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POLYCRISIS RESILIENCE SERIES · RESEARCH REPORT

Polycrisis Resilience in the 21st Century

Reducing human and systemic vulnerability to interconnected global crises, 2026–2100



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THE FRAMEWORK AT A GLANCE

THE DEFINITION

Polycrisis Resilience is the capacity of individuals, communities, institutions, economies, societies and interconnected systems to anticipate, withstand, adapt to, recover from and reduce their vulnerability to multiple interacting crises.

Central thesis: the severity of the polycrisis depends on hazards and on vulnerability, and vulnerability can be reduced through sustained development.

TEN DEVELOPMENT PATHWAYS

- Clean energy transition
- Technology diffusion
- Climate adaptation
- Human development
- Infrastructure strengthening
- Public health and clean environments
- Institutional strengthening
- Economic diversification
- Food and water security
- Digital infrastructure

FIVE PERIODS, 2026–2100

2026–2030 Establishing foundations

2031–2040 Accelerating development and diffusion

2041–2050 Strengthening global adaptive capacity

2051–2075 Reducing structural vulnerability

2076–2100 Consolidating long-term resilience

EXECUTIVE SUMMARY

Executive Summary

How badly the century's interconnected crises hurt will depend on the hazards, and just as much on how vulnerable the people and systems in their path are. Vulnerability can be reduced, and most of the tools for doing so are development tools.

The twenty-first century is being shaped by risks that do not stay in their lanes. Climate change, polluted air, biodiversity loss, poverty, food and energy insecurity, conflict, population change, technological disruption and fragile infrastructure interact, overlap and sometimes reinforce one another, creating risk environments that can exceed what a single society or institution can manage. This report asks what Polycrisis Resilience means across the whole world between 2026 and 2100: how coordinated investment in development, technology diffusion, environmental protection, economic security and institutions can reduce the vulnerability of 8.1 billion people, a number the United Nations expects to peak near 10.3 billion around 2084 (United Nations, 2024). It is not mainly a report about surviving crises after they happen. It is about changing the conditions that make people, economies and infrastructure vulnerable in the first place.

1.4 bn
people live in the 41 countries in the world's worst fifth on four or more of seven challenges, down from 3.9 billion in 2000

−52%
child deaths a year, from 10.4 million in 2000 to 4.9 million in 2024, though the world added 2 billion people

300 m
fewer child deaths in 2025–2100 if progress matched the best peers rather than stalling

3.8 bn
Africans projected for 2100, up from 1.5 billion today; the region's share of humanity roughly doubles

Principal findings

- **Hazard and vulnerability are different things, and only one of them is mostly a matter of development.** Across 160 countries, exposure to climate hazards has almost no link to national income (correlation 0.04), while child mortality, sanitation, clean cooking, institutions and connectivity are all tightly tied to it (0.8 or more in absolute value). Where hazards strike is set by geography. How much harm they do is set by how people live (Figure 5).
- **The century's vulnerabilities travel together, and mostly because of poverty.** Across countries the average link between vulnerabilities is 0.51; hold income fixed and it falls to 0.24, less than half. Countries are also far more likely to suffer several challenges at once than chance would suggest: 19% of countries are in the worst fifth on four or more of seven, against 4% if the challenges were independent (Section 4).
- **Vulnerability has already fallen at historic scale.** Deaths before age five dropped from 178 to 37 per 1,000 births between 1960 and 2024. Climate-related disaster deaths averaged 10 per

100,000 people a year in the 1960s and 0.26 in the 2010s. Electricity access rose from 78% to 92% and clean cooking from 48% to 75% since 2000 (Section 6).

- **The remaining gaps are concentrated and large.** About 655 million people lack electricity, 2.0 billion lack clean cooking, 1.5 billion lack basic sanitation, and Africa holds 89% of the first of these (Figure 3). Seventy percent of Africans, and almost all people in low-income countries, live where four or more challenges overlap.
- **Demography will make development a race.** If access to services never improved, population growth alone would raise the number of people without clean cooking from 2.0 billion to 4.0 billion by 2100. Development decides whether that number is 1.7 billion (current pace) or 86 million (best-peer pace) (Section 9).
- **Ten development pathways work on several vulnerabilities at once.** Clean energy, technology diffusion, adaptation, human development, infrastructure, public health, institutions, diversification, food and water security, and digital infrastructure support one another and can be pursued as one strategy (Section 7).
- **Prevention is usually cheaper than response, but not everywhere.** Reported benefit-cost ratios of 2:1 to more than 10:1 apply to adaptation and resilient infrastructure (Global Commission on Adaptation, 2019; Hallegatte et al., 2019); each project still has to be tested locally (Section 6).
- **Impact can be measured.** Eight measures, from exposure and climate vulnerability to avoided losses and cascading risk, give a century scorecard with baselines today (Section 10).

How to read this report

Part I maps the risk environment of the century (Section 1 to Section 4). **Part II** sets out the concept of Polycrisis Resilience and the case that development is long-term risk reduction (Section 5, Section 6). **Part III** presents the H Heuristics framework, ten development pathways that reduce vulnerability together (Section 7). **Part IV** applies it to regions (Section 8). **Part V** looks across five periods from 2026 to 2100 (Section 9), and **Part VI** proposes how to measure impact (Section 10). Everything quantitative comes from public data; the scenarios are arithmetic illustrations, not forecasts, and the report says where evidence is thin. Figures and tables link to their sources.

CONCEPT

The definition used in this report

Polycrisis Resilience is the capacity of individuals, communities, institutions, economies, societies, and interconnected systems to anticipate, withstand, adapt to, recover from, and reduce their vulnerability to multiple interacting crises. (Hughes, 2026a)

PART I · SECTION 01

The Emergence of the Global Polycrisis

A polycrisis is a cluster of crises whose causes and effects are tangled together, so that the whole does more damage than the parts. The idea is not new, but the evidence that the twenty-first century has one is.

IN BRIEF

- Several crises arrive together and feed one another; handling them one at a time misses the connections.
- Eight risk domains, from climate to technology, now interact across a world of 8.1 billion people, heading for about 10 billion.
- Interconnection is not only a danger: the same links that spread harm can spread protection.

1.1 What a polycrisis is

The word *polycrisis* was used in the late 1990s by the thinkers Edgar Morin and Anne Brigitte Kern to describe the tangle of problems facing humanity (Morin and Kern, 1999), and it entered public debate in 2022 when the historian Adam Tooze used it to describe the pile-up of pandemic, war, inflation and energy shocks (Tooze, 2022). Researchers have since given it a sharper meaning. A polycrisis is a set of crises in different systems that are causally entangled, so that together they harm humanity's prospects by more than the sum of their separate effects (Lawrence et al., 2022; Lawrence et al., 2024). The key idea is not that many bad things happen at once, which has always been true, but that they interact.

Interaction changes what has to be done. When crises are linked, a flood that strikes during a currency crisis does more damage than the same flood in a stable economy, because rebuilding must be paid for at punishing cost, and a drought in one region becomes a price shock in another and then unrest. Researchers call this *systemic risk* and point to the growing density of links between trade, finance, energy, information and people as the reason cascades have become more likely (Centeno et al., 2015; Helbing, 2013; Renn et al., 2022).

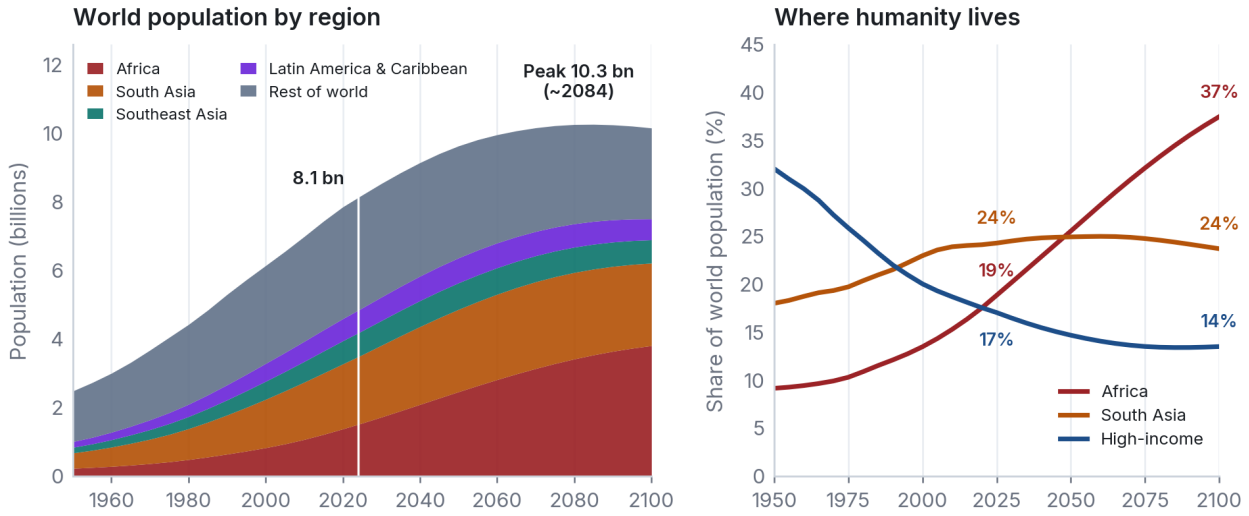
A connected world is not only more exposed, because the same links can carry help: mobile money moves cash to households within days of a shock (Suri and Jack, 2016; Jack and Suri, 2014), phones carry warnings, and pooled insurance pays out across borders (CCRIF SPC, 2025; African Risk Capacity, 2025). Resilience means building the links that protect while limiting those that spread harm, which is why this report treats development as risk reduction: the roads, power, clinics, schools, markets and institutions that make a society richer also decide whether a shock is absorbed or amplified.

1.2 A world of 8 billion heading for 10

The world's population was 2.5 billion in 1950, is 8.1 billion now and, in the United Nations medium projection, peaks near 10.3 billion around 2084 before slowly declining (United Nations, 2024; Our World in Data, 2025). Figure 1 shows where that growth happens. Africa's share of humanity rises from 19% today to 37% in 2100, while high-income countries fall to about 14%. Most of the people who face the century's risks will therefore live where services are thinnest today. The projection also says that population will stop growing, so this is not a forecast of doom, but the setting for every comparison in this report.

Figure 1 Humanity grows by about two billion and shifts towards Africa; the population then levels off

World population by region and selected regional shares of world population, 1950–2100



Source: UN World Population Prospects 2024, medium variant (United Nations, 2024; Our World in Data, 2025); World Bank classification for the high-income group (World Bank, 2025b); H Heuristics grouping of countries.

1.3 Eight domains of risk

This report follows eight domains: climate and environmental degradation; pollution and public health; poverty and inequality; food, water and energy insecurity; conflict and geopolitical instability; institutional fragility; technological disruption; and infrastructure vulnerability. Table 1 shows where each stands.

CASCADES

Four recent cascades

COVID-19 (2020–21). A health crisis caused about 15 million excess deaths worldwide (Msemburi et al., 2023), then spilled into supply chains, food and energy prices and public debt.

Pakistan floods (2022). Record monsoon rains struck an economy already short of foreign currency; damage and losses above $30 billion had to be financed at punishing cost (Government of Pakistan et al., 2022).

Texas freeze (2021). A cold snap disabled gas supply and power generation together, and each failure deepened the other (FERC and NERC, 2021).

Software outage (2024). A single faulty update disrupted about 8.5 million computers, and with them airlines, hospitals and banks (Weston, 2024).

Table 1 The risk domains at a glance

Domain	Where it stands	Direction
Climate and environment	The world was about 1.43 °C above pre-industrial in 2025 and about 1.55 °C in 2024, and 2015–2025 were the eleven warmest years on record (WMO, 2026). Seven of nine planetary boundaries are transgressed (Planetary Boundaries Science, 2025)	Worsening
Pollution and health	Air pollution from household fuels and the ambient air together is linked to about 7.2 million deaths a year (2021) (WHO, 2026). World average PM2.5 is 33 μg/m³, barely changed since 2000	Mixed: cooking cleaner, air not
Poverty and inequality	About 10% of people live below $3 a day, down from 37% in 2000 (countries with survey data) (World Bank, 2026). 25 low-income countries hold 0.75 billion people	Improving, uneven
Food, water and energy	About 645 million people were hungry in 2025 and 2.1 billion faced moderate or severe food insecurity (FAO et al., 2026). 655 million lack electricity and 692 million basic drinking water (World Bank, 2026)	Improving, fragile
Conflict and instability	117.8 million people were forcibly displaced at the end of 2025, the first fall in a decade (UNHCR, 2026). Armed conflicts reached their highest number since records began in 2024 (UCDP, 2025)	Worsening
Institutions	World average government effectiveness score +0.17 on a −2.5 to +2.5 scale, against -1.21 in low-income countries (World Bank, 2025a)	Little change
Technology	Internet use 72% of people, up from 6% in 2000, but only 20% in low-income countries (World Bank, 2026). One faulty software update in 2024 disrupted 8.5 million computers worldwide (Weston, 2024)	Rapid, uneven, concentrated
Infrastructure	1.5 billion people lack basic sanitation and 2.0 billion clean cooking; infrastructure laid down now will shape risk for generations (World Bank, 2026)	Improving, lagging

Source: as cited in each row; H Heuristics calculations from World Bank data. 'Direction' is the author's summary of the trend.

