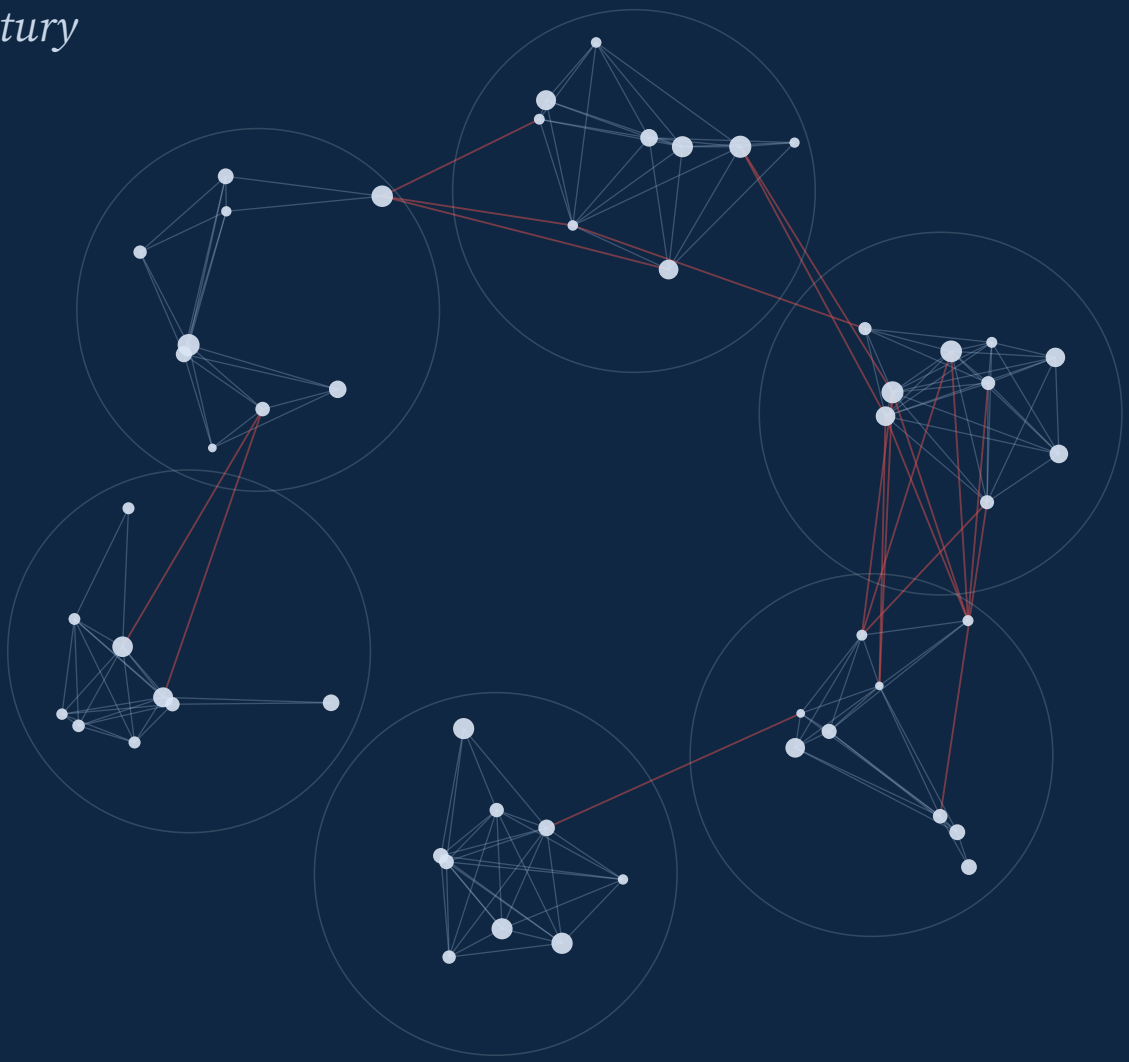
H HEURISTICS

H HEURISTICS CENTURY PATHWAYS · PROGRAMME REPORT

Century Pathways

Paradoxical Outlook Optimization: how positive development loops can improve humanity's outlook in a worsening century



Hunter Hughes
Founder, H Heuristics

H Heuristics Research Report · November 2026

researchreports.hheuristics.com

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ABOUT THIS REPORT

Suggested citation. Hughes, H. (2026). *Century Pathways: Paradoxical Outlook Optimization: How Positive Development Loops Can Improve Humanity's Outlook in a Worsening Century.* H Heuristics Research Report, November 2026.

The programme. H Heuristics Century Pathways is the H Heuristics research and influence programme on positive development loops. It builds on the Positive Pathways framework (HH-2026-60) and on Sustainable Convergence and Polycrisis Resilience, concepts developed by Hunter Hughes, Founder of H Heuristics.

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Data and methods. All data are public (World Bank, UN, UNDP, WHO, INFORM). Projections, partial correlations, growth regressions, screens and campaign estimates are the author's calculations and judgements. Blue text links to sources; figure, table and section references link within the document.

EXECUTIVE SUMMARY

Executive Summary

The twenty-first century may grow more dangerous while humanity grows safer. That is the paradox this report is built on, and H Heuristics Century Pathways is the programme designed to make it come true.

H Heuristics has spent 2026 documenting how climate, pollution, economic and geopolitical pressures interact and fall hardest on the people least able to carry them. This report sets a new direction. **H Heuristics Century Pathways** is a research and influence programme on the positive feedback loops, in clean energy, digital access, clean cooking, health, learning and convergence, that can shrink human exposure to polycrisis faster than the hazards grow. Its guiding principle is **Paradoxical Outlook Optimization**: conditions may worsen while outcomes improve, if the right investments are made early enough.

96%	**4.0 bn**	**747 bn**	**1.1 pp**
of world population growth to 2050 occurs in countries with high INFORM risk; they will hold 65% of humanity by 2100	people would cook with polluting fuels in 2100 if today's access rates froze; at proven peer pace, about 14 million	person-years without five basic services separate a frozen century from one at proven peer pace	a year of faster growth in countries that started with both high internet use and high schooling, against those with neither

Principal findings

- **The century's population growth is concentrated where risk is highest.** Countries rated high-risk by the INFORM index hold 49% of the world's people today but account for 96% of population growth to 2050. Sub-Saharan Africa alone accounts for 59% of that growth and rises from 16% of humanity to 34% by 2100 (Figure 2).
- **Standing still means going backwards.** If access rates froze at today's levels, population growth alone would raise the number of people without electricity from 0.67 billion to 1.8 billion by 2100, and without clean cooking from 2.0 to 4.0 billion (Figure 3).
- **The paradox can be resolved.** At the pace the top quarter of peer countries has already achieved, the same gaps fall to about 4 million and 14 million people by 2100. Across five services, the century's total falls from 859 billion person-years without basic services (frozen) to 255 billion (trend) and 112 billion (proven pace).
- **The same places hold the greatest opportunity.** High-risk countries are home to 61% of the world's children. Young populations adopt fast, build new infrastructure rather than replace old, and compound human capital for decades. The demographic risk is also the demographic dividend.
- **Investments pay several dividends at once.** Holding income constant, internet use is associated with better outcomes on 5 of 5 human and environmental measures, and electricity, water,

sanitation and vaccination on 4 each (Figure 7). The best investments kill two or more birds with one stone.

- **The learning-to-development chain is real but gated.** Each extra year of schooling in 2010 is associated with 0.36 points of faster annual growth to 2023. Electricity is the most robust predictor once both are included (+0.44 points per 10 points of access), while internet use alone is not significant. Online learning converts into development only when power, foundational skills and jobs are in place (Figure 6).
- **Research can be a multiplier too.** A report that reaches the right hundred readers can open doors for poverty reduction, clean technology diffusion and better policy. Century Pathways treats every report as the first step of a campaign: publish, translate, engage, commit and track.

What H Heuristics will do

- **Develop the concepts**: Paradoxical Outlook Optimization, Positive Development Dynamics, Sustainable Convergence and Polycrisis Resilience, with a disciplined working vocabulary (Section 4).
- **Publish the research**: five tracks, from big ideas such as the diffusion of innovations to specialised pathways such as the clean cooking transition, and intersections such as online learning to economic development (Section 8).
- **Influence leadership and governance**: every report becomes a campaign with one clear ask, timed to the policy calendar and tracked in public (Section 9).
- **Start with clean cooking**: twelve countries hold about two thirds of the people cooking with polluting fuels, and most of the largest groups already have electricity (Section 10).
- **Count what matters**: lives saved, person-years of exposure avoided, capitals built and gaps closed, in an annual Century Ledger (Section 11).

SECTION 01

H Heuristics Century Pathways

A research and influence programme for a difficult century: understand the risks well enough to know what to build, then help build it.

IN BRIEF

- Polycrisis research becomes the rationale, not the subject.
- H Heuristics develops concepts, publishes research and influences decisions.
- Century Pathways builds on the Positive Pathways framework (HH-2026-60).

1.1 Why a new direction

The H Heuristics series has measured, in detail, the human cost of interacting crises: rising heat exposure, polluted air, stacked hazards, slow recovery from shocks and the concentration of all of these in the poorest places (H Heuristics, 2026; Hughes, 2026b). The findings were often devastating. Continuing to publish mainly on how bad things could become would risk fatalism in readers and would under-use what the research has actually shown: that exposure tracks development more closely than it tracks hazard. People in richer, better-served places live through the same heatwaves, storms and price shocks with far lower death rates.

Century Pathways turns that finding into a programme. The polycrisis remains the reason for the work, the measure of how much protection is needed and where. The subject becomes the response: the investments in energy, connectivity, cooking, health, learning and institutions that compound into lower exposure, and the decisions that would make them happen faster.

