AI, Inequality and Development

Rethinking Inclusion in the Digital Age

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"I took this stuff that I got out of your seal and I put it in ice water, and I discovered that when you put some pressure on it for a while and then undo it, it doesn't stretch back. It stays the same dimension. In other words, there is no resilience in this particular material when it is at a temperature of 32 degrees. **I believe that has some significance for our problem.***"*

— Richard Feynman, testimony to the Rogers Commission on the Space Shuttle Challenger disaster, 11 February 1986

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AI and Economic Impact: An O-Ring Perspective

Motivation: How Large is AI's Economic Impact?

- Acemoglu (2024) estimates AI will raise aggregate TFP by $\approx 0.5\%$ over the next decade — widely cited, widely treated as an upper bound.
- We argue this is substantially too low.
- Key missing ingredient: **task complementarities** — formalised via Kremer's (1993) O-ring production technology.

"A chain is only as strong as its weakest link."

— the O-ring principle

The O-Ring Production Function (Kremer 1993)

Kremer's production function for a task with n steps:

$$y = k\,B\prod_{i=1}^{n} q_i \tag{1}$$

where

- $q_i \in (0, 1]$ is the **skill / success probability** at step i
- B is a productivity shifter
- