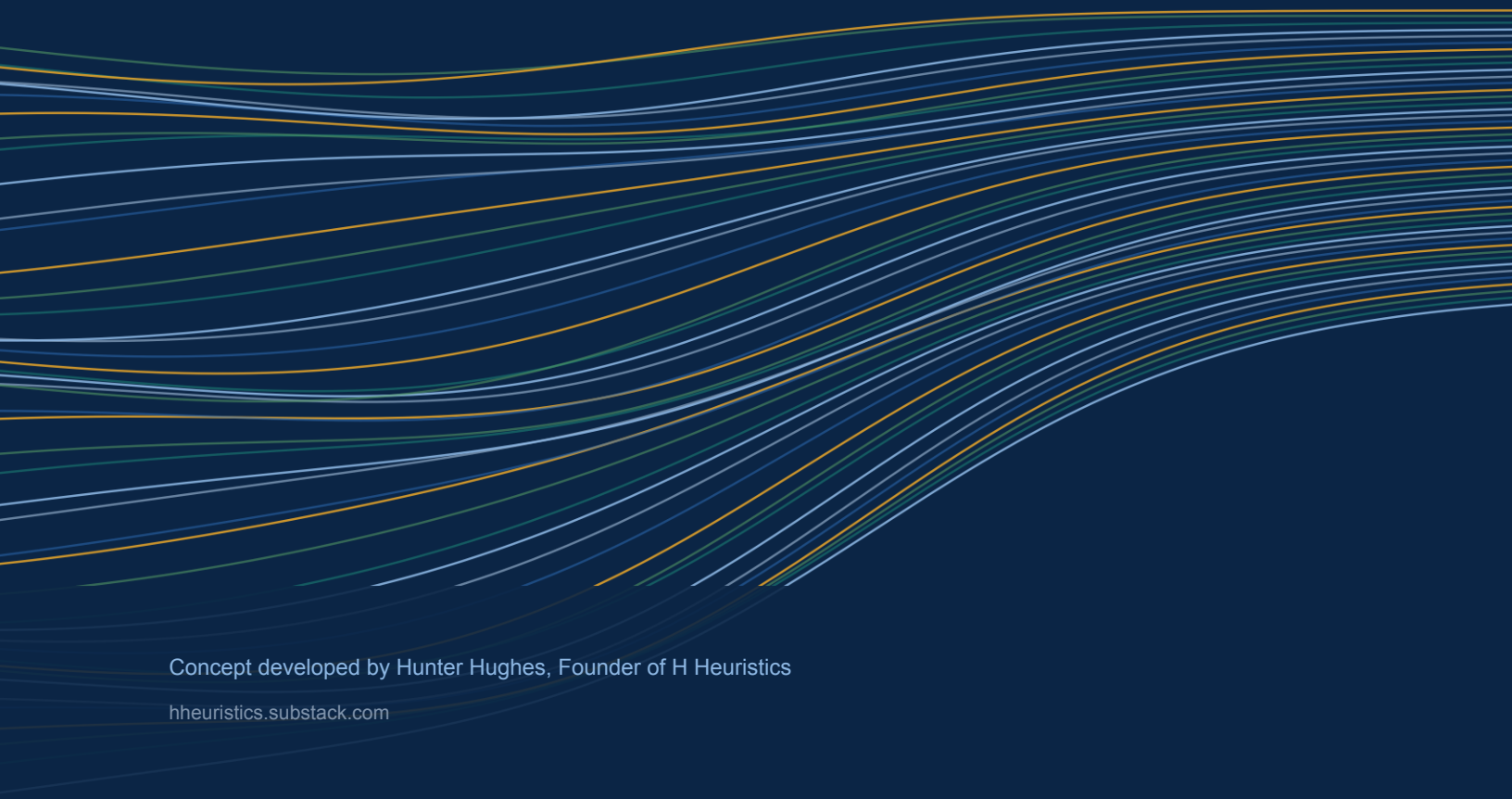
H HEURISTICS

RESEARCH REPORT · NOVEMBER 2026

The Development Economics of Polycrisis Resilience

Economic Development, Global Convergence, and the Reduction of Systemic Human Vulnerability



Concept developed by Hunter Hughes, Founder of H Heuristics

hheuristics.substack.com

ABOUT THIS REPORT

Purpose and scope

This report sets out a research framework for a question that sits at the junction of development economics and global risk analysis: **can economic development be deliberately accelerated and directed so that it reduces humanity's exposure to interconnected systemic crises?**

It was prepared by H Heuristics to organise a multi-year research programme. It synthesises evidence from the development, climate-economics, public-health and risk literatures; proposes an analytical structure (six economic pathways, a development–resilience feedback loop and a convergence agenda); identifies priority geographies; and specifies the empirical work needed to test the central hypotheses.

The concept of treating development as a resilience mechanism against the global polycrisis was developed by **Hunter Hughes, Founder of H Heuristics**.

HOW TO READ THIS REPORT

Chapters 1–4 set out the problem, the conceptual framework, the convergence thesis and the development–resilience feedback loop.

Chapter 5 examines the six economic pathways in turn; **Chapter 6** looks at how they interact and how to sequence them.

Chapters 7–9 cover geographic priorities, financing and the principal risks and counter-arguments.

Chapters 10–12 specify the research programme, draw out strategic implications and conclude.

A note on evidence

Quantitative figures are drawn from the sources cited in each exhibit and in the reference list, and are rounded. Data vintages differ across sources (most are 2022–2025), and several international datasets were being revised when this report was written, most notably the World Bank's poverty estimates after the 2025 switch to 2021 purchasing-power parities. Figures should be refreshed from the primary sources before being cited in other work.

Several exhibits are **conceptual or illustrative** rather than empirical, and are labelled as such: the convergence arithmetic in Chapter 3 is a stylised calculation, and the pathway-interaction matrix in Chapter 6 is a structured expert-judgement device intended to guide research design. They are not estimates.

This document is a research framework and discussion paper. It is not investment, financial or policy advice.

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EXECUTIVE SUMMARY

Development as resilience infrastructure

The world is living through a **polycrisis**: climate and ecological stress, economic and financial instability, food and energy insecurity, health shocks and conflict are interacting in ways that amplify one another. Most analysis focuses on the hazards, or on the governance needed to manage them. This report asks instead: **who is harmed when shocks arrive, and why**?

The answer is overwhelmingly structural. The same storm, drought, pandemic or price spike kills and impoverishes far more people where incomes are low, infrastructure is thin, health systems are weak, institutions are fragile and technology has not arrived. These conditions also reinforce each other: poverty weakens the capacity to adapt, and unabsorbed shocks deepen poverty. **Economic development is, among other things, the process by which these structural vulnerabilities are removed.**

H Heuristics proposes that development economics be examined through the lens of long-term human resilience: how investment, global convergence, technology diffusion and institutional progress can reduce cumulative human suffering across the twenty-first century. The central research question is:

> **CENTRAL RESEARCH QUESTION**
> How can economic development be accelerated and directed to minimise human suffering and strengthen societal resilience throughout the twenty-first century?

Principal arguments

- **Vulnerability is largely a development outcome.** Disaster mortality, hunger and the economic cost of shocks fall steeply with income, infrastructure, education and institutional quality.
- **Six complementary pathways carry the effect:** growth and poverty reduction; infrastructure and clean energy; technology diffusion; human capital and health; environmental and climate resilience; and institutional and financial capacity. Their effects interact strongly, so diagnosis and sequencing matter.
- **Global convergence is a resilience mechanism.** A world with far more people holding reliable energy, health care, skills, digital access and capable institutions can absorb shocks that would overwhelm today's. The gaps remain large: 655 million people lack electricity and about 2.1 billion lack clean cooking.
- **Development and resilience form a feedback loop.** Capabilities reduce vulnerability, lower vulnerability reduces suffering, and a healthier, more secure population can develop further. The loop runs in reverse as a trap when shocks erode the gains.
- **The direction of development matters as much as its speed.** Growth that raises pollution, ecological degradation or climate exposure creates new vulnerabilities. Sustainable convergence, built on clean energy, resilient infrastructure and inclusive institutions, is the objective.
- **Finance is the limiting factor in the places where returns to resilience are highest.** International public adaptation finance (about US$26 billion in 2023) is a small fraction of estimated needs.

CHAPTER 1

The polycrisis and the development question

1.1 From perfect storm to polycrisis

The word *polycrisis* was used by the French thinkers Edgar Morin and Anne Brigitte Kern in 1999 to describe the entanglement of planetary-scale problems, was revived in European policy debate by Jean-Claude Juncker in 2016, and entered wide use after the historian Adam Tooze popularised it in 2022 to describe the simultaneous energy, inflation, pandemic, war and climate shocks of that period (Tooze, 2022). Researchers at the Cascade Institute have since sought to give it analytical content. In their formulation, a **global polycrisis** occurs when crises in multiple global systems become causally entangled in ways that significantly degrade humanity's prospects (Lawrence, Janzwood and Homer-Dixon, 2022; Lawrence et al., 2024).

The distinction from a simple list of risks is important. A polycrisis is defined by *causal interaction*: a drought raises food prices, which strains public finances and fuels unrest; a pandemic disrupts supply chains and widens fiscal deficits, constraining the response to the next shock. The World Economic Forum's *Global Risks Report 2026*, based on a survey of more than 1,300 leaders, ranks geoeconomic confrontation first among near-term risks, followed by interstate conflict, extreme weather, societal polarisation and misinformation, and finds that environmental risks account for five of the top ten long-term risks (WEF, 2026). Figure 1 sketches the structure. Scientists meanwhile report that humanity has transgressed six of the nine planetary boundaries that define a safe operating space for the Earth system (Richardson et al., 2023).

1.2 Why development economics belongs at the centre

The polycrisis literature has concentrated on two questions: what are the hazards and how do they interact, and what global governance can contain them? A third question has received less systematic attention: **where do the human consequences fall, and what determines their size?**

The evidence points to development status as a leading determinant. Cross-country studies find that richer countries, and those with better institutions, suffer fewer deaths from comparable natural hazards (Kahn, 2005). Educational attainment is associated with lower disaster fatalities, even after controlling for income (Striessnig, Lutz and Patt, 2013). The World Bank estimates that natural hazards push around 26 million people into poverty each year and cost the global economy hundreds of billions of dollars in consumption losses, with the poorest bearing a disproportionate share (Hallegatte et al., 2016). Roughly 1.8 billion people, 89 percent of them in low- and middle-income countries, are directly exposed to a once-in-a-hundred-years flood (Rentschler, Salhab and Jafino, 2022). The Intergovernmental Panel on Climate Change estimates that between 3.3 and 3.6 billion people live in contexts that are highly vulnerable to climate change (IPCC, 2022).

These regularities imply that the polycrisis is not a single exogenous threat to which the world responds uniformly. It is a set of shocks transmitted through a highly *unequal* landscape of capacity. Changing that landscape is the domain of development economics.