> *"The goal is not to predict what humanity will suffer in a difficult century. It is to identify what humanity can build, deploy and improve now to make that century safer, more prosperous and more sustainable."*
>
> H Heuristics Century Pathways

1.2 The role of H Heuristics

H Heuristics is an independent research practice. It does not build cookstoves, lay fibre or run clinics. Its leverage lies in three things it can do well. It can **develop concepts** that change how a problem is framed, as Sustainable Convergence and Polycrisis Resilience aim to do (Hughes, 2026a; Hughes, 2026c). It can **publish research** that turns those concepts into numbers decision-makers can use: benchmarks, delay costs, lives at stake. And it can **influence leadership and governance**, using the founder's social capital and the credibility of the work to put the findings in front of the people who decide what gets measured, targeted and funded.

Everything else in the programme follows from that role. A report on the clean cooking transition is not the end product; it is the first step in a campaign whose end product is more house-

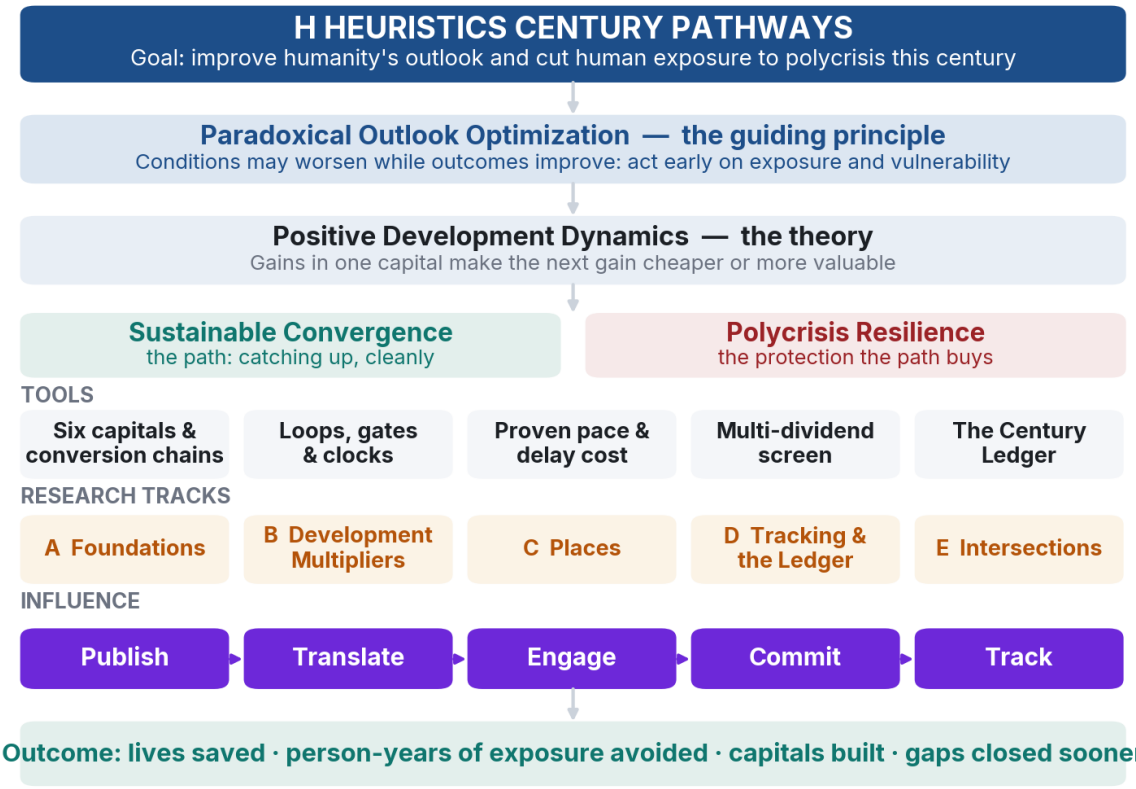
holds cooking cleanly, fewer deaths from smoke, and more time and health for women and children. The research is the lever; the outcome is human capital built and lives saved.

1.3 How this report relates to Positive Pathways

The framework report *Positive Pathways* (HH-2026-60) set out the analytical core: multipliers, loops, gates, clocks and a ledger, with evidence that proven peer pace on six basic services would avoid about 32 billion person-years of deprivation by 2050 (Hughes, 2026f). This report builds the programme around that core. It adds a guiding principle for a worsening century, extends the horizon to 2100, introduces a multidimensional layer of six capitals and conversion chains, sets out a multi-dividend principle for choosing investments, and, most importantly, adds the influence strategy that connects publication to change.

Figure 1 The architecture of H Heuristics Century Pathways

Principle, theory, applications, tools, research tracks and influence steps



Source: H Heuristics.

Read from top to bottom, the architecture is a chain of reasoning. The goal sets the measure of success. The principle says how to pursue it in a worsening century. The theory explains why progress compounds; the two flagship concepts apply it to development and to protection. The tools make the theory measurable, the research tracks organise publication, and the influence steps carry findings into decisions. The outcome row is where all of it is judged.

SECTION 02

The Outlook Paradox

The century's hazards are likely to rise, and its population growth is concentrated where they are highest. Yet the number of people exposed can still fall dramatically. The data show both halves of the paradox.

IN BRIEF

- 96% of population growth to 2050 is in high-risk countries.
- Frozen access rates would roughly double the people without basic services by 2100.
- Proven peer pace would nearly eliminate the same gaps within the century.

2.1 Risk is hazard times exposure times vulnerability

The standard risk identity is the key to the paradox. Risk equals hazard multiplied by exposure multiplied by vulnerability. Over the next few decades hazards are largely set by past emissions and by the physical climate system. Exposure and vulnerability are different: they depend on where people live, what their homes are built from, and whether they have power, clean air, cooling, warnings, savings, connections and clinics. Those are development variables, and they can change within years. A century can therefore become more hazardous and less deadly at the same time. The twentieth century did exactly that for natural disasters, whose death rate fell roughly fortyfold while populations in hazard zones multiplied (EM-DAT, 2025).

2.2 Where the century's people will be

The demographic half of the paradox is stark (Figure 2). The UN projects world population rising from 8.2 billion in 2025 to 9.6 billion in 2050 and about 10.2 billion in 2100 (United Nations, 2024). Countries rated high-risk by the INFORM index (European Commission, 2025) hold 49% of today's population but account for 96% of the growth to 2050; their share of humanity rises to 65% by 2100. Low- and lower-middle-income economies account for 97% of growth to 2050. Sub-Saharan Africa alone accounts for 59%, and its share of the world's people roughly doubles, from 16% to 34%. The 37 countries that are both high-risk and service-poor (electricity below 80% or clean cooking below 50%) rise from 19% of humanity to 37%.

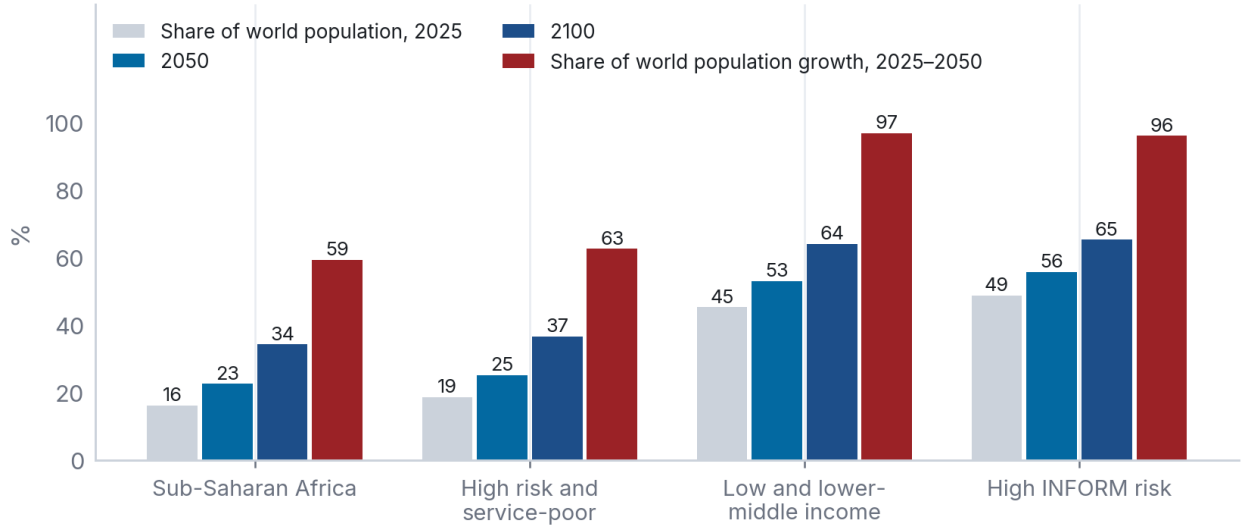
2.3 Exposure momentum

Population growth in underserved places creates **exposure momentum**: even if the share of people with a service stays the same, the number without it rises. To measure it, this report projects five basic services to 2100 for every country under three paths: **frozen**, where today's access rates stay fixed; **trend**, where each country continues its 2012–2024 logistic trend; and **proven pace**, where lagging countries move at the 75th percentile of their peers' trends, as in HH-2026-60 (Hughes, 2026f).

The results show both halves of the paradox. Frozen, the century gets worse: the number of people without clean cooking doubles to about 4.0 billion and the number offline rises to 4.0 billion.

Figure 2 Population growth is concentrated in the highest-risk, least-served countries

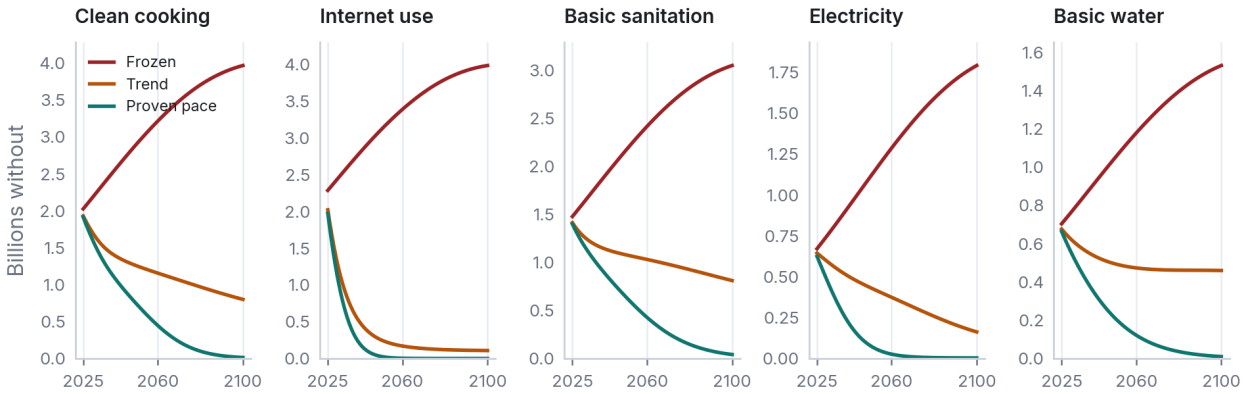
Share of world population in 2025, 2050 and 2100, and share of population growth 2025–2050, by country group (%)



Source: H Heuristics calculations from UN World Population Prospects 2024 (medium variant) (United Nations, 2024), INFORM Risk Index (European Commission, 2025) and World Development Indicators (World Bank, 2026). High risk: INFORM risk score of 5 or more. Service-poor: electricity access below 80% or clean cooking below 50%.

Figure 3 Standing still means going backwards; proven pace nearly closes every gap within the century

People without each service, 2025–2100, under three paths (billions)



Source: H Heuristics calculations from World Development Indicators (World Bank, 2026) and UN World Population Prospects 2024 (United Nations, 2024). Frozen: latest access rate held constant. Trend: each country's 2012–2024 logistic trend. Proven pace: the 75th percentile of trends among peers starting at 5–90% coverage.

On current trends, most gaps shrink but many persist; about 801 million people would still cook with polluting fuels and 812 million would lack basic sanitation in 2100. At proven pace, every gap falls to a few tens of millions or less by 2100. Across the five services, the difference between a frozen century and a proven-pace century is about 747 billion person-years, and the difference between trend and proven pace alone is about 143 billion.

METHOD

Why proven pace is a fair benchmark

Proven pace asks lagging countries to match what comparable countries have already done in the past decade, not to invent a new speed. It is ambitious but not utopian.

Table 1 People without basic services under three paths

Service	2025 (m)	2100, frozen (m)	2100, trend (m)	2100, proven pace (m)	Person-years 2026–2100: frozen / trend / proven (bn)
Electricity	672	1,791	163	4	98 / 27 / 8
Clean cooking	2,027	3,968	801	14	240 / 88 / 42
Internet use	2,287	3,986	109	0	251 / 26 / 13
Basic water	704	1,531	460	10	89 / 37 / 13
Basic sanitation	1,478	3,051	812	42	181 / 77 / 36
Total					859 / 255 / 112

Source: as Figure 3. Countries without a usable trend are excluded, so totals are lower bounds.

> It is also not a forecast. Fragility, conflict and debt slow some countries far below their peers. The point of the benchmark is to show what is at stake and where help would matter most.

2.4 What the paradox means for the programme

Three implications follow. First, the programme should weight its attention by where people will be, not only where they are: by 2050 the high-risk, service-poor countries hold a quarter of humanity, and by 2100 more than a third. Second, the cost of standing still is not zero but strongly negative, because population growth turns constant access rates into rising numbers of people exposed. Third, the gap between trend and proven pace is where research and influence can matter most: it is large, it is concentrated in a limited number of countries, and it is defined by what peers have already achieved. Initiatives such as Mission 300, which aims to connect 300 million Africans to electricity by 2030 (World Bank, 2024), show that the scale of ambition needed is already on the table; the task is to make sure it converts into lasting loops.

SECTION 03

Paradoxical Outlook Optimization

A guiding principle for a worsening century: optimise outcomes, not forecasts. Act on exposure and vulnerability, early, where compounding is fastest and populations are growing.

IN BRIEF

- Outcomes can improve while conditions worsen.
- Five paradoxes show where the leverage lies.
- Six operating rules turn the principle into decisions.

3.1 The definition

Paradoxical Outlook Optimization

Paradoxical Outlook Optimization is the deliberate effort to improve humanity's expected outcomes while the hazard baseline worsens, by investing early in the development loops that shrink exposure and vulnerability faster than hazards grow, and by concentrating effort where population growth, compounding and lock-in make each year of action worth the most.

Concept proposed by H Heuristics for the Century Pathways programme

The word *paradoxical* carries the argument. A worsening baseline is usually taken as a reason for pessimism. Paradoxical Outlook Optimization treats it as a reason for urgency and precision: the worse the hazard trajectory, the larger the payoff from reducing exposure, and the more it matters to invest where loops compound fastest. *Outlook* means expected human outcomes over the century: lives, health, capabilities and exposure, not GDP alone. *Optimization* means choosing among investments by their compounded, multidimensional return, under explicit uncertainty.

3.2 Five paradoxes that point to leverage

- **The hazard paradox.** Hazards rise while deaths can fall. Exposure and vulnerability, not hazard, decide outcomes over the decades that matter for policy.
- **The demographic paradox.** Population growth is concentrated in high-risk places, which raises exposure; but the same places hold 61% of the world's children, the cohorts with the most decades of compounding human capital ahead of them.
- **The latecomer paradox.** Countries that build later can build better. Solar, mobile networks and digital payments let latecomers skip stages that earlier developers had to pass through, and avoid stranding fossil assets they never built.
- **The lock-in paradox.** The infrastructure not yet built is the easiest to get right. Most of the buildings, grids and cooling equipment of 2060 in fast-growing countries do not yet exist, so choices made now are cheap relative to retrofits later.

- **The optimism paradox.** Honest accounts of harm are what make positive action credible. The programme keeps the risk evidence as its denominator so that its optimism is earned, not assumed.

3.3 Six operating rules

Six rules turn the principle into choices about what to research, where and when (Table 2).

Table 2 Paradoxical Outlook Optimization in practice

Rule	What it means	How it shows up in the programme
Act on exposure, not just hazard	Prioritise what can be changed this decade	Every report leads with levers and Ledger units
Go where people will be	Weight effort by future, not current, population	Focus countries chosen by 2050 population and gaps
Start early	Compounding and lock-in reward the first decade	Delay cost reported for every pathway
Choose multi-dividend investments	Prefer actions that build several capitals at once	Multi-dividend screen (Section 6)
Open the gates first	Fix the weakest link before adding access	Gates and conversion rates in every report
Be honest about uncertainty	Scenarios, not forecasts; report failures	Nulls and limits sections are mandatory

Source: H Heuristics.

3.4 The objective, stated plainly

If the programme had to be reduced to one objective it would be this: **minimise the person-years of human exposure to polycrisis over the century, weighted by severity, subject to the evidence on what works and the resources available**. Every report should be able to say how its subject moves that number, how fast, at what cost and with what other dividends. This is an aspiration for the discipline of the work, not a claim that the century can be optimised like a machine. But it gives the programme a single test that cuts across sectors.

The objective also explains why time is weighted so heavily. A person-year avoided in 2030 is worth the same as one in 2090, but an investment made in 2030 avoids person-years for six decades, compounds through the loops it starts, and shapes the assets built after it. In the exposure-momentum results, most of the difference between a trend century and a proven-pace century is decided by what happens before 2040.

SECTION 04

The Concept Architecture

A small, disciplined vocabulary that links big ideas such as the diffusion of innovations to specialised ones such as the clean cooking transition. Every term has a definition, a measure and a claim that could be proved wrong.

IN BRIEF

- Four tiers: principle, flagships, cross-cutting mechanisms, pathways.
- Established ideas are cited, never claimed.
- Each pathway concept maps to a measurable target.

4.1 Four tiers

The programme's concepts fall into four tiers. The **principle** says how to act in a worsening century. The **flagship concepts** say what H Heuristics contributes. The **cross-cutting concepts** describe the mechanisms that make progress compound across all pathways. The **pathway concepts** make each mechanism concrete in one sector, with a target that can be tracked.

Table 3 The four tiers of Century Pathways concepts

Tier	Concepts	Role
Principle	Paradoxical Outlook Optimization	How to act when conditions worsen
Flagships	Positive Development Dynamics (theory); Sustainable Convergence (path); Polycrisis Resilience (protection)	H Heuristics' core intellectual contributions
Cross-cutting	Accelerated Diffusion; Diffusion Gap; Proven Pace; Delay Cost; Affordability Dividend; Six Capitals; Conversion Chain; Multi-Dividend Investment; Lock-in Window; Exposure Dividend; Harmful Twin	Mechanisms that apply to every pathway
Pathway	Clean Cooking Transition; Electrified-but-Polluting; Productive Use Conversion; Digital Rails; Learning-to-Earning Conversion; Anticipatory Finance; Thermal Resilience	Targets and measures in specific sectors

Source: H Heuristics.

4.2 The big concepts

Several cross-cutting ideas rest on long research traditions, and H Heuristics should build on them openly. The **diffusion of innovations** describes how new technologies spread along Scurves driven by imitation and word of mouth (Rogers, 2003; Bass, 1969); the lag between invention and adoption in poorer countries has shortened over two centuries but remains large (Comin, 2010). **Learning curves** describe how costs fall with cumulative production (Wright, 1936; Way, 2022). **Cumulative causation** and the **big push** describe how advantages and disadvantages reinforce themselves and why complementary investments must arrive together (Myrdal, 1957; Murphy, 1989). **Positive tipping points** describe thresholds beyond which clean technologies become self-propelling (Lenton, 2022). Century Pathways adds measurement and a focus on who is left behind and for how long.