PART I · SECTION 02

Climate, Pollution and Human Health

The physical environment is the source of many of the century's hazards. It is also where development has the most to show: deaths from climate disasters have fallen sharply even as the climate warmed, while air pollution has barely moved.

IN BRIEF

- The planet is about 1.4 to 1.5 °C warmer than in the late nineteenth century and seven of nine planetary boundaries are exceeded.
- Climate-related disaster deaths per person fell by about 97% from the 1960s to the 2010s, which shows that vulnerability can fall faster than hazard rises.
- Air pollution is the exception: about 7.2 million deaths a year and a world average that has not improved much since 2000.

2.1 A warming world under pressure

The climate evidence is not in doubt. The World Meteorological Organization puts 2025 at about 1.43 °C above the 1850–1900 average, after 2024 reached about 1.55 °C, and notes that the eleven years from 2015 to 2025 were the eleven warmest on record (WMO, 2026; Copernicus Climate Change Service, 2025). The Intergovernmental Panel on Climate Change finds that every additional increment of warming raises the frequency and severity of heat extremes, heavy rainfall and droughts, and that risks escalate faster when hazards combine (IPCC, 2023; Zscheischler et al., 2018). Climate is one of several stresses on the Earth system: the Planetary Health Check finds seven of nine planetary boundaries now transgressed, covering climate, biodiversity, land, freshwater, nutrient flows, novel chemicals and ocean acidification (Planetary Boundaries Science, 2025; Richardson et al., 2023). These pressures damage the natural systems that crops, water supplies and coasts depend on, so environmental degradation becomes a slow-moving driver of hunger, disease, migration and conflict.

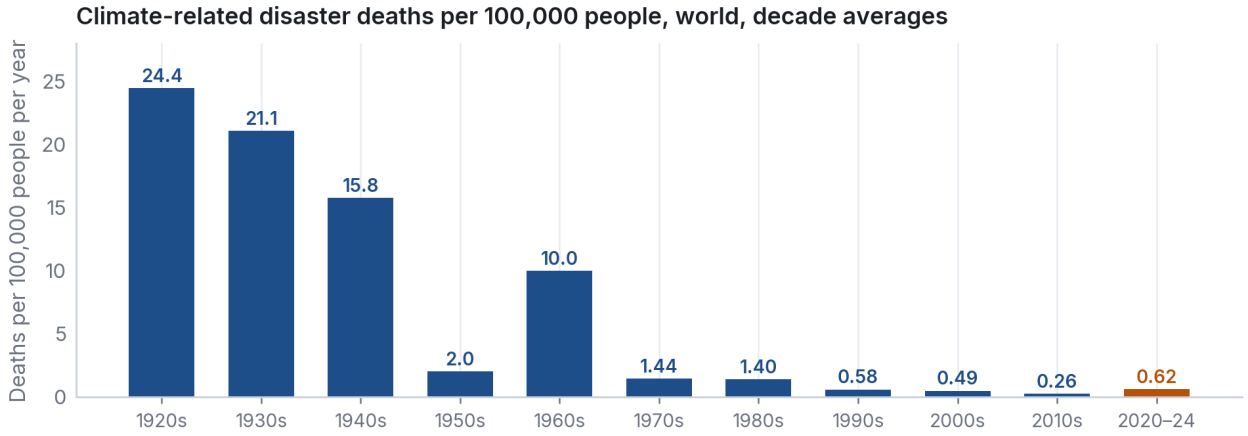
The hazards will not be shared evenly. Exposure to floods, cyclones, drought and heat depends mainly on geography. That matters for the argument of this report: because hazard is set largely by where a country lies, the thing that policy can change most is what happens to the people and assets in the hazard's path.

2.2 Why deaths from disasters have fallen

The strongest evidence that vulnerability can be reduced comes from the long record of disaster deaths. Figure 2 shows decade averages of the world death rate from droughts, floods, storms, extreme temperature, landslides and wildfires, taken from the international disaster database (CRED, 2025; Ritchie et al., 2025). In the 1920s the rate was about 24 deaths per 100,000 people a year, dominated by famines and floods in a few countries. By the 1960s it was 10. By the 2010s it was 0.26, a fall of about 97% in half a century, while the world population more than doubled. Studies of national data find the same pattern: richer, better-educated and better-governed countries lose fewer people to the same hazard (Kahn, 2005; Toya and Skidmore, 2007; Formetta and Feyen, 2019), and the world's vulnerability to river floods has fallen faster than exposure has grown (Jongman et al., 2015). Bangladesh is the clearest single example, where cyclone deaths fell by more than 95% as shelters, warnings and volunteers spread (Haque et al., 2012).

Figure 2 The death rate from climate-related disasters fell by about 97% between the 1960s and the 2010s

Climate-related disaster deaths per 100,000 people per year, world, decade averages



Source: H Heuristics calculations from the EM-DAT international disaster database via Our World in Data (CRED, 2025; Ritchie et al., 2025). Rate is the world total of deaths from drought, flood, extreme weather, extreme temperature, landslide and wildfire per 100,000 people, averaged over each decade. Earthquakes and volcanoes are excluded. The final bar is a five-year average.

Two cautions apply. The 2020–24 average rose to 0.62, driven by a handful of large events and by deadly heat waves, which shows that the gains are not guaranteed and that heat in particular is a growing danger. And a falling death rate is not the same as falling economic damage, which tends to rise with the value of what is exposed. The lesson is not that climate risk has been solved. It is that the harm a given hazard does is not fixed, and that the countries that invested in warnings, shelters, health care and incomes changed it.

2.3 Air pollution: the stubborn exception

Pollution is where the record is weakest. The World Health Organization estimates that household air pollution from cooking with solid fuels caused about 2.9 million deaths in 2021 and that ambient (outdoor) air pollution caused about 4.3 million (WHO, 2026; WHO, 2024). The household burden has been falling as clean cooking has spread, from 48% of people with clean cooking in 2000 to 75% now, yet 2.0 billion people still cook with polluting fuels, and almost all of them live in Africa and South Asia. Outdoor air has barely improved: the population-weighted world average for fine particles is 33 micrograms per cubic metre, against 37 in 2000 and a World Health Organization guideline of 5 (World Bank, 2026). Low-income and lower-middle-income countries bear the household burden, while upper-middle-income countries now account for the largest share of the ambient burden (2.0 million deaths against 0.24 million in low-income countries), a sign that industrial growth on dirty fuels trades one pollution problem for another.

Pollution matters beyond health. It is a driver of climate change (soot and methane, as well as carbon dioxide, warm the planet), it lowers crop yields and worker productivity, and it is a case where benefits are shared: cleaner energy cuts emissions and deaths together. It also shows the limits of waiting for growth to solve problems. Section Section 6 returns to this point with data.

2.4 Biodiversity, land and water

Environmental degradation also works through ecosystems. Loss of forests, wetlands, mangroves and soil strips away natural protection from floods, storms and droughts, and removes the food and water supplies of the poorest rural communities, who depend most directly on nature. These links are why the framework includes food and water security among its development pathways (Section 7), and why adaptation that works with nature, such as protecting mangroves, features among the best-evidenced investments (Global Commission on Adaptation, 2019).

PART I · SECTION 03

Poverty, Inequality and Resource Insecurity

Poverty is the common thread of this polycrisis. It determines who is exposed, who is hurt and who recovers, and it is why a shock that is an inconvenience in one country is a catastrophe in another.

IN BRIEF

- Extreme poverty has fallen from about 37% to about 10% of people since 2000, but the remainder is concentrated in Africa and fragile states.
- Roughly 2.0 billion people lack clean cooking, 1.5 billion basic sanitation and 655 million electricity.
- Hunger is falling but fragile, and Africa now has more hungry people than Asia.

3.1 Poverty as the amplifier

Poverty does not cause hazards, but it magnifies every one of them. Poor households live in flood plains and flimsy housing, work outdoors in the heat, hold no savings to rebuild with and rely on services that fail first. The World Bank estimates that disasters cause consumption losses equal to about $520 billion a year, far more than the value of assets destroyed, and push an estimated 26 million people into extreme poverty each year, because poor households cannot smooth consumption or restore what they lose (Hallegatte et al., 2017; Hallegatte et al., 2016). Poor countries are likewise less able to borrow, insure or spend their way out of trouble, and economic damage from shocks such as tropical cyclones can persist for more than a decade (Hsiang and Jina, 2014; Cerra and Saxena, 2008).

The long-run record is encouraging. In the countries with survey data, the share of people living below $3 a day (in 2021 prices) fell from about 37% in 2000 to about 10% in 2024 (World Bank, 2026). Yet the gains are uneven. Extreme poverty is now concentrated in Africa, where 43% of people are below the line, and in countries affected by conflict, where growth has stalled. A future in which poverty falls everywhere is not guaranteed, and a future in which it falls fastest where it matters least would leave the largest vulnerabilities in place.

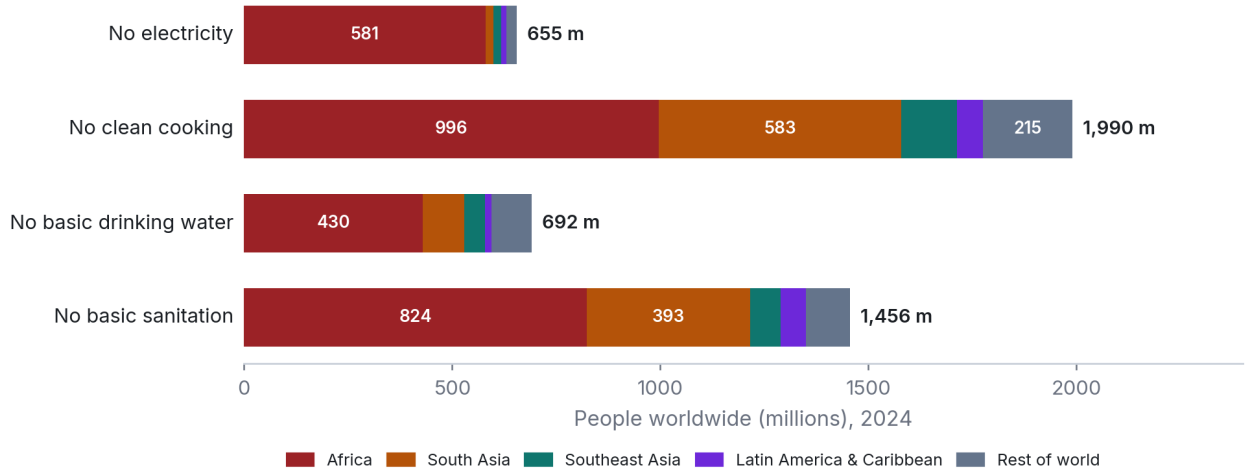
3.2 Food, water and energy

Food, water and energy are three pillars of daily life that depend on one another and on the climate. After a rise during the pandemic and the energy and food price shocks of 2022, global hunger has eased for three years in a row: about 645 million people, or 7.8%, were hungry in 2025, down from 2022 (FAO et al., 2026). But some 2.1 billion people still face moderate or severe food insecurity, and for the first time Africa, with about 309 million hungry people, has more than Asia (FAO et al., 2026). Conflict, extreme weather and economic shocks remain the main drivers of acute food crises (FSIN and GNAFC, 2025).

Access to water and energy shows the same pattern of large gains and persistent gaps. Between 2000 and 2024 the number of people without electricity fell from 1.3 billion to 655 million, and without clean cooking from 3.2 billion to 2.0 billion (World Bank, 2026; IEA et al., 2025). Figure 3 shows who is left. Africa holds 89% of the people without electricity, 50% of those without clean cooking and 62% of those without basic drinking water. South Asia holds most of the remaining clean-cooking gap. Energy matters beyond comfort: clinics need power for vaccines and surgery, pumps need power for water, and phones need power for payments and weather warnings.

Figure 3 Africa and South Asia hold most of the world's people without basic services

People without electricity, clean cooking, basic drinking water and basic sanitation, by region, millions



Source: H Heuristics calculations from World Bank World Development Indicators, 2024 or nearest year (World Bank, 2026). Access shares are applied to national populations; regions follow the H Heuristics grouping.