Figure 1. A stylised polycrisis: causal entanglement across six systems, conditioned by adaptive capacity



Conceptual diagram. Arrows indicate illustrative channels of amplification (for example, climate stress to food insecurity, food insecurity to conflict). Low adaptive capacity at the centre increases the strength of every link.

THE CORE PROPOSITION

Economic development, when directed toward sustainable and inclusive outcomes, reduces the structural conditions that make populations vulnerable to interconnected global crises. It does so by weakening the feedback loops through which poverty, inadequate infrastructure, limited health care access, energy insecurity, environmental degradation, weak institutions and technological exclusion reinforce one another.

1.3 The development gap in numbers

Table 1 summarises indicators that recur throughout this report. They describe a world in which a large minority of humanity lacks the basic capabilities that make resilience possible, even as the technologies to provide them have never been cheaper.

Table 1. Selected indicators of the development and resilience gap

Indicator	Latest estimate	Source
People living on less than US$3 a day (2021 PPP)	On the order of 800 million	World Bank PIP, June 2025 update
People without electricity access (2024)	655 million; about 85% in sub-Saharan Africa	Tracking SDG7, 2025
People without clean cooking (2024)	About 2.1 billion; about half in sub-Saharan Africa	Tracking SDG7; IEA
People undernourished (2024)	About 670 million (roughly 8%)	FAO et al., SOFI 2025
Under-five deaths a year	About 4.8 million	UN IGME, 2024
Internet use, 2024	About 68% globally; about 35% in least developed countries	ITU
Children unable to read a simple text at age 10, low- and middle-income countries	About 70% (2022)	World Bank / UNESCO
People covered by at least one social protection benefit (2023)	About 52% globally; roughly 1 in 10 in low-income countries	ILO, 2024
People in countries spending more on interest than on health or education	Over 3 billion	UNCTAD, A World of Debt
International public adaptation finance to developing countries (2023)	US$26 billion, versus US$310–365 billion a year needed by 2035	UNEP, Adaptation Gap Report 2025

Source: As listed. Figures rounded; see the note on evidence on page 2. Refresh from primary sources before citation.

1.4 What this report does and does not claim

The claim is **not** that growth alone solves the polycrisis, nor that all development is resilience-enhancing. Development paths that lock in fossil-fuel dependence, concentrate gains, degrade ecosystems or move populations into harm's way can raise vulnerability. Nor is the claim that development substitutes for global mitigation: avoiding the worst climate outcomes requires rapid emissions reductions, and no amount of adaptive capacity can fully offset unmitigated change.

The claim is a conditional and testable one: **that the marginal resilience return to well-directed development investment is very high where capacity is lowest**, that this return is currently under-recognised in both development and risk-management practice, and that a research programme organised around it can identify the highest-value interventions, sequences and financing structures.

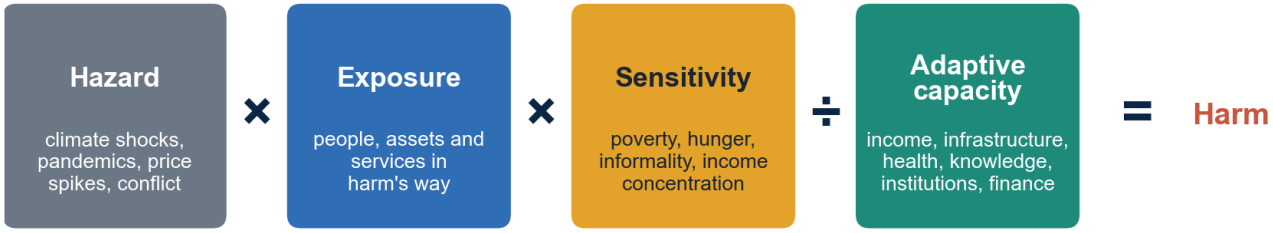
CHAPTER 2

A conceptual framework: vulnerability as a function of development

2.1 Hazard, exposure, sensitivity and adaptive capacity

The disaster-risk and climate-adaptation literatures decompose risk into the interaction of a *hazard* (a drought, a pandemic, a price spike), *exposure* (the people and assets in its path), and *vulnerability*, which is itself composed of *sensitivity* (how badly a given unit is harmed by a given shock) and *adaptive capacity* (the ability to anticipate, absorb and recover). Figure 2 presents this structure in a stylised multiplicative form.

Figure 2. A stylised decomposition of systemic harm



Development acts mainly on the denominator and on sensitivity, and can also reduce exposure through better siting, infrastructure and diversification.

Conceptual. The multiplicative form is a heuristic for organising evidence, not an estimated model.

Economic development operates on the framework in three ways. First, and most important, it raises **adaptive capacity**: income and savings that buffer losses, infrastructure that keeps services running, health systems that treat casualties, knowledge and technology that enable adjustment, and institutions that coordinate and finance responses. Second, it lowers **sensitivity**: reducing dependence on rain-fed agriculture, shortening the distance between households and destitution, and addressing malnutrition and ill health that make shocks lethal. Third, development can reduce **exposure** through safer housing, better land-use planning and diversification away from hazard-prone livelihoods, although rapid urbanisation can also *raise* exposure when it concentrates people and assets in flood plains and coasts. Development does not control the hazard in the short run, although its energy pathway affects the hazard in the long run.

2.2 Five channels from development to resilience

Table 2. How development reduces vulnerability: channels and examples

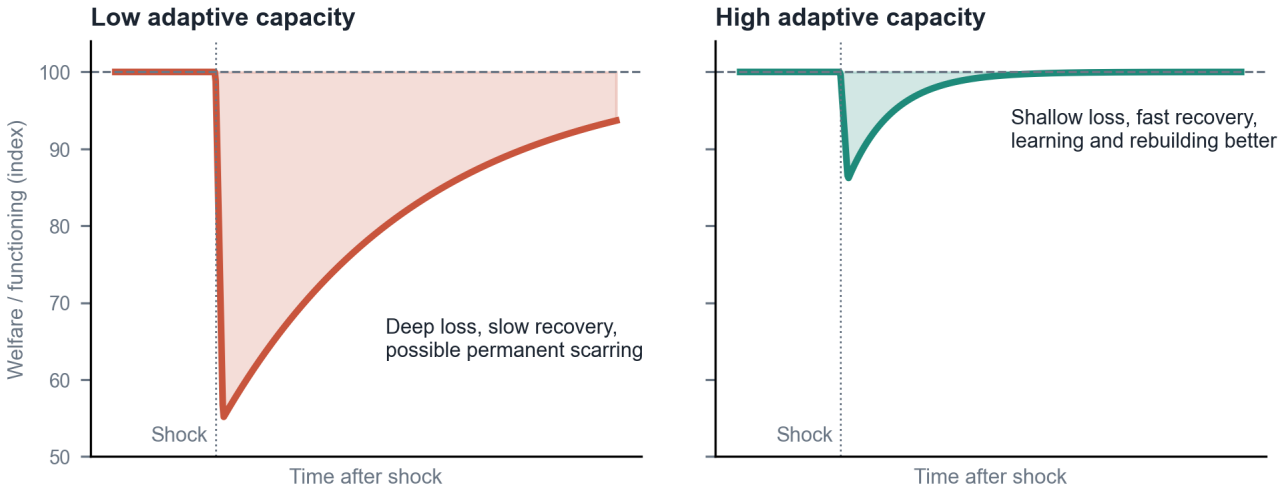
Channel	Mechanism	Illustration
Buffering	Higher income, savings, assets and insurance absorb losses without forcing distress sales or withdrawal of children from school	Households with financial accounts recover faster from income shocks
Protection	Infrastructure and services physically protect people and keep critical systems running	Cyclone shelters and embankments; reliable grid power to clinics
Anticipation	Information, forecasting and communication give people time to act	Early-warning systems; mobile alerts; satellite-based crop monitoring
Recovery	Public finance, social protection and credit speed the return to normal	Cash transfers triggered by drought; reconstruction financing
Learning and transformation	Education, research and institutions enable structural change rather than return to the status quo	Shifts to drought-tolerant crops; relocation; new industries

Source: H Heuristics synthesis, drawing on the disaster-risk and adaptation literatures.

2.3 Resilience as a trajectory, not a state

Resilience is not a binary property. It is best understood by what happens to wellbeing after a shock: how far it falls, how long it takes to recover, and whether it recovers to the original level, to a higher one, or to a permanently lower one (Béné et al., 2012). Figure 3 contrasts two stylised trajectories. Where adaptive capacity is low, the loss is deeper and recovery slower, and the shock can leave permanent scars: children withdrawn from school, productive assets sold, health damaged in early life. Where capacity is high, the loss is shallower and recovery faster, and the system may even emerge stronger.

Figure 3. Shock response under low and high adaptive capacity



Conceptual illustration; curves are stylised and not drawn from data.

2.4 Poverty, shocks and the vulnerability trap

The most damaging feature of low development is that it is **self-reinforcing**. Poor households, firms and governments are more exposed to shocks, less able to recover, and left with fewer resources to invest in future protection. Several literatures support this logic, although with important nuances.

- **Poverty traps.** Theories of poverty traps hold that low-asset households and economies can be stuck at a low-level equilibrium because of threshold effects in nutrition, assets or investment (Sachs, 2005; Barrett and Carter, 2013). Empirical evidence for *universal* traps is mixed (Kraay and McKenzie, 2014), but there is strong evidence of *localised* and *shock-induced* traps, for instance where a drought forces the sale of productive livestock.
- **Climate and growth.** Temperature shocks reduce economic growth in poor countries, but not in rich ones: Dell, Jones and Olken (2012) estimate that a 1°C rise in temperature in a given year reduced growth in poor countries by roughly 1.3 percentage points. Later work finds a non-linear relationship between temperature and economic output (Burke, Hsiang and Miguel, 2015), with the damage concentrated in hot, poorer regions.
- **Scarring.** Early-life shocks, including malnutrition and disease, have lasting effects on adult productivity, so a single crisis can reduce the capacity of an entire cohort.
- **Fiscal fragility.** Governments facing high debt service must often cut investment in health, protection and infrastructure after a shock, which raises vulnerability to the next.

IMPLICATION

If vulnerability is partly a stock of accumulated deficits, then development investment has a double dividend: it improves present living standards and it lowers the expected future cost of every shock. Conventional cost-benefit analysis, which discounts and treats shocks as exogenous, tends to **understate** the return to capacity-building in the most vulnerable places.

CHAPTER 3

Global convergence as a resilience mechanism

One of the most important components of this research programme is the relationship between global economic convergence and polycrisis resilience. The persistence of substantial differences in income, infrastructure, technological access, health care and institutional capacity creates an uneven distribution of vulnerability. The development of emerging economies can progressively reduce these disparities.