Table 4 Cross-cutting concepts and how each is measured

Concept	Definition	Measure	Status
Accelerated Diffusion	Shortening the time from availability of a beneficial technology to near-universal use	Years to 95% coverage	H Heuristics, built on Rogers
Diffusion Gap	How long lagging countries trail leaders in reaching the same adoption level	Years between reaching 50%	H Heuristics
Proven Pace	Adoption speed already achieved by the top quarter of comparable countries	75th percentile of peer trends	H Heuristics (HH-2026-60)
Delay Cost	What each year of postponed acceleration loses	Person-years or lives per year	H Heuristics
Affordability Dividend	Fall in the cost of essentials driven by learning curves	Power, fuel, data and water bill as % of income, poorest 40%	H Heuristics
Multi-Dividend Investment	An investment that builds two or more capitals at once	Number of capitals and outcomes moved	H Heuristics
Lock-in Window	Period when choices about long-lived assets set exposure for decades	Asset life × build rate	H Heuristics, after Arthur
Exposure Dividend	Exposure avoided because of a development gain	Person-years avoided	H Heuristics
Harmful Twin	The damaging loop a pathway could feed	Named in every report	H Heuristics

Source: H Heuristics; established ideas cited in the text.

4.3 The specialised concepts

Pathway concepts translate the mechanisms into targets a ministry or funder can adopt. The **Clean Cooking Transition** is the model. Its measure is the *full-switch rate*, the share of households that cook mainly with a clean fuel, because partial switching, known as fuel stacking, leaves exposure high: the HAPIN trial found that giving LPG stoves to pregnant women did not raise birthweight (Clasen, 2022). Its most actionable sub-concept is the **Electrified-but-Polluting household**, one that already has electricity but still cooks with polluting fuel. About 1.38 billion people live in such households (Hughes, 2026f); for them electric cooking is the shortest route, because the gate is already open.

Table 5 Pathway concepts and their targets

Pathway	Concept	Target measure
Clean cooking	Clean Cooking Transition; Electrified-but-Polluting households	Full-switch rate; electrified-but-polluting population
Distributed clean power	Productive Use Conversion	Share of new connections powering income-earning activity
Digital public infrastructure	Digital Rails	Adults with ID and an account; days to pay an emergency transfer
Connectivity and learning	Learning-to-Earning Conversion	Share of learners with higher earnings within five years
Early warning	Last-Mile Warning Reach; Anticipatory Finance	People warned in time; cash paid before the shock
Heat and cooling	Thermal Resilience	People able to keep home and work below danger thresholds
Primary health	Zero-dose children (established)	Children with no routine vaccine

Source: H Heuristics.

RULE

Concept discipline

- A new term enters the vocabulary only with a definition, a measure and a claim that could be shown to be false.
- Established terms (diffusion of innovations, learning curves, leapfrogging, resilience dividend, positive tipping points, big push) are cited and built on, never presented as new.
- Synonyms are folded in. Labels such as Positive Systems Transformation or Compounding Human Development are absorbed into the flagship concepts rather than launched separately.

SECTION 05

Six Capitals and Conversion Chains

Development is multidimensional. Access becomes capability, capability becomes productivity, productivity becomes development, and development is reinvested. Each step is a conversion that can be measured, and each one leaks.

IN BRIEF

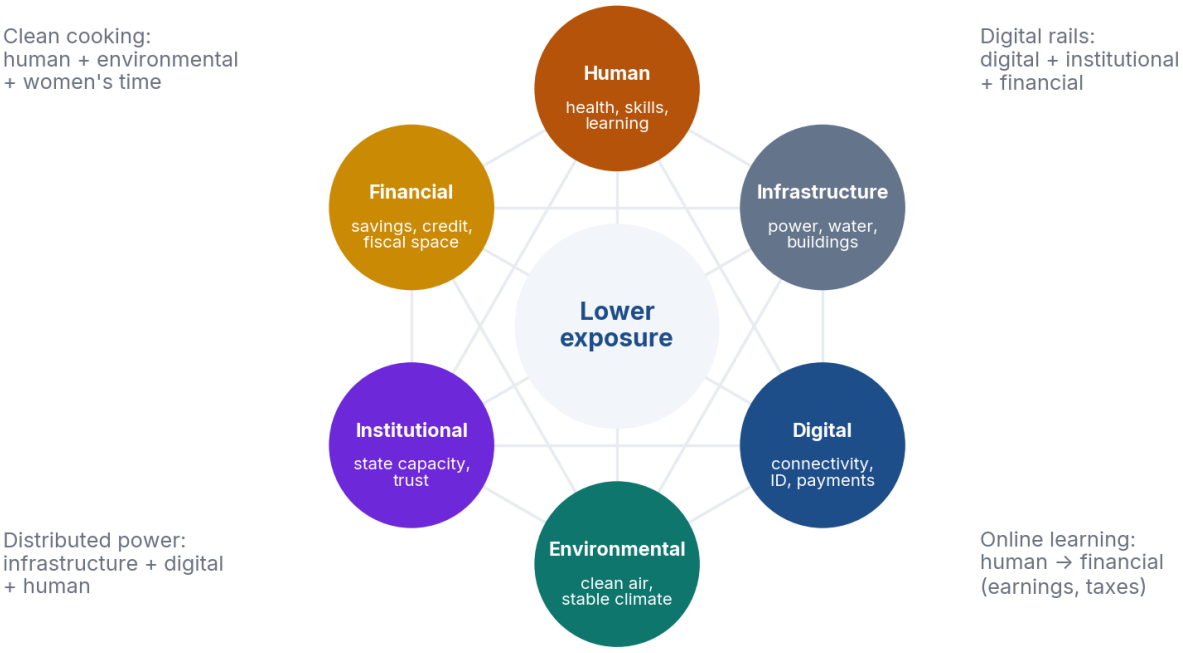
- Six capitals: human, infrastructure, digital, environmental, institutional, financial.
- Exposure falls fastest when several capitals rise together.
- Online learning converts into growth only where power and schooling are in place.

5.1 The six capitals

Every pathway builds one or more stocks of capital, and the stocks interact. A household with power, a phone, an account, clean air and a vaccinated child can absorb a heatwave or a price shock that would break a household lacking them. That is the multidimensional form of Polycrisis Resilience: exposure falls not when one capital rises, but when several rise together and reinforce each other (Figure 4).

Figure 4 Six capitals, each strengthening the others

The six capitals of Century Pathways and examples of investments that build several at once



Source: H Heuristics.

Table 6 The six capitals

Capital	What it holds	Built by	Protects against
Human	Health, skills, learning	Primary health, clean cooking, digital learning	Disease, heat stress, income loss
Infrastructure	Power, water, buildings, transport	Distributed power, water and sanitation, cooling	Outages, floods, heat, water shocks
Digital	Connectivity, identity, payments, data	Connectivity, digital public infrastructure, AI tools	Isolation, slow relief, missed warnings
Environmental	Clean air, stable climate, ecosystems	Clean cooking, clean power, efficient cooling	Pollution, climate damage
Institutional	State capacity, trust, rules	Digital payments, early warning, transparency	Leakage, capture, poor response
Financial	Savings, credit, fiscal space	Mobile money, avoided losses, wider tax base	Shocks that force distress sales

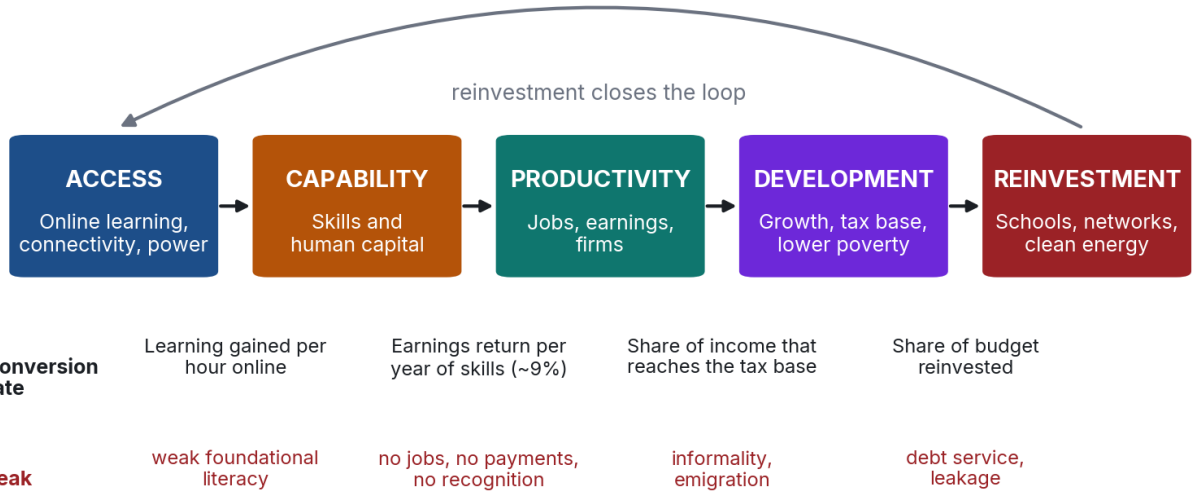
Source: H Heuristics.

5.2 Conversion chains

The question that prompted this report gives the model case: online learning accumulates human capital, which translates into economic development. Century Pathways calls this a **conversion chain** (Figure 5). Access becomes capability, capability becomes productivity, productivity becomes development, and development is reinvested in more access. Each arrow is a **conversion rate** that can be measured, and each has a characteristic leak.