3.3 Inequality between and within countries

The gap between countries is wide. A person in a high-income country can expect to live about 15 years longer than one in a low-income country (80 against 65), a child in a low-income country is 13 times as likely to die before age five, and income per person is about 26 times higher in high--income countries (at purchasing power parity) (World Bank, 2026). Inequality within countries adds to this: the poorest households, women and girls, older people, informal workers and people in remote or crowded settlements are usually the first to lose and the last to recover (Hallegatte et al., 2017). Measuring vulnerability only at the level of national averages therefore understates the problem, a limitation the report returns to in Section 10.

PART I · SECTION 04

Conflict, Institutions and Technological Dependence

Two more domains complete the map: the political and institutional conditions that decide whether societies can act together, and the technologies and networks on which modern life now depends. Both can reduce vulnerability or multiply it.

IN BRIEF

- Challenges stack: 19% of countries are in the worst fifth on four or more of seven challenges, against 4% if they were independent.
- The number of people living in such countries has fallen from 3.9 billion in 2000 to 1.4 billion, but they are concentrated in Africa and low-income countries.
- Technological dependence is a new systemic risk, but technology diffusion is also among the strongest tools for resilience.

4.1 Conflict and geopolitical instability

War and political instability are the most direct way for a polycrisis to turn into catastrophe. They destroy infrastructure and health systems, displace people, disrupt food and energy, and stop the institutions that would otherwise manage other crises. The Uppsala Conflict Data Program counted more state-based armed conflicts in 2024 than in any year since its records begin in 1946 (UCDP, 2025). UNHCR reported 117.8 million people forcibly displaced at the end of 2025, a first fall in a decade but still among the highest on record (UNHCR, 2026). The World Economic Forum's 2026 survey of global leaders ranks geoeconomic confrontation, including trade restrictions and competition over critical resources, as the top short-term risk to the world (World Economic Forum, 2026). For resilience, the point is that conflict and fragile institutions interact with every other domain: they raise the cost of disasters, cut the delivery of aid and health care, and hold back the investment that reduces future risk.

4.2 Institutions as the capacity to act

Institutions decide whether knowledge and money become protection. Government effectiveness, as measured by the World Bank's governance indicators, averages -1.21 in low-income countries and +1.13 in high-income ones on a scale from −2.5 to +2.5, and the gap has barely moved since 2000 (World Bank, 2025a). Strong institutions run early warning systems, adaptive social protection and pre-arranged disaster finance, which pay out faster and are spent better than appeals launched after a disaster (Clarke and Dercon, 2016; Bowen et al., 2020). A recent global study found that how well countries handled the COVID-19 pandemic was more closely related to trust in government and social cohesion than to measures of preparedness on paper (COVID-19 National Preparedness Collaborators, 2022). Institutions are the hardest pathway to build quickly, which is why this report treats them as a long-horizon investment (Section 9).

4.3 Technology and systemic dependencies

Modern societies have built dependence on a small number of networks: power grids, payment systems, software platforms, logistics and communications. These make life more productive and, when they fail, more fragile. A single faulty software update in July 2024 knocked about 8.5 million computers offline worldwide, disrupting airlines, hospitals and banks (Weston, 2024). A winter storm in Texas in 2021 took out power and gas supply together and showed how energy and water systems fail in tandem (FERC and NERC, 2021). Sociologists of technology have long argued that tightly coupled systems with complex interactions will produce accidents that no single operator can foresee (Perrow, 1984).

Technology is also the other side of resilience. Warnings, mobile money, telemedicine, satellite data and cheap solar power are what make low-cost protection possible. The average cost of new solar electricity fell by about 90% between 2010 and 2023 (IRENA, 2024), and internet use rose from 6% of the world's people in 2000 to 72% in 2024, though only 20% in low-income countries (World Bank, 2026; ITU, 2025). Technology diffusion matters as much as invention: new technologies reach poor countries slowly, and shortening that lag is among the biggest available levers on both income and resilience (Comin and Hobijn, 2010). Section Section 8 measures the lag.

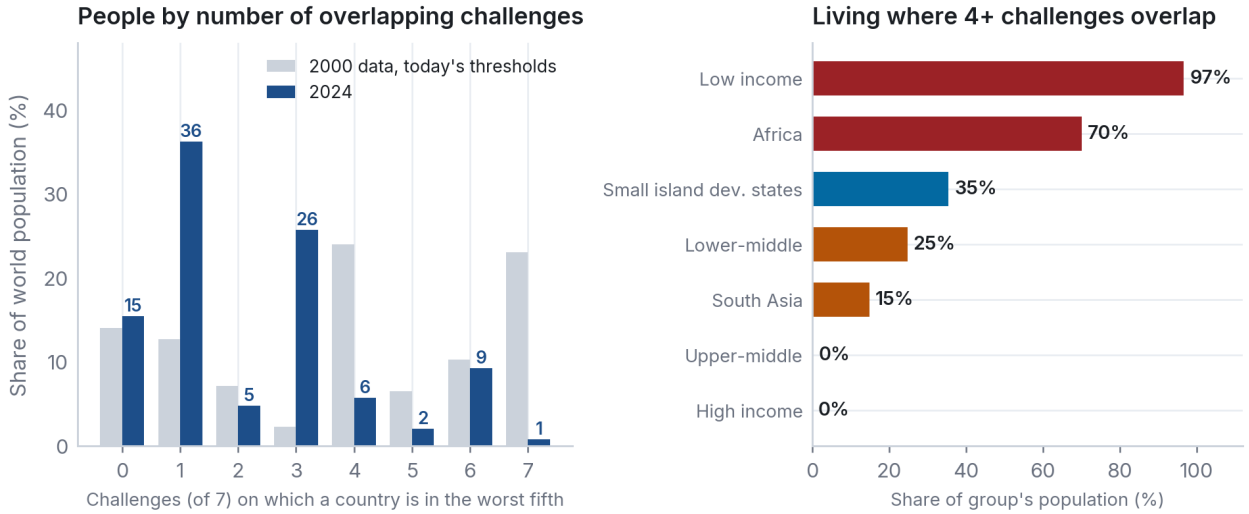
4.4 Where challenges overlap

To see how challenges stack, this report flags each country as being in the worst fifth of the world on each of seven challenges: climate hazard, air pollution, poverty, food and water, child health, energy access and political instability, using 2024 data and, for 2000, the same thresholds (Figure 4). Today, 41 countries are in the worst fifth on four or more, with 1.4 billion people (18% of humanity); in 2000 the same thresholds would have put 72 countries and 3.9 billion people (64%) in that group. That fall, by about 2.5 billion people, is the main quantitative finding of Part I: vulnerability has dropped at scale, and mostly through development. What remains is concentrated: 97% of people in low-income countries and 70% of Africans live in such countries, as against none in high-income countries and one tiny country (Equatorial Guinea) in the upper-middle group. Overlap is also higher than chance: 19% of countries have four or more flags, against 4% if flags fell independently. Challenges cluster because they share causes, chiefly poverty (Figure 5).

The pattern in Figure 5 anchors the report's central argument. Climate hazard is unrelated to national income, which means hazards are spread across rich and poor alike. All of the other vulnerabilities, from child mortality to connectivity, are tightly tied to income, and much of the correlation among them reflects shared poverty. This is the empirical case for development as risk reduction: if most vulnerabilities share a root, then work on the root reduces many of them together. It is not a proof of cause, and the controls are simple, but it matches long-run studies of disaster losses, institutions and income (Kahn, 2005; Toya and Skidmore, 2007; Rodrik, 1999).

Figure 4 Overlap has fallen by about 2.5 billion people since 2000 but remains near-universal in low-income countries

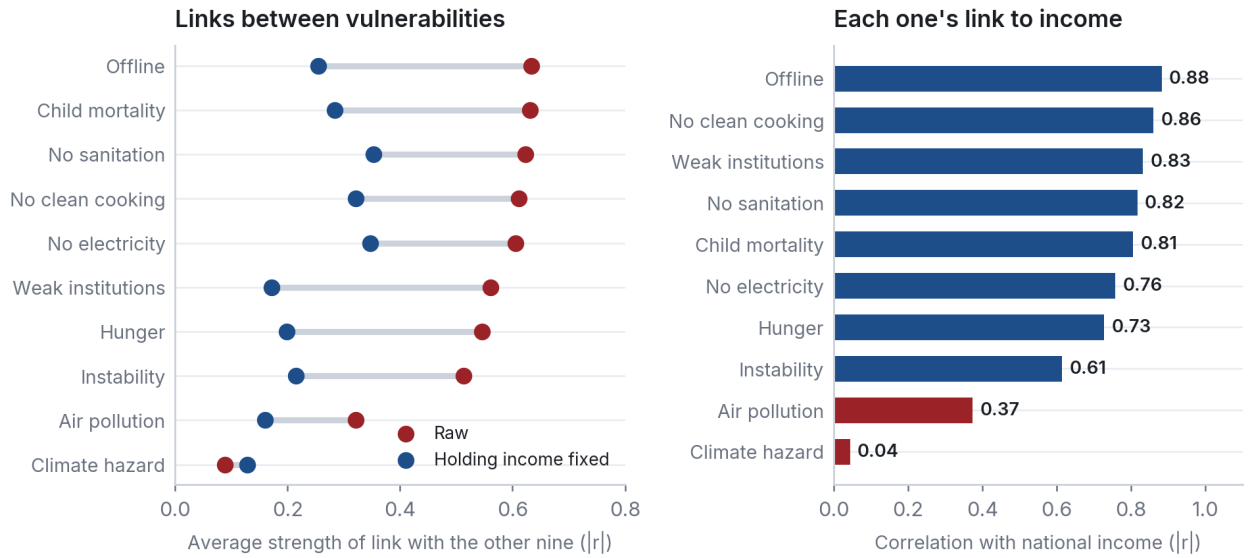
People by number of overlapping challenges, 2000 and 2024, and share of people in countries with four or more



Source: H Heuristics calculations from (World Bank, 2026; World Bank, 2025a; European Commission JRC, 2026; WHO, 2026). A country is 'in the worst fifth' on a challenge if its value is in the worst 20% of 217 economies in 2024 (air: PM2.5 or clean cooking; food and water: undernourishment or drinking water). 2000 values use 2024 thresholds. Seven challenges: climate hazard, air, poverty, food and water, child health, energy, instability.

Figure 5 Vulnerabilities are linked, but about half of the link disappears once income is held fixed

Links between ten vulnerabilities and their relationship to national income



Source: H Heuristics calculations from (World Bank, 2026; World Bank, 2025a; European Commission JRC, 2026), 160 countries, 2024. Left: average absolute correlation of each vulnerability with the other nine, raw and after removing the linear effect of log income. Right: correlation with national income. Climate hazard is the INFORM hazard score.

PART II · SECTION 05

Defining Polycrisis Resilience

Polycrisis Resilience is a capacity, not a prediction. It describes how well people and systems can anticipate, withstand, adapt to, recover from and, above all, reduce their vulnerability to crises that interact.

IN BRIEF

- Six capacities act before, during and after crises; a polycrisis tests all of them at once.
- The central shift is from managing crises as they arrive to reducing the structural vulnerability that makes them severe.
- Human vulnerability (who is harmed) and systemic vulnerability (how failure spreads) are the two measures that matter most.

5.1 A definition

Polycrisis Resilience

Polycrisis Resilience is the capacity of individuals, communities, institutions, economies, societies, and interconnected systems to anticipate, withstand, adapt to, recover from, and reduce their vulnerability to multiple interacting crises.

H Heuristics definition (Hughes, 2026a)

Four features of the definition do most of the work. It names the **holders** of resilience, from individuals and communities to economies and the networks between them, because resilience at one level does not guarantee it at another: a resilient firm can sit inside a fragile supply chain. It lists **capacities** rather than outcomes, because a society can survive one crisis by luck and still lack the ability to survive the next. It is aimed at **multiple interacting crises**, which is what separates it from resilience to a single hazard. And it ends with **reducing vulnerability**, the part of the definition that points to action before a crisis arrives and makes development, not only emergency management, part of resilience. The wider resilience literature has long separated absorbing shocks, adapting to them and transforming the system (Holling, 1973; Folke, 2006; Walker et al., 2004; Béné et al., 2012); the definition builds on that tradition and adds the capacities to prevent and reduce.

5.2 Six capacities

The definition can be unpacked into six capacities, which act at different moments in the life of a crisis (Table 2). Three, absorptive, adaptive and transformative, are well established in the literature (Walker et al., 2004; Béné et al., 2012). Polycrisis Resilience adds three that stress acting before and after: risk reduction, preventive and recovery capacities (Hughes, 2026a).