3.1 The convergence evidence

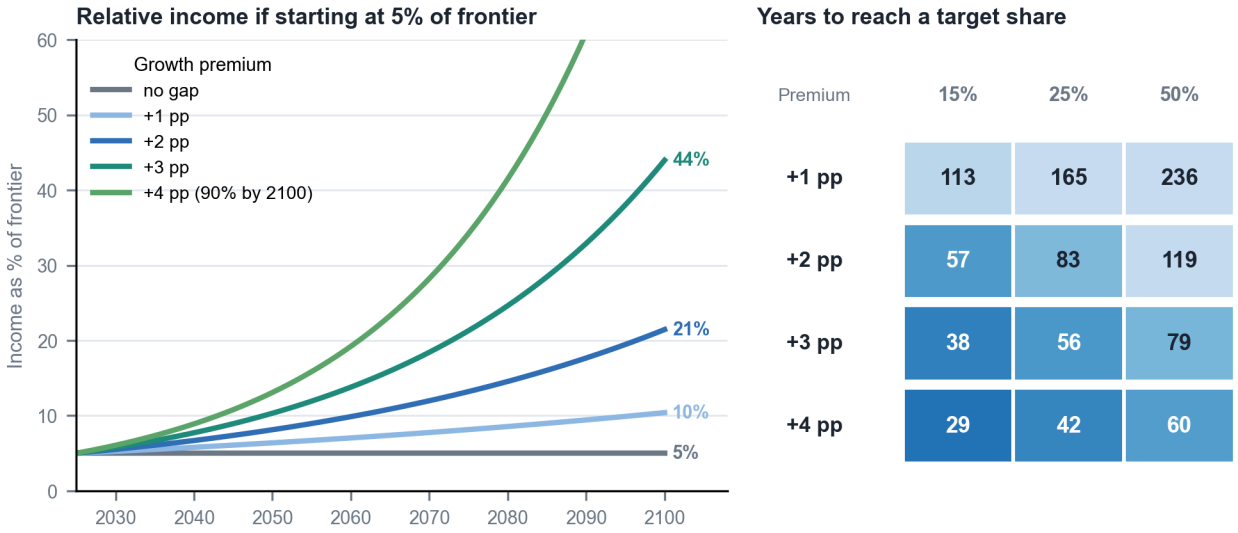
Convergence has a contested history. Through much of the twentieth century, poor countries as a group fell further behind rich ones, a pattern Pritchett (1997) called "divergence, big time". The conditional version of the hypothesis, that countries converge to their own steady states at around two percent a year once policies, institutions and human capital are held constant, has long had empirical support (Barro and Sala-i-Martin, 1992). Rodrik (2013) found that manufacturing labour productivity converged unconditionally across countries, even when aggregate income did not.

Since the mid-1990s the picture has changed. Kremer, Willis and You (2022) document that the long divergence gave way to convergence, associated with improvements in policies and a reduction in the incidence of the worst policy failures. Patel, Sandefur and Subramanian (2021) find evidence of unconditional convergence in income per capita since about 1990. The record is far from uniform: many of the fastest-growing economies are in Asia, whereas much of sub-Saharan Africa has converged more slowly or inconsistently, and conflict-affected states have often diverged. Premature deindustrialisation, in which countries lose manufacturing employment at lower income levels than earlier developers, threatens a traditional route to convergence (Rodrik, 2016).

3.2 How long would convergence take?

The arithmetic of convergence is sobering. Figure 4 illustrates, for a stylised economy starting at five percent of frontier income and growing faster than the frontier by a given premium, the share of frontier income reached by 2100 and the number of years needed to reach target levels. A growth premium of one percentage point a year, the order of magnitude suggested by recent unconditional-convergence estimates, delivers only about ten percent of frontier income by 2100. A sustained premium of three to four points, which the fastest developers (including South Korea, China and Vietnam) have achieved for decades, brings a country to a level of 40 to 90 percent of frontier income over the same period.

Figure 4. Convergence arithmetic: income relative to the frontier and years to target (stylised)



Illustrative calculation, not a forecast. Frontier growth is assumed at 2 percent a year; the economy starts at 5 percent of frontier income (a rough order of magnitude for the lowest-income countries at purchasing-power parity). Years to reach a target share t are ln(t/5) divided by ln((1.02+p)/1.02), where p is the growth premium.

The policy implication is that the **growth premium is the key variable**, and that small differences in sustained premium translate into large differences in the number of people who experience adequate resilience over the course of the century. An economy that sustains a premium of four points reaches 25 percent of frontier income in about 40 years; at one point, it would take well over a century.

3.3 Convergence in what? Six dimensions of resilience-relevant convergence

Income is an imperfect proxy for resilience. The research programme should track convergence across the dimensions that most directly shape the capacity to withstand systemic shocks. The following are proposed as the core convergence indicators.

Table 3. Proposed convergence dimensions

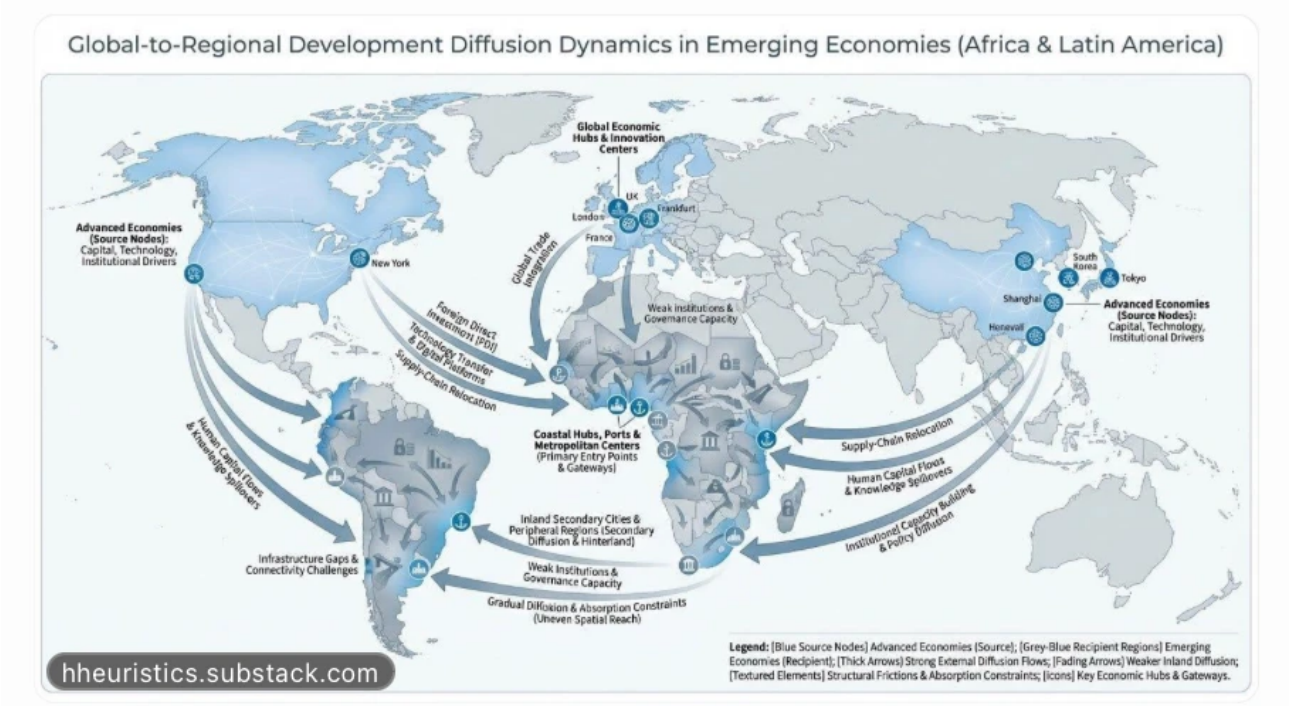
Dimension	Representative indicators	Why it matters for resilience
Income	GDP per capita (PPP); share below poverty lines; median income; asset ownership	Buffer against shocks; demand for and capacity to finance protection
Electricity and clean cooking	Access rates; reliability (hours of supply); per-capita consumption of modern energy; clean-cooking share	Powers clinics, pumps, communications and enterprises; removes the largest source of household air pollution
Health and education	Under-five and maternal mortality; life expectancy; stunting; learning outcomes; completion rates	Health systems absorb pandemics; educated populations adapt and migrate more effectively
Technology and digital infrastructure	Mobile broadband coverage and use; digital payments; digital ID; agricultural technology adoption	Enables early warning, financial inclusion, remote services and knowledge flow
Industrial and productive capacity	Manufacturing and service productivity; export diversification; infrastructure stock	Diversification reduces dependence on single commodities and hazards
Climate adaptation and institutional capacity	Adaptation investment; state-capacity measures; social-protection coverage; tax-to-GDP ratio; disaster-loss outcomes	The most direct determinants of the response to any shock

Source: H Heuristics.

3.4 Diffusion dynamics and absorption constraints

Convergence does not happen automatically. It depends on flows of capital, technology, ideas and people from advanced economies and increasingly from large emerging ones, and on the capacity of recipient economies to absorb them. Figure 5 maps this diffusion architecture for emerging economies in Africa and Latin America. Flows concentrate on coastal hubs, ports and metropolitan centres, with weaker diffusion into inland regions and secondary cities. Weak institutions and governance capacity act as a filter; infrastructure gaps and connectivity challenges produce what the figure labels gradual diffusion and absorption constraints.

Figure 5. Global-to-regional development diffusion dynamics in emerging economies (Africa and Latin America)



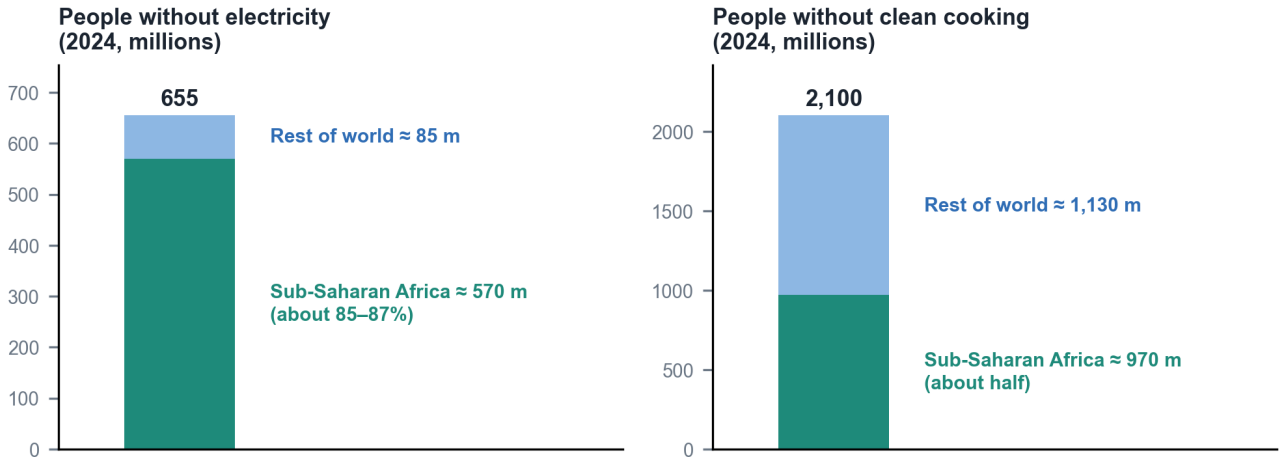
Conceptual diagram prepared by H Heuristics (hheuristics.substack.com). Strong arrows indicate strong external diffusion flows; fading arrows indicate weaker inland diffusion.