Figure 5 The learning-to-development conversion chain

Stages, conversion rates and typical leaks



Source: H Heuristics. The ~9% earnings return per year of schooling is the global average in Psacharopoulos and Patrinos (2018) (Psacharopoulos, 2018).

The evidence on individual links is strong in places and thin in others. Well-designed adaptive software produced large learning gains within months in urban India (Muralidharan, 2019), and

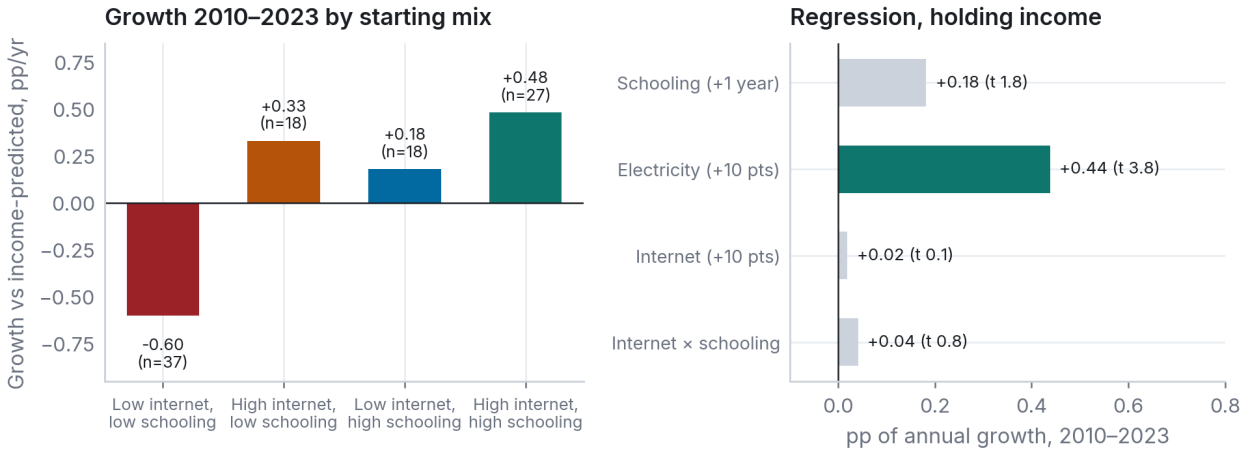
structured pedagogy is among the most cost-effective ways to raise learning (GEEAP, 2023). The average return to a year of schooling is about 9% in earnings (Psacharopoulos, 2018), and it is tested skills, not years in school, that best predict national growth (Hanushek, 2012). Online gig work already engages an estimated 154–435 million people (Datta, 2023). The weakest link is usually the first: about 70% of ten-year-olds in low- and middle-income countries cannot read a simple text (World Bank, 2022), and digital access without foundational literacy converts poorly.

5.3 Testing the chain across countries

As a first test, this report relates growth in income per person between 2010 and 2023 to each developing country's starting levels of schooling, internet use and electricity, holding starting income constant (World Bank, 2026; UNDP, 2025). Schooling alone is a strong predictor: each additional year of mean schooling in 2010 is associated with 0.36 percentage points of faster annual growth (t = 3.7, 100 countries). When electricity and internet use are added, electricity is the most robust predictor (+0.44 points per 10 points of access, t = 3.8); internet use on its own is not significant, and the interaction between internet use and schooling is positive but not statistically distinguishable from zero (Figure 6).

Figure 6 Countries that started with both connectivity and schooling grew fastest; electricity is the robust gate

Growth in income per person, 2010–2023, by starting mix of internet use and schooling



Source: H Heuristics calculations from World Development Indicators (World Bank, 2026) and UNDP Human Development Report data (UNDP, 2025). 100 developing economies with over one million people. Left: mean growth residual after controlling for log income, by whether internet use and schooling in 2010 were above or below the level predicted by income. Right: OLS with robust standard errors; teal = significant at 5%.

The descriptive pattern is nonetheless suggestive. Countries that started with both more internet use and more schooling than their income would predict grew +0.48 points a year faster than income alone predicts; those with neither grew -0.60 points slower, a gap of about 1.1 points a year. Internet use in 2010 is also associated with larger later gains in expected years of schooling (+0.23 years per 10 points), though again not significantly. The honest reading is that the online-learning chain is plausible and partly visible at the macro level, but that it is gated by electricity and foundational skills and has not yet been demonstrated robustly. That is exactly why it deserves its own research track.

5.4 Intersections worth studying

The chain above is one of many. Eight intersections stand out for the strength of the case that they compound and for the size of the research gap (Table 7).

Table 7 Eight high-value intersections

Intersection	Chain	Why it matters
Power × learning	Electricity → lit, connected schools and homes → study hours and digital learning	Power gates the digital loop: internet use almost never exceeds electricity access (Hughes, 2026f)
Learning × digital work	Online learning → digital skills → remote and platform income	The learning-to-earning link is the least measured
Clean cooking × women's time	Clean fuel → hours freed → paid work and schooling	Electrification raised women's employment in South Africa (Dinkelman, 2011)
Health × learning	Vaccination and nutrition → more learning per school year	Vaccination predicts faster gains in other services (Hughes, 2026f)
Digital rails × early warning	ID and payments → cash paid when a forecast triggers	Turns a warning into money before the shock
Clean power × productive use	Solar → mills, pumps, cold chains → incomes → tax base	Fixes the weak link found in rural Kenya (Lee, 2020)
Cooling × productivity × learning	Thermal protection → fewer lost work hours and better learning	640 billion work hours lost to heat in 2024 (Romanello, 2025)
AI × skills × firms	AI tools → productivity where skills are already high	Gains concentrated among stronger firms (Otis, 2024)

Source: H Heuristics.

SECTION 06

Multi-Dividend Investments

The best investments kill two or more birds with one stone. Choosing them deliberately is the single most powerful way to stretch scarce money, time and attention.

IN BRIEF

- Internet use is associated with better outcomes on 5 of 5 measures; electricity, water, sanitation and vaccination on 4.
- Multi-dividend investments build several capitals at once.
- The principle applies to research too: one report can serve several goals.

6.1 The principle

A multi-dividend investment produces benefits in two or more capitals or outcomes from a single expenditure. Clean cooking improves health (human capital), cuts smoke and forest loss (environmental capital) and frees time, mostly women's, for work and school (human and financial capital). Digital payment rails reduce leakage (institutional capital), speed up relief (financial capital) and widen markets (digital and financial capital). Disaster-risk research calls the analogous idea in its field a triple dividend (Tanner, 2015). Century Pathways generalises it: every investment should be screened for the number of capitals it builds, and for whether those capitals reinforce each other.

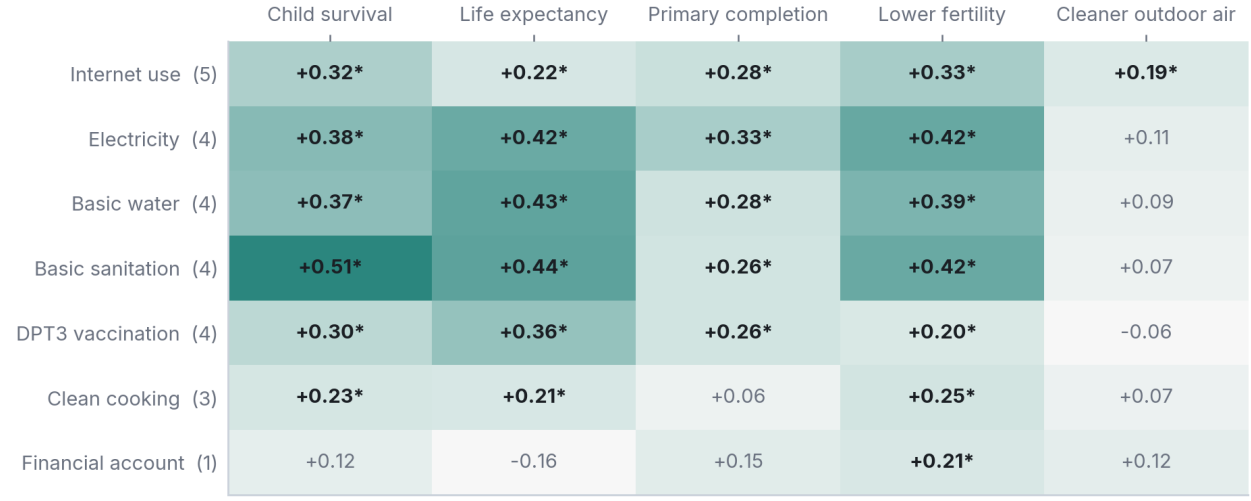
6.2 Evidence across countries

To test whether access to basic services travels with several good outcomes at once, this report correlates each service with five outcomes across developing economies around 2022, after removing the part of each that is explained by income (World Bank, 2026). The outcomes are child survival, life expectancy, primary-school completion, lower fertility and cleaner outdoor air (Figure 7). Internet use is significantly and favourably associated with all 5 outcomes; electricity, basic water, basic sanitation and vaccination with 4, 4, 4 and 4; clean cooking with 3; and financial accounts with 1. Sanitation has the strongest single association, with child survival (partial r = 0.51).

These are associations, not causal effects: countries that provide one service well tend to provide others well, and some of the pattern reflects governance. But the consistency of the signs is the point. Across seven services and five outcomes, almost every association runs in the favourable direction. Basic services are bundles of dividends, and the cross-lagged evidence in HH-2026-60 shows that physical foundations come first: electricity, water, sanitation and vaccination predict faster later gains in internet use and clean cooking, not the reverse (Hughes, 2026f).