Table 2 The six capacities of Polycrisis Resilience

Capacity	Core question	Main phase	Illustrative mechanisms	Illustrative indicators
Risk reduction	Are the underlying drivers of vulnerability falling?	Before	Land-use planning, building codes, poverty reduction, diversification	Exposed population; poverty rate; export concentration
Preventive	Are crises becoming less likely and less severe?	Before	Early warning, outbreak surveillance, financial regulation, emission cuts	Early warning coverage; disease surveillance capacity
Absorptive	Do essential functions keep working during a crisis?	During	Reserves, stocks, redundancy, insurance, continuity plans	Reserves in months of imports; backup power in clinics
Recovery	How quickly and fully are functions restored?	After	Fiscal space, contingent finance, reconstruction capacity	Interest share of revenue; time to recover output
Adaptive	Does the system learn and adjust between crises?	Between	Education, information systems, flexible institutions	Schooling; government effectiveness; data systems
Transformative	Can the system change its pathway when needed?	Long run	Structural change, energy transition, relocation, reform	Economic complexity; clean energy share

Source: H Heuristics (Hughes, 2026a).

The capacities draw on the same assets: education, health, savings, infrastructure, institutions and trust. A strong health system contributes to prevention, absorption, recovery and adaptation alike, so investment in shared foundations strengthens several capacities at once. Where the foundations are weak, all six are weak together, which is one reason vulnerabilities cluster (Figure 5). The capacities also involve trade-offs, such as buffers against flexibility or efficiency against redundancy, which should be made deliberately with the full range of possible crises in view (Linkov et al., 2014).

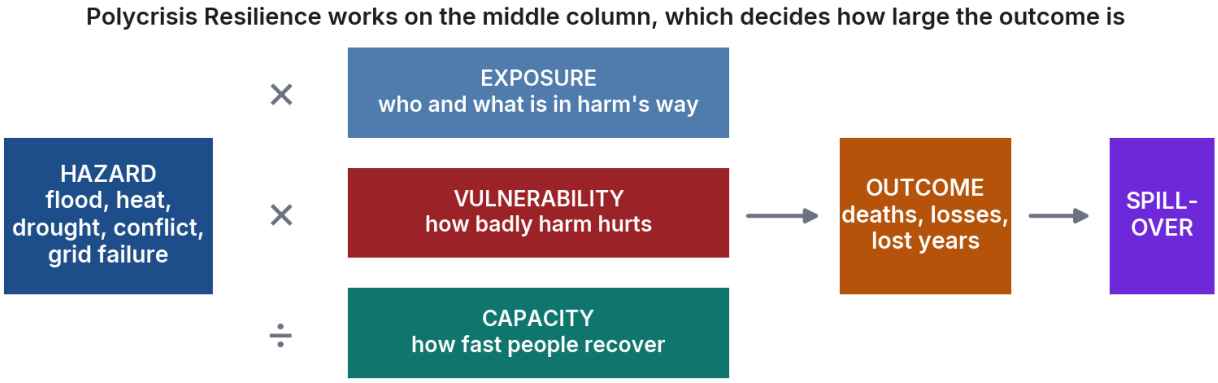
5.3 From crisis response to structural vulnerability reduction

Most public attention and money go to what happens after a crisis: emergency relief, reconstruction and political debate. That work saves lives, and it will always be needed. But it treats the crisis as the problem. The Polycrisis Resilience approach treats the *conditions* the crisis meets as the problem, and asks why the same hazard kills dozens in one place and none in another. Figure 6 sets out the idea as a simple, stylised chain: the harm from a hazard depends on how many people and assets are in its path (exposure), how badly they are hurt when it arrives (vulnerability), and how quickly they recover (capacity). Hazards are mostly set by geography and by the climate. The middle three are set by development.

The two approaches are partners rather than rivals. A society that has reduced its structural vulnerability still needs shelters, stockpiles and emergency finance for what remains, and a society with good emergency tools but high underlying vulnerability will meet one overwhelming crisis after another. The practical difference is where marginal money and attention go. The evidence in Section 6 suggests that in much of the world the larger returns are on the structural side.

Figure 6 Hazard is largely given; exposure, vulnerability and capacity are what development can change

How a hazard becomes an outcome, and where Polycrisis Resilience intervenes



Source: H Heuristics schematic, following standard disaster-risk and climate-risk framing (IPCC, 2023; UNDRR, 2017; Cutter et al., 2008). The chain is stylised, not an equation.

Table 3 Two ways of reducing the cost of crises

	Crisis response	Structural vulnerability reduction
Timing	After the shock	Years or decades before it
Unit of action	The single crisis: a flood, a pandemic, a price spike	The conditions shared by many crises: poverty, weak services, fragile institutions
Typical tools	Relief, emergency finance, repair	Power and water systems, health care, schooling, housing, warnings, institutions
Benefit	Reduces suffering and speeds recovery once harm has begun	Reduces the harm and the number of people exposed, often for several hazards at once
Cost pattern	Paid when needed, at crisis prices, usually by whoever can pay	Paid early, spread over time; returns come as losses that never happen
Weakness	Overwhelmed when crises overlap or arrive in quick succession	Slow, hard to see and politically easy to postpone

Source: H Heuristics.

5.4 Human and systemic vulnerability as central measures

Two kinds of vulnerability are central to the framework, and they call for different measures. **Human vulnerability** is the susceptibility of people and households to harm: whether they have clean energy, safe water, health care, income and schooling, and how many live in conditions that a shock turns to catastrophe. It is measured in lives, illnesses, lost income and lost years of life. **Systemic vulnerability** is the tendency of linked systems to transmit and amplify failure: how many sectors a power cut disables, how fast a price shock spreads from one commodity to a region's food supply. It is measured in overlaps, dependencies and the speed at which problems cascade. This report uses both: human measures such as child mortality and the number of people without basic services, and a systemic measure, the number of challenges that overlap in a country (Section 4). Part VI proposes how to bring them together.

PART II · SECTION 06

Development, Prevention and Interconnected Solutions

The framework treats development as long-term risk reduction. The evidence supports that for most services and outcomes, shows where development does not help on its own, and points to prevention as the best-value way to use it.

IN BRIEF

- Income per person explains most of the variation in clean cooking, sanitation, internet use and child survival (correlations 0.74 to 0.86) but little of the variation in air pollution (0.28) or climate hazard (0.04).
- Global child mortality has fallen from 178 to 37 per 1,000 births since 1960; low-income countries today have higher rates than high-income countries had in 1960.
- Reported benefit-cost ratios for prevention range from 2:1 to more than 10:1, with real caveats.

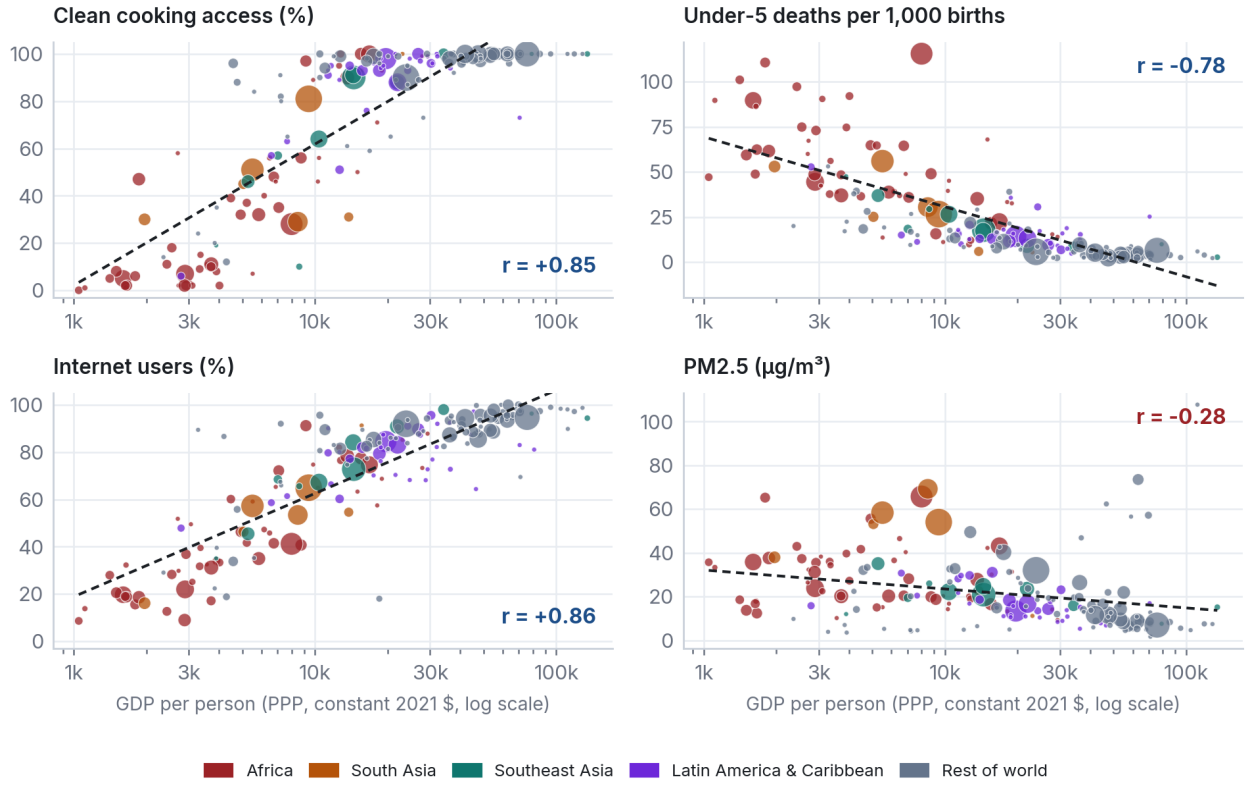
6.1 Development as risk reduction

It is common to treat economic development and resilience as separate goals, as though growth were one project and protection from shocks another. The H Heuristics framework starts from a different proposition: when pursued through appropriate pathways, development changes the very conditions that decide whether people are exposed to interconnected threats and how severely those threats affect them. A household with reliable electricity, clean cooking fuel, a sound roof, a nearby clinic and a bank account is less exposed to nearly every shock than one without, whatever the cause of the shock.

If development reduces vulnerability, richer countries should look better on the measures that matter. Figure 7 tests this across about 198 economies. The relationship is strong for most services. Income per person has a correlation of 0.86 with internet use, 0.85 with clean cooking, 0.78 with sanitation, 0.74 with electricity and -0.78 with under-five mortality. Correlation is not proof of cause, but it is consistent with a large body of research on income, institutions and disaster deaths (Kahn, 2005; Toya and Skidmore, 2007; Formetta and Feyen, 2019).

Figure 7 Income is closely tied to clean cooking, internet use and child survival, but hardly at all to air pollution

Selected indicators against GDP per person across the world's economies



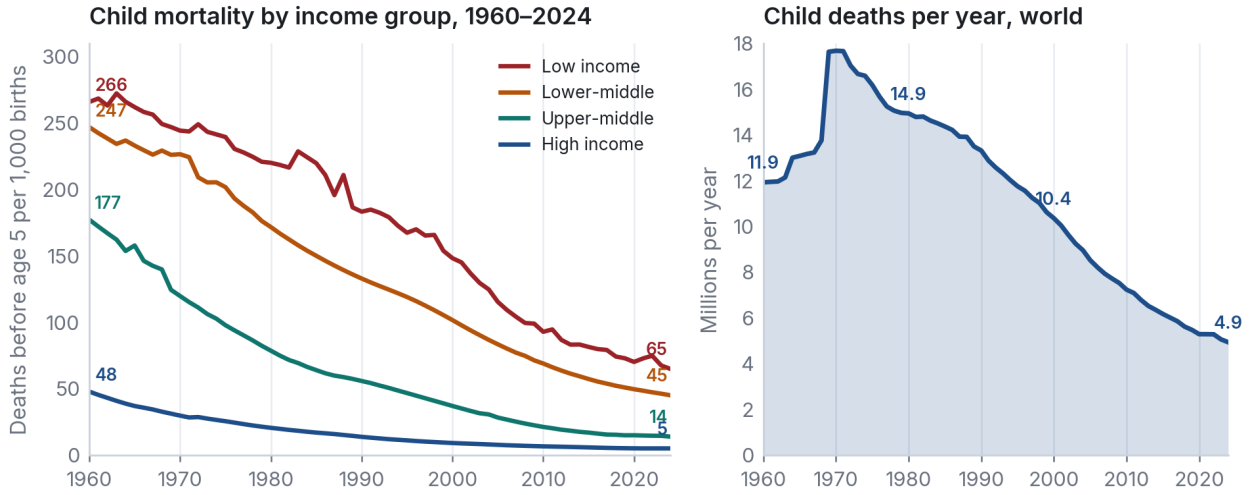
Source: World Bank World Development Indicators, latest year, 2024 or nearest (World Bank, 2026). Each dot is a country (size shows population); dashed line is a linear fit against the logarithm of income; r is the correlation.