This matters for resilience because the people most exposed to systemic shocks are frequently those furthest from the hubs: smallholder farmers, peri-urban informal workers, and residents of inland and peripheral regions. Convergence measured at the national level can conceal persistent divergence within countries. The research programme should therefore examine *spatial* convergence (between coastal hubs and hinterlands), as well as convergence between countries.

3.5 Energy access: a convergence frontier with direct resilience payoffs

Energy access illustrates the scale of the remaining gap and the concentration of the opportunity. Some 655 million people lacked electricity in 2024, more than 80 percent of them in sub-Saharan Africa, and around 2.1 billion lacked access to clean cooking, roughly half in the same region (IEA et al., 2025). Costs have fallen dramatically: IRENA estimates that the cost of electricity from solar photovoltaics fell by about 90 percent between 2010 and 2023, and battery storage costs have fallen by a similar order of magnitude over the same period. Distributed solar, mini-grids and storage now allow households and clinics to leapfrog the centralised grid in many settings.

Figure 6. People without electricity and clean cooking, 2024



Source: IEA, IRENA, UNSD, World Bank and WHO (2025), Tracking SDG7: The Energy Progress Report; IEA. Regional shares are approximate.

3.6 Convergence must be sustainable

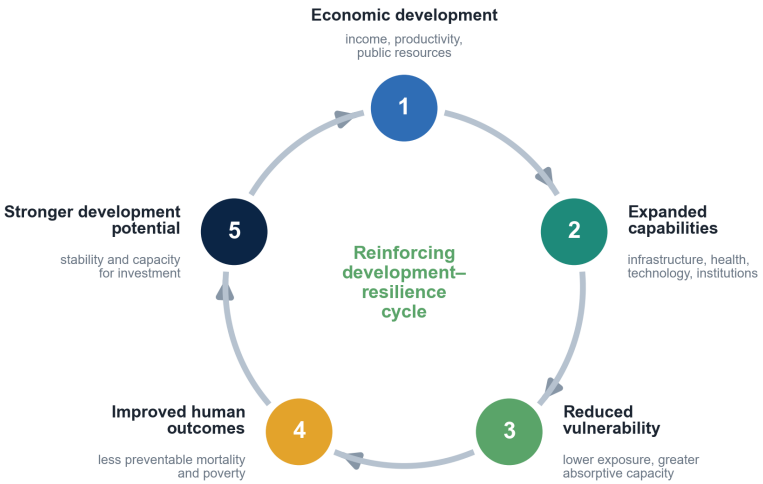
The underlying hypothesis is that a more economically and technologically capable global population has greater collective capacity to withstand systemic risks. Importantly, however, **convergence must be sustainable**: economic growth that increases pollution, ecological degradation or climate exposure can create new vulnerabilities. Emerging economies that follow a carbon-intensive path risk locking in stranded assets and raising global hazards; those that grow through unmanaged urban sprawl or groundwater depletion risk undermining their own foundations. The research programme should therefore treat convergence in *clean* energy, resilient infrastructure and ecological health as part of the objective, rather than as an afterthought. The empirical question is whether latecomers can capture the cost declines in clean technologies to converge on higher incomes with lower environmental burdens than earlier industrialisers; the early evidence from solar adoption in countries such as Pakistan is encouraging but incomplete.

CHAPTER 4

The development–resilience feedback loop

The framework should investigate how development and resilience reinforce one another. Figure 7 depicts the loop at its simplest: development expands capabilities; capabilities reduce vulnerability; lower vulnerability reduces preventable harm; and a population with better health, security and savings has greater capacity to develop further.

Figure 7. The development–resilience cycle



Conceptual. A potentially reinforcing development and resilience cycle.

4.1 The virtuous loop

Table 4. Stages of the loop and their evidence base

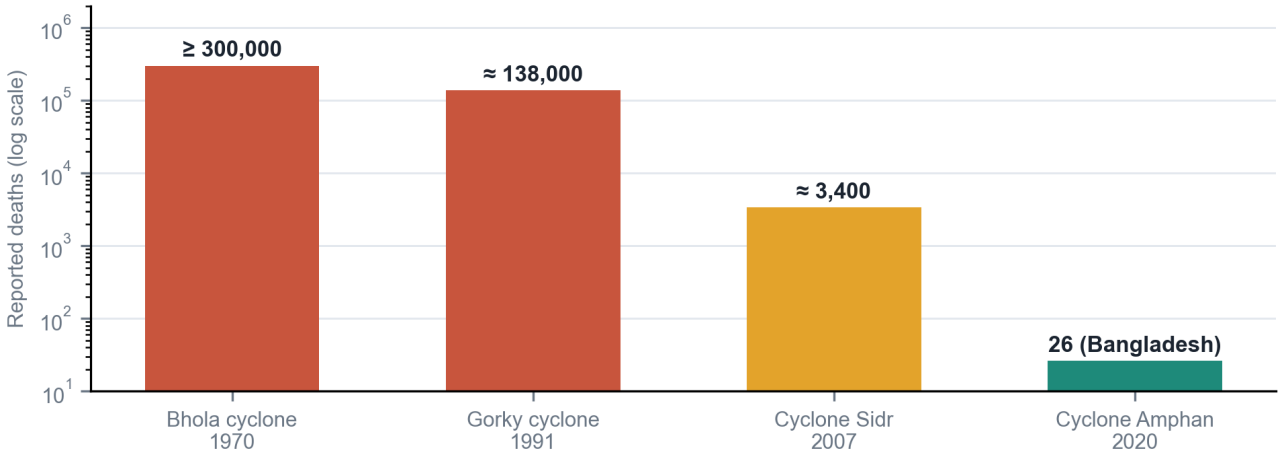
Stage	Mechanism	Illustrative evidence
1. Economic development	Higher productivity, incomes and public resources	Conditional and, since the 1990s, increasingly unconditional convergence (Kremer et al., 2022; Patel et al., 2021)
2. Expanded capabilities	Better infrastructure, health care, technology and institutions	Resilient infrastructure yields roughly US$4 of benefit per US$1 invested in low- and middle-income countries (Hallegatte, Rentschler and Rozenberg, 2019)
3. Reduced vulnerability	Lower exposure and greater capacity to absorb systemic shocks	Disaster death rates fall steeply with income and education (Kahn, 2005; Striessnig et al., 2013)
4. Improved human outcomes	Lower preventable mortality, poverty and human suffering	Global under-five mortality has fallen by more than half since 1990 (UN IGME)
5. Stronger development potential	Greater economic stability and capacity for future investment	Healthier, better-educated cohorts have higher lifetime productivity; stable economies attract investment

Source: As listed.

4.2 Case in point: Bangladesh and cyclone mortality

Bangladesh offers one of the clearest examples of a loop turning in a favourable direction. The 1970 Bhola cyclone killed at least 300,000 people, and the 1991 cyclone about 138,000. By the time Cyclone Sidr struck in 2007, deaths had fallen to roughly 3,400, and Cyclone Amphan in 2020 killed 26 people in Bangladesh. The improvement reflects a combination of rising incomes and mobile communications, an extensive network of community cyclone preparedness volunteers, early-warning systems, purpose-built cyclone shelters and embankments, and a strengthened disaster-management institution, much of it financed on a very modest budget by international standards.

Figure 8. Reported deaths in major Bangladesh cyclones



Source: Compiled from widely cited reported death tolls; estimates for 1970 vary (about 300,000 to 500,000). Cyclone intensity, landfall and tracks differ between events, so the comparison is indicative.

Several lessons are relevant to the research programme. The key investments were not especially expensive and were not all *growth* per se; they were targeted capability investments that growth and international finance made affordable. Institutional continuity and community-level organisation mattered as much as hardware. And the gains remain vulnerable: rising sea levels, salinity and population density along the coast mean the loop must continue to turn merely to hold risk constant.

4.3 The vicious loop

The same structure runs in reverse. Shocks erode household assets, damage infrastructure, interrupt schooling and treatment, strain public budgets and, in the worst cases, drive conflict and displacement. The pandemic illustrates the dynamic at global scale: the World Bank estimated that COVID-19 pushed roughly 70 million additional people into extreme poverty in 2020 (World Bank, 2022), and the combination of pandemic, war-driven food and energy price rises and tightening financial conditions in 2022 compounded the damage in lower-income countries. Rising debt-service costs have since forced many governments to reduce spending on health, education and protection just as needs increased.

Table 5. Reinforcing loops: favourable and adverse

Loop	Favourable direction	Adverse direction
Income–health	Higher income funds health care; healthier workers earn more	Illness depletes savings; poor health lowers earnings
Energy–productivity	Reliable power raises productivity and incomes, financing more infrastructure	Unreliable power suppresses enterprise; poverty limits investment in supply
Fiscal–protection	Larger tax base finances protection and resilience, reducing future losses	Shock-induced deficits and debt service crowd out protective investment
Education–adaptation	Educated populations adapt, innovate and demand better governance	Shock-induced school dropout reduces future adaptive capacity
Ecosystems–livelihoods	Healthy ecosystems sustain agricultural and fishing incomes	Degradation forces poverty-driven over-exploitation

Source: H Heuristics synthesis.

RESEARCH IMPLICATION

The loop framing suggests looking for **tipping points**: thresholds in income, energy access, schooling or fiscal capacity beyond which the favourable loops dominate and the adverse ones weaken. Identifying where those thresholds lie, and how to push countries across them, is a central empirical task for the programme.

CHAPTER 5

Six economic pathways to polycrisis resilience

This chapter examines each of the six pathways in turn. For each, it sets out the mechanisms through which the pathway reduces vulnerability, summarises evidence, identifies priority research questions and proposes indicators. The pathways are separable for analysis but not in practice; Chapter 6 considers how they interact.



PATHWAY 1

Economic growth and poverty reduction

Rising incomes, employment opportunities, productive capacity and household financial security reduce vulnerability to economic and environmental shocks.

Poverty is the single strongest correlate of vulnerability to almost every category of shock. A household living near the poverty line has little margin to absorb a crop failure, an illness or a price spike without cutting food intake, selling assets or withdrawing children from school. Growth that raises and stabilises incomes, especially among the poorest, directly increases buffering capacity, and an expanding economy also generates the fiscal resources and demand for public goods that fund the other pathways.

Mechanisms

- **Income and asset buffers:** higher incomes allow savings, insurance and investment in safer housing and diversified livelihoods.
- **Employment and livelihood diversification:** a shift from rain-fed farming to wage work and services reduces correlated exposure to climate shocks.
- **Fiscal base:** a larger formal economy raises tax revenue, enabling investment in protective infrastructure and social protection.