Figure 7 Basic services travel with several good outcomes at once, even at the same income

Partial correlation between each service and five outcomes, holding income constant



Source: H Heuristics calculations from World Development Indicators (World Bank, 2026). Developing economies, latest data around 2022 (outdoor PM2.5 for 2019). Cells are partial correlations controlling for log income per person; * $p < 0.05$. The number after each service is the count of significant favourable associations.

6.3 A multi-dividend matrix

The cross-country evidence covers services that are measured well. For all ten pathways, Table 8 records which of the six capitals each builds, as a documented judgement that later reports will test.

Table 8 Which capitals each pathway builds

Pathway	Human	Infra.	Digital	Environ.	Instit.	Financial	Total
Distributed clean power	●	●●	●	●●		●	7
Digital public infrastructure	●		●●		●●	●●	7
Early warning	●		●		●●	●●	6
Water and sanitation	●●	●●		●		●	6
Clean cooking	●●	○		●●		●	5.5
Affordable connectivity	●	○	●●		●	●	5.5
Digital learning-to-earning	●●		●			●●	5
AI and digital tools	●		●●		●	●	5
Heat protection and cooling	●●	●		○		●	4.5
Primary health	●●				●	●	4

Source: H Heuristics judgement from the evidence in this report and HH-2026-60 (Hughes, 2026f). Infra. = infrastructure; Environ. = environmental; Instit. = institutional. ●● strong, ● moderate, ○ weak or conditional (counted as 0.5). Cooling scores weak on environmental capital because of its harmful twin.

The matrix explains why clean power and digital public infrastructure rank highly despite modest direct effects on mortality: they build the most capitals, and they open gates for other path-

ways. It also explains why primary health remains a priority despite a narrower spread: its human-capital dividend is the largest and most certain, and the human capital it builds is the input to every other chain.

6.4 The same principle, applied to research

The multi-dividend principle applies to H Heuristics' own work. A single report on technology diffusion in emerging economies can serve poverty reduction, clean technology diffusion and digital inclusion at once, because the mechanisms are shared. If it reaches a hundred well-placed readers, it can open conversations in several fields simultaneously. Choosing report topics that sit on intersections, and writing them so that each audience finds its own dividend, is how a small research practice multiplies its reach. Section 9 sets out how to turn that reach into influence.

6.5 Multi-dividend investments in practice

The record contains many examples. Mobile money in Kenya lifted an estimated 2% of households out of extreme poverty and had its largest effects for women-headed households, building financial and human capital at once (Suri, 2016). Biometric smartcards in India made welfare payments faster and reduced leakage, strengthening institutional and financial capital together (Muralidharan, 2016). Vaccination has saved an estimated 154 million lives in fifty years and returns many times its cost, while the surviving children go on to learn and earn (Shattock, 2024; Sim, 2020). Bangladesh's cyclone warnings, shelters and volunteers cut deaths from hundreds of thousands to a few thousand while building local institutions (Haque, 2012). In each case one programme built several capitals, and the capitals then reinforced each other. None of these was designed as a multi-dividend investment; the programme's contribution is to make that design deliberate, by asking at the outset which capitals an investment will build and how they will reinforce each other.

SECTION 07

The Century Pathways Cycle

One process for every report and every campaign: five steps that build the evidence, four that carry it into decisions, and one that tracks the result and starts the next cycle.

IN BRIEF

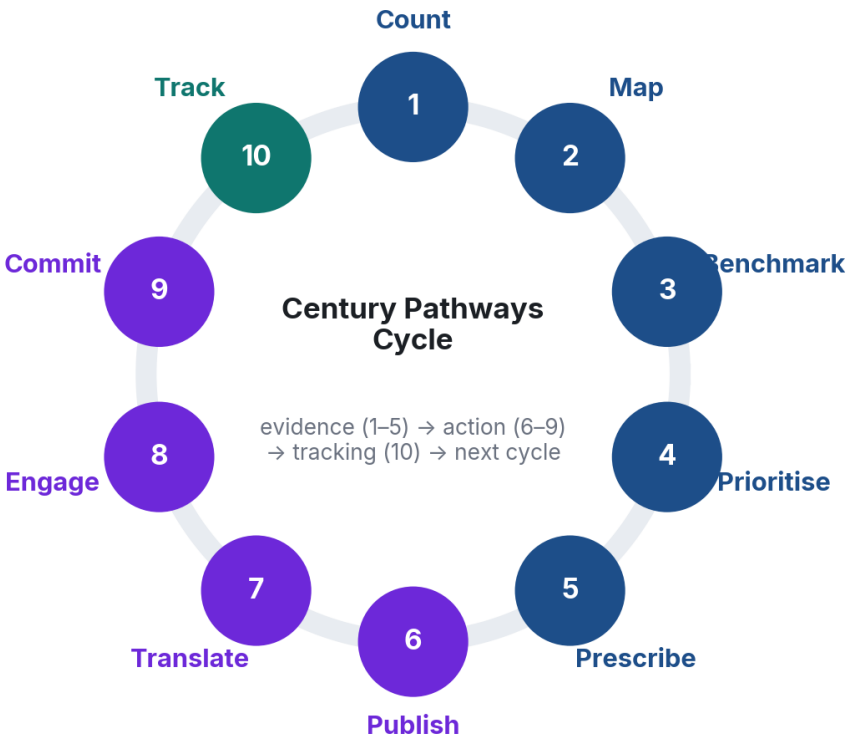
- Evidence: count, map, benchmark, prioritise, prescribe.
- Action: publish, translate, engage, commit.
- Tracking closes the loop and builds credibility.

7.1 Ten steps

The Positive Pathways framework set out how to analyse a pathway (Hughes, 2026f). Century Pathways extends that process past publication, because the programme's purpose is change, not reports. The resulting cycle has ten steps (Figure 8).

Figure 8 The Century Pathways Cycle: evidence, action and tracking

Ten steps, from counting the gap to tracking commitments



Source: H Heuristics.

Steps 1 to 5 are research; steps 6 to 9 are influence; step 10 is accountability. The cycle is meant to repeat: each year's Ledger updates the benchmarks, revises the screen and identifies the next campaign. Over time the programme accumulates three assets that make each cycle cheaper and

Table 9 What each step produces

Step	Question	Output
1 Count	Who lacks what, where, and how exposed are they?	Gap and exposure ledger by country
2 Map	What is the loop, which gates block it, what leaks, what is its harmful twin?	Loop map with conversion rates
3 Benchmark	How fast is each country moving against proven and frontier pace?	Pace benchmarks and delay cost
4 Prioritise	Which investments pay the most dividends, soonest, with what certainty?	Multi-dividend screen
5 Prescribe	What bundle, in what sequence, with which milestones?	2030 and 2035 milestones; one clear ask
6 Publish	Is the evidence open, honest and reproducible?	Report, data and code
7 Translate	What does each audience need to act?	Leader brief, country cards, essay, op-ed
8 Engage	Who decides, who funds, who implements, who amplifies?	Briefings, roundtables, partnerships
9 Commit	What specific, measurable commitment is being sought?	Named targets adopted by others
10 Track	Did pace change? Were lives saved?	Annual Century Ledger entry

Source: H Heuristics.

more persuasive than the last: a reusable pace-and-ledger model, a library of evidence on each conversion link, and a network of people who have used the work.

A full cycle for one pathway takes roughly a year: about three months of research, a month of translation, six months of engagement and a commitment phase that runs into the next year's Ledger. With several pathways at different stages, the programme always has a report in preparation, a campaign under way and a Ledger entry being compiled.

SECTION 08

The Report Series

Five tracks organise the research: foundations for the big ideas, Development Multipliers for specialised pathways, places, tracking, and intersections. Each report follows one template and launches one campaign.

IN BRIEF

- Track A: big concepts such as the diffusion gap.
- Track B: specialised pathways, starting with the clean cooking transition.
- Track E: intersections, starting with online learning to economic development.

8.1 Five tracks

The research is organised in five tracks that run in parallel, each with its own purpose (Table 10).

Table 10 The five research tracks

Track	Purpose	First reports
A Foundations	Develop and test the big concepts	The Diffusion Gap; The Affordability Dividend; Paradoxical Outlook Optimization; Exposure Accounting; Conversion Chains and the Six Capitals
B Development Multipliers of the 21st Century	One evidence report per pathway	Clean Cooking Transition; Digital Rails; Distributed Power and Productive Use; Early Warnings and Anticipatory Finance; Primary Health; Connectivity to Earnings; Cooling Without the Heat Trap; Water and Sanitation; AI and the Productivity Gap
C Places	Apply the framework where the gaps and growth are	Nigeria, India, Ethiopia, DR Congo, Pakistan, Bangladesh; Sub-Saharan Africa; South Asia
D Tracking	Keep score and learn from success	Annual Century Ledger; 'What Worked' cases: Indonesia's LPG switch, Brazil's Pix, Bangladesh's cyclone warnings, Pakistan's solar boom
E Intersections	Measure how capitals convert into one another	From Online Learning to Economic Development; The Household Stack; Women's Time as a Multiplier; Healthy Learners; Anticipatory Cash; The Convergence Multiplier

Source: H Heuristics.

8.2 One template

Every Track B, C and E report uses the same structure, so that readers learn the format and results can be compared across pathways and places. The structure follows the cycle:

- **The gap and the exposure**: who lacks what, where, and the lives and person-years at stake.
- **The loop and its intersections**: conversion chain, cross-capital dividends, joint gates and place in the household stack.

- **The evidence, including failures**: the best causal estimates for each link, and the trials and programmes that did not work.
- **The clock**: pace against proven and frontier benchmarks, delay cost and lock-in window.
- **The harmful twin**: the damaging loop the pathway could feed, and how to avoid it.
- **The ask**: one specific, measurable commitment, with 2030 and 2035 milestones.