6.2 What the record since 1960 shows

The most telling evidence is what has already happened. Figure 8 follows deaths before the age of five since 1960 (Our World in Data, 2025; United Nations, 2024). The world rate fell from 178 per 1,000 births in 1960 to 77 in 2000 and 37 in 2024. Because births grew, deaths rose to about 18 million a year around 1970 before falling to 4.9 million in 2024. Every income group improved, and the lag is striking: low-income countries today, at 65 per 1,000, have a higher child death rate than high-income countries had in 1960 (48); lower-middle-income countries, at 45, are where rich countries were around 1961; upper-middle-income countries are where rich countries were in about 1990. Development is, in a literal sense, a lag, and shortening it reduces vulnerability. Progress since 2000 has been broad: electricity access rose from 78% to 92%, clean cooking from 48% to 75%, sanitation from 56% to 82% and internet use from 6% to 72% (World Bank, 2026). The exception is clean air, discussed below.

Figure 8 Child mortality has fallen in every income group, and the lag between rich and poor countries is measured in decades

Under-five mortality by income group, 1960–2024, and world child deaths per year



Source: H Heuristics calculations from UN child-mortality estimates (IGME, via Our World in Data) weighted by UN births (Our World in Data, 2025; United Nations, 2024); income groups from the World Bank (World Bank, 2025b). Deaths are births times the under-five rate.

6.3 Where development does not fix it automatically

Air pollution is the clearest exception. Across the world's economies the correlation between income and fine-particle pollution is only -0.28, and the income-group averages show why: population-weighted PM2.5 is 50 µg/m^3 in lower-middle-income countries (driven by South Asia), 27 in upper-middle-income countries and 13 in high-income countries, where it fell steadily. Fast-growing economies have often grown on coal, diesel, biomass burning and unregulated industry. Climate hazard is a second case. It is set largely by geography, with a correlation of -0.04 with income, so growth does not move it, although growth changes how much damage it does.

The lesson is not that development is a poor route to resilience, but that it reduces vulnerability **when the pathway is chosen with that aim**. Growth through clean power, clean transport, regulated industry and well-planned cities reduces vulnerability twice, through income and through lower exposure. Growth that locks in pollution or builds in flood plains can reduce one vulnerability while creating another. This is why Section 7 speaks of pathways and not simply of growth.

6.4 Preventive capacity and the economics of acting early

Prevention is the part of Polycrisis Resilience whose logic is most economic. The costs of letting vulnerability stand are large and fall hardest on those least able to bear them: disasters cost an estimated $520 billion a year in lost consumption and push about 26 million people into extreme poverty annually (Hallegatte et al., 2017), air pollution is linked to about 7.2 million deaths a year (WHO, 2026), and output losses after crises tend to last (Cerra and Saxena, 2008; Hsiang and Jina, 2014). Studies of prevention report high average returns (Table 4). These are averages across many places and designs, not guarantees for any project, and they mostly concern resilience investments rather than the whole development agenda.

The difficulty is not that prevention is unprofitable but that its payoffs come later than its costs, and the countries with the largest gaps have the least room to borrow. Adaptation needs in developing countries are estimated at $310–365 billion a year by 2035, against about $26 billion of inter-

Table 4 What the economic evidence says about prevention and resilience

Source	Finding	Scope and caveat
Global Commission on Adaptation (Global Commission on Adaptation, 2019)	$1.8 trillion invested globally in 2020–2030 in five areas could yield $7.1 trillion in net benefits; benefit-cost ratios from 2:1 to more than 10:1	Five areas only: early warning, resilient infrastructure, dryland farming, mangroves, water; modelled
World Bank, *Lifelines* **(Hallegatte et al., 2019)**	Each $1 invested in more resilient infrastructure yields about $4 in benefits in low- and middle-income countries	Infrastructure only; average across countries
Global Commission on Adaptation (Global Commission on Adaptation, 2019)	Warning people 24 hours before a storm or heat wave can cut damage by about 30%	Depends on warnings reaching and being acted on
UNDRR, *Resilience Pays* **(UNDRR, 2025)**	Prevention is systematically underfunded relative to response	Evidence review, not a single ratio
World Bank, *Unbreakable* **(Hallegatte et al., 2017)**	Welfare losses from disasters are far larger than asset losses; poor households lose most	Shows why returns to protecting the poor are high
H Heuristics scenarios (Section 9)	Best-peer rather than current pace would avoid about 117 million child deaths and 71 million household air pollution deaths in 2026–2100	Arithmetic scenarios, not forecasts; no dollar value attached

Source: as cited; H Heuristics summary.

national public adaptation finance in 2023 (UNEP, 2025), and development assistance fell sharply in 2025 (OECD, 2026). Pre-arranged finance and risk pools, which pay out within weeks (Clarke and Dercon, 2016; CCRIF SPC, 2025; African Risk Capacity, 2025), adaptive social protection (Bowen et al., 2020) and new mechanisms such as the Global Shield, the Fund for responding to Loss and Damage and the IMF Resilience and Sustainability Trust (Global Shield against Climate Risks, 2025; FRLD, 2025; IMF, 2025) help, but each investment should still be screened locally for use, upkeep, lifetime cost, who gains and the credible alternative.

Because vulnerabilities share roots, solutions should share roots too. This is the logic of *multisolving*: designing one investment to work on several problems at once (Sawin, 2018). An appraisal of rural clinic electrification that counts only the health benefit misses the school that can then open at night, the longer-lasting vaccines and the cut in diesel pollution, and systems thinkers warn that partial fixes can fail or backfire (Meadows, 2008). Section 7 organises interconnected solutions into ten pathways.

PART III · SECTION 07

The H Heuristics Framework: Ten Development Pathways

The H Heuristics framework organises Polycrisis Resilience around ten interconnected development pathways. Each reduces vulnerability in its own right, and together they reinforce one another.

IN BRIEF

- Ten pathways, from clean energy to digital infrastructure, cover the main ways development lowers exposure, vulnerability and the cost of recovery.
- The pathways are mutually reinforcing: one development intervention can reduce vulnerability across several risk categories.
- A five-stage cycle turns the pathways into practice: identify, prioritise, strengthen, reduce and sustain.

7.1 Ten pathways

The framework organises Polycrisis Resilience around interconnected development pathways (Table 5). The pathways are not a checklist to be completed one at a time. They are ten views of one task: building systems that can absorb disruption, adapt to changing conditions and keep essential services running. The right-hand column gives a piece of evidence from this report for each pathway, so that the framework can be read as a set of testable claims.

7.2 Which pathway reaches which vulnerability

Figure 9 shows how each pathway bears on seven vulnerabilities from Part I. The scoring is a transparent judgement by H Heuristics, and readers may weigh it differently, but two patterns are clear. No pathway tackles everything, and every vulnerability is reached by several pathways, so a programme built around one sector leaves gaps. And some pathways are strong across many columns: institutions and human development touch nearly all, which is why they are slow to build and valuable once built.

7.3 Mutually reinforcing pathways

These pathways are mutually reinforcing. Clean electricity can support clean cooking, improve health care delivery, strengthen water infrastructure and enable digital services; one development intervention can therefore reduce vulnerability across several interconnected risk categories. Four reinforcing loops stand out:

- **Energy and health.** Power lets clinics keep vaccines cold and run surgery, and clean cooking cuts the household smoke that kills about two million people a year (WHO, 2026; IEA et al., 2025).

Table 5 The ten development pathways and their resilience contributions

Development pathway	Resilience contribution	Evidence in this report
Clean energy transition	Reduces pollution, emissions and energy vulnerability	655 million people lack electricity; solar power cost fell about 90% in 2010–2023 (IRENA, 2024; World Bank, 2026)
Technology diffusion	Expands access to productivity-enhancing and protective technologies	Internet use is 20% in low-income countries against 93% in high-income ones (World Bank, 2026; Comin and Hobijn, 2010)
Climate adaptation	Reduces exposure to environmental hazards	Warning 24 hours ahead cuts damage by about 30% (Global Commission on Adaptation, 2019); disaster death rates fell about 97% from the 1960s to the 2010s (CRED, 2025)
Human development	Reduces poverty and underlying socioeconomic vulnerability	Child mortality fell from 178 to 37 per 1,000 births since 1960; schooling predicts lower disaster mortality (Lutz et al., 2014)
Infrastructure strengthening	Improves the reliability of essential systems	Each $1 in more resilient infrastructure yields about $4 in benefits in low- and middle-income countries (Hallegatte et al., 2019)
Public health and clean environments	Reduces environmental and health-related exposure	Air pollution is linked to about 7.2 million deaths a year (WHO, 2026)
Institutional strengthening	Improves coordination, governance and crisis preparedness	Adaptive social protection and pre-arranged finance work faster than appeals (Bowen et al., 2020; Clarke and Dercon, 2016); trust predicted pandemic outcomes (COVID-19 National Preparedness Collaborators, 2022)
Economic diversification	Reduces dependence on vulnerable economic sectors	Shocks can depress growth for a decade (Hsiang and Jina, 2014); the case for diversification is largely by reasoning and is not tested directly here
Food and water security	Reduces resource-related vulnerabilities	About 645 million people are hungry (FAO et al., 2026); 692 million lack basic drinking water (World Bank, 2026)
Digital infrastructure	Improves information access, early warning and coordination	Mobile money raised consumption and lifted households from poverty in Kenya (Suri and Jack, 2016); early warning coverage is uneven (UNDRR and WMO, 2023)

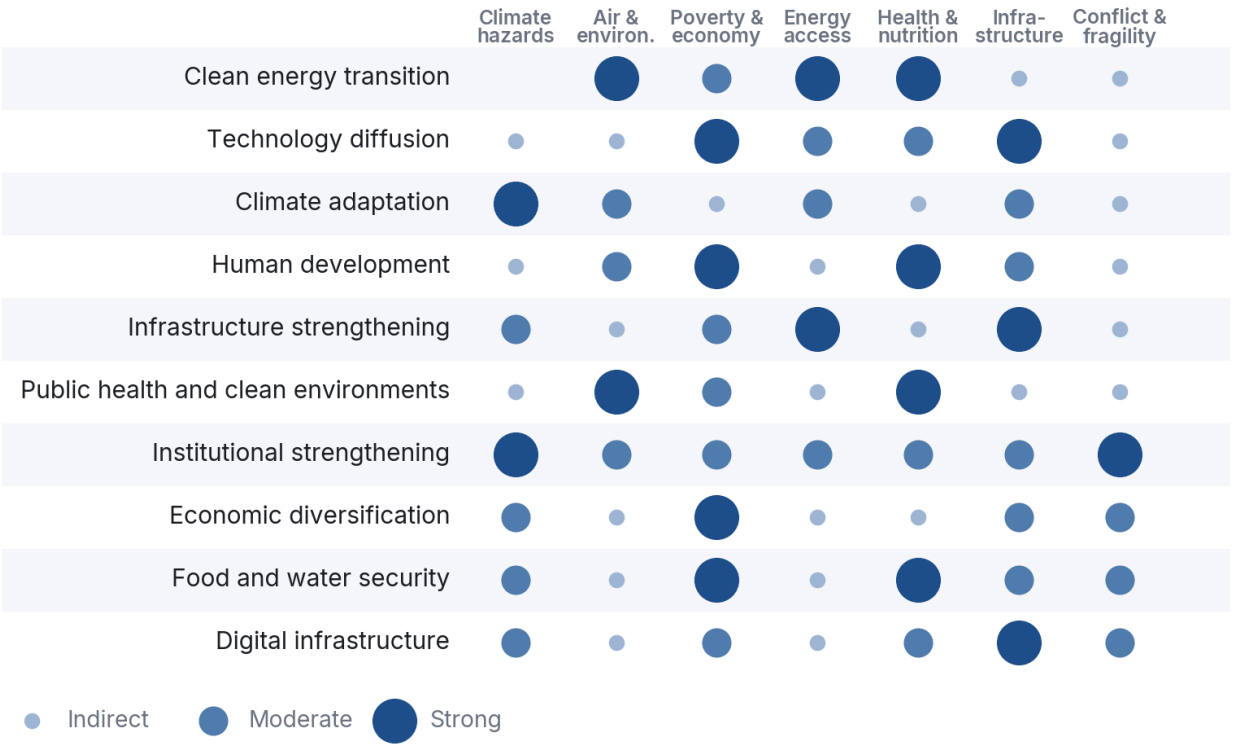
Source: H Heuristics framework (Hughes, 2026a); evidence from the sources cited.

- **Connectivity and protection.** Phones and data networks deliver warnings, cash transfers and weather advice, and make adaptation and social protection cheaper to run (Suri and Jack, 2016; WMO, 2025).
- **Education and adaptation.** Schooling raises the ability to understand warnings, move, find new work and rebuild, and is among the strongest predictors of lower disaster mortality (Lutz et al., 2014).
- **Institutions and everything else.** Capable public institutions plan networks, regulate pollution and run programmes, so each of the other nine pathways depends on them.