Evidence

- Growth has produced the largest reductions in extreme poverty in history, notably in China, Vietnam and India, and the global number of people in extreme poverty has fallen by more than a billion since 1990 on World Bank estimates. Progress has stalled in recent years, however, with extreme poverty increasingly concentrated in sub-Saharan Africa and in conflict-affected states.
- Shocks are themselves a major driver of poverty. Hallegatte et al. (2016) estimate that natural hazards push around 26 million people into poverty each year, and that the poorest lose a larger share of their wealth when hit. The World Bank estimates that COVID-19 added around 70 million people to extreme poverty in 2020.
- The poverty-reducing power of growth varies by sector and country. Agricultural growth tends to reduce poverty more than growth in other sectors in low-income settings, whereas capital-intensive or enclave growth, as in some resource economies, reduces it much less.

Priority research questions

- How much more poverty-reducing is growth when it is concentrated in labour-intensive sectors, and which sectors offer that route in a world of premature deindustrialisation?
- What is the elasticity of poverty to growth when shocks are frequent, and does it differ systematically for hazard-prone regions?

Candidate indicators: poverty headcount at multiple lines; vulnerability to poverty (probability of falling below the line); asset ownership; share of formal employment; income volatility.



PATHWAY 2

Infrastructure and clean energy development

Electricity access, clean cooking, transportation, water infrastructure and resilient energy systems improve living standards while addressing interconnected environmental risks.

Infrastructure is the physical substrate of resilience. Roads and rail keep food, medicine and people moving when shocks strike; water and sanitation systems prevent disease outbreaks; and electricity powers cold chains, clinics, pumps, telecommunications and enterprise. Energy is of special importance because it lies at the intersection of nearly every polycrisis channel: it determines household welfare, economic productivity, health (through household air pollution), and, through its carbon intensity, the future climate hazard.

Mechanisms

- **Service continuity:** reliable power and transport keep health, water and food systems operating during and after shocks.
- **Health:** clean cooking eliminates the largest source of household air pollution, a leading environmental cause of premature death; clean power and water reduce disease burden.
- **Decentralisation and redundancy:** distributed solar, storage and mini-grids add robustness that centralised systems with long, single-line dependencies lack.
- **Climate mitigation by design:** building new capacity on clean sources avoids lock-in of carbon-intensive assets.

Evidence

- The access gap remains large: 655 million people lacked electricity and 2.1 billion lacked clean cooking in 2024, concentrated in sub-Saharan Africa and, for cooking, also in South and Southeast Asia (IEA et al., 2025). The World Health Organization attributes more than three million premature deaths a year to household air pollution from polluting cooking fuels.
- The World Bank's *Lifelines* study estimates that infrastructure disruptions cost firms and households in low- and middle-income countries hundreds of billions of dollars a year, and that resilience investments return roughly US$4 of benefit for every US$1 spent (Hallegatte, Rentschler and Rozenberg, 2019).
- Initiatives such as Mission 300, led by the World Bank and African Development Bank to connect 300 million Africans to electricity by 2030, signal growing institutional commitment. Analyses by the IEA suggest that universal energy access by 2030 would cost on the order of US$40–45 billion a year, around one percent of global energy investment.

Priority research questions

- What is the resilience value (avoided losses, health benefits, enterprise effects) of an additional connection, by type of supply and context?
- How should resilience be priced into infrastructure design standards, and who should pay for the incremental cost?

Candidate indicators: electricity access and reliability (SAIDI/SAFI); clean-cooking share; per-capita modern energy consumption; infrastructure-disruption losses; share of low-carbon capacity.



PATHWAY 3

Technology diffusion and productivity

Wider access to existing technologies can accelerate development, improve agricultural productivity, expand health care access and increase adaptive capacity.

For most lower-income countries, the binding technological constraint is not invention but *adoption*. Cross-country differences in the speed of technology adoption explain a significant share of income differences (Comin and Hobijn, 2010). Technologies that already exist, including improved seeds, mobile phones, digital payments, solar panels, vaccines and weather forecasting, can raise productivity and strengthen resilience at low marginal cost if the complementary capabilities and infrastructure are in place.

Mechanisms

- **Productivity and incomes:** higher agricultural and enterprise productivity raises incomes and reduces the land and resources needed per unit of output.
- **Information and anticipation:** forecasting, early-warning systems and market information reduce losses from shocks.
- **Financial access:** digital payments and mobile money enable faster, cheaper transfers, remittances and insurance payouts.
- **Service delivery:** telemedicine, digital education and e-government extend reach into remote areas.

Evidence

- Suri and Jack (2016) found that access to the M-Pesa mobile-money system in Kenya lifted about two percent of households, some 194,000, out of poverty, with larger effects for women-headed households, partly by enabling risk-sharing through remittances.
- The diffusion of high-yielding crop varieties in the second half of the twentieth century raised GDP per capita, with the largest effects in countries that adopted earliest (Gollin, Hansen and Wingender, 2021).
- About 68 percent of the world was online in 2024, but only about 35 percent in the least developed countries (ITU). Mobile networks now cover most of the world's population, so the gap is increasingly one of affordability, devices, skills and relevant content, not signal.
- Artificial intelligence presents both an opportunity (for example, improved forecasting, diagnostics and tutoring) and a new diffusion gap, as the compute, data and skills required are heavily concentrated.

Priority research questions

- Which technologies have the highest resilience return per dollar for the poorest households, and what are the complementary investments required for adoption?

- How can digital public infrastructure (identity, payments, data exchange) be designed so that it is inclusive and also supports shock-responsive social protection?

Candidate indicators: mobile broadband use; digital payment penetration; digital ID coverage; agricultural technology adoption rates; early-warning coverage; AI-readiness indices.



PATHWAY 4

Human capital and public health

Investments in education, health care, nutrition and workforce development improve human capabilities and reduce vulnerability to cascading crises.

People are the most important form of resilience infrastructure. Healthy, educated and well-nourished populations earn more, adapt more readily, and are less likely to be killed or incapacitated by shocks. Conversely, health-system failure is one of the pathways through which an ordinary hazard becomes a catastrophe, as the COVID-19 pandemic made plain. Investment in human capital is also the main channel through which the benefits of development are transmitted across generations.

Mechanisms

- **Survival and health:** accessible primary care, immunisation, maternal and child health services and disease surveillance reduce preventable deaths and provide surge capacity.
- **Skills and adaptability:** education improves risk perception, technology adoption, labour mobility and the ability to respond to warnings.
- **Nutrition and early life:** adequate nutrition in the first thousand days prevents the stunting and cognitive deficits that reduce lifetime productivity.
- **Workforce:** a skilled health, engineering and administrative workforce is a prerequisite for implementing every other pathway.

Evidence

- Under-five mortality has fallen from about 93 deaths per 1,000 live births in 1990 to under 40 today, but remains around 70 in sub-Saharan Africa, against four or five in high-income countries (UN IGME). About 4.8 million children under five die each year, mostly from preventable causes.
- Educational attainment lowers disaster fatalities even after controlling for income (Striessnig, Lutz and Patt, 2013). Yet around 70 percent of ten-year-olds in low- and middle-income countries cannot read and understand a simple text, a figure that rose after COVID-19 school closures.
- Pandemic preparedness depends heavily on baseline health-system capacity. Countries with strong primary care and surveillance were better placed to contain outbreaks and maintain essential services.

Priority research questions

- What is the resilience return to health and education, including intergenerational effects, relative to other pathways, and how does it vary with baseline capacity?
- Which health-system investments (workforce, laboratories, supply chains, primary care) most reduce excess mortality in systemic shocks?

Candidate indicators: under-five and maternal mortality; stunting prevalence; learning outcomes; health workers per capita; immunisation coverage; excess mortality in shocks.



PATHWAY 5

Environmental and climate resilience

Development pathways that reduce pollution, improve resource efficiency and strengthen climate adaptation can prevent economic progress from generating additional environmental vulnerabilities.

Environmental systems provide the ecological services on which livelihoods depend, and the changing climate is a principal source of hazard. The aim of this pathway is two-fold: to ensure that development does not itself erode the environmental base, and to build capacity to adapt to the climate change that is already unavoidable. It is where the interests of the development and mitigation communities most clearly meet, and where they can most clearly conflict.

Mechanisms

- **Adaptation:** climate-resilient agriculture, irrigation, water management, coastal protection, resilient housing and urban planning reduce hazard-related losses.
- **Pollution control and resource efficiency:** cleaner energy and industrial processes reduce the health burden and the ecological footprint of growth.
- **Ecosystem services:** protection of watersheds, mangroves, soils and fisheries sustains productive livelihoods and natural buffers.
- **Risk finance:** insurance and contingent finance transfer risk and speed post-disaster liquidity.

Evidence

- The Global Commission on Adaptation estimated that investing US$1.8 trillion globally between 2020 and 2030 in five adaptation areas could generate US$7.1 trillion in net benefits, with benefit-cost ratios ranging from about 2:1 to 10:1 (GCA, 2019).
- UNEP estimates that developing countries will need US$310–365 billion a year for adaptation by 2035, while international public adaptation finance was about US$26 billion in 2023, a decline from the previous year (UNEP, 2025).
- The relationship between income and pollution is not automatic. The environmental Kuznets curve, in which pollution rises and then falls with income, holds for some local pollutants but not for carbon dioxide, and later developers may be able to leapfrog the most polluting stages. Whether they do depends on technology and policy choices.
- Climate impacts fall hardest on those least responsible: sub-Saharan Africa's per-capita carbon dioxide emissions are less than one tonne, against roughly five globally and about fourteen in the United States.

Priority research questions

- Which adaptation measures have the best benefit-cost ratios for the poorest populations, and how do those ratios compare with other development investments?
- Can low-income countries sustain high growth premiums on a low-carbon path, and what financing would that require?

Candidate indicators: adaptation spending per capita; disaster mortality and economic loss; ecosystem health indicators; air-quality exposure; share of agriculture under irrigation or climate-smart practices.



PATHWAY 6

Institutional and financial capacity

Stronger institutions, public finances, social protection and development finance enable societies to prevent, absorb and recover from systemic disruptions.

Institutions determine whether other capabilities are translated into resilience. Capable states can plan and enforce building codes, maintain early-warning systems, provide social protection, manage fiscal stress, and coordinate across jurisdictions in a crisis. Weak institutions turn the same hazard into a catastrophe, as illustrated by the contrast between countries with similar income levels but very different outcomes in earthquakes and floods (Kahn, 2005). Financial capacity, including domestic revenue, access to credit on reasonable terms, and international support, determines the ability to invest ahead of shocks and to respond after them.

Mechanisms

- **State capacity and revenue:** the ability to raise taxes and administer programmes underpins every public-good investment (Besley and Persson, 2013).
- **Social protection:** adaptive safety nets that scale up automatically after shocks protect assets and human capital.
- **Fiscal and debt space:** sustainable debt and access to contingent finance enable counter-cyclical responses.
- **Governance and trust:** transparent, accountable institutions improve compliance, reduce corruption in reconstruction and sustain social cohesion.