8.3 Formats

Each report is published as a flagship PDF with open data and code, a web edition with interactive charts, a Substack essay for general readers, a two-page leader brief, and a set of one-page country cards for the countries where the gap is largest. The essay and the brief carry the same single message; the cards carry the country-specific numbers a minister or funder needs.

8.4 A first cycle

A first cycle of eight releases establishes the programme, launches the first campaign and produces the first annual scorecard (Table 11).

Table 11 A proposed first publication cycle

Order	Report	Track	Why now
1	Century Pathways (this report)	A	Sets the programme
2	The Clean Cooking Transition	B	Most lives at stake; method ready; original electrified-but-polluting angle
3	From Online Learning to Economic Development	E	The founding question; tests the conversion chain
4	The Diffusion Gap	A	The big-concept anchor for all diffusion work
5	Digital Rails and Distributed Power	B	The keystone rails that open other gates
6	Early Warnings and Primary Health	B	Complete the protect-now bundle
7	Nigeria and Ethiopia profiles	C	Largest future growth and gaps
8	Century Ledger 2027	D	First annual scorecard

Source: H Heuristics proposal.

SECTION 09

From Report to Reality

H Heuristics changes what decision-makers measure, target and fund. Research becomes influence through a chain of readers, conversations and opened doors, and the chain can be built deliberately.

IN BRIEF

- Influence is a loop: credibility brings readers, readers open doors, outcomes build credibility.
- A hundred well-placed downloads can matter more than ten thousand casual ones.
- One clear ask per campaign, timed to the policy calendar.

9.1 How research changes decisions

Research rarely changes policy directly. More often it changes how people think about a problem, which options seem reasonable and which numbers they cite; Carol Weiss called this the enlightenment function of research (Weiss, 1979). Decisions then happen when a problem, a workable solution and a political opportunity come together, what John Kingdon called a policy window (Kingdon, 1984). Century Pathways is designed around both insights: concepts and numbers that change framing, and campaigns timed to the moments when decisions are made.

9.2 The research influence loop

Influence works as a loop (Figure 9). A rigorous report attracts readers; readers start conversations, cite the work and invite the author; conversations open doors to advisers, funders, ministries and media; doors lead to decisions; decisions lead to outcomes; and evidence of outcomes builds the credibility that brings the next report more readers. Each link can be strengthened on purpose.

This is why a modest number of downloads can be high impact. A report on technology diffusion in emerging economies that is downloaded a hundred times by officials, development bankers, researchers and journalists can open more doors than one read casually by many thousands. The same report can serve several agendas at once, poverty reduction, clean technology diffusion and digital inclusion, because the mechanisms are shared. The goal is not to maximise readers but to reach the right ones, and to make it easy for them to use the work.

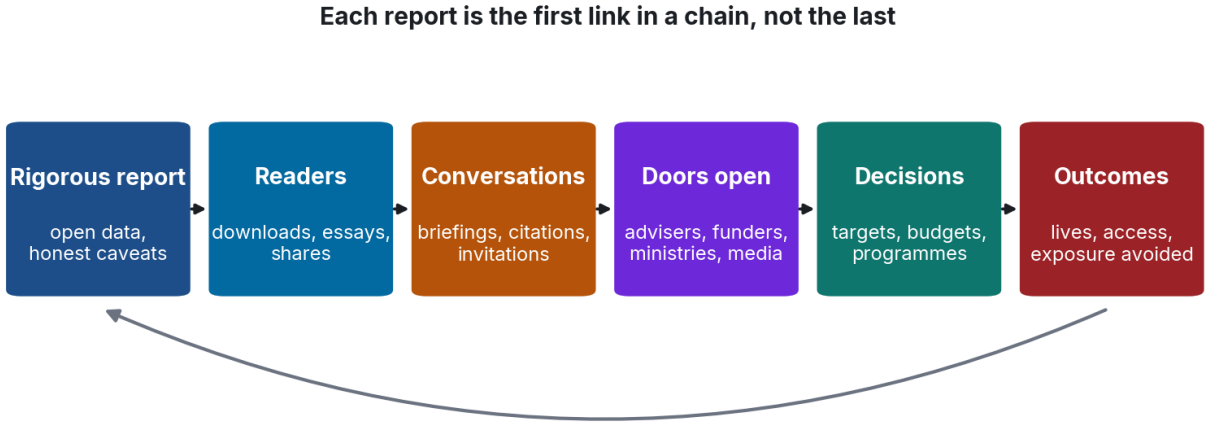
9.3 An influence ladder

Influence builds in stages, and each stage has visible signs that it has been reached (Table 12).

An honest assessment places H Heuristics in the early stages. A 2026 self-assessment found that the series had produced many works but that uptake by other researchers was still beginning (H Heuristics, 2026). The first priority is therefore credibility: rigorous methods, open data, published corrections and a steady record of useful numbers. Visibility and usefulness follow; embedding and decisions come last and cannot be rushed.

Figure 9 The research influence loop

From a rigorous report to outcomes, and back to credibility



Credibility and evidence of impact feed the next report: the research influence loop

Source: H Heuristics.

Table 12 Stages of influence and how to recognise them

Stage	What it means	Signs of progress
1 Credible	Rigorous, open, cited	DOIs, preprints, citations, corrections published
2 Visible	The ideas circulate	Downloads, essay readers, media mentions, speaking invitations
3 Useful	Officials and funders use the tools	Requests for country briefs; benchmarks quoted in plans
4 Embedded	Partners adopt the metrics	Full-switch rate or proven pace used in others' reports
5 Decisive	Decisions change	Targets, budgets and programmes cite the work

Source: H Heuristics.

9.4 Who to reach

Each report has several audiences, and each needs something different from the same evidence (Table 13).

9.5 Timing and principles

Campaigns should land when attention already exists: the annual Tracking SDG 7 release each June (IEA, IRENA, UNSD, World Bank and WHO, 2025), the UN High-Level Political Forum in July, the UN General Assembly in September, the World Bank and IMF meetings in April and October, and the UN climate conference each November. Five principles protect the programme's most valuable asset, its credibility.

- **Independence.** No paid promotion of products or firms; disclose any partnership or funding.

Table 13 Audiences and what each needs

Audience	Examples	What they need from H Heuristics
Decision-makers	Ministers of energy, health, finance and planning; heads of government	A two-page brief, one ask, country numbers
Funders	Development banks, climate funds, philanthropy	Benchmarks, delay costs, cost-effectiveness
Implementers	Utilities, clean-energy and pay-as-you-go firms, NGOs	Where gates are open; what conversion rates to expect
Coordinators	Clean Cooking Alliance, SEforALL, WHO, ESMAP, Mission 300	Independent evidence and new metrics
Amplifiers	Journalists, think tanks, academics, civil society	Clear findings, charts, quotable numbers

Source: H Heuristics. Organisations are named as examples of audiences, not as partners.

- **Contribution, not attribution.** Claim that the work helped put an issue on the agenda, never that it caused a decision.
- **Correct errors in public.** Every correction strengthens trust.
- **Praise progress.** Naming countries that move fast persuades more than shaming laggards.
- **One ask per campaign.** A clear, measurable request beats a long list of recommendations.

9.6 Using social capital well

The founder's network is one of the programme's main assets, and it should be used deliberately. A simple map helps: list the people in ministries, development banks, NGOs, companies, universities and media who can be reached directly, note which pathway and which country each connects to, and match each campaign to the people best placed to act on it. Personal introductions, offers of free country analysis and invitations to review drafts before publication are the most effective ways to turn readers into users. Each successful use then becomes evidence of usefulness that opens the next door.

SECTION 10

A Worked Campaign: The Clean Cooking Transition

Clean cooking is the right first campaign: the lives at stake are large, the gap is concentrated, much of it sits behind an already open gate, and the dividends run across health, environment, time and human capital.

IN BRIEF

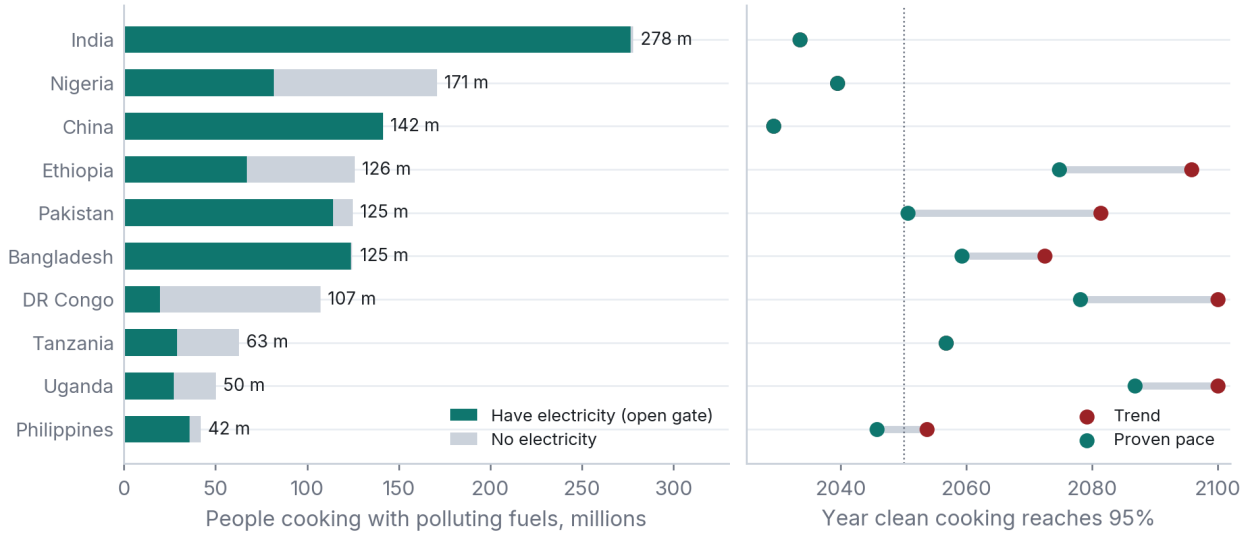
- Twelve countries hold 64% of people cooking with polluting fuels.
- 1.38 bn people already have power but cook with polluting fuels.
- The ask: target the full-switch rate, and electrified-but-polluting homes first.