The opposite is also true. Vicious circles, in which poverty weakens institutions, weak institutions undermine services and failing services deepen poverty, are what the framework seeks to reverse. Positive feedback of this kind is the reason it insists on treating the pathways together (Meadows, 2008; Sawin, 2018).

Figure 9 Each pathway has a home area where its effect is strongest, and every vulnerability is reached by several pathways

Strength of link between each development pathway and seven vulnerabilities



Source: H Heuristics judgement, based on the evidence in this report and Hughes (2026a). Larger circles indicate stronger and better-evidenced links.

7.4 From pathways to practice: a five-stage cycle

The framework turns the pathways into a repeating cycle of five stages, with continuous assessment, learning and improvement at the centre (Hughes, 2026a). The cycle works at any scale, from a city planning office to the international system.

Table 6 The five-stage Polycrisis Resilience cycle

Stage	Question it answers	Where in this report
1. Identify vulnerability	Where are people most exposed, and to which interacting challenges?	Overlap map and links (Section 4)
2. Prioritise development interventions	Which investments reduce the most vulnerability for each dollar?	Pathways and economics (Section 6, Section 7)
3. Strengthen interconnected systems	How do energy, health, water, digital, urban and institutional systems support each other?	Regional applications (Section 8)
4. Reduce systemic vulnerability	How many fewer people are exposed, and how much less is lost in shocks?	Century outlook (Section 9)
5. Strengthen long-term resilience	Are gains durable, financed and learning from experience?	Measuring impact (Section 10)

Source: H Heuristics, from the framework in Hughes (2026a).

PART IV · SECTION 08

Regional and Global Applications

The same ten pathways apply everywhere, but their order and mix change with place. This section applies the framework to the Global South as a whole, five regional settings, the high-income economies and the global system that links them.

IN BRIEF

- The Global South holds 83% of humanity (6.7 billion people); Africa and South Asia hold most of the gaps in basic services.
- Regional priorities differ: power and cooking in Africa, air and heat in South Asia, industry and coasts in Southeast Asia, cities and inequality in Latin America, coasts and finance in small islands.
- High-income economies are not exempt from systemic risk, and global cooperation shapes how fast technology and finance reach everyone else.

8.1 The Global South

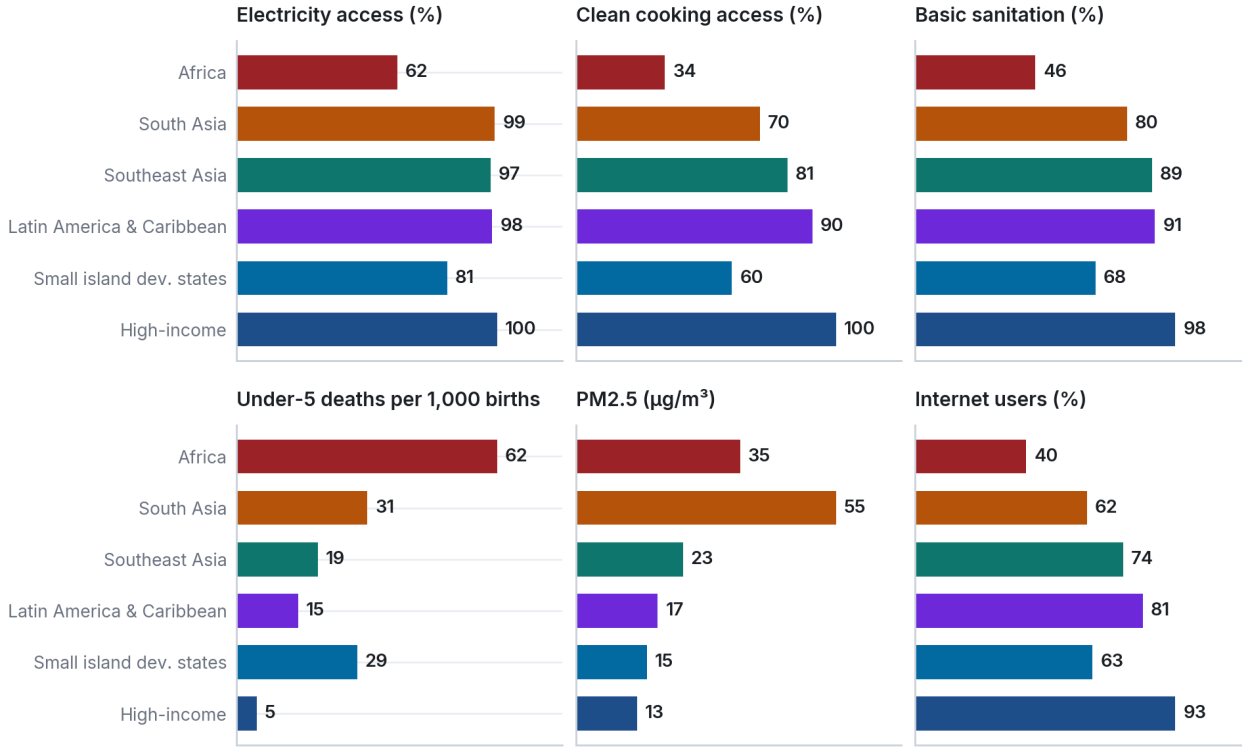
The Global South, defined here as the 131 low-, lower-middle- and upper-middle-income economies, holds 6.7 billion people, 83% of humanity (World Bank, 2025b; World Bank, 2026). It contains at least 98% of the world's people without electricity, clean cooking or basic sanitation, and the United Nations expects its population to grow from 6.7 billion to about 8.8 billion by 2075 before easing (United Nations, 2024). A detailed analysis of the group, with six development priorities and scenarios to 2100, is in the companion report on the Global South (Hughes, 2026d). Its main finding applies here too: development there is the biggest single lever on world vulnerability, and polycrisis resilience in the Global South is, to a large degree, polycrisis resilience for the world.

8.2 Africa and the long-term development opportunity

Africa is the region where the development lever is largest and the clock matters most. Its 1.51 billion people are projected to become 2.5 billion by 2050 and 3.8 billion by 2100, more than a third of humanity (United Nations, 2024). Today only 62% have electricity and 34% clean cooking, and 62 of every 1,000 children die before age five, against 5 in high-income economies. About 63% of the world's child deaths now occur in Africa, and 70% of Africans live in a country where four or more of the seven challenges overlap. The opportunity is as large as the gap. Africa has emitted about 4% of global carbon dioxide (1.0 tonnes per person against 9.9 in high-income economies) (Our World in Data, 2025a), has abundant solar resources, is the youngest region and has the lowest base from which to improve. Priorities are electrification through distributed solar and storage, including the World Bank and African Development Bank's Mission 300 programme to connect 300 million people by 2030 (World Bank, 2024), clean cooking people will use exclusively (HAPIN Investigators, 2024; IEA, 2025), health systems and sanitation, climate adaptation, and institutions that can use finance well. The companion report on Africa develops the case (Hughes, 2026b).

Figure 10 Africa lags on services and child survival, South Asia on air quality, and small island states on cooking and sanitation

Selected indicators for five regions, with high-income economies for comparison



Source: H Heuristics calculations from World Bank World Development Indicators, 2024 or nearest (World Bank, 2026); population-weighted means. SIDS: UN-recognised small island developing states with data (UN-OHRLLS, 2025).

8.3 South Asia and climate vulnerability

South Asia combines near-universal electricity (99%) with the world's most polluted air (55 µg/m³ on average, with 100% of people in countries in the worst fifth on air quality) and very high exposure to floods, cyclones, drought and heat (95% in the highest-hazard fifth). Its 1.97 billion people are projected to grow to about 2.5 billion by 2075 (United Nations, 2024). 583 million people still lack clean cooking and 393 million lack basic sanitation. The 2022 floods in Pakistan caused damage and losses above $30 billion (Government of Pakistan et al., 2022), showing how a hazard interacts with debt, prices and health. Bangladesh shows what sustained preparedness achieves: cyclone deaths fell by more than 95% between 1970 and 2007 as warnings, shelters and volunteers spread (Haque et al., 2012). Priorities include extreme-heat adaptation, air quality, flood management, resilient urbanisation, clean cooking and clean power.

8.4 Southeast Asia and industrial transformation

Southeast Asia is where the industrial pathway is most visible. Its 695 million people have 97% electricity access, 81% clean cooking and a child mortality rate of 19 per 1,000, and no country in the group is in the worst fifth on four or more challenges. Its main vulnerabilities are exposure (93% of people live in high-hazard countries) and the pollution and emissions of fast manufacturing growth. The region's population is projected to peak near 0.8 billion around 2075 (United Nations, 2024). Priorities are clean industrialisation, coastal and flood adaptation, resilient grids and ports, and shortening the lag in the technologies that firms need (Comin and Hobijn, 2010). The choices of cleaner or dirtier manufacturing now will set the region's air and emissions for decades.

8.5 Latin America and environmental resilience

Latin America and the Caribbean have the highest services of any developing region (98% electricity, 90% clean cooking, 15 child deaths per 1,000), but a government effectiveness score of -0.2 and wide differences inside and between countries: the region's combined score runs from 17 in Haiti to 74 in Uruguay on the dashboard in Section 10. Haiti is in the worst fifth on all seven challenges, while 51% of the region's people live in countries that are on none. Environmental resilience is central: forests, wetlands and coastal systems provide protection and carbon storage and are under pressure. Priorities include resilient urban infrastructure, inequality reduction, ecosystem protection, disaster finance such as the Caribbean Catastrophe Risk Insurance Facility (CCRIF SPC, 2025), and institutions for continuity across political cycles.

8.6 Small island developing states

Small island developing states are in an unusual position. They emit about 0.6% of global carbon dioxide (3.3 tonnes per person) but sit among the most exposed places: 50% of their people live in high-hazard countries, and 35% in countries with four or more overlapping challenges. Their average clean cooking access is 60% and sanitation 68%. They depend on a few ports, one grid and a narrow economy, so a single storm can disable a country. Priorities are coastal adaptation, resilient and distributed power, disaster finance and pooled insurance (CCRIF SPC, 2025; Global Shield against Climate Risks, 2025; FRLD, 2025), water security and digital connectivity to reach remote communities. Their case is also the clearest argument for international finance that is fast, predictable and not conditional on a disaster having happened.

8.7 High-income economies and systemic resilience

High-income economies have few people in conditions of deep deprivation: none live in a country with four or more overlapping challenges, and child mortality is 5 per 1,000. They are not exempt from polycrisis. Their risks are systemic: tight dependence on a few networks, such as power grids, software platforms, payment systems and long supply chains (Section 4); heat waves, which raised their recorded climate disaster death rate above that of lower-income groups in 2015–2024 (CRED, 2025); and air pollution that, at 13 μg/m^3, is still more than twice the World Health Organization guideline. High-income economies produced 37% of 2023 carbon dioxide emissions with 17% of the people (9.9 tonnes per person against a world average of 4.6) (Our World in Data, 2025a), so decarbonisation at home is a resilience measure for everyone. They also hold most of the finance, science and technology that others need. Priorities are resilient and redundant infrastructure, heat adaptation, honest stress-testing of dependencies, fast decarbonisation, and honouring commitments on finance and technology.

8.8 Global cooperation and technology diffusion

No region can build its resilience alone, and the global system sets how fast technology, knowledge and finance reach the places that need them. Technology diffusion is a case in point: Table 7 measures how many years each income group is behind the high-income group on two indicators. Lower-middle-income countries are about 17 years behind on internet use (59% in 2024, a level the high-income group reached around 2007) and more than 60 years behind on child survival. Low-income countries are further back on both. The lag is shrinking fastest where technology is cheapest to spread: mobile telephony and, more recently, solar power. Historical studies find that technologies reach poor countries with a delay of decades and that the delay has been getting shorter (Comin and Hobijn, 2010; Kremer et al., 2022).

Table 7 Development lag: how many years behind high-income countries?

Indicator	Low income	Lower-middle	Upper-middle
Internet use, 2024 level (%)	20	59	86
Year high-income countries had that level	before 2000 (26% in 2000)	2007	2018
Child deaths per 1,000 births, 2024	65	45	14
Year high-income countries had that rate	before 1960 (48 in 1960)	1961	1990

Source: H Heuristics calculations from (World Bank, 2026; Our World in Data, 2025; World Bank, 2025b); population-weighted income-group series; years by linear interpolation.

Cooperation matters in three further ways. **Finance:** adaptation needs in developing countries are many times current international public finance (UNEP, 2025), and development assistance fell sharply in 2025 (OECD, 2026), so the world is moving away from the scale of support that the framework implies. **Knowledge and standards:** early-warning systems, digital public infrastructure and clean cooking programmes spread faster when tested designs are shared, as the Early Warnings for All initiative aims to do (WMO, 2025). **Shared risks:** carbon emissions, pandemics, financial contagion and supply-chain failures cross borders by nature, so even the most self-reliant country has a stake in other countries' resilience (Lawrence et al., 2024; Renn et al., 2022). Global Polycrisis Resilience is, in this sense, a public good, and an under-supplied one.