Evidence

- Tax revenue in low-income countries averages roughly 13 percent of GDP, against about 34 percent in OECD countries, limiting the fiscal capacity for resilience investment (OECD; World Bank).
- Only about half of the global population has any social protection coverage, and roughly one in ten in low-income countries (ILO, 2024). Ethiopia's Productive Safety Net Programme, which reaches millions of rural households with cash or food in exchange for public works and can scale up in droughts, is a widely studied example of shock-responsive protection.
- Debt service is crowding out development spending: UNCTAD estimates that over three billion people live in countries that spend more on interest payments than on either health or education.
- Remittances to low- and middle-income countries, estimated at roughly US$650 billion or more a year, are a major private channel of household risk-sharing, larger than official development assistance.

Priority research questions

- What institutional features, beyond income, best predict resilience outcomes in matched shocks, and which are amenable to reform?
- How should debt architecture, including contingent clauses and swaps, be reformed so that vulnerable states can invest in resilience without unsustainable burdens?

Candidate indicators: tax-to-GDP ratio; social-protection coverage and adequacy; debt-service-to-revenue ratio; government effectiveness indicators; disaster-risk-finance coverage.

CHAPTER 6

Interactions, complementarities and sequencing

The six pathways reinforce one another. Electricity powers clinics and schools; literate populations adopt technology faster; institutions determine whether infrastructure is built and maintained; and a growing economy finances all of them. Equally, a deficit in one pathway can bottleneck the others: a farmer with a smartphone but no market access, a clinic with a generator but no trained staff, or a power plant in a state that cannot collect revenue.

6.1 A map of complementarities

Figure 9 sets out a structured assessment of how strongly each pathway enables each other pathway. It is an **expert-judgement device** intended to focus the empirical work, not an estimate: the cell values reflect the strength of the mechanisms described in Chapter 5 and the breadth of supporting literature, and should be tested and revised through the research programme. Two features stand out. Institutions and finance, infrastructure and energy, and technology diffusion have the highest total enabling strength across the other pathways, which marks them as likely *keystone* investments. And the connection between climate resilience and growth or human capital is rated lower, reflecting indirect rather than direct channels, but in climate-exposed regions these relationships may be much stronger than shown.

Figure 9. Illustrative interaction matrix among the six pathways

Row pathway →	Growth & poverty	Infrastructure & energy	Technology diffusion	Human capital & health	Environment & climate	Institutions & finance
Growth & poverty	—	Medium	Medium	High	Low	High
Infrastructure & energy	Medium	—	High	Medium	High	Medium
Technology diffusion	Medium	High	—	High	Medium	Medium
Human capital & health	High	Medium	High	—	Low	Medium
Environment & climate	Low	High	Medium	Low	—	High
Institutions & finance	High	Medium	Medium	Medium	High	—

Row pathway → strength of enabling effect on column pathway

Expert-judgement scoring by H Heuristics for research design; not an empirical estimate. Reads from row to column.

6.2 Complementarity, big pushes and bottlenecks

The economics literature offers two complementary perspectives. The **big push** tradition (Rosenstein-Rodan, 1943; Murphy, Shleifer and Vishny, 1989) argues that investments with strong complementarities can be individually unprofitable but jointly transformative, so coordinated investment across sectors can move an economy from a low to a high equilibrium. The **growth-diagnostics** tradition (Hausmann, Rodrik and Velasco, 2005) argues that, in practice, a few binding constraints limit growth in each country at each time, and that scarce resources should go to relaxing the most binding one.

Resilience requires both. Where several pathways are weak at the same time and strongly complementary, a coordinated package may be needed; where one constraint clearly dominates, such as a lack of reliable electricity or an unsustainable debt overhang, targeted action will have the highest return. A resilience-oriented diagnostic should therefore ask, for each country or region: which capacity deficit is most binding for the shocks it most faces, and which complementarities would be unlocked by relaxing it?

6.3 Sequencing principles

- **No-regret first.** Begin with investments that are valuable under all plausible hazard scenarios, such as basic health services, primary education, reliable power for essential services, and early-warning systems.
- **Build keystones early.** Prioritise state capacity, revenue mobilisation and core infrastructure, since they enable and sustain the other pathways.
- **Protect the gains.** Pair growth-enhancing investments with social protection and insurance so that shocks do not undo them.
- **Avoid lock-in.** Where long-lived assets are being built, choose designs that are low-carbon and climate-robust from the outset, since retrofitting is costly.
- **Match to context.** The bottleneck differs across precarious, emerging and advantaged settings, as Table 6 suggests.

Table 6. Illustrative priorities by country type

Country type	Typical binding constraints	Priority emphasis
Precarious (low income, fragile or very unequal)	Extreme poverty; energy and health deficits; weak revenue; conflict and displacement risk; high debt-service burden	Basic services and safety nets; off-grid and mini-grid energy; health and nutrition; revenue and public-financial management; concessional finance
Emerging (rising and established middle-income)	Productivity growth; informality; urban exposure; carbon-intensive growth; middle-income-trap risks	Resilient urban and transport infrastructure; clean-power scale-up; skills and technology adoption; domestic finance and insurance markets
Advantaged with frailties	Ageing; inequality; legacy infrastructure; fiscal pressure; exposure of concentrated assets	Infrastructure renewal; adaptation of existing stock; support for vulnerable groups; contributions to global public goods

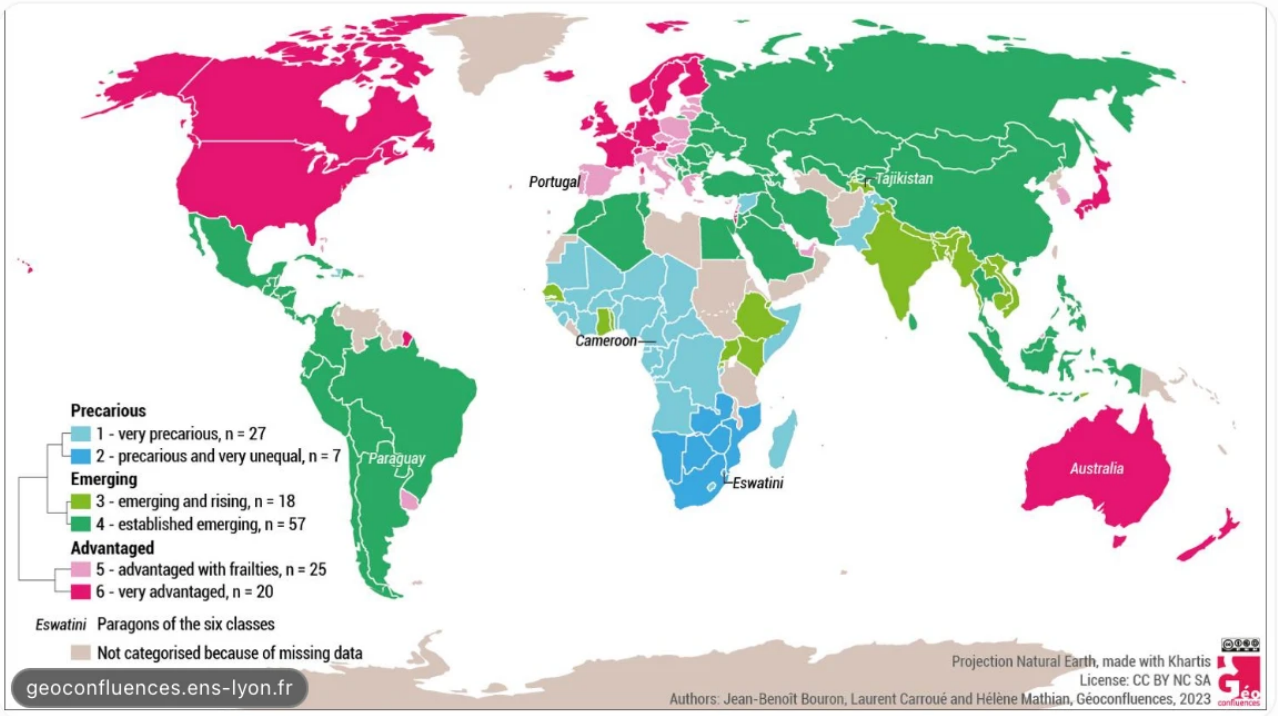
Source: H Heuristics, using the typology in Bouron, Carroué and Mathian (2023) (see Chapter 7).

CHAPTER 7

Geographic research priorities

Resilience investment has the highest expected return where development constraints and overlapping systemic risks coincide. Figure 10 shows a global typology of countries produced by the Géoconfluences group at ENS Lyon, which classifies 154 countries into six classes grouped under three headings (precarious, emerging and advantaged); countries with missing data are left unclassified.

Figure 10. A global typology of development: precarious, emerging and advantaged countries



Map by Jean-Benoît Bouron, Laurent Carroué and Hélène Mathian, Géoconfluences (ENS de Lyon), 2023, licensed CC BY-NC-SA, reproduced with attribution. Class definitions and sample sizes are as shown in the legend.

The map is useful for the research programme for three reasons. First, the 34 countries in the two *precarious* classes, concentrated in sub-Saharan Africa and parts of South Asia, are where baseline capacity is lowest and the need for investment greatest. Second, the 75 *emerging* countries are home to most of humanity and will determine global trajectories for energy, emissions and growth. Third, the classification underlines that even advantaged countries contain frailties, so convergence is a global rather than regional agenda.

7.1 Priority regions

Prioritise regions where development constraints and overlapping systemic risks create particularly significant opportunities for resilience investment:

Table 7. Priority regions for the research programme

Region	Resilience profile	Illustrative priority pathways	Example research focus
Sub-Saharan Africa	Largest energy-access and extreme-poverty gaps; fastest-growing population; high climate and conflict exposure; high cost of capital	Energy and infrastructure; human capital and health; institutions and finance; agricultural technology	Returns to distributed energy at scale; the effect of cost of capital on resilience investment; urban growth and flood exposure
South Asia	Large concentrations of poverty; extreme heat, flood and air-pollution exposure; dense coastal and delta populations	Climate adaptation; clean cooking and air quality; social protection; urban infrastructure	Heat adaptation and labour productivity; shock-responsive social protection; groundwater depletion
Southeast Asia	Rapid growth with high typhoon, flood and sea-level exposure; manufacturing hubs exposed to supply-chain shocks	Resilient urban and industrial infrastructure; clean power; early-warning	Cost-effective coastal adaptation; supply-chain diversification and local resilience
Latin America	Middle-income with high inequality and informality; biodiversity-rich; exposed to drought and hurricanes; recurrent macro-fiscal stress	Institutions and fiscal capacity; social protection; climate-resilient agriculture; productivity	Escaping the middle-income trap sustainably; protecting ecosystem services during growth
Middle East and North Africa	Severe water scarcity and heat; food-import dependence; conflict; rapidly growing youth population	Water systems; food-system resilience; job creation; institutions	Water-energy-food resilience; export diversification; post-conflict reconstruction
Vulnerable small island developing states	Extreme exposure to cyclones and sea-level rise; small, undiversified economies; high debt and cost of insurance	Adaptation and risk finance; resilient infrastructure; debt restructuring	Contingent finance design; relocation and adaptation limits; renewable transition

Source: H Heuristics synthesis.

