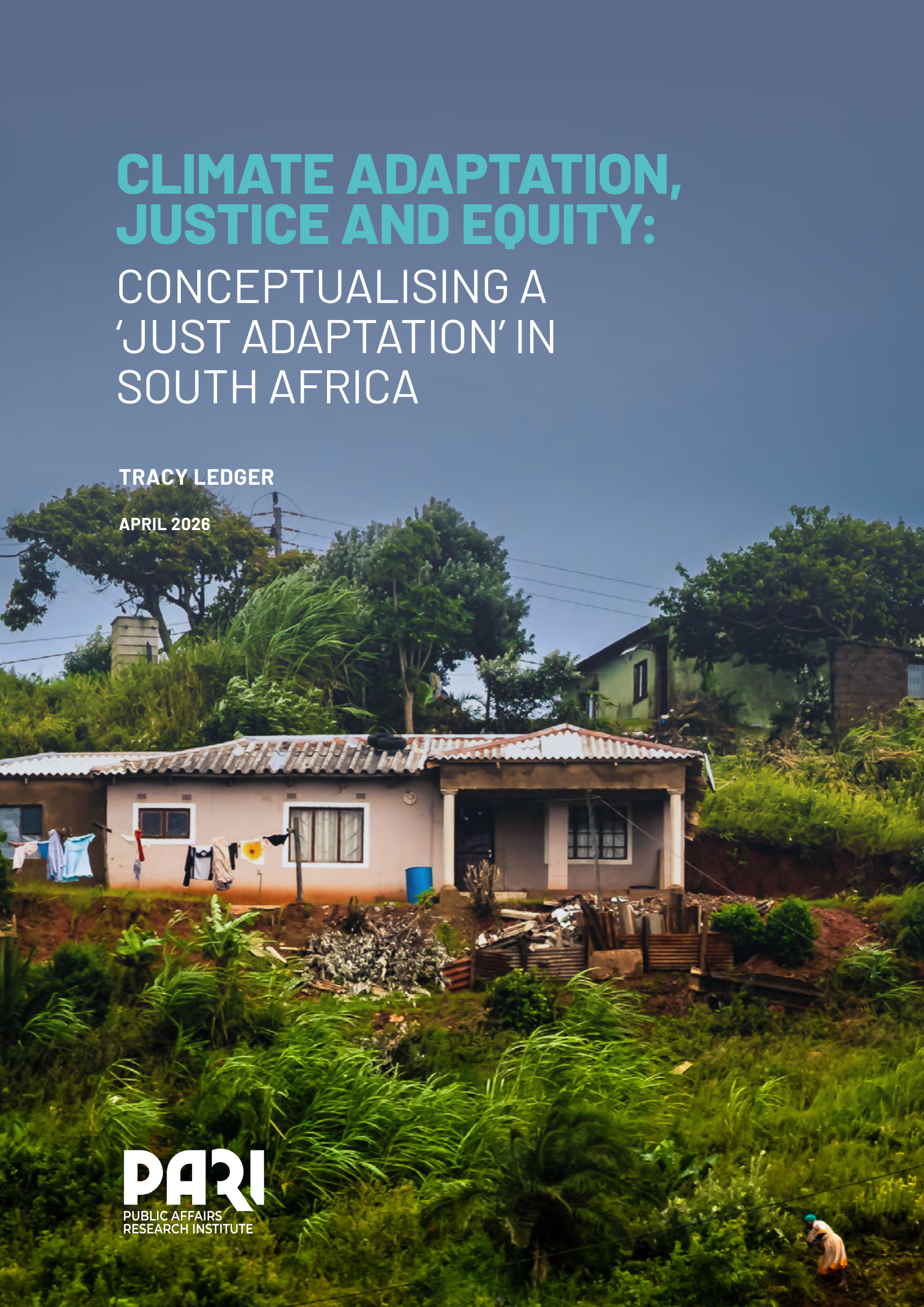
CLIMATE ADAPTATION, JUSTICE AND EQUITY:

CONCEPTUALISING A 'JUST ADAPTATION' IN SOUTH AFRICA

TRACY LEDGER

APRIL 2026



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The lack of urgency to implement adaptation strategies ignores South Africa's particular vulnerability to climate change, created by a combination of climate risk – particularly in respect of the food and water sectors – and high levels of poverty and inequality, which will amplify the negative impact of adverse climate events.

CHAPTER 1

BACKGROUND

1.1. What is *climate adaptation*?

The adverse impacts of climate change are expected to be both long term (a permanent shift in climatic conditions that will impact resource availability and the viability of various lifeforms in different places – including humans) and more immediate: a significant increase in severe climate events, such as flooding, storms, drought and heatwaves. In general terms, countries that:

- are less well-developed,
- have higher levels of poverty and
- face higher climate risks to key sectors such as agriculture (from drought and/or floods) or who have limited availability of climate-sensitive natural resources (such as water)

will be the worst impacted by climate change.

The IPCC defines adaptation to climate change as the adjustments required in ecological, social and/or economic systems to respond to observed or expected changes in climate. The goal of adaptation is primarily to reduce the adverse impacts of those changes and, in addition, to take advantage of any opportunities that may arise. In general, adaptation policies aim to increase the ability (capacity) of systems – such as agriculture and water – humans and other organisms to be able to adjust to long-term climate change and to recover as quickly as possible from individual adverse climate events.

South Africa's National Climate Change Adaptation Strategy (NCCAS) 2020 defines climate adaptation in a similar manner to the IPCC:

> ***The process of adjustments to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustments to expected climate and its effects (DFFE, 2020).***

To date, the focus of global climate action policy and finance has largely been on mitigation – policies to reduce emissions and avert catastrophic temperature increases – rather than on adaptation. That is, the primary policy goal has been to try to **avoid** severe climate change, rather than to invest in **coping** with that change. Within mitigation efforts, the greatest focus has been on decarbonising the energy sector, given its disproportionate contribution to global emissions. Finance flows for mitigation are significantly higher than those for adaptation: it is estimated that in 2023, USD 1.78 trillion of climate finance was allocated to mitigation (with 47 per cent of that allocated to energy transitions) compared to USD 65 billion in adaptation finance, and USD 58 billion for initiatives that addressed both mitigation and adaptation goals (Naran et al., 2025).

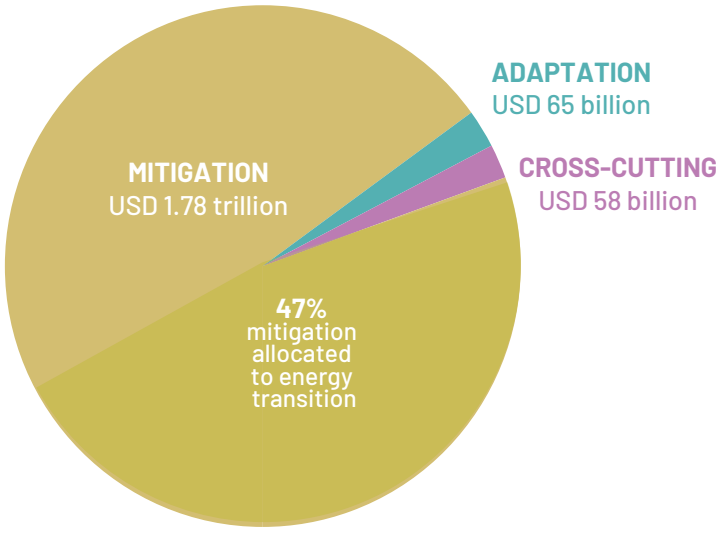


Figure 1: Global climate finance allocation in 2023 (Naran et al., 2025).

In South Africa, most of the state's climate change plans (and funding) to date have centred on mitigation, notably decarbonising the electricity sector through retiring coal-fired power stations and encouraging investment in renewable energy. There has been comparatively less focus on decarbonising other sectors and much less on implementing adaptation policies such as the NCCAS 2020 or the adaptation sections of the Climate Change Act (the implementation of which have been deferred to a currently unknown future date).[1]

Additionally, actions to date have disproportionately focused on short-term reactions (Adom et al., 2025) to adverse climate events – that is, disaster management – rather than on strategies designed to reduce vulnerability to future events.[2] **This lack of urgency to implement adaptation strategies ignores South Africa's particular vulnerability to climate change, created by a combination of climate risk – particularly in respect of the food and water sectors – and high levels of poverty and inequality, which will amplify the negative impact of adverse climate events.**

South Africa is not alone in this failure: The 8th Conference of the Parties (COP8) in 2002 stated that climate adaptation required 'urgent action', but that action has been slow to materialise, particularly in developing countries. Adaptation goals are now generally included in Nationally Determined Contributions (NDCs) submitted to the UNFCC, although the focus is still on mitigations. While most countries have some kind of climate adaptation policy or plan in place, implementation of these plans is limited and fragmented, generally focussed on specific sectors, such as agriculture, and often driven by short-term responses to particular events, such as severe floods (Arteaga et al., 2023). However, adaptation is slowly becoming more prominent on both international and national agendas, with recent surveys suggesting a general acceleration of implementation efforts in 2025,[3] although finance flows still lag far behind the estimated requirements. This acceleration is being driven by two main factors:

Firstly, there is a growing realisation that global climate action needs to allocate much more attention and resources to adaptation, given **climate reality and the decreasing likelihood that current mitigation efforts will prevent significant temperature increases**: The 1.5 degree ceiling has not yet been definitively breached, but there is an increasing balance of scientific opinion that it can no longer be avoided (Birkmann et al., 2022). There has been a broad scientific consensus in place for more than ten years that adverse climate events are becoming more intense and more frequent (Cannon and Müller-Mahn, 2010). The likely impact on economy and society of this is both considerable and cumulative, although estimates of impact still vary widely. The general view is that a temperature increase of close to two degrees will significantly reduce global GDP by 2060, with that impact disproportionately allocated to less developed countries (Kumar et al., 2025).

The only way to minimise the impact of these adverse events on economies and societies is through adaptation (Joakim, Mortsch and Oulahen, 2015) and rapid action is required to prevent the worst scenarios. This increased adaptation focus does not imply that mitigation should be abandoned (no least because the more successful the mitigation, the less pressure on adaptation), but rather that most countries – particularly those most vulnerable to the negative impacts of climate change – need to start paying much greater attention to adaptation in the immediate future.

1 Private entities – households and businesses – do engage in a range of adaptation activities and investments on their own initiative, outside of state-led actions.

2 https://mg.co.za/thought-leader/opinion/2026-03-03-financing-climate-adaptation-looking-beyond-the-budget-for-solutions/

3 https://cop30.br/en/news-about-cop30/global-adaptation-efforts-advance-as-countries-move-from-planning-to-action-unfccc-report-shows#:~:text=The%20report%20confirms%20that%20countries,coherence%20and%20urgency%20in%20implementation.

Secondly, even where there is still a view that global warming can (eventually) be controlled and held below the 1.5 degree target, adaptation may create 'breathing space' (Adger, Arnell and Tompkins, 2005a: 75) for mitigation strategies to take effect. That is, adaptation could shield economy and society from the worst effects of climate change during a transition period – estimated to be several decades – to greater climate stability.

Adaptation strategies are inherently more complex and have a higher risk of failure than mitigation strategies

It is not as simple to plan or implement adaptation as it is for mitigation, in large part because there are no clear metrics or targets to aim for as there are in mitigation. Further, there is no end point at which a country can say that the task of adaptation is completed; there is no comparable zero-emissions state to be achieved (Brisley et al., 2012).

One of the key features of climate change – and its potential to wreak havoc on economic, social and ecological systems – is its unpredictability. As a general rule, even carefully constructed adaptation policies carry higher risks of failure than mitigation policies, due in large part to the inherent uncertainty of climate change (Schipper, 2020), together with the multiple and complex adaptation linkages between and among systems. All adaptation is thus 'anticipatory adaptation' (Cannon and Müller-Mahn, 2010: 627) because the future conditions to which we are adapting can only be estimated, never perfectly known.

The implication is that most adaptation strategies, by definition of the reality of imperfect future knowledge, will inevitably not have perfect outcomes; it is almost impossible to adapt perfectly to an unknown future, despite the fact of ever-sophisticated climate prediction models. The most likely scenario is that the majority of adaptation strategies will not be able to prevent every single adverse impact of climate change; we will have to learn to live with a certain level of adverse outcome, no matter how well we design and implement strategies. The nature of the challenge suggests that the most that we can achieve for the most time is adaptation that meets most of our goals. We could refer to this likely outcome as **imperfect adaptation**, noting of course that the level of imperfection will vary over time and across locations.

Maladaptation

Adaptation strategies need to be carefully considered against the specific context (both climate and non-climate) in which they will be implemented. The evidence suggests that adaptation strategies do not always yield the desired impact – sometimes strategies can undermine resilience and vulnerability (Cevik and Jalles, 2023) resulting in *maladaptation*.

Maladaptation is defined by the IPCC as actions that have **unintended consequences** and can create a higher risk of increased vulnerability in poor populations. These outcomes can arise because they contribute to increasing emissions, or because they undermine coping strategies or safety nets of poor and vulnerable groups (Birkmann et al., 2022). The latter outcome is more likely when the multiple causal factors driving poverty are poorly understood and adaptation strategies inadvertently have a negative impact on livelihoods and coping abilities of vulnerable households.

Additionally, focusing on short-term actions to address climate events rather than addressing structural factors that create vulnerability to climate change can result in maladaption (ibid). For example, focusing on short-term disaster relief efforts after floods, but ignoring the factors that push poor households to build houses in flood-prone areas will most likely reduce long-term adaptive capacity and amplify the negative impact of successive climate events.

1.2. Aim and scope of this research

As the global focus shifts to accelerating adaptation interventions, we can expect the details of adaptation plans to come under greater scrutiny: are they actually likely to achieve their objectives, and how feasible are they in terms of being implementable in a particular local context (Gorbig et al., 2026)? Given the limited finance flows into adaptation, policymakers need to make critical decisions around what kinds of strategies will have the greatest impact.

There is a strong case to be made for urgent action on climate adaptation in South Africa. The country has numerous policies and regulations in place (such as the Climate Change Act 22 of 2024 and the NCCAS 2020), although implementation of these to date is very limited.

One policy challenge is how to accelerate implementation, but a far more important issue is: **How well do South Africa's adaptation plans address the critical risks to the country's development goals presented by climate change?** Do the details of these policies and programmes actually reflect the best possible response to future climate change for South Africa, given the particular future risks created by the combination of high current levels of poverty and inequality and imperfect adaptation outcomes? This research aims to provide an answer to these questions, together with recommendations for how South Africa's climate adaptation response can be strengthened to reduce the future risk to growth, equity and poverty reduction.

The aims of this research are:

- to identify shortcomings in how adaptation policies in general – and South Africa's in particular – have been conceptualised and designed, which shortcomings increase the risk of unsuccessful adaptation outcomes and/or maladaptation.
- To make detailed policy recommendations for how these outcomes could be avoided.

This research paper presents a detailed analysis of the linkages between climate, change, poverty and development, and critically applies that analysis to South Africa's current climate adaptation strategies. The report draws attention to the key issues most relevant to South Africa's situation that have not been sufficiently considered in the country's adaptation plans. In particular, the research presents an alternative framing of the concepts of *resilience* and *vulnerability* that is relevant to high-poverty- and -inequality contexts like South Africa. This alternative framing is used to expand the definition of maladaptation to specifically include the **failure to reduce existing vulnerabilities** to climate change. We further propose that the application of several key concepts that are common in the energy-justice literature (such as distributive justice and the notion of a systems transition) to climate adaptation can support policies with a significantly reduced risk of maladaptation.

This alternative framing indicates the necessity of expanding the scope of policies to ensure that adaptation will reduce vulnerability. It should be noted that our critical analysis has focused on South Africa, but similar findings would be made in respect of the adaptation strategies of other countries. That is, the shortcomings in South Africa's policies reflect the general approach towards framing adaptation – both in country policies and across the adaptation literature – rather than any country-specific failings.

1.3. Outline of this report

Chapter 2 examines the linkages between climate change and poverty and inequality, highlighting the significant risks to South Africa's development goals of getting climate adaptation wrong.

Chapter 3 presents an alternative framing of the central adaptation concepts of *resilience* and *vulnerability* and the maladaptation risks for South Africa of failing to develop policies that **directly** address household/individual vulnerability as an issue distinct from system resilience.

Chapter 4 considers how notions of *system transition* and *justice* – particularly distributive justice – that have been conceptualised in energy transitions, can be applied to a climate adaptation policy framework to improve the likelihood that adaptation strategies will reduce vulnerability.

Chapter 5 presents the implications of our analysis and recommendations for how to translate our findings into concrete programmes of action.

DEFINING VULNERABILITY, RESILIENCE AND ADAPTIVE CAPACITY

Adaptation is the means whereby the ends of increased climate resilience and reduced vulnerability to climate impact are achieved. Although resilience and vulnerability are sometimes used interchangeably in climate adaptation literature (as comparable opposite states) they are not simply two sides of the same coin and require different policy strategies and approaches (Joakim, Mortsch and Oulahen, 2015). Vulnerability and resilience also have different meanings in different disciplines, which meanings are not always compatible. This is particularly the case with vulnerability (Gallopin, 2006). There is additionally some 'confusion' (Joakim, Mortsch and Oulahen, 2015: 137) about the relationship between the two. This lack of clarity and separation (i.e. confusing the drivers of one with the drivers of the other) can undermine the development of effective adaptation strategies. The related term *adaptive capacity* may add to the confusion

It is key that policies are based on clear understandings of each of these terms, to what or whom they apply, as well as the factors that drive each one and how they interact with each other. Conflating terms, or tending to see them as binary (opposite) states, can result in maladaptation as policies fail to address key risks to socioeconomic development.

For the purposes of this report, and based on a review of relevant literature and South Africa's NCCAS 2020, the following broad definitions for vulnerability, resilienc and adaptive capacity have been utilised.

Vulnerability

Vulnerability is the propensity to suffer adverse effects from climate change-related events. For example, food insecure households are vulnerable to future climate events that could increase food prices and reduce the availability of food. Those who can only afford to live in areas prone to flooding are vulnerable to an increase in the frequency of such events because they cannot afford to insure themselves against the loss of their possessions.

Across the literature, vulnerability is most commonly applied to individuals/households/communities, rather than to systems such as water, agriculture or energy. This reflects, in part, the long history of the term's use in multiple disciplines (Joakim, Mortsch and Oulahen, 2015). This report uses vulnerable to describe individuals, household, communities and their livelihoods[4] (such as micro enterprises). Importantly, this report follows the notion that **a person's vulnerability 'is defined by their existent (current) state' (ibid.: 138) while acknowledging that it is not always used this way in the climate adaptation literature. This aspect of vulnerability focuses our attention on the present position of people that makes them vulnerable, and not only on their expected future position as a result of climate change**. Additional groups may become vulnerable in future (if climate events increase poverty) but this approach focuses our attention on why people are currently vulnerable, rather than only potentially vulnerable.

Vulnerabilities to climate change are often caused by multiple, interconnected factors that may reinforce each other. As one example, food insecure households are vulnerable to future increases in food prices due to climate change. But that vulnerability may also be increased if they struggle to access water that they could use for home production of food, or by high energy prices that make it difficult for them to cook or store food.

Poverty is a key cause of vulnerability, but it isn't the only cause and is also not perfectly analogous to vulnerability (Eriksen et al., 2007). As poverty in a country rises, so vulnerability to future climate events will increase (because poorer households have fewer resources to cope) but will do so at different rates in different circumstances (such as poor households' access to support programmes).

4 Generally not included in literature definitions of vulnerability.

Resilience

Resilience is the ability to experience a relatively limited impact from a climate shock **and** recover from (cope with) that shock. Both attributes need to be in place for the definition to be met. The term is most often used to describe the characteristics of systems, such as agriculture and water, and we have followed that use in this report. For example, resilient agricultural systems will experience fewer adverse effects from drought than non-resilient systems **and** be able to recover from these.

Resilience has an implied temporal component, which questions whether a system is truly resilient if it takes 100 years to recover. Although not directly addressed in the literature or policy documents, as climate events become more extreme and more frequent, this temporal qualifier is likely to become more important in designing adaptation strategies; systems that cannot recover within a certain period – likely to get shorter in the future as climate pressure increases – will no longer be considered resilient.

Adaptive capacity

Adaptive capacity is related to resilience and can be defined as (a system's) ability to cope with climate stress. The term focuses our attention on the constituent components required to cope. Adaptive capacity is also closely related to vulnerability and often used in reference to the same individual, households and communities defined as vulnerable: firstly, the higher a household's vulnerability to climate shocks, the greater the adaptive capacity they will require to recover. But often (albeit not for all shocks), higher vulnerability implies lower adaptive capacity, since many factors that create vulnerability – such as poverty – also undermine adaptive capacity. The implication is that policies to reduce the negative impact of climate shocks on individuals can either focus on reducing their (present) vulnerability to that shock or increasing their adaptive capacity (their ability to recover) or – ideally – both of these factors. **The more present vulnerability is reduced, the lower the adaptive capacity requirement that must be delivered by adaptation strategies.**

Vulnerability

Vulnerable Individuals, households and communities are those most likely to suffer adverse effects from climate change-related events.

Adaptive capacity

The ability of a system to cope with climate stress.

Resilience

A resilient system can undergo a climate shock and recover from (cope with) that shock.