PART V · SECTION 09

The Century-Scale Outlook, 2026–2100

Vulnerability falls slowly and its benefits come late. This section follows five periods from 2026 to 2100, comparing three paths for access to essential services and child survival: stalled, current pace and the pace the best-performing peers have achieved.

IN BRIEF

- At current pace 1.7 billion people would still lack clean cooking in 2100; at best-peer pace, 86 million. If access never improved, population growth alone would raise the number to 4.0 billion.
- Cumulative child deaths in 2026–2100: about 392 million if progress stalled, 208 million at current pace and 92 million at best-peer pace.
- The biggest gap between paths opens in 2051–2075, when the benefits of earlier decisions accumulate.

9.1 How the outlook is built

METHOD

Method in brief

Scope. 217 economies; population and births from the UN medium projection to 2100 (United Nations, 2024; Our World in Data, 2025); 2024 access levels from the World Bank (World Bank, 2026).

Three paths. *Stalled*: access shares stay at 2024 levels (so only population changes). *Current pace*: each country continues its 2010–2024 trend. *Best-peer pace*: each country improves at the 90th-percentile pace achieved by developing countries starting from similar levels in 2010–2024, or its own trend if faster.

What it is not. It is not a forecast: it leaves out climate shocks, conflict and finance, and caps access at 99% and child mortality at a floor of 5 per 1,000 births.

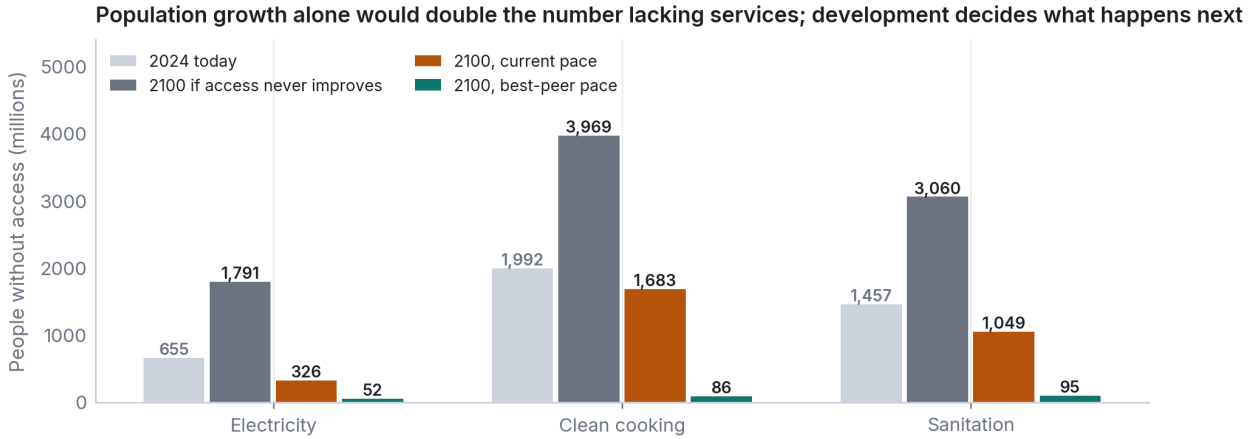
The right question about pace is how far recent progress falls short of what is needed. The comparison, for countries still below 90% access, is between the pace of the last 15 years, the best-peer pace and the pace needed to reach 95% by 2040. Electricity needs about 2.4 percentage points a year against 1.7 achieved, and clean cooking 2.6 against 2.0. Best-peer pace is 2.9 for electricity and 2.4 for cooking, so universal access by about 2040 is not beyond what has already been achieved by the fastest movers, but it asks the average country to move at that rate.

9.2 Two forces: demography and development

The outlook is a race between two forces. Population growth, concentrated in Africa and South Asia, pushes the number of people without services up; development pulls it down. Figure 11 separates them. If access never improved, the number of people without clean cooking would rise from 2.0 billion today to 4.0 billion in 2100, without electricity from 655 million to 1.8 billion, and without sanitation from 1.5 to 3.1 billion. At current pace the 2100 numbers are 1.7 billion, 326 million and 1.0 billion; at best-peer pace, 86, 52 and 95 million. Current pace roughly stops electricity gaps growing but does not finish the job for cooking or sanitation, where the count stops falling after about 2030. And the burden shifts: at current pace, 91% of the people still without clean cooking in 2100 would live in Africa.

Figure 11 Without development, population growth alone would double the number of people without services by 2100

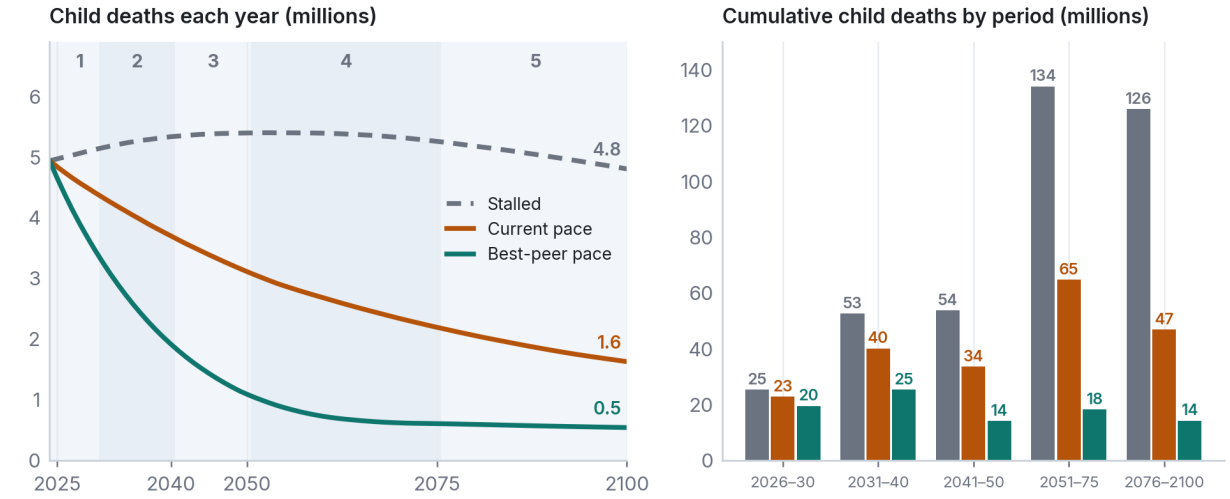
People without electricity, clean cooking and basic sanitation in 2024 and 2100 under three paths, millions



Source: H Heuristics scenarios from (World Bank, 2026; United Nations, 2024). 'Access never improves' holds each country's 2024 access share constant; population follows the UN medium projection. Illustrative arithmetic, not a forecast.

Figure 12 Child deaths could fall to about 0.5 million a year at best-peer pace, against about 5 million if progress stalls

World child deaths per year and cumulative by period under three paths, millions



Source: H Heuristics scenarios from (World Bank, 2026; United Nations, 2024; Our World in Data, 2025). Child deaths are UN births times each country's under-five mortality path. Illustrative arithmetic, not a forecast.

Child survival shows the long-term effect most clearly. In 2024 about 4.9 million children under five died, a rate of 37 per 1,000 births. At current pace the rate would fall to 24 in 2050 and 15 in 2100; at best-peer pace to 8 and 5; and if progress stalled the rate would stay near 41, with deaths about 5 million a year because births keep growing in high-mortality countries. Over 2026–2100 these paths add up to 392, 208 and 92 million child deaths. Moving from current to best-peer pace would avoid about 117 million deaths, and 76% of the current-pace total would occur in Africa.

9.3 Five periods

The century is divided into five periods that follow the framework's horizons, from establishing foundations to consolidating long-term resilience. Table 8 gives the numbers under each path, and the paragraphs below describe what each period asks of the ten pathways.

Table 8 The five periods at a glance: what the three paths imply

Period	Theme	Child deaths a year, millions (stalled / current / best-peer)	No clean cooking at period end, millions (current / best-peer)	No electricity at period end, millions (current / best-peer)
2026–2030	Establishing foundations	5.1 / 4.6 / 3.9	1,591 / 1,378	576 / 445
2031–2040	Accelerating development and diffusion	5.3 / 4.0 / 2.5	1,611 / 1,000	467 / 160
2041–2050	Strengthening global adaptive capacity	5.4 / 3.4 / 1.4	1,611 / 558	437 / 49
2051–2075	Reducing structural vulnerability	5.4 / 2.6 / 0.7	1,637 / 87	382 / 47
2076–2100	Consolidating long-term resilience	5.0 / 1.9 / 0.6	1,683 / 86	326 / 52

Source: H Heuristics scenarios from (World Bank, 2026; United Nations, 2024). Period averages (child deaths) and end-of-period levels. Illustrative arithmetic, not a forecast.

9.4 2026–2030: Establishing foundations

The first five years are about laying foundations that the later decades depend on. Priorities are mapping vulnerability so investment can be targeted, building the data and institutions that later work requires, starting the large electricity and clean cooking programmes, extending early warning to everyone (the goal of the Early Warnings for All initiative, set for 2027 (WMO, 2025)) and securing pre-arranged finance and social protection systems before the next shock (Clarke and Dercon, 2016; Bowen et al., 2020). The numbers are modest but set the slope: by 2030 about 445 million people would lack electricity at best-peer pace, against 576 million at current pace and 755 million if access stalled, and clean cooking gaps would be 1,378, 1,591 and 2,204 million. Warming is also projected to reach 1.5 °C in many scenarios in this period (IPCC, 2023), so protecting people from hazards already locked in comes first.

9.5 2031–2040: Accelerating development and diffusion

The second period is when pace decides the path. At best-peer pace, 95% of the world's people would have electricity by about 2031 and basic drinking water by about 2030, against 2042 for both at current pace; clean cooking and sanitation would follow by about 2052 and 2048, whereas at current pace neither reaches 95% by 2100. The work shifts from pilots to scale: grids and distributed power, clean cooking supply chains, water and sanitation, and digital infrastructure. Annual child deaths would be about 2.5 million at best-peer pace, 4.0 at current pace and 5.3 if progress stalled. Infrastructure built in this decade will operate for fifty years or more.

9.6 2041–2050: Strengthening global adaptive capacity

By mid-century, basic services should no longer be the main constraint in much of the world, and the emphasis shifts towards adaptive capacity: the ability of people and institutions to learn, plan and change as the climate keeps shifting. Education, health systems, social protection, flexible institutions, heat adaptation and resilient cities become the main work, while the population is still growing, to about 9.6 billion in 2050, with Africa at 2.5 billion. By 2050 child mortality would be about 8 per 1,000 births at best-peer pace and 24 at current pace, and the cooking gap 558 million against 1,611 million. This is also when choices about emissions determine how severe late-century hazards will be (IPCC, 2023).

9.7 2051–2075: Reducing structural vulnerability

The third period is where early investments pay off most visibly: the gap between the three paths is largest here. Cumulative child deaths in 2051–2075 would be 18 million at best-peer pace, 65 at current pace and 134 if progress stalled. Clean cooking and sanitation would be close to universal at best-peer pace (87 and 96 million remaining in 2075), but at current pace 1,637 million people would still lack clean cooking. These decades see the world's population approach its peak, near 10.3 billion around 2084, and Africa's reach 3.3 billion (United Nations, 2024). The priorities are structural: resilient housing and cities, economic diversification, deep institutional capacity and the renewal of the infrastructure built in the 2030s.

9.8 2076–2100: Consolidating long-term resilience

The last period is about consolidation: keeping what has been built and preventing backsliding. Population is expected to level off and fall slowly after about 2084, to 10.2 billion in 2100, and societies age, which brings new vulnerabilities to heat, health and care. By 2100 annual child deaths would be about 0.5 million at best-peer pace, 1.6 at current pace and 4.8 if progress stalled, and household air pollution deaths about 0.12, 1.37 and 3.89 million a year, against about 2.5 million today. The work is to maintain systems through generations and keep institutions learning. Much of the benefit in this period is invisible: harms that never happen, because the vulnerability they would have exploited was removed decades earlier.

Across the century, moving from current to best-peer pace would remove about 88 billion person-years of cooking with polluting fuels, 56 billion person-years without basic sanitation and 23 billion without electricity over 2026–2100, and avoid about 117 million child deaths and 71 million deaths from household air pollution. They assume that climate, conflict and financial shocks do not derail progress (Section 11).

PART VI · SECTION 10

Measuring the Impact

For Polycrisis Resilience to guide action it has to be measured. Eight measures, drawn from the framework, give a century scorecard with baselines for 2000 and 2024 and scenario paths to 2100 where the data allow.