7.2 Cross-cutting geographies

- **Fragile and conflict-affected states.** A growing share of the extreme poor live in states affected by conflict and fragility, where service delivery is weakest and external finance hardest to deploy. These states require distinct instruments and risk tolerance, since conventional development approaches may not work.
- **Rapidly urbanising peripheries.** The next two billion urban residents will mostly live in Africa and Asia; whether their cities are built resilient or exposed will largely be decided in the next two decades. The UN projects that Africa's population will reach about 2.5 billion by 2050.
- **Climate-vulnerable agricultural regions.** Rain-fed farming areas in the Sahel, the Horn of Africa, South Asia and Central America combine high poverty with high exposure and low infrastructure.
- **Within-country divergence.** Lagging regions in otherwise advancing economies, the inland and peripheral areas in Figure 5, merit attention as national averages mask the highest vulnerability.

Country-level studies could examine how different combinations of economic development, clean energy, technology diffusion and institutional improvements produce different resilience outcomes. Comparing countries with similar income but different outcomes, and countries that have improved quickly (such as Bangladesh, Rwanda, Vietnam, Ethiopia and Morocco on selected dimensions), may reveal the mechanisms and policy combinations that matter most.

CHAPTER 8

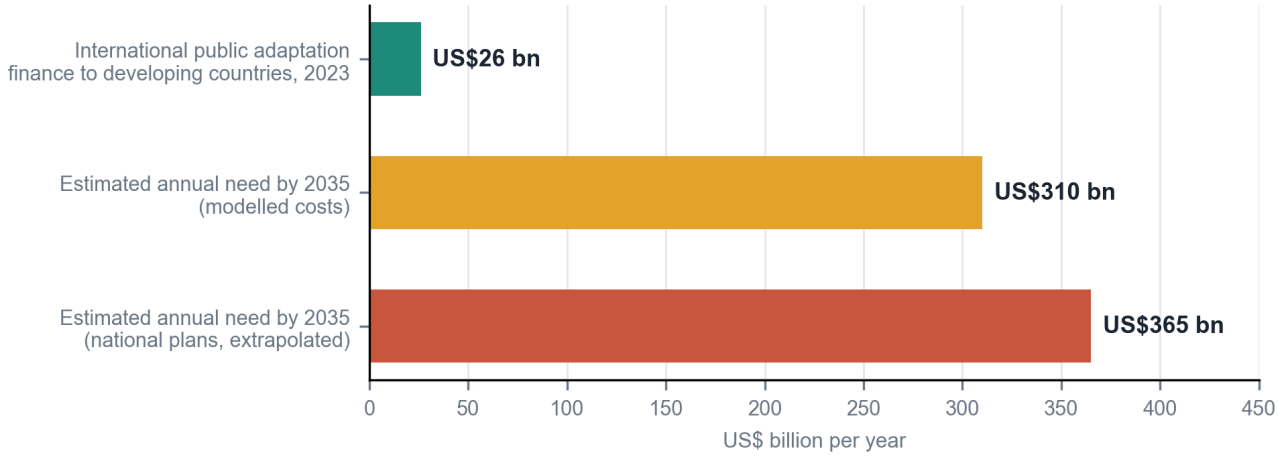
Financing resilience-oriented development

Money is the most immediate constraint. The places where the resilience returns to development investment are highest are, almost by definition, the places with the least capacity to finance it from domestic resources, and often those facing the highest cost of capital.

8.1 The adaptation finance gap as a signal

The adaptation finance gap is a measurable symptom of the broader resilience financing problem. UNEP's *Adaptation Gap Report 2025* estimates that developing countries' adaptation finance needs will reach US$310 billion a year by 2035 on modelled costs, and US$365 billion a year when extrapolated from national plans, roughly twelve to fourteen times current international public flows, which were about US$26 billion in 2023 (UNEP, 2025). Debt makes up a large share of these flows, which compounds affordability concerns. The report also finds that the Glasgow goal of doubling adaptation finance by 2025 is unlikely to be met.

Figure 11. Adaptation finance: current flows versus estimated needs



Source: UNEP, Adaptation Gap Report 2025 (Running on Empty). Needs are for 2035 and are expressed in the report's price basis; they should be refreshed from the primary source.

Adaptation is only one slice of resilience-relevant investment. Universal energy access, health-system strengthening, social protection and resilient infrastructure add further requirements, though many such investments are also standard development investments, which is precisely the point: **conventional development finance is resilience finance**, and resilience-tagging can help direct it to where it does most good.

8.2 Sources and instruments

Table 8. Financing instruments and their resilience role

Source or instrument	Resilience role	Key constraints and research questions
Domestic revenue	Most sustainable source; builds the fiscal contract and state capacity	Low tax bases and informality; how quickly can revenue rise, and with what trade-offs?
Multilateral development banks	Concessional and long-maturity lending; guarantees; crowding-in; technical capacity	Capital adequacy and balance-sheet optimisation; speed and scale; resilience mainstreaming
Concessional and grant finance	Essential for the poorest and most fragile settings and for public goods with weak financial returns	Donor fatigue and falling aid budgets; additionality; adaptation share
Private investment and blended finance	Scales energy, infrastructure and technology deployment	High perceived risk and cost of capital; currency risk; limited pipeline of bankable projects; realistic private potential for adaptation is modest
Debt architecture and relief	Creates fiscal space; contingent clauses pause service after disasters	Slow restructuring processes; creditor coordination; moral hazard
Risk finance and insurance	Fast post-disaster liquidity; incentives for risk reduction	Premium affordability; basis risk; limited uptake
Remittances	Household-level risk-sharing and investment	Transfer costs; dependence on host-country conditions
Carbon and climate finance	Mobilises resources for clean energy and nature	Integrity and accounting; allocation to adaptation; access for the most vulnerable

Source: H Heuristics synthesis.

8.3 Principles for resilience-oriented finance

- **Lower the cost of capital where resilience returns are highest.** The cost of capital for comparable projects is far higher in many African countries than elsewhere, a gap that perceived rather than actual risk helps to drive. Guarantees, first-loss capital and currency-hedging facilities can narrow it.
- **Finance before the shock.** Pre-arranged, rule-based finance, such as contingent credit lines, parametric insurance and disaster-linked debt clauses, is faster and cheaper than ad hoc appeals after the event.
- **Match instruments to cash flows.** Revenue-generating infrastructure suits blended and private finance; public goods such as early warning, primary health care and social protection require grants and concessional funding.
- **Avoid trading one vulnerability for another.** Debt-financed resilience that leaves countries more fragile could be self-defeating, so financing terms should be part of the resilience assessment.
- **Measure and tag.** Common methods for tagging and measuring resilience benefits would improve allocation and accountability.

CHAPTER 9

Risks, trade-offs and counter-arguments

A research programme built on the proposition that development builds resilience should engage seriously with the ways it could be wrong or incomplete. The following are the strongest challenges, together with the research implication of each.

Table 9. Principal challenges and research responses

Challenge	The argument	Research response
Growth raises emissions and ecological pressure	Convergence in consumption on carbon-intensive paths would raise hazards faster than it builds capacity	Study decoupling feasibility; quantify clean-technology cost declines; model low-carbon convergence paths and their financing needs
Development increases exposure	Urbanisation, coastal settlement and asset accumulation put more people and capital in harm's way	Separate exposure from vulnerability effects; assess land-use and planning policies; track net outcomes per hazard
Premature deindustrialisation and the middle-income trap	The traditional route to rapid convergence through manufacturing may be narrowing	Examine services- and technology-led pathways; empirical study of growth premiums in latecomers
Automation and artificial intelligence	Technological change could reduce labour-intensive development opportunities and widen gaps	Assess scenarios for diffusion of AI to lower-income settings and implications for jobs and productivity
Geoeconomic fragmentation	Trade barriers, conflict and weakened cooperation reduce flows of capital and technology on which convergence depends	Stress-test convergence under fragmentation scenarios; identify resilient South–South channels
Weak institutions limit absorption	Investment fails where governance is poor; money alone is not sufficient	Identify institutional prerequisites; evaluate delivery models in fragile settings
Distribution, exclusion and aid effectiveness	Aggregate gains may bypass the most vulnerable; past external-finance programmes have a mixed record	Disaggregate resilience indicators; assess what works (cash transfers, health and vaccine programmes) and emphasise country ownership
Causal identification	Correlations between income and resilience may reflect confounders, and reverse causation (resilience raising income) is plausible	Use quasi-experimental and natural-experiment designs; combine micro and macro evidence

Source: H Heuristics synthesis.

What development alone cannot do

Even the best-directed development cannot make populations immune to extreme outcomes. Wealthy countries still suffer major losses from hurricanes, wildfires, heatwaves and floods. Development reduces the human cost of shocks; it does not eliminate them. A credible resilience strategy therefore combines development with emissions mitigation, global public-health and financial-stability cooperation, and conflict prevention.

AN HONEST ACCOUNTING OF UNCERTAINTY

The strongest evidence concerns **pathways in isolation** (for example, health, education, early warning, and income effects on disaster mortality). Evidence on **interactions**, thresholds and the **aggregate resilience return** to a coordinated development strategy is much thinner. Estimating these is the programme's central scientific task, and results may show that some pathways matter less than assumed.

CHAPTER 10

The research programme

10.1 Priority research questions

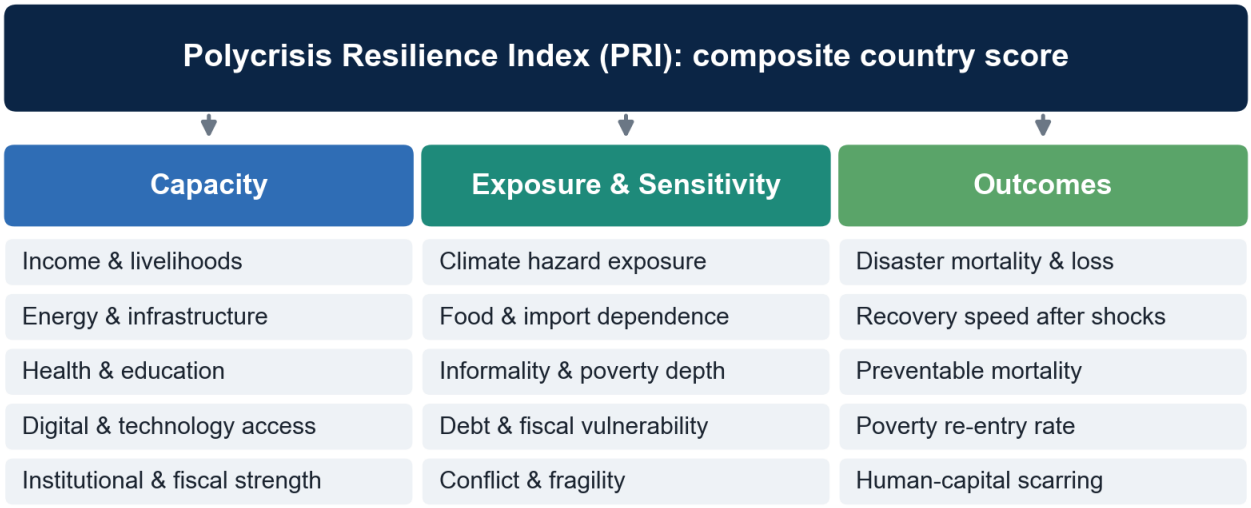
The following twelve questions structure the programme.