CHAPTER 2

CLIMATE CHANGE, POVERTY AND DEVELOPMENT

2.1. Climate change can deepen poverty at an accelerating rate

The overarching aim of all adaptation strategies is to safeguard equitable socioeconomic development (current and potential) from the adverse impacts of climate change. Achieving that goal requires policymakers to have a clear understanding of how climate change, poverty and inequality intersect in a particular local context (Swanson, 2021) and that strategies are designed to reflect these interconnections. This is not an easy or straightforward task: the negative impacts of climate change, poverty, inequality and low development scores all exacerbate each other in multiple ways (Birkmann et al., 2022) and the scale of the challenge is immense.

Climate change will impact the availability of resources such as water, food and arable and habitable land. Although there is often a focus in the literature on the negative impact of these events on those who depend **directly** on these ecosystems for their main livelihoods (such as small-scale farmers or fishers), all poor communities will be severely impacted. In many instances, urban households may be even more severely impacted by disruptions to food systems, for example, because they have none of the own-production coping opportunities that some rural households may have.

Climate change thus presents a key threat to achieving the UN Sustainable Development Goals (SDGs), with the most likely impacted SDGs being SDG 1 (no poverty), SDG 2 (zero hunger), SDG 6 (universal access to clean water and sanitation) and SDG 10 (decent work and economic growth). These at-risk SDGs mirror many of South Africa's priority development goals under the National Development Plan and all are directly linked to inequality, within and between countries.

High current levels of poverty make countries particularly vulnerable to the adverse impacts of climate change because poor communities usually have limited ability to cope with and recover from adverse climate events like drought (which increases food prices) and floods (which damage homes and property). That is, **there is a high correlation between how poor a community is and how vulnerable it is to the adverse impacts of climate change**. The solution to poverty and inequality is equitable growth[5] (the 'right kind of growth' (Bowen, Cochrane and Fankhauser, 2012: 95) that results in broad-based socio-economic progress rather than just an increase in GDP), but climate change makes that goal much harder to achieve by directly exacerbating poverty **and** reducing development potential. High-poverty and rapid climate change thus make for a potentially devastating blow to a country's growth prospects.

The higher the current level of poverty and inequality and the development deficit in basic areas such as access to services, housing and food security, the greater the relative impact of climate events such as drought, extreme heat and floods. That is, **future impacts of climate change are 'significantly influenced' by current levels of poverty and equity** (Birkmann et al., 2022: 1213).

5 To be differentiated from "inclusive growth" which does not specifically aim to increase the equitable distribution of the benefits of that growth.

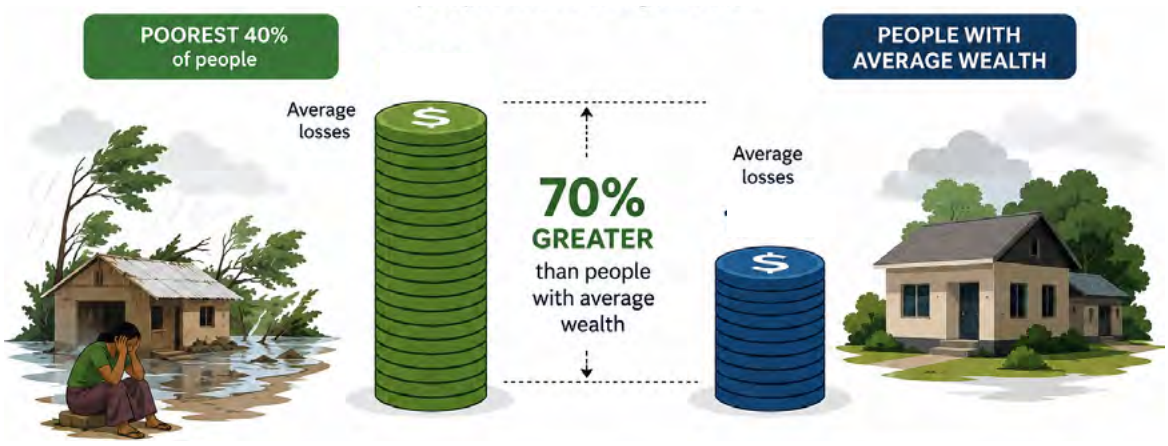
As a result, **countries with high current (baseline) levels of poverty are far more vulnerable to climate change than those with lower poverty levels** (Bowen, Cochrane and Fankhauser, 2012) because poor households are disproportionately negatively impacted by climate change: Hallegatte and Rozenberg's (2017) study across 92 developing countries found that the poorest 40 per cent of people experienced losses due to climate shocks that were on average **70 per cent greater than the losses experienced by people with average wealth**. This disproportionate impact rapidly exacerbates intra-country inequality, with poorer countries becoming much worse off as climate change accelerates.

The effect is not constant, but rather amplified over time because of the inverse correlation between poverty and adaptive capacity (the ability to cope). More extreme and unpredictable climate events make it harder for poor households to get – and stay – out of poverty (Anderson, 2011): they generally cannot afford insurance to cover the loss of homes, property or businesses. The result is that as climate change accelerates, poverty and inequality are likely to increase, at an escalating rate. And increasing poverty makes adaptation progressively challenging and expensive (because individual households and small enterprises have very little adaptive capacity and the state then has to cover this coping shortfall).

Each successive climate shock deepens poverty and increases the future adaptation burden: many households living just above the poverty line will be pushed below it and existing poverty will deepen (Birkmann et al., 2022). This means that vulnerability to the next climate event increases at an **accelerating** rate, creating ever-greater adverse impacts, exponential increases in poverty, and so on in an ever-deepening downward spiral.

This downward spiral effect will be experienced at a much faster rate the greater the starting (baseline) level of poverty and inequality in a country. Each new climate shock – drought, floods, excessive heat – will have a disproportionately greater negative impact because it is felt by an ever-increasing percentage of poor and vulnerable people created by previous shocks (Birkmann et al., 2022). These countries have a much greater risk of experiencing significantly worse – and worsening – climate change impacts than countries with lower levels of poverty and inequality. They therefore require an urgent and substantial adaptation response, but they are also the countries that are least likely to have the financial and other resources to significantly scale up adaptation in a relatively short time.

Additionally, research also shows that **recovery from climate shocks can take decades for severely impacted groups**: Giannini et al. (2017) showed that the impact of severe drought and associated famine from 1982 to 1984 was still visible on livelihoods and food security in Mali, 30 years after the fact. The most severely impacted households were shown to be those that were most vulnerable (i.e. unable to diversify their livelihoods) **30 years previously**. The implication is that the negative impacts of climate shocks endure for very long periods of time and are not easily undone. This long recovery period is a key impact amplification factor because it is very likely that multiple climate shocks will be experienced by poor households during that time, effectively reducing the possibility of recovery to zero for many of them.



> ***The likely reality of imperfect adaptation is particularly important for high-poverty countries, given the non-linear relationship between climate change and poverty (the higher the level of poverty, the exponentially greater the impact of climate change, the more difficult any recovery, and the longer that recovery will take). Less than perfect adaptation outcomes may have a marginal negative impact in places with low levels of poverty and inequality (since most people will have the resources to cope with minor shocks). But the impact of even small levels of imperfect adaptation can have significant impacts in places that already have very high (baseline) levels of poverty and inequality.***

South Africa is firmly located in this high-risk group: it is the most unequal country in the world and more than half of all households live below the upper-bound poverty line. A quarter of households are classified as extremely poor – living below the food poverty line. Current levels of economic growth are low (less than 2 per cent per annum) and many key natural resources (water, arable land) are limited.

2.2. Poverty may create barriers to successful implementation of adaptation strategies

In addition to being caused and/or exacerbated by climate change, poverty and inequality may create barriers to successful implementation of mitigation and adaptation strategies. For example, poor and/or otherwise vulnerable communities may resist efforts to preserve biodiversity because they do not have other livelihood opportunities beyond those natural resources (Rogers, 2012). That is, their coping strategies to maintain their livelihoods may often be in direct conflict with the goals of national adaptation strategies (O'Brien et al., 2008). As deforestation and the exploitation of wildlife resources increase, so these coping strategies intensify. Livelihoods are so fragile that these communities cannot afford to wait for the future returns on current adaptation strategies. These forced survival responses further undermine adaptation efforts.

Where access to limited resources (such as water) is largely through payment, very poor households can only increase access by means such as illegal connections, or bypassing metering systems, which actions undermine water sector adaptation plans.

Even where households and small farmers may want to implement climate adaptation strategies and technologies, they are often not able to do so because of financial, capacity or other constraints (Kidane, Wanner and Nursery-Bray, 2022). Financial barriers to adaptation implementation have been identified as the most pervasive limitation (ibid.). Additionally, high levels of inequality may result in more affluent parts of key sectors (such as large commercial farmers in agriculture) or higher-income residential areas being able to self-fund climate adaptation, creating a high-visibility, but ultimately false impression of adaptation success while benefits accrue to a relatively small part of the population.

Climate shocks deepen inequality: the poorest 40% of people suffer **substantially higher losses.**

2.3. Climate tipping points and *undevelopment*

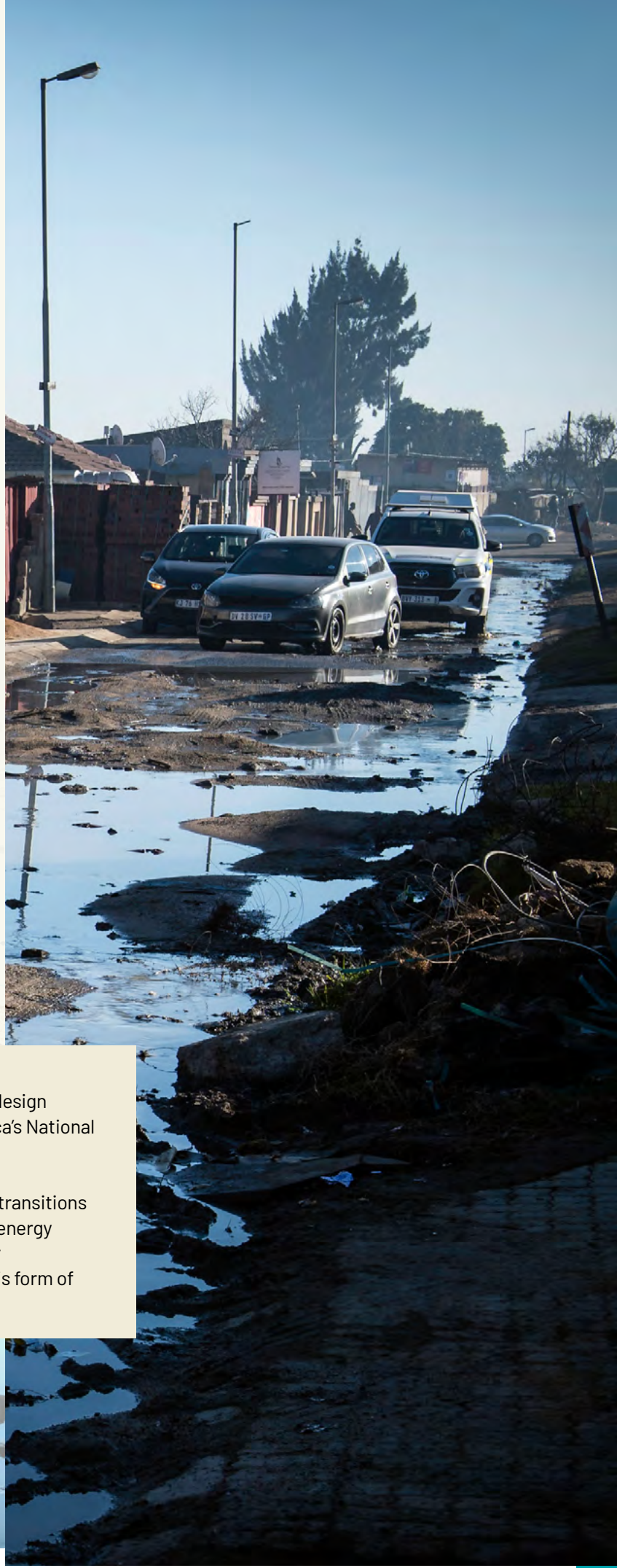
Successful adaptation requires **taking action before it is too late**; before it is no longer possible to adjust to avoid serious damage (Cevik and Jalles, 2023) or to increase resilience and reduce vulnerability to the desired level. It is likely that 'too late' may be a very short time away in countries with high climate risk and high baseline levels of vulnerability.