IN BRIEF

- Where data exist, the baselines show large gains: child mortality 77 to 37 per 1,000 births since 2000 and the share of people in countries with four or more overlapping challenges 64% to 18%.
- Two of the eight measures, economic losses avoided and early-warning preparedness, lack consistent global data, which is itself a finding.
- A future Polycrisis Resilience Index should keep exposure, vulnerability and capacity separate, publish its weights and test its sensitivity.

10.1 Eight measures for a century

The framework proposes measuring impact through eight changes: reductions in human exposure to environmental hazards; reductions in climate-related vulnerability; improvements in access to essential infrastructure; improvements in healthcare and clean cooking access; reductions in poverty and resource insecurity; improvements in institutional preparedness; economic losses avoided through prevention; and long-term reductions in cascading systemic risks. Table 9 gives each a concrete indicator, a baseline and, where the scenarios in Section 9 allow, a path to 2050 and 2100. Entries marked n/m are not modelled; entries marked "gap" are cases where no consistent global data exist today.

10.2 Reading the scorecard

Three things stand out. First, **most measures with data have improved a lot**: the share of people in countries with four or more overlapping challenges fell from 64% to 18%, child mortality by more than half, people without electricity by half, and without clean cooking by more than a third, even as population grew. Second, **the measures that have not improved are exactly the ones development does not move automatically**: fine-particle air pollution is only about 11% lower than in 2000, and climate disaster deaths per 100,000 people were higher in 2020–24 than in the 2010s. Third, **two of the eight measures cannot be tracked at all.** No consistent global data set reports early-warning coverage with the quality of the underlying service, or the losses that prevention avoided relative to a counterfactual. Better measurement of avoided losses is probably the most valuable single addition to the field: it would turn the resilience dividend from a modelling claim into an observed number.

Table 9 A century scorecard for Polycrisis Resilience

Measure	Indicator (world)	2000	2024	2050: current / best-peer	2100: current / best-peer
1. Human exposure to environmental hazards	Household air pollution deaths a year, millions (modelled from 2021 rates) (WHO, 2026)	n/m	2.5	1.4 / 0.5	1.4 / 0.1
	Fine-particle air pollution, µg/m³ (population-weighted)	37	33	n/m	n/m
2. Climate-related vulnerability	Climate disaster deaths per 100,000 people a year (decade average) (CRED, 2025)	0.49 (2000s)	0.62 (2020–24)	n/m	n/m
3. Access to essential infrastructure	People without electricity, millions (World Bank, 2026)	1,330	655	437 / 49	326 / 52
	People without basic sanitation, millions	2,714	1,456	1,105 / 401	1,049 / 95
4. Healthcare and clean cooking	Child deaths per 1,000 births (births-weighted)	77	37	24 / 8	15 / 5
	People without clean cooking, millions	3,198	1,990	1,611 / 558	1,683 / 86
5. Poverty and resource insecurity	Share of people below $3 a day, % (countries with data) (World Bank, 2026)	37	10	n/m	n/m
	Undernourished share of people, %	13	9	n/m	n/m
6. Institutional preparedness	Government effectiveness score (−2.5 to +2.5), population-weighted (World Bank, 2025a)	-0.31	+0.17	n/m	n/m
	Early-warning and preparedness coverage	gap	gap	gap	gap
7. Economic losses avoided through prevention	Disaster losses as a share of GDP against a no-prevention counterfactual	gap	gap	gap	gap
8. Cascading systemic risk	Share of people in countries with 4+ of 7 overlapping challenges, % (2024 thresholds)	64	18	n/m	n/m

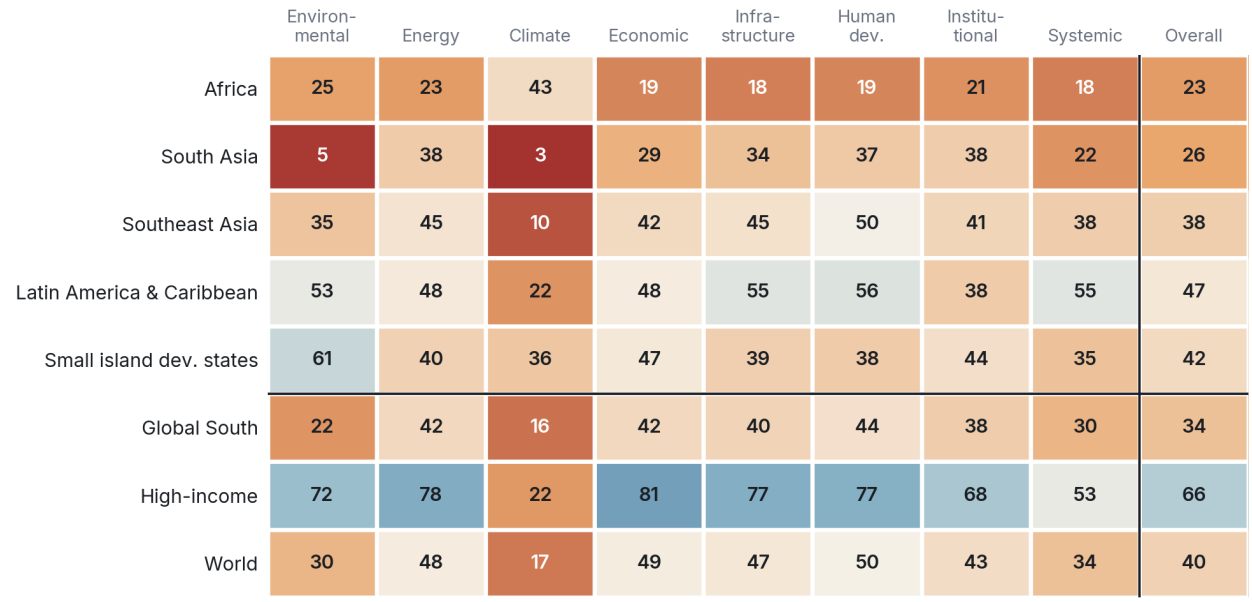
Source: H Heuristics calculations from (World Bank, 2026; World Bank, 2025a; WHO, 2026; CRED, 2025; Our World in Data, 2025); scenario paths from Section 9. n/m = not modelled; gap = no consistent global data.

10.3 A dashboard across regions

The eight dimensions can also be applied to places. Figure 13 scores five regional settings on eight dimensions, using percentile ranks among 217 economies (100 is best), averaged within each dimension and across countries using population weights. The overall scores run from 23 in Africa and 26 in South Asia to 47 in Latin America and 66 in high-income economies. The regions differ in where they are weak: Africa on nearly everything, South Asia on air quality and climate hazard, small islands on infrastructure and services. The result illustrates method, with equal weights and simple averages, not a definitive ranking. Dropping any one dimension leaves the ordering of the five regions unchanged, and the country-level overall score has a correlation of 0.88 with the logarithm of income, which is a reminder that composite scores mostly measure development; they say less about hazard.

Figure 13 Regions differ in where they are weak: Africa on nearly everything, South Asia on air and climate, small islands on infrastructure

Eight-dimension dashboard by region, scores 0–100 (higher is better)



Source: H Heuristics calculations from World Bank (World Bank, 2026; World Bank, 2025a) and INFORM (European Commission JRC, 2026). Scores are percentile ranks among 217 economies (100 = best; for climate, 100 = least exposed), averaged within each dimension and across countries with population weights.

10.4 Towards a Polycrisis Resilience Index

An eventual index could combine these dimensions to compare vulnerability across countries, regions and populations. It should keep exposure, vulnerability and capacity separate, because a country can have high exposure and high capacity (and be resilient) or low exposure and low capacity (and be fragile). It should publish its weights, use comparable public data, show uncertainty and be tested against real outcomes, so that it is revised when it fails to predict losses after actual shocks. Index design should also look below the national level: city, district and household data show who is left behind. Existing indices, among them INFORM, WorldRiskIndex and ND-GAIN, are partial starting points (European Commission JRC, 2026; Bündnis Entwicklung Hilft and IFHV, 2025; Notre Dame Global Adaptation Initiative, 2025).

CONCLUSION

Conclusion: The Central Thesis

The twenty-first-century polycrisis is real and its pressures are growing. Its severity is not fixed: it depends on how vulnerable the people and systems in its path are, and that is something that can be changed.

IN BRIEF

- The severity of the polycrisis depends on hazards and on vulnerability; only the second is largely within human control.
- Eight priorities follow from the evidence, and all are development priorities.
- The conclusions rest on public data and arithmetic scenarios, and their limits are stated.

THESIS

The central thesis of H Heuristics Polycrisis Resilience

The severity of the 21st-century polycrisis will depend not only on the magnitude of the challenges humanity faces, but also on the vulnerability of the populations and systems exposed to them.

Through sustained development, technological progress, environmental improvements, and stronger institutions, humanity can reduce that vulnerability over time.

Polycrisis Resilience therefore represents a long-term approach to making societies less vulnerable to interconnected global crises, while improving the conditions for human development throughout the century.

11.1 What the evidence shows

The evidence in this report supports the thesis in five ways. **Hazard is not destiny.** Climate-related disaster deaths per person fell about 97% between the 1960s and 2010s, and child deaths fell from 178 to 37 per 1,000 births since 1960 (Figure 2, Figure 8). **Vulnerabilities share roots.** About half of the average link between vulnerabilities disappears once income is held fixed, which is why one development investment can reduce several risks (Figure 5). **Overlap has fallen at scale.** About 2.5 billion fewer people live in countries where four or more challenges overlap than in 2000 (Figure 4). **The remaining burden is concentrated and demographically loaded.** Africa and South Asia hold most of the gaps, and Africa's population is projected to more than double (Figure 3, Figure 1). **Pace matters across a century.** Between current and best-peer pace lie about 117 million child deaths and billions of person-years without basic services (Section 9).

11.2 Eight priorities

The following eight priorities summarise what the report suggests for governments, development partners, businesses and communities.

1. **Close the energy and cooking gaps first.** About 655 million people lack electricity and 2.0 billion lack clean cooking; both are upstream of health, education, jobs and digital services.

Favour distributed solar and storage where cheapest, and clean cooking solutions that people will use exclusively (HAPIN Investigators, 2024).

2. **Protect people from the hazards already coming.** Early warnings that reach every community, heat plans and resilient infrastructure have the strongest evidence of returns (Global Commission on Adaptation, 2019; Hallegatte et al., 2019; WMO, 2025).
3. **Choose clean pathways for industry and cities.** Air pollution does not fall automatically with income, so build clean technology and planning into growth from the start.
4. **Invest in people.** Health, nutrition, education, water and sanitation are direct risk reduction, and their effects accumulate across generations.
5. **Target where challenges stack.** Concentrate integrated programmes in the countries with four or more overlapping challenges, mostly in Africa, and in fragile small islands.
6. **Spread technology and build institutions that can use it.** Shorten the diffusion lag, extend connectivity and fund the public administration that turns money into outcomes.
7. **Finance prevention before the crisis.** Expand pre-arranged finance, risk pools and adaptive social protection; close the adaptation finance gap rather than widening it (UNEP, 2025; OECD, 2026).
8. **Measure what matters and publish it.** Build a transparent index with separate exposure, vulnerability and capacity scores, and fill the data gaps on early warning and avoided losses.

11.3 Limits and what would change the conclusions

Several limits should be kept in mind. The income groups used here are a convenience, and national averages hide differences between regions, cities and households. The overlap flags use the worst fifth of countries as a threshold, which is a choice. Correlations do not prove cause, and the income control is a simple linear one. The scenarios hold the stated paths fixed and omit climate shocks, conflict, financial crises, and the feedbacks between services and growth; real outcomes will be messier. Population figures follow the United Nations medium projection, which is uncertain especially beyond mid-century. The framework's pathway scores are judgements. Some findings would change with better evidence: if trials showed that clean cooking fuels did not cut deaths in real-world use, the gains from the energy pathway would be smaller and quality of use more important; if adaptation spending in the poorest countries returned less than global averages suggest, the case for risk pooling and social protection would rise relative to physical infrastructure.

Polycrisis Resilience does not promise that crises will not occur. It proposes that what happens when they do occur is within human influence, and that the most reliable way of changing the outcome is steady, coordinated work on the conditions in which people live. The century ahead will bring hazards that no policy can prevent. It does not have to bring the vulnerability that makes them catastrophic.

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About H Heuristics. H Heuristics is an independent research practice founded by Hunter Hughes. It publishes research on polycrisis, resilience, development and the clean transition, with an emphasis on public data, transparent methods and practical recommendations. Reports are available at researchreports.hheuristics.com.

About this report. This report sets out a century-scale view of Polycrisis Resilience for 2026–2100. It covers 217 economies, eight risk domains, ten development pathways, regional applications, three paths to 2100 over five periods, and a proposed scorecard for measuring impact.

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