1. How much of the cross-country variation in disaster and pandemic mortality, and in economic loss from shocks, is explained by development indicators once hazard exposure is controlled for?
2. At what thresholds of income, energy access, schooling and fiscal capacity do the favourable feedback loops overtake the adverse ones?
3. What are the marginal resilience returns to each of the six pathways, across country types, and how do they compare per dollar spent?
4. Which pathway combinations produce the strongest complementarities, and where are the binding constraints in priority regions?
5. Can unconditional convergence be sustained and accelerated, and what would it take to sustain growth premiums of three points or more in the poorest countries?
6. Can latecomers converge on a low-carbon path, and how do energy, urban and industrial choices today affect vulnerability in 2050?
7. How do spatial gaps within countries (coast versus hinterland) shape the distribution of resilience?
8. Which technologies and delivery models produce the greatest resilience return for the poorest, and what complementary investments do they require?
9. What institutional features most reliably translate resources into resilience, and which reforms are feasible?
10. What financing architecture would mobilise resilience investment at the necessary scale without creating new debt vulnerabilities?
11. How would geoeconomic fragmentation, climate tipping elements or AI-driven change alter convergence and resilience outcomes?
12. What portfolio of development investments minimises expected cumulative human suffering under deep uncertainty over the twenty-first century?

10.2 The Polycrisis Resilience Index

H Heuristics proposes developing a composite **Polycrisis Resilience Index (PRI)** to measure countries' and regions' structural resilience and to track progress. The index would be built on three groups of indicators, shown in Figure 12: *capacity* (the six pathways), *exposure and sensitivity* (hazard, dependence and fragility), and observed *outcomes* (mortality, loss and recovery after real shocks).

Figure 12. Proposed architecture of the Polycrisis Resilience Index



Design proposal. Indicator selection, weighting and validation are part of the research programme.

Three design principles apply. **First**, the index should be validated against outcomes: a measure of capacity is useful only if it predicts how countries actually fare in shocks, which requires linking the capacity and exposure indicators to the realised-outcomes group. **Second**, it should be transparent about weighting and sensitivity, and report sub-indices rather than a single number alone. **Third**, it should be sub-nationally disaggregated where data allow, since national averages hide the most vulnerable groups.

10.3 Empirical strategies

Table 10. Methods and what they are designed to answer

Method	Application	Principal limitation
Cross-country and panel regression	Relationship between development indicators and shock outcomes; threshold estimation	Endogeneity; limited power for rare events
Event studies and natural experiments	Compare outcomes after similar shocks (cyclones, droughts, floods, pandemics) across contexts	Hazard intensity measurement; selection into exposure
Synthetic control and difference-in-differences	Effects of specific interventions (for example, early-warning systems, mini-grids, cash-transfer programmes)	Few treated units; spillovers
Household and microsimulation models	Distributional effects of shocks and policies on poverty and welfare	Data requirements; behavioural assumptions
System-dynamics and agent-based models	Feedback loops, tipping points and cascading effects across systems	Calibration and validation
Integrated assessment and macro-climate models	Scenarios for growth, emissions and damages under alternative development paths	Treatment of distribution and adaptation; deep uncertainty
Case studies and process tracing	Mechanisms in successful and failed cases, such as Bangladesh, Rwanda, Ethiopia, Vietnam	Generalisability
Robust decision-making	Choosing investments that perform acceptably across many plausible futures	Requires stakeholder engagement and scenario design

Source: H Heuristics.

10.4 Data foundations

Most required data exist but are fragmented. Core sources include the World Bank's Poverty and Inequality Platform and World Development Indicators; IEA and the Tracking SDG7 partnership for energy; WHO, UN IGME and IHME for health; UNESCO and the World Bank for education; ITU and GSMA for connectivity; the EM-DAT disaster database and UNDRR for hazard losses; ILO for social protection; IMF and UNCTAD for fiscal and debt data; OECD for development finance; and Géoconfluences-type typologies and the World Governance Indicators for institutions. Gaps remain in sub-national data, informal-sector measures, and consistent loss accounting, and addressing them is a research deliverable in its own right.

10.5 Phasing

Table 11. Indicative research phases

Phase	Focus	Outputs
1. Foundations (first year)	Literature synthesis; indicator selection; data audit; pathway-level evidence reviews	Evidence maps for each pathway; data inventory; PRI prototype design
2. Estimation (years 1–2)	Panel and event-study estimation; threshold analysis; first PRI release; regional case studies	Working papers; PRI version 1; country profiles for priority regions
3. Integration (years 2–3)	System-dynamics and scenario modelling; financing analysis; policy-package design	Integrated model; investment-portfolio analysis; financing architecture proposals
4. Translation (ongoing)	Policy briefs; engagement with governments, development banks and investors; index updates	Annual PRI report; briefing series; open data and methods

Source: H Heuristics.

CHAPTER 11

Strategic implications

Although this report is a research framework, the logic of the argument has implications for the main actors in the development and risk-management systems. They are offered as hypotheses to be tested, not as settled recommendations.

TEN PRIORITIES FOR THE DECADE

(1) Accelerate sustainable growth premiums in the poorest countries; (2) close the electricity and clean-cooking gaps; (3) scale distributed and low-cost clean energy; (4) strengthen primary health care and basic education; (5) extend digital public infrastructure and financial inclusion; (6) build adaptive social protection; (7) mobilise domestic revenue and reform debt architecture; (8) scale adaptation and risk-finance instruments; (9) invest in resilient and low-carbon urban growth; (10) build the evidence base, including the PRI, to steer investment to its highest-return uses.

11.1 For governments of developing and emerging economies

- Treat resilience as an organising objective of the development strategy, and diagnose which capacity deficits are most binding for the shocks the country most faces.
- Invest in keystone capacities (revenue, public financial management, adaptive social protection, core infrastructure) before and alongside sector programmes.
- Build low-carbon, climate-robust choices into long-lived assets from the outset, since retrofitting is expensive.
- Develop sub-national strategies for lagging and peripheral regions, where vulnerability is highest.

11.2 For multilateral and bilateral development institutions

- Make resilience returns, including avoided losses, health and long-run human-capital effects, an explicit part of project appraisal, since conventional metrics understate them.
- Expand contingent and pre-arranged finance, reduce the cost of capital for resilience-enhancing investment, and use guarantees and balance-sheet optimisation to crowd in private capital.
- Align debt policy and development finance so that resilience investment does not worsen fiscal fragility.
- Strengthen data and monitoring, including consistent tagging of resilience benefits.

11.3 For investors, philanthropy and the private sector

- Recognise the structural opportunity in energy access, resilient infrastructure, agricultural technology, digital financial services and health supply chains in lower-income markets, while noting the risks and the need for blended structures.
- Use catalytic and first-loss capital to build bankable pipelines for resilience investment in higher-risk settings.

- Support public-goods investments (early warning, data, and research) that private markets will not fund but which raise returns across portfolios.

11.4 For researchers

- Test the aggregate and interactive effects of the pathways, not only the effects of each one.
- Link development and risk modelling communities, which currently use different tools and languages.
- Prioritise causal identification, sub-national data and the distribution of effects.

CHAPTER 12

Conclusion

The polycrisis is often presented as a problem of hazards: too many, too connected, too severe. This report has argued that it is equally a problem of **capacity**, and that capacity is, in large part, what economic development creates. Poverty, inadequate infrastructure, limited health care access, energy insecurity, environmental degradation, weak institutions and technological exclusion reinforce one another and make populations vulnerable to the shocks that define the age. Development, by expanding the resources, infrastructure, technologies and institutional capabilities available to societies, can weaken those feedback loops.

The proposition has implications for how we think about priorities. If it holds, then raising the growth premium of the poorest economies, closing the gaps in energy, health, education and connectivity, building capable institutions and financing resilience in the most vulnerable places are among the highest-return investments for reducing human suffering this century, and are complements to rather than substitutes for mitigation and global cooperation. The direction of travel matters: growth that is clean, inclusive and resilient builds the capacity that carbon-intensive, exclusionary or ecologically destructive growth erodes.

The proposition is also a hypothesis, one that needs to be tested through rigorous empirical work on pathways, thresholds, interactions and financing. This report has set out the framework, the indicators and the research questions for doing so. The central question remains the one with which it began:

> **THE CENTRAL RESEARCH QUESTION**
> How can economic development be accelerated and directed to minimise human suffering and strengthen societal resilience throughout the twenty-first century?

H Heuristics intends to pursue it. Readers with data, evidence, critique or interest in collaboration are invited to engage with the programme.

APPENDIX A

Glossary

Table A1. Glossary of terms

Term	Meaning in this report
Polycrisis	A condition in which crises in multiple global systems become causally entangled in ways that significantly degrade humanity's prospects (Cascade Institute).
Resilience	The capacity of people, communities and systems to anticipate, absorb, adapt to and recover from shocks, and where possible to transform in response to them.
Adaptive capacity	The set of resources, institutions and knowledge available to respond to a shock or stress.
Vulnerability	The propensity to be harmed by a shock, a function of sensitivity and adaptive capacity.
Exposure	The presence of people, livelihoods and assets in places that could be adversely affected by a hazard.
Convergence	The tendency of poorer economies to grow faster than richer ones, narrowing gaps in income per capita; conditional convergence holds after controlling for country characteristics, unconditional convergence does not require this.
Growth premium	The difference between a country's per-capita growth rate and that of the frontier.
Technology diffusion	The spread of existing technologies and practices across firms, regions and countries.
Poverty trap	A self-reinforcing mechanism that perpetuates poverty, such as asset thresholds or nutrition-productivity links.
Adaptive social protection	Safety-net systems that can expand automatically or rapidly in response to shocks.
Parametric insurance	Insurance that pays out on a pre-defined trigger (such as rainfall or wind speed) rather than on assessed loss.
Mini-grid	A small-scale local electricity network, typically solar-based, serving a community or enterprise cluster.
PPP	Purchasing-power parity: price adjustments allowing comparison of incomes across countries.
PRI	The proposed Polycrisis Resilience Index.

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ABOUT H HEURISTICS

H Heuristics is a research and publishing initiative founded by Hunter Hughes, focused on practical frameworks for understanding and improving long-term human outcomes. The concept of the development economics of polycrisis resilience was developed by Hunter Hughes. More at hheuristics.substack.com.

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