A combination of the poverty-development-climate linkages outlined above, the likely ever-increasing frequency of adverse climate events and the growing adaptation burden will eventually result in 'significant adaptation limits' (Birkmann et al., 2022) in countries with high levels of vulnerability (poverty). That is, the repeated cycle of – climate shocks deepen poverty, greater poverty reduces the efficacy and success of implementation of adaptation strategies – may create a **climate tipping point**. Beyond that point the goal of broad-based climate adaptation will be close to impossible to achieve, and even the most ambitious climate adaptation policies will have little impact on the adaptive capacity of economy and society.

When that happens national development progress will almost certainly stall and there is a high possibility of deterioration in key development indicators as the country becomes trapped in a downward spiral of *undevelopment*. This outcome is most likely in places that are highly susceptible to climate change impacts, that have high baseline (starting) levels of poverty and inequitable access to resources likely to come under pressure (such as water and arable land) and which do not have limitless resources.

The climate tipping point – and thus the risk of an undevelopment spiral – may be reached relatively quickly in an environment that combines high baseline poverty, multiple extreme climate events, a limited adaptation response and the likelihood of imperfect adaptation discussed above. Relatively small misses in adaptation for wealthier countries will have relatively small impacts on socioeconomic development potential, but the same small misses in poorer countries (like South Africa) could have devastating implications.

The risk of becoming trapped in a spiral of undevelopment could be viewed as a form of maladaptation, where adaptation amplifies the impact of climate change through 'ineffectual' strategies (Adger, Arnell and Tompkins, 2005b: 78). **This form of maladaptation will occur when strategies fail to reduce a key vulnerability (such as food insecurity or living in a flood-prone area) fast enough to prevent the next shock from increasing the percentage of the population experiencing that vulnerability.** This version of maladaptation is a different definition from the most common currently in use; that maladaptation occurs due to unintended policy consequences that increase vulnerability. The risk of undevelopment arises not as a result of unintended policy consequences, but rather as **policy design failure**.



Chapter 3 analyses how these adaptation policy design failures arise, with a specific focus on South Africa's National Adaptation Plan, NCCAS 2020.

Chapter 4 focuses on how approaches to energy transitions – notably definitions of distributive justice in the energy transition literature – could provide guidelines for designing adaptation strategies that will avoid this form of maladaptation.

CHAPTER 3

FUTURE SYSTEM RESILIENCE VERSUS PRESENT COMMUNITY VULNERABILITY WHAT ARE POLICIES GETTING WRONG?

3.1. Policymaking as problem solving: will adaptation strategies deliver adaptation objectives?

Policymaking can usefully be conceptualised as problem solving: the state identifies a problem it wants to solve (such as an aspect of vulnerability to climate change) and develops a policy or programme that aims to do that (McGuiness and Slaughter, 2019). Problem-oriented policy development forces focused thinking about the (multiple and actual) causes of the problem, with the aim of designing policies and programmes that address these actual causes, rather than assumed causes. Within this problem-oriented approach, *success* in policymaking can be determined against the following criteria:

Has the state identified the most important problems to be solved?

In the example of climate adaptation plans, this would require that policymakers have correctly identified the most important existing vulnerabilities (such as food insecurity, ability to access water, land tenure, access to suitable land for housing) that combine to create significant socioeconomic development risk to future climate events.

Given the high likelihood of imperfect adaptation as the best outcome that can be hoped for, and thus almost unavoidable increases in vulnerability as a result of climate change, **South Africa's adaptation strategies have to focus on significantly reducing these existing vulnerabilities to climate shocks (such as food insecurity) over time and not only on hoping to avoid making them worse as a result of future adverse climate events (through, for example, making agricultural systems more climate resilient to limit future food-price increases or putting disaster-recovery systems in place).**

Reducing an existing vulnerability (from its current level) could also be seen as a comparatively low risk/high reward adaptation strategy: not only are there fewer uncertainties around understanding the drivers of current vulnerabilities (compared to the difficulties of accurately predicting future climate events) but reducing existing vulnerability will limit the demands on future adaptation strategies.

Has the state accurately diagnosed the problem?

This accurate problem diagnosis is the basis for deciding which actions are needed to solve problems. The policy goal should be to ensure that the chosen strategies focus on the most important factors necessary to **reduce existing vulnerability and prevent future increases in vulnerability**. Getting this right requires policymakers to understand **all** the factors and causal linkages that combine to create and entrench existing vulnerabilities as well as the ways in which expected future climate events are most likely to exacerbate these. Additionally, successful strategies are situationally determined responses to specific problems (Grindle, 2013); they respond to local requirements and context rather than copying solutions from other places.

The starting point, therefore, of successful climate adaptation is for policymakers to identify key existing vulnerabilities that make communities or groups particularly sensitive to future climate change impacts, the factors that create and entrench those vulnerabilities in the present and the risks that these vulnerabilities will increase in the future as a result of climate change. As Jessen, Fertner and Fryd (2025: 2) summarise it, vulnerability in relation to climate change can be divided into two distinct components: vulnerability 'as an outcome' and 'as vulnerability as a contextual starting point'. **The adaptation problem thus has two distinct temporal parts that must both be addressed: present vulnerability and the risk of increasing vulnerability in the future.** Both present vulnerability and future risk determine the socioeconomic impact of climate change.

Once detailed problem diagnosis has been completed (i.e. policymakers have a good understanding of how vulnerability is currently created and entrenched, and detailed estimates of how adverse climate events might **exacerbate** these vulnerabilities in the future) the next step is to develop adaptation strategies that will:

i. Permanently reduce those existing vulnerabilities as quickly as possible[6] (i.e. policies to act on current vulnerability);
ii. Create mechanisms that will ensure livelihood stabilisation and relatively quick recovery from climate shocks; and
iii. Make systems such as agriculture and water more resilient to future climate shocks (i.e. policies to limit the impact of future climate shocks).

All three strategy components are required to deliver a robust climate adaptation response. **It is important to note that only policy component (i) above qualifies as 'reducing vulnerability to climate change'. Components (ii) and (iii) have as their implicit goals limiting an increase in vulnerability (such as the impact of rising food prices on food insecurity). The most that these strategies can ever hope to achieve (especially considering the reality of imperfect adaptation) is to maintain the vulnerability status quo. In a high baseline vulnerability environment (i.e. high levels of poverty and low development indicators) the risk of steady increases in vulnerability due to strategies that focus only on (ii) and (iii) is considerable.**

Therefore, as a general policy development rule, we could say that the first component (a permanent reduction in current levels of vulnerability) should receive at least as much policy attention and resources as the other two components given the enormous effort required to completely restore vulnerable groups to their previous positions after an adverse climate event and the inevitability of imperfect adaptation when working to reduce future adverse impacts. **A policy approach combining all three components can thus be seen as a 'higher payoff' strategy than considering only the latter two (disaster responses and system resilience).**

Heading here?

- How well do South Africa's adaptation plan, NCCAS 2020 (DFFE, 2020) and its 2025 adaptation NDC submission (DFFE, 2025) compare against this ideal policy-making process?
- Do adaptation objectives clearly reflect priority vulnerabilities and do the details of chosen strategies reflect all three vital components of reducing existing vulnerabilities, increasing disaster management responses and increasing system resilience?
- Most importantly, do strategies allocate (at least) equal weight to reducing existing vulnerabilities as they do to preventing future increases in those vulnerabilities?
- Finally, do strategies reflect accurate problem diagnosis; do policymakers appear to have a good understanding of all the factors that create and entrench present and future vulnerabilities?

6 The time urgency reflects the most likely scenario that adverse climate events will increase in both frequency and intensity.

The answer to many of these questions is a clear **no**.

i. A review of NCCAS 2020 indicates that adaptation objectives are generally aligned with key vulnerabilities, that is, adaptation objectives reflect many priority vulnerabilities, such as food insecurity or access to water, which are essential to meeting development goals and where poor households generally have low adaptive capacity (the ability to cope with shocks that will exacerbate that vulnerability). Desired adaptation outcome G9 states: *Secure food, water and energy supplies for all citizens.*

   This appears to be a suitable objective but the details of the adaptation strategies selected to deliver this goal show clearly that the strategic focus is largely on disaster-management responses to assist communities with climate information and to recover from adverse events, and on increasing system resilience to future events. There is comparatively little (almost no) focus on attempting to **reduce existing vulnerabilities** such as food insecurity and poor child nutrition. That is, **there is a disproportionate focus on how to reduce future risk and a neglect of how to reduce the level of vulnerability to that risk.**

   The related adaptation objectives in South Africa's 2025 NDC submission also neglect reducing existing vulnerabilities, instead placing the greatest emphasis on preventing future increases in vulnerability. All the adaptation risks in this document are described as risks that will arise due to future events, rather than the risks presented by current levels of poverty and inequality. Goal 4 does include the objective of enhancing nutritious food access and affordability, which is focused on reducing a key existing vulnerability, but as discussed below, none of the identified interventions are designed to deliver this objective.

   None of South Africa's adaptation plans address the fact that a considerable number of people are driven to live on flooding-prone land (particularly in urban and peri-urban areas) as a result of poverty and a failure of the state to provide suitable affordable housing alternatives.