10.1 The case

Household air pollution caused an estimated 3.2 million deaths in 2020 (WHO, 2024), and about 2.1 billion people still cook with polluting fuels (IEA, IRENA, UNSD, World Bank and WHO, 2025). The gap is concentrated: twelve countries hold 64% of the people cooking with polluting fuels (Figure 10). In several of the largest, almost everyone already has electricity: India (278 million users, 100% electrified), China (142 million), Bangladesh and Pakistan. For them the clean cooking transition is less a matter of new infrastructure than of fuel prices, appliance finance and habit, which can move within years.

Figure 10 The clean cooking gap is concentrated, and much of it sits behind an open gate

People cooking with polluting fuels, and year of near-universal clean cooking, ten largest countries



Source: H Heuristics calculations from World Development Indicators (World Bank, 2026) and UN World Population Prospects 2024 (United Nations, 2024). Left: people cooking with polluting fuels in 2025, split by whether the population share is electrified. Right: year clean-cooking access reaches 95% on the country's 2012–2024 trend and at proven peer pace (capped at 2100).

Table 14 Country cards for the clean cooking campaign

Country	Polluting-fuel users (m)	Of whom electrified (m)	Deaths a year at world average rate (thousands)	95% clean cooking: trend	95%: proven pace
India	278	277	424	2033	2033
Nigeria	171	82	261	2039	2039
China	142	142	216	2029	2029
Ethiopia	126	67	192	2096	2075
Pakistan	125	114	191	2081	2051
Bangladesh	125	124	190	2072	2059
DR Congo	107	20	163	after 2100	2078
Tanzania	63	29	96	2057	2057
Uganda	50	27	77	after 2100	2087
Philippines	42	36	64	2054	2046
Kenya	39	26	60	2051	2051
Mozambique	33	10	50	after 2100	2073

Source: as Figure 10. Deaths apply the global average of about 1.5 deaths per 1,000 polluting-fuel users a year (WHO 2020 deaths over 2.1 billion users) and are illustrative; actual rates vary with fuel, ventilation and health care.

10.2 The ask

Following the one-ask principle, the campaign asks governments and funders to do two linked things. First, **adopt the full-switch rate as the headline target**, rather than access to a clean stove, because partial switching leaves exposure high (Clasen, 2022). Second, **target electrified-but-polluting households first**, with electric cooking finance and tariffs, because the gate is already open and the solar learning curve keeps lowering the cost. Both asks are concrete, measurable and compatible with existing commitments, including the $2.2 billion pledged at the 2024 Summit on Clean Cooking in Africa (IEA, 2024).

10.3 The plan

The campaign runs over about a year, following the action steps of the cycle (Table 15).

The stakes justify the effort. Moving lagging countries to proven pace from 2026 would avoid an estimated 2.9–6.7 million deaths from household air pollution by 2050, and each year of delay costs on the order of 292 thousand lives at the central estimate (Hughes, 2026f). Behind each life saved are the dividends that make the campaign a human-capital investment and not only a health one: cleaner air for children's lungs and learning, hours returned to women for work and school, and less pressure on forests.

Table 15 A twelve-month campaign plan

Months	Phase	Actions
0–3	Research	Report B1: full-switch rates, electrified-but-polluting households, lives and delay cost by country, the Indonesia LPG case (Budya, 2011), the HAPIN caution
3–4	Translate	Country cards for the six largest electrified-but-polluting populations; a leader brief built around the two asks; a public essay
4–9	Engage	Brief clean-cooking coordinators, development banks and energy and health ministries; offer free country analyses; time an op-ed to the June SDG 7 release; host a roundtable
9–12	Commit	Seek adoption of the full-switch rate in at least one national plan or funder framework
12+	Track	Report each country's switching pace against proven pace, and lives and person-years, in the Century Ledger

Source: H Heuristics proposal.

10.4 What success looks like, and what could go wrong

Success within a year would be modest but real: the full-switch rate cited in at least one national plan or funder framework, country cards used in briefings, and an invitation to present the evidence to a coordinating body. Over five years it would be faster switching in the countries engaged, visible in the Ledger. The main risks are a recommendation that ignores local fuel markets, an ask that is too broad to act on, and claims that outrun the evidence. Grounding each country card in local data, keeping to one ask and reporting the HAPIN caution alongside the case for clean cooking are the safeguards. The campaign's lessons, including what did not work, will shape the template for every campaign that follows.

SECTION 11

Measuring Impact: The Century Ledger

If Century Pathways is to save lives and cut exposure, it must count them, and it must count its own influence by the same standard it asks of others.

IN BRIEF

- Outcomes in lives, person-years, capitals and gaps.
- Influence in outputs, uptake, adoption and decisions.
- Milestones for 2030, 2035, 2050 and 2100.

11.1 What the world achieves

The Ledger keeps the headline measures of the Positive Pathways framework and adds two that the programme's multidimensional and conversion-chain layers require (Table 16).

Table 16 The Century Ledger: outcome measures

Measure	Definition	Why it matters
Lives saved	Deaths avoided against a stated counterfactual	The ultimate test
Person-years of exposure avoided	Years lived without a service or above a hazard threshold, avoided	Counts how many and how long
Capitals built	Progress across the six capitals, by country	Captures multidimensional resilience
Pace against peers	Each country's trend against proven and frontier pace	Turns benchmarks into accountability
Conversion rates	Learning-to-earning, productive use, full-switch rates	Shows whether access converts into development
Cost of essentials	Power, cooking fuel, data and water as a share of income for the poorest 40%	Makes affordable living measurable

Source: H Heuristics.

11.2 What H Heuristics achieves

The programme measures its own contribution on a four-step chain: **outputs** (reports, briefs, cards, datasets), **uptake** (downloads, citations, media and reuse of data), **influence** (metrics adopted, briefings requested, invitations, partnerships) and **outcomes** (commitments made, pace changes in the countries engaged, and the lives and person-years in the Ledger). Each annual Ledger reports these alongside the world's progress, so that the programme holds itself to the standard it asks of others.

11.3 Milestones

Milestones make the programme accountable. Those for the world are taken from the proven-pace scenario; those for H Heuristics follow the influence ladder (Table 17).

Table 17 Illustrative milestones for the world and for the programme

Horizon	For the world (proven-pace path)	For H Heuristics
2030	People without electricity below 489 m; clean-cooking gap below 1.6 bn; full-switch rate tracked in major countries	Ten pathway and intersection reports; four annual Ledgers; full-switch rate adopted by at least one partner
2035	Every lagging country moving at least at proven pace in power, cooking and connectivity	Benchmarks cited in national plans or funder frameworks
2050	People without electricity about 79 m; without clean cooking about 0.74 bn	A recognised reference for exposure accounting and pace
2100	Basic-service gaps near zero; about 747 bn person-years avoided against a frozen century	Concepts embedded in how development is judged

Source: H Heuristics calculations in this report and HH-2026-60 (Hughes, 2026f). World milestones are proven-pace scenario values, not forecasts.

The Ledger will be produced each December from the same public sources used here, updated as new data are released: World Bank indicators, UN population projections, WHO burden estimates, ITU connectivity data and the Global Findex (World Bank, 2026; United Nations, 2024; ITU, 2025; World Bank, 2025). Its code will be published so that others can reproduce it, extend it to their own countries and hold the programme to its own milestones. Over time the Ledger is intended to become the programme's most cited product: a single, regularly updated account of whether humanity is moving fast enough to stay ahead of the hazards of the century.

SECTION 12

Limits and Commitments

A constructive programme is only as credible as its caveats. These are the limits of this report and the commitments that will keep Century Pathways honest.

IN BRIEF

- Associations are not causes; scenarios are not forecasts.
- Some reinforcing loops are harmful.
- Five commitments for the programme.

12.1 Limits

- **Associations, not causes.** The multi-dividend and conversion-chain tests hold income constant but not governance, geography or history. They show direction and consistency, not causal size.
- **Scenarios, not forecasts.** Frozen, trend and proven-pace paths are benchmarks. Conflict, debt and fragility can hold countries far below their peers; some gaps will not close on any benchmark without peace.
- **Population projections are uncertain.** Faster fertility decline would ease exposure momentum, and is itself a dividend of education and health.
- **Judgement in the scores.** The multi-dividend matrix and the pathway screen are documented judgements, to be revised as evidence accumulates.
- **Influence is uncertain and slow.** A small research practice cannot guarantee policy change. The programme can make change more likely and measure its contribution honestly.

12.2 Harmful loops

Positive feedback is a mechanism, not a virtue. Cooling demand can raise emissions that raise cooling demand; fossil infrastructure can lock in its own use; digital platforms can concentrate gains among the already connected; debt can crowd out the investments that would repay it. Every Century Pathways report names the harmful twin of its loop and shows how its recommendations avoid feeding it.

12.3 Commitments

- Publish data, code and methods with every report.
- Report failures and null results as prominently as successes.
- Pair every number about harm with a lever and an estimate of how much it reduces the harm.
- Publish an annual Century Ledger of the world's progress and of the programme's own influence.
- Revise concepts, scores and benchmarks in public as the evidence changes.

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About H Heuristics. H Heuristics is an independent research practice founded by Hunter Hughes, publishing research on development, resilience, the clean transition and interconnected global risks at researchreports.hheuristics.com.

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