   In summary, key adaptation policy documents give the superficial impression that they are focused on reducing existing vulnerabilities, but the details of these plans make it clear that this is not actually the case.

ii. This failure to adequately address existing vulnerabilities reveals a failure to understand the serious risk to future development created by this approach, combined with poor problem diagnosis – the failure to investigate the reasons for **existing** vulnerabilities. In part, this flawed diagnosis is the result of the complexity of economy-society-climate change vulnerability linkages, which include multiple factors that are beyond the mandates of individual line departments organised on limited sector demarcations. For example, the Department of Agriculture has no mandate over the food retail sector, which is key in determining access to food. As a result of this, incorrect assumptions are being made about what kinds of actions will reduce vulnerability to climate change and this results in strategies that are unlikely to achieve that goal.

   The aggregate approach of NCCAS 2020 (to secure food, water and energy in aggregate supply) is particularly problematic, since it does not recognise that key vulnerabilities arise in large part because of the way in which households and communities *access* resources like food, water and energy, rather than the national availability of these resources. **It is the inability to access available resources that is the foundation of a vulnerability such as food insecurity or energy poverty**; a vulnerability that may be exacerbated by national food shortages or electricity supply disruptions, but which is certainly not eradicated by national food surpluses or the ending of load shedding.

iii. Where actions in these plans do focus directly on reducing individual vulnerability such as food insecurity, they are often focused on very small groups of vulnerable people (such as the tiny percentage of the South African population that produces its own food) and not on the wider vulnerable community.

The realities of food insecurity in South Africa are a useful lens with which to highlight the details of this policy failure

At present, South Africa usually[7] produces enough food in aggregate to meet the basic food requirements of all residents. Despite this, food insecurity rates are high and nutrition levels are low: Almost 28 per cent of children under the age of five are stunted and the results of inadequate nutrition are reflected in a high public healthcare burden associated with diet-related non-communicable diseases. However, the main reason for these poor outcomes has little to do with national food production. Instead, the key driver of food insecurity and malnutrition in South Africa is the relative retail price of food compared to household income. Even in years where weather conditions are close to perfect for crop production, and the country produces a surplus of food, unaffordability is still a significant barrier to universal access to sufficient nutrition. One quarter of households live below the food poverty line and another 15 per cent cannot afford to buy a basic nutritionally sufficient basket of food (Ledger and Mathibela, 2025).

The food security adaptation strategies in NCCAS 2020 contain no detailed diagnosis of the problem; of the reasons for that current vulnerability. As a result of this omisison, where some (limited) actions have been included to directly address this vulnerability, they are woefully inadequate. One proposes to support small-scale farmers to make better use of water resources, which will not directly impact food security at a meaningful level since most South African households purchase *all* their food. Another proposed action – to encourage home food gardens – is almost as pointless: many residents of urban areas (where food insecurity rates are highest) have very limited opportunities to grow their own food and the greatest limit on own food production is the difficulties that the poorest households – particularly those living in informal settlements – face in accessing water. (And there are no actions in the NCCAS 2020 to address these access challenges). The retail cost of food and the structure of the distribution of food from producer to consumer – which are the most important reasons for food insecurity in South Africa (Ledger, 2016) – receive no attention at all.

Adaptation Goal 4 under the South Africa's second NDCs is 'enhance nutritious food access and affordability through support to agricultural and fisheries producers and distributors in adapting to warmer and windier conditions and changes in rainfall' (DFFE, 2025: 11). Nowhere is there any indication of how these supply-side interventions will result in more affordable food, when even in past excellent agricultural output years a significant percentage of South African households have remained food insecure.

Two of the NDC 2025 indicators proposed to track progress are the annual increase in the cost of a basket of food and child malnutrition numbers, which is a recognition of key vulnerabilities, but none of the proposed interventions have been designed to directly address the reality that 80 per cent of South African households do not spend enough money on food to purchase a nutritionally sufficient basket of food (Ledger, 2016). Most importantly, **none of the actions proposed under South Africa's adaptation strategy are directly focused on reducing the cost of food to a level where all households can afford to purchase it**. Simply monitoring an outcome is not sufficient to change it.

The policy implication is crystal clear**: simply reducing the climate impact on food production may limit future deterioration in food security (although imperfect adaptation means that the best we can hope for is a limited negative impact and not a zero impact) but it will in no way whatsoever reduce that vulnerability. In fact, successive 'limited impacts' will, over time, result in a steady increase in that vulnerability, with a potentially disastrous impact on South Africa's socioeconomic development prospects**.

7 Except in the event of severe adverse climate events, such as bad drought years.

3.2. This flawed approach threatens long-term development potential

Neither NCCAS 2020 nor South Africa's 2025 NDCs interrogate **why existing vulnerabilities exist; how they are created and maintained**. Why are such a high number of households currently unable to access sufficient nutritious food? Why is energy unaffordable for so many households? Instead, the 'solution' to these vulnerabilities is automatically assumed to lie in increasing system resilience, such as moving towards 'climate smart agriculture' or providing better climate information and affordable insurance to farmers. Although these actions are necessary to safeguard resources at an aggregate level, they will have little to no impact on how these resources are allocated among communities and households.

The main reason for these policy gaps is that **many of the drivers of current vulnerabilities are not directly caused by climate issues.** That is, the reasons why South Africans struggle to access food or sufficient water are by and large not the result of climate change. The limitation of adaptation strategies to a very narrow definition of climate risk (essentially only future risks produced directly by climate events) has effectively rendered these drivers of vulnerability invisible; as not the legitimate focus of adaptation. This has probably been compounded by the tendency to view climate adaptation as a purely technical issue; the realm of engineers with nothing to do with the messier reality of poverty and inequality. This is a fundamentally flawed view: a significant portion of what should be included in *climate risk* is exactly that reality, given the disproportionate impact of current vulnerabilities on future outcomes. Owen (2021: 1374) suggests that if adaptation strategies only address the 'symptoms of vulnerability' such as the potential impact of future climate events without addressing the underlying reasons for that vulnerability, then those strategies 'will never be effective or equitable' (ibid.). Cannon and Müller-Mahn (2010: 625) go further, calling it 'pointless (or even irresponsible)' to separate climate and non-climate causes of vulnerability. They conclude that focusing only on (system) resilience is not a sufficient response to vulnerability, given the range of other factors that underpin that vulnerability.

We could expand the definition of maladaptation to include adaptation that fails to meet critical vulnerability **reduction** objectives central to national development agendas. On that definition, significant portions of South Africa's adaptation plans seem to run a high risk of delivering maladaptation. This kind of maladaptation has particularly serious consequences for countries that have high baseline levels of poverty, food insecurity and inequality, greatly increasing the risk of a spiral into undevelopment as a result of repeated climate shocks combined with inadequate policies.

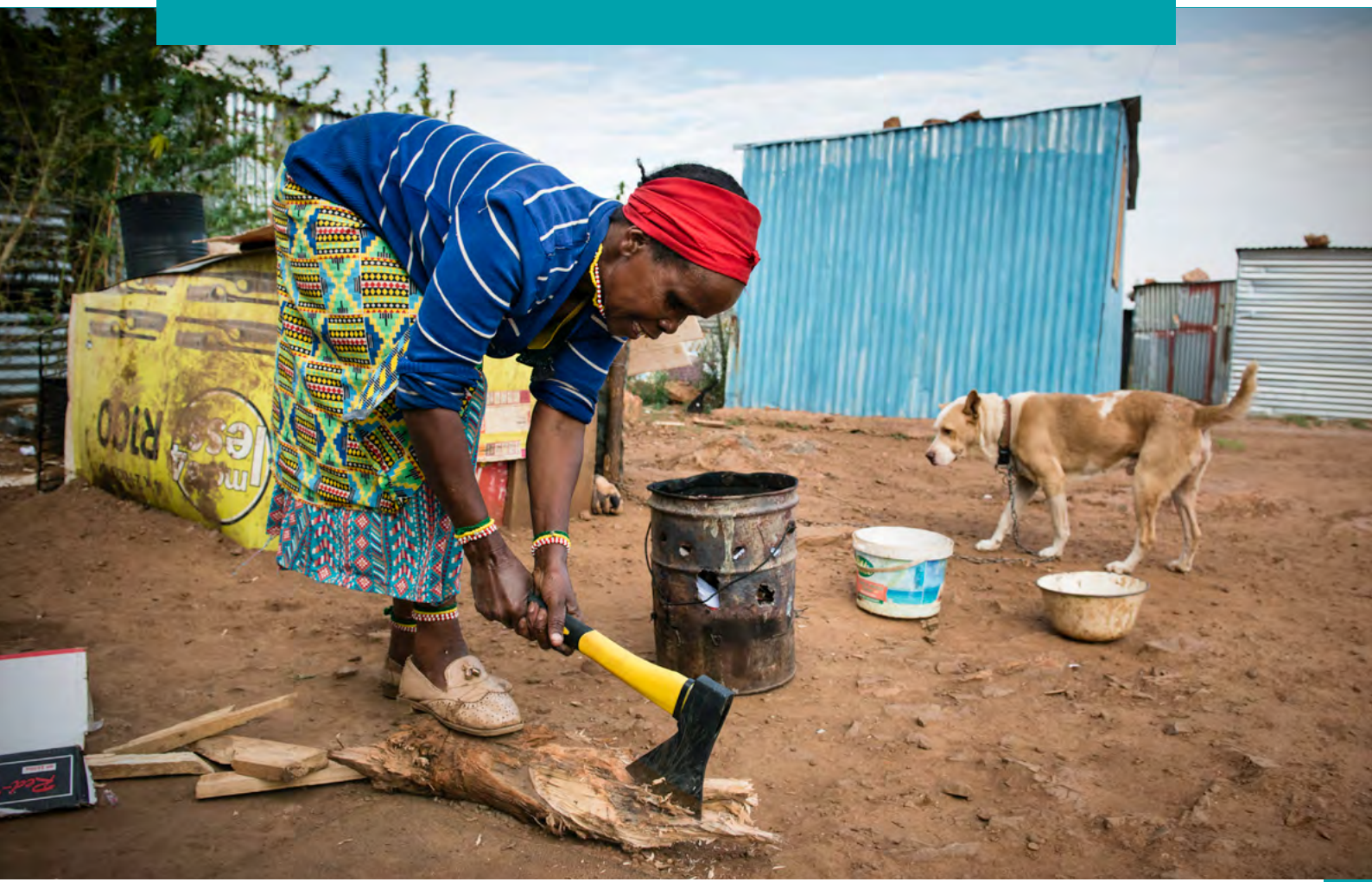
It should be pointed out that South Africa is not alone in this policy omission space. The adaptation strategies of other countries also suggest a limited focus on reducing existing (baseline) vulnerabilities, compared to reducing the impact of future vulnerabilities. Where objectives do imply a goal of reducing existing vulnerabilities (the most common are the interrelated goals of making food more affordable and increasing access to more nutritious foods) the same erroneous thinking is often applied: that safeguarding national production from future climate impacts will be sufficient to deliver this goal. That is**, there is a general assumption across national adaptation strategies that increasing system resilience in a particular area will automatically result in reduced community vulnerability in that same area**: if we make agriculture more climate resilient, we will reduce food insecurity and better food will become more affordable. Much the same approach is applied to the water sector: if we safeguard national water resources from climate impacts, then communities that currently struggle to access water – because of affordability or user-allocation regimes – will somehow be able to do so. This is why safeguarding food production systems is uncritically presented as the solution to the vulnerability to food insecurity, even though the market mechanisms that determine the price that people pay for food in retail outlets have steadily eroded the relationship between the farm gate and the retail price of food over the past four decades (Ledger, 2016). Nor does empirical evidence support the assumption that keeping agriculture perfectly protected from adverse climate events will significantly reduce that vulnerability: even in bumper agricultural production years South Africa's food insecurity rates have not significantly declined.

Additionally, increased system resilience may simultaneously **decrease** individual/household vulnerability and deepen inequality (Chu et al., 2025). For example, a food system may become more climate resilient, but if that results in higher food prices (because of the higher costs of investing in resilience) then poor households will become more vulnerable by having to allocate more income to food purchases and the overall net impact may be to increase national vulnerability to climate shocks. None of South Africa's food sector adaptation strategies appear to have considered this possible outcome.

Conflating resilience with vulnerability may, therefore, create unintended outcomes from adaptation strategies that, over the longer term, may exacerbate the negative impact of climate change. When adaptation strategies focus all their attention on solving tomorrow's anticipated problems, they effectively make invisible (and thus not a policy focus) a significant part of vulnerability.

How could we go about developing better adaptation plans?

A better approach to developing adaptation policies (i.e. an approach that is more likely to succeed in achieving the twin goals of reducing present vulnerability and limiting the risk of future increases in vulnerability) is one that can recognise and incorporate both temporal components of vulnerability. We propose that such a 'better approach' is to overlay a justice framework onto the policy development process, based on what has been developed in the energy transition space. In the next chapter we have summarised the main elements of this framework (particularly, conceptualisations of distributive justice that incorporate multiple temporal facets of vulnerability) that we believe will be valuable to climate adaptation policy development.




SUB TROPICAL
BANANAS
ESWATINI BANANA
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CHAPTER 4

DISTRIBUTIVE JUSTICE AND SYSTEM TRANSITIONS

4.1. The relative neglect of justice in adaptation has contributed to the current policy shortcomings

Equity and justice are relatively new concepts in climate adaptation policy. Even though social vulnerability to climate change is increasingly recognised as an important issue, there is little consistency on the inclusion of clear notions of justice into adaptation policies (Jessen, Fertner and Fryd, 2025) and detailed incorporation into implementation remains particularly limited. This has directly contributed to 'tendencies to disassociate climate adaptation and social vulnerability' (ibid.: 1) and to imagine adaptation as solely a 'technological domain' (Pelling, 2010: p1).

Where the issue of vulnerability has been included through the incorporation of a justice/equity[8] component into adaptation policies, the greatest focus has been on recognitional, procedural and distributive justice, albeit that there is still very limited operationalisation of these concepts. Additionally, recent studies find that the greatest focus to date has been on recognitional justice (Brousseau et al., 2024), rather than procedural and distributive justice. Recognitional justice focuses attention on who is most vulnerable to the future impacts of climate change – and we could characterise South Africa's main adaptation strategies as focusing mostly on this aspect of justice (although NCCAS 2020 does not refer to the identification of vulnerable groups as 'recognitional justice'). The most common policy action under this justice category is to identify vulnerable groups and to ensure that they are included in adaptation programmes such as weather proofing of homes.

Procedural justice aims to include input from a wide range of stakeholders into policy design, to ensure that the needs, concerns and priorities of all communities (and particularly those most vulnerable to climate change) are understood and addressed. In this aspect of justice most climate adaptation plans do not score highly (Brousseau et al., 2024) including – in our assessment – South Africa's. The wide scope of climate adaptation (it essentially covers almost every aspect of social and economic life) and its relative novelty have probably resulted in this outcome, but it is a serious omission. The literature on problem-oriented governance repeatedly highlights the value of obtaining detailed input from impacted communities in successful problem definition. High levels of procedural justice are thus strongly correlated with the ability to develop policies that will solve identified problems (Ledger, 2024).

Distributive justice is a more complex issue and there are multiple definitions in use across the climate literature. In broad terms, distributive justice deals with equity in how costs and benefits are distributed among different groups. However, there are significant differences in how distributive justice is conceptualised and operationalised, both among existing adaptation strategies and between adaptation strategies and mitigation strategies. Much of the climate adaptation literature adopts a similar view to Adger, Arnell and Tompkins (2005b: 83) who propose that distributive justice in adaptation outcomes 'means identifying who gains and who loses from any impact or adaptation policy decision'. That is, the general view is that distributive justice should focus on the equity of the future outcomes of adaptation policies.

8 It appears that these terms are sometimes used interchangeably.

This reflects the view that the IPCC conceptualisation of vulnerability in the 2007 Assessment Report (AR4) was essentially as an outcome (i.e. a future result) of exposure to adverse climate events (Jessen, Fertner and Fryd, 2025). Although the 6th Assessment Report (AR6 – 2023) expanded the definition of vulnerability (ibid.) as 'the propensity or predisposition to be adversely affected' (i.e. as a present and a future condition) this has not resulted in a general adaptation policy shift to examine the reasons for current vulnerability, and to design policies specifically to address these, but rather in a greater focus on identifying such vulnerable groups. This represents a confusion between recognitional and distributive justice, to the detriment of the latter. In addition, policies often label recognition activities as 'distributive equity', which exacerbates the relative neglect of real distributive justice by giving the impression that it has been included (Chu et al., 2025; Jessen, Fertner and Fryd, 2025; Hughes, 2020).

In summary, where issues of distributive justice/equity are incorporated into adaptation plans, they almost invariably fall into one of two categories:

i. The need to ensure that adaptation actions do not make things worse *in future* for vulnerable groups (Brousseau et al., 2024), such as the possibility that increasing the area of agriculture under irrigation could reduce water availability for other groups (Adger, Arnell and Tompkins, 2005b); and/or
ii. The importance of identifying vulnerable groups and ensuring that adaptation actions such as disseminating information include these groups. That is, ensuring that vulnerable communities have a fair share of policy actions and resources (Berkhout, 2022). These actions also largely represent a focus on reducing the *future impact* of adverse climate events on vulnerable groups.

In line with our analysis in the previous chapter, we could conclude that current definitions of distributive justice in adaptation policies generally include only one temporal component of vulnerability – future vulnerability to climate risk. In a context where existing vulnerability is very high and the long-term development risk of failing to significantly reduce existing vulnerability is potentially catastrophic, limiting distributive justice issues in this way is deeply problematic.

We believe that a combination of the relative novelty of the incorporation of justice into the design and implementation of climate adaptation policies and strategies, together with a very limited view in those policies of what constitutes 'distributive justice' is a key reason for the failure of most adaptation strategies to include actions that are designed to reduce vulnerability, rather than just limit its increase in the future.

Despite being globally acknowledged as an innovator in the conceptualisation of just energy transitions, and the fact that the Climate Change Act 22 of 2024 is clear that South Africa requires a 'just transition' to a climate resilient future – NCCAS 2020 does not mention the word *justice* even once. The 2025 NDCs do cover the issue of justice, although the focus seems primarily to be on climate justice, which also focuses attention on the distribution of the future impact and costs of climate change on different groups, rather than on reducing existing vulnerability to that change. South Africa's NDCs acknowledge (in Section 8) 'that there is still no internationally agreed equity framework (that relates multiple dimensions of justice to the broad scope of climate action and support)' but make no attempt to propose a comprehensive justice framework for adaptation policy in South Africa.[9] This is a serious policy omission.

In contrast to the justice gaps in adaptation, detailed and well-developed concepts of multiple justice components are commonly included in energy transition literature and policies. We believe that many of the shortcomings in adaptation strategies identified in this research paper could be addressed by incorporating several of these mitigation justice framings and, in particular, the detailed conceptualisations of distributive justice in respect of energy.

9 It is generally understood that South Africa's Just Transition Framework applies to all aspects of the climate transition (and not just energy) but there has been no definitive policy decision that it should be applied to and integrated into all adaptation strategies. In addition, the Framework has significant shortcomings in how it defines distributive justice (Ledger, forthcoming).

4.2. Distributive justice in energy transitions

Mitigation strategies – particularly energy transitions – have focused considerable attention on the subject of justice and developed detailed analyses, metrics and implementations strategies in an attempt to ensure equitable transitions, under the umbrella of *just transitions*. This concept has developed considerably over the past 40 years: an initial jobs preservation focused movement has now 'evolved into a much broader and multifaceted concept' (Yu, 2023: 21).

Distributive justice is only one component of a truly just climate transition. Other components include recognitional, procedural and restorative justice and all need to be in place for a transition to be considered truly just. In this paper we have focused on the issue of distributive justice, since it is most directly related to the key subject matter – how to redesign adaptation policy to focus on both existing and future vulnerabilities to climate change. This focus is in no way intended to suggest that the other areas of justice are unimportant in designing and implementing a just adaptation. In particular, procedural justice is central to identifying and understanding the drivers of existing vulnerabilities.

The two main definitions of distributive justice/equity utilised in the energy transitions literature are summarised below:

i. The first is associated with a concern that *current inequalities* in the fossil fuel energy system (i.e. who benefits and who loses under the current energy system) will be replicated in a green/renewable energy system (Gilbert, Hoen and Gagarin, 2024). As Johnson et al. (2020: 1) put it – '"greening" energy systems may not make them any fairer, inclusive or just'. The conclusion is that a key problem to be solved by the energy transition is to *reduce* existing vulnerabilities such as energy poverty as an integral part of redesigning energy systems. This approach highlights the importance of identifying these *existing* system inequalities and developing transition policies that will address them.

ii. The second category of definitions focuses on distributive justice as a tool to *prevent any future increase in inequality* that could be caused by the energy transition (notably loss of employment and income, and regional economic decline).

Some of the earlier literature (and South Africa's Just Transition Framework) focuses only on the second component (i.e. preventing an increase in inequality as a *result* of the transition) but a significant part of the more recent work in this area emphasises the relative importance of the first component – of ensuring that existing energy system inequalities are not reproduced in the 'new' energy system – while acknowledging that both parts are necessary to ensure comprehensive distributive justice.

The key points from the energy transition conceptualisation of distributive justice that are relevant for adaptation policies are:

i. The definition of distributive justice under a just energy transition clearly includes reducing existing vulnerabilities and limiting the impact of system transition on future vulnerabilities. It thus specifically includes both temporal elements of vulnerability.

ii. Within that two-component definition, *existing* vulnerabilities (such as energy poverty) are clearly viewed as priority issues to be addressed *during* the energy transition and forms part of the process of system re-structuring. That is, existing vulnerabilities are understood to be in large part the results of current system structure and operation; to be ***endogenous*** to the energy system and a result of its 'rules' of operation. The implication for policy design of this 'endogenous vulnerability' approach is significant: if you understand an equity outcome, such as access to energy, to be the result of system design and operation, then restructuring that system to reduce vulnerability is an integral part of the transition rather than a separate policy initiative. Such an approach would reflect Malloy and Ashcraft's (2020) conclusion that a 'just adaptation' requires a clear understanding of injustices caused by systems.

    In contrast, adaptation policies are almost always underpinned by the (generally unspoken) assumption that key vulnerabilities such as food insecurity are ***exogenous*** to the system – caused by external factors such as poverty, rather than the result of how the food system regulates access.[10] This effectively makes critical current vulnerabilities an issue separate to climate adaptation, and has directly contributed to the lack of adaptation policies designed to reduce existing vulnerabilities.

Additionally, the notion of an energy transition **as a 'transition'** supports this comprehensive and inclusive view of distributive justice; the clear idea that one kind of system is being replaced by another creates a conceptual framework for the fundamental overhaul of system rules and creates the discursive and political space for designing significantly different ways of operating across the system. In contrast, most adaptation tends to be conceptualised as a technical adjustment (Pelling, 2010) with no intention of completely replacing one kind of system with another. NCCAS 2020 confirms this 'technical adjustment' approach with its definition of climate resilience as – 'the ability of a social, economic or ecological system to absorb disturbances **while retaining the same basic structure and ways of functioning**' (our emphasis). The clear assumption is that there is nothing within the 'basic structure and ways of functioning' of, for example, a food system that directly contributes to a key vulnerability such as food insecurity.

10 Such as the location of food retail outlets, creating nutritious food deserts in many urban areas, or the steady widening of the farm gate – retail price of food over the past 30 years, which effectively means that most consumers pay prices for basic food items that are many multiples of the price that producers receive (Ledger, 2016).

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GLOBAL GOAL ON ADAPTATION: **THE BELÉM INDICATORS**

The Global Goal on Adaptation (GGA) presented at COP30 in Brazil at the end of 2025 presented the Belem Adapatation Indicators, a set of voluntary indicators intended to support countries in developing 'an adequate adaptation response' by measuring progress across a range of adaptation categories. Each set of indicators is linked to a specific adaptation objective, reflecting the outcome of Decision 2/CMA.5.

Proposed indicators for water and food systems

Indicators for Target 9 (a)

The indicators for assessing progress under target 9(a), significantly reducing climate-induced water scarcity and enhancing climate resilience to water-related hazards towards a climate-resilient water supply, climate-resilient sanitation and access to safe and affordable potable water for all, are as follows:

WATER STRESS	*a. Level of water stress, including as an outcome of adaptation actions where applicable, accounting for relevant climate hazard intensity and/or frequency;*
WATER-USE EFFICIENCY	*b. Level of water use efficiency, including as an outcome of adaptation actions where applicable;*
WATER AND SANITATION INFRASTRUCTURE	*c. Proportion of critical water and sanitation infrastructure systems that are resilient to climate-related hazards under different warming scenarios, as appropriate for regions and contexts, including as an outcome of adaptation actions where applicable;*
CLIMATE ADAPTATION PLANS	*d. Proportion of the total area of basins and cryosphere for which a climate adaptation plan has been developed and implemented on the basis of different warming scenarios, as appropriate for regions and contexts where applicable;*
SAFE AND AFFORDABLE POTABLE WATER	***e. Proportion of the population using safe and affordable potable water services that are climate-resilient, including as an outcome of adaptation actions where applicable;***
SANITATION SERVICES	*f. Proportion of the population using sanitation services that are safely managed and climate-resilient, including as an outcome of adaptation actions where applicable;*
MEASURES TO IMPROVE AND EXTEND SERVICES	*g. Extent of measures taken to improve and extend water, sanitation and hygiene services to populations disproportionately affected by climate change and to vulnerable groups relative to needs;*
AMBIENT WATER QUALITY	*h. Proportion of bodies of water with good ambient water quality for drinking water supply, including as an outcome of adaptation actions where applicable;*
PEOPLE SUPPORTED	*i. Number of people per 100,000 supported in planned relocation processes in response to water-related hazards, where adaptation measures were taken to ensure safety of populations.*

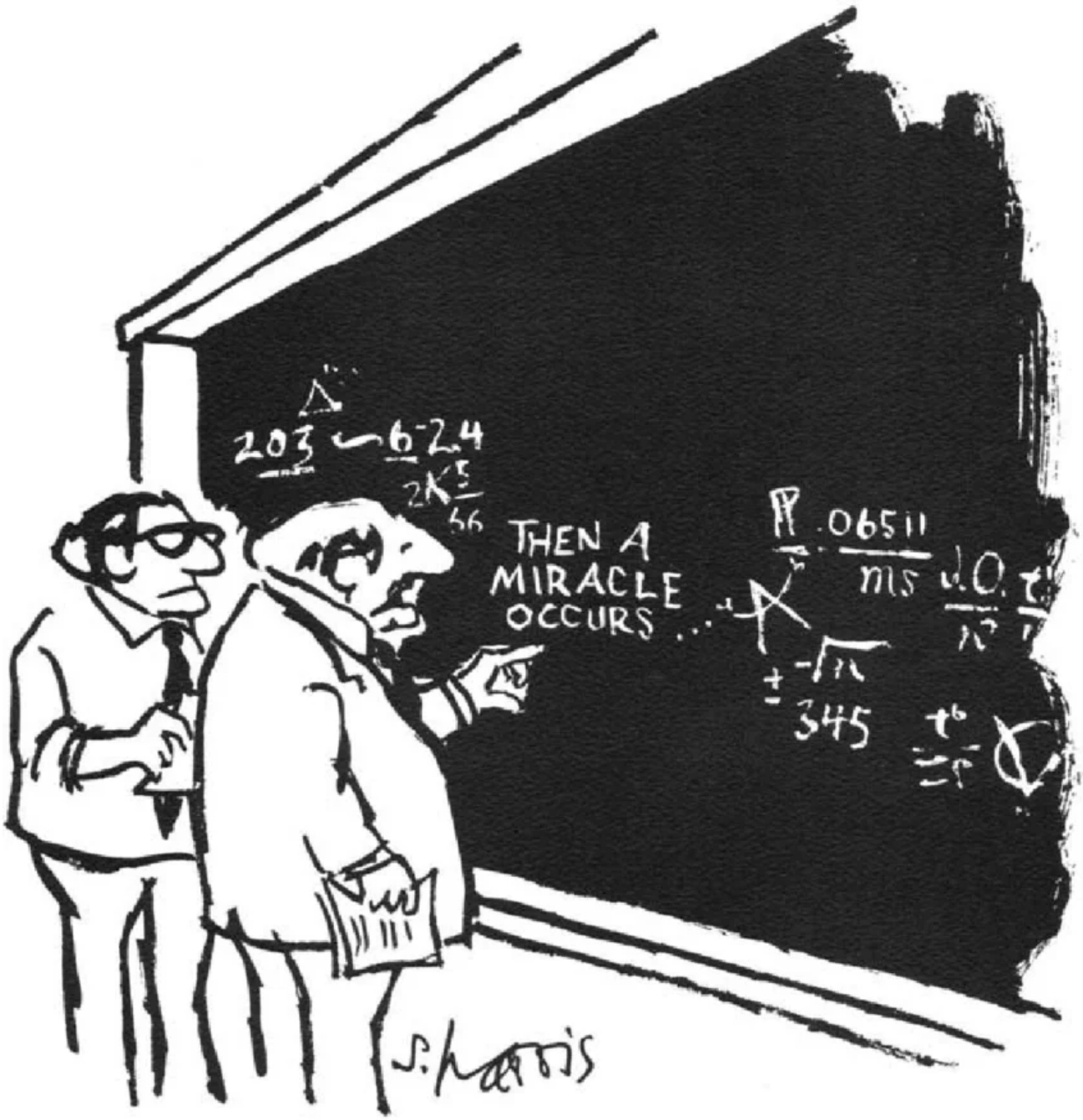
Indicators for Target 9 (b)

The indicators for assessing progress under target 9(b), attaining climate-resilient food and agricultural production and supply and distribution of food, as well as increasing sustainable and regenerative production and equitable access to adequate food and nutrition for all, are as follows:

FOOD AND AGRICULTURAL PRODUCTION	*a. Proportion of area under management for food and agricultural production utilizing practices and technologies relevant to climate change adaptation;*
INSTITUTIONAL FRAMEWORKS	*b. Extent of implementation of institutional frameworks for knowledge transfer, research and development, and extension services supporting climate change adaptation in the areas of food and agriculture relative to needs;*
DEGRADED AREAS	*c. Level of degraded areas that are under management for food and agricultural production, including as an outcome of adaptation actions where applicable;*
FOOD AND AGRICULTURAL YIELD	*d. Level of food and agricultural yield in areas that are under management for food and agricultural production, including as an outcome of adaptation actions where applicable;*
ACCESS TO FOOD AND NUTRITION	***e. Proportion of the population with equitable access to adequate food and nutrition, including as an outcome of adaptation actions where applicable.***

Both the water and food sections contain indicators that are directly related to reducing *existing* vulnerabilities and therefore represent a significant step in the right direction. However, **the challenge is whether climate adaptation specifically plans for these outcomes or whether they proceed on the (flawed) assumption that attaining 'climate-resilient food production' and 'climate-resilient water supply' will somehow automatically result in universally affordable and accessible food and water.** Adaptation plans will only deliver the outcomes contained in the Belém indicators if they are based on a detailed analysis of exactly what creates and entrenches existing levels of food insecurity or the reasons why households struggle to access affordable water.

Applying a comprehensive distributive justice framework and reimagining adaptation as a system transition (rather than as a system adjustment) would support South Africa in developing adaptation plans that have the best chance of delivering outcomes that reflect the Belém indicators.



"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

CHAPTER 5

IMPLICATIONS FOR ADAPTATION POLICIES AND INTERVENTIONS

5.1. Summary and conclusions of the research

- There is a growing realisation that global climate action needs to allocate much more attention and resources to adaptation, given **climate reality and the decreasing likelihood that current mitigation efforts will prevent significant temperature increases**: The 1.5 degrees ceiling has not yet been definitively breached, but there is an increasing balance of scientific opinion that it can no longer be avoided (Birkmann et al., 2022). There has been a broad scientific consensus in place for more than ten years that adverse climate events are becoming more intense and more frequent (Cannon and Müller-Mahn, 2010). The only way to minimise the impact of these adverse events on economies and societies is through adaptation (Joakim, Mortsch and Oulahen, 2015).

- The overarching aim of all adaptation strategies is to safeguard equitable socioeconomic development (current and potential) from the adverse impacts of climate change. Successful adaptation therefore requires **taking action before it is too late**: before it is no longer possible to adjust to avoid serious damage (Cevik and Jalles, 2023). It is likely that 'too late' may be a very short time away in countries with high climate risk and high baseline levels of vulnerability.

- High current levels of poverty make countries particularly vulnerable to the adverse impacts of climate change because poor communities usually have limited ability to cope with and recover from adverse climate events like drought (which increases food prices) and floods (which damage homes and property). That is, **there is a high correlation between how poor a community is and how vulnerable it is to the adverse impacts of climate change**. The solution to poverty is equitable growth (the 'right kind of growth' – Bowen, Cochrane and Fankhauser, 2012: 95), but climate change makes that goal much harder to achieve by directly exacerbating poverty *and* reducing development potential.

- A combination of the poverty-development-climate linkages outlined above, the likely ever-increasing frequency of adverse climate events and the growing adaptation burden will eventually result in 'significant adaptation limits' (Birkmann et al., 2022) in countries with high levels of vulnerability (poverty). That is, the repeated cycle of – climate shocks deepen poverty, greater poverty reduces the efficacy and success of implementation of adaptation strategies – may create a **climate tipping point**. Beyond that point the goal of broad-based climate adaptation will be close to impossible to achieve and even the most ambitious climate adaptation policies will have little impact on the adaptive capacity of economy and society. When that happens national development progress will almost certainly stall and there is a high possibility of deterioration in key development indicators as the country becomes trapped in a downward spiral of undevelopment. This outcome is most likely in places that are highly susceptible to climate change impacts, that have high baseline (starting) levels of poverty and inequitable access to resources likely to come under pressure (such as water and arable land) and which do not have limitless resources.

- **South Africa is firmly located in this high-risk group,** given the non-linear relationship between climate change and poverty (the higher the level of poverty, the exponentially greater the impact of climate change, the more difficult any recovery and the longer that recovery will take). Less than perfect adaptation outcomes may have a marginal negative impact in places with low levels of poverty and inequality (since most people will have the resources to cope with minor shocks). But the impact of even small levels of imperfect adaptation can have significant impacts in places that already have very high (baseline) levels of poverty and inequality. South Africa is the most unequal country in the world and more than half of all households live below the upper-bound poverty line. A quarter of households are classified as extremely poor – living below the food poverty line. Current levels of economic growth are low (less than 2 per cent per annum) and many key natural resources (water, arable land) are limited.
- Most adaptation strategies acknowledge the multiple linkages between poverty and climate vulnerability, particularly the fact that poverty increases vulnerability to climate change. But few plans acknowledge the *twin temporal aspects of vulnerability*; that **successful adaptation requires reducing existing vulnerabilities and limiting the negative impact of future adverse climate events.**
- System resilience is not synonymous with individual vulnerability. Adaptation must proactively contribute to reducing existing vulnerability, in addition to increasing system resilience, to limit future increases in vulnerability.
- South Africa's adaptation strategies (NCCAS 2020 and the 2025 NDCs) focus almost exclusively on increasing system resilience. The result is that these policies only include one temporal aspect of vulnerability – the future impact of climate change. The failure to include strategies to reduce existing vulnerabilities greatly increases the risk that adaptation strategies will not be sufficient to prevent a long-term decline in the country's socioeconomic development potential.

5.2. Policy Implications

The critical adaptation policy challenge is to develop detailed strategies that will reduce existing vulnerabilities and limit the impact of future adverse climate events. In the South African context, reducing existing vulnerabilities in the key areas of food, water and energy[11] should be urgent policy priorities. This goal can be achieved by the following policy actions:

5.2.1. Meeting the Climate Change Act requirement that all of South Africa's climate policies operate under the overarching guidelines of a just transition

Johnson et al. (2020: 1) points out that '"greening" energy systems may not make them any fairer, inclusive or just'. In the same way, making systems more resilient to future climate events will probably not make any impact on existing vulnerabilities.

The first policy step required is thus the development of a detailed justice framework to be applied to the design and implementation of adaptation policies and plans. Both NCCAS 2020 and the country's adaptation NDCs require significant overhaul and amendment to reflect that justice framework.

From the perspective of this research paper – which is focused on how adaptation policies can prevent a significant deterioration in socioeconomic development outcomes – the key justice issue is distributive justice.[12] In this regard, adaptation policy can benefit considerably by adopting key conceptualisations of distributive justice applied to just energy transitions. In particular, the way in which distributive justice is understood to require identifying and reducing existing vulnerabilities and reducing the future likelihood of increasing those vulnerabilities. This approach further focuses attention on how vulnerabilities are produced by systems and encourages policymakers to think about how different rules of operation within systems can reduce vulnerability and inequality.

5.2.2. Approaching climate adaptation as a series of system transitions

Most adaptation strategies are fundamentally conceptualised as adjustments to existing systems; changes to makes systems more resilient to expected future climate events but not to fundamentally change the aims or operation of those systems.

In contrast, energy transitions are envisioned as *transitions* – as a shift from one kind of system to another. We believe that the concept of system transition (rather than system adjustment) is the critical factor in focusing policy attention on existing vulnerabilities that need to be addressed, and that adaptation policy would benefit considerably from moving to an explicit system transition approach.

This, however, is not the standard way in which adaptation is conceptualised. Instead, there is a strongly-held view that adaptation is about avoiding significant system change – focusing on 'what is to be preserved… rather than what is to be transformed' (Pelling, 2010: 1). South Africa's own NCCAS 2020 makes that quite clear by defining the goal of system resilience as preservation of what currently exists. This insistence on system preservation acts as a very effective deterrent to reducing existing vulnerabilities, since achieving this goal requires a system redesign to change the system 'rules' that determine access to resources and benefits. Cannon and Müller-Mahn (2010) are clear that adaptation strategies that preserve business as usual are in fact 'non-adaptation'.

11 Affordable access to energy supports a reduction in key vulnerabilities through mechanisms such as access to colling, food storage, cooking and the diversification of livelihoods.

12 While acknowledging the importance of other categories of justice, and particularly procedural justice given its critical role in accurate problem diagnosis – the accurate identification of the drivers of existing vulnerabilities.

5.2.3. Shifting from an incremental adaptation approach to a transformative adaptation approach

The most common adaptation strategies can be described as **incremental adaptation** (Eriksen et al 2021), where solutions are centred on technological and managerial fixes that are designed to respond to a particular event (anticipation of more severe droughts) or have a preventative effect (preserve water resources by more efficient irrigation systems) in a particular sector (in this case, agriculture).

The common approach to adaptation is thus a defensive one (Pelling, 2010), where the main focus is (7future technological fixes and preserving the existing economic structure as much as possible, rather than addressing the systemic (non-climate) causes of today's poverty that make communities particularly vulnerable to climate change. This seldom reflects a conscious decision to ignore poverty, or an ignorance of the fact that poverty and climate vulnerability are linked. Instead, it generally reflects a flawed and incomplete understanding of the complex and multiple factors that create and preserve poverty.

The notion of **transformative adaptation** represents a significant break from the standard approach of incremental adaptation, where transformation is intended 'to describe responses that produce non-linear changes in systems or their host social and ecological environments' (Pelling, O'Brien and Matyas, 2015). That is, transformative adaptation is the opposite of business as usual and implies that the policy goal is not to preserve the fundamental structure and operation of systems (as NCCAS 2020 proposes) but rather to reimagine these systems so that they contribute directly to reducing existing vulnerability.

Kates, Travis and Wilbank (2012) specify two conditions which mean that transformational adaptation is required: large vulnerability and the risk of severe climate change. Both conditions apply to South Africa and if we do not take the transformational road, the risk of adaptation failure is high. They further describe '**anticipatory transformational adaptation**' (p 7157) as a strategy that takes action *before* negative climate impacts manifest. This is exactly the kind of approach that South Africa requires to be reflected across all adaptation policies and actions.

In summary, we need to fundamentally rethink our definition of climate adaptation to incorporate a comprehensive approach towards reducing vulnerability that goes beyond narrow climate boundaries. This requires that we shift from an incremental adaptation approach to a transformational adaptation approach, where the aim is to reduce vulnerability by fundamentally transforming key systems such as water, energy and food.

> ***Transformational adaptation can only be achieved through an all-of-the-state approach to designing and implementing policy, given the multiple and complex linkages between economy and climate vulnerability that characterize sectors such as food and water. These linkages generally exceed the mandates of individual national line departments, which is one reason why they are not clearly recognised.***

WHY SHOULD ADAPTATION POLICY ASSUME RESPONSIBILITY FOR WHAT ARE ESSENTIALLY 'DEVELOPMENT' PROBLEMS?

Successful adaptation is adaptation that addresses 'structural vulnerability to climate change, which means the root causes of vulnerability' (Birkmann et al., 2022: 1188). That is, success in climate adaptation is unlikely to be achieved without the full integration of focused programmes to reduce poverty, vulnerability and inequality *as an integral part of the climate adaptation response.*

However, we may anticipate some opposition to our proposal that adaptation strategies should focus on reducing key vulnerabilities such as food insecurity or the affordability of water, on the basis that these are not strictly speaking 'adaptation' issues, but rather broader development challenges, to be addressed under other mandates. To this argument we offer the following defence:

a. Firstly, we are not suggesting that adaptation strategies assume the responsibility for the entire national development agenda, or even for reducing poverty in general. But we are proposing that, since adaptation policy should be conceptualised as fundamentally being about redesigning systems – food, water, energy, housing – to *reduce* vulnerability to climate change. And given that a significant portion of the drivers of individual vulnerability arise from the normal operations of these systems,[13] that concurrently with redesigning systems to increase future resilience, we redesign them to reduce existing vulnerability. This combined approach is likely to be the most efficient and effective strategy to achieve success in meeting climate adaptation objectives.

b. Much of the recent literature advocates for a better integration of development and adaptation strategies, acknowledging the linkages between the two. However, the general approach is to advocate for the inclusion of adaptation considerations into development strategies; that development plans should consider adaptation issues by 'mainstreaming' adaptation into development. We are advocating for the explicit inclusion of 'development' issues (such as food insecurity) into adaptation plans – the **mainstreaming of development** into adaptation. The difference between the two approaches is significant for policy making: the second approach requires that policymakers explicitly consider how critical development (vulnerability) issues are impacted by current system design and how changes to system operation to reduce vulnerability can be addressed simultaneously with changes to increase system resilience.

c. Adaptation strategies that explicitly include interventions that will directly address key development priorities (such as affordable access to food, basic services and housing) are also necessary to ensure that the coping strategies of poor households trying to maintain their livelihoods are not in direct conflict with the goals of national adaptation strategies (a risk highlighted by O'Brien et al., 2008).

d. There is a strong resource efficiency/value for money argument to be made for adopting this approach: integrating system redesign to facilitate reduced vulnerability into system redesign to facilitate increased resilience reduces the risk of unintended consequences that will not only undermine adaptation efforts, but invariably require additional resources to rectify.

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13 Identifying the ways in which system rules and governance structure create and entrench vulnerabilities is an empirical question, to be determined by detailed analysis of individual systems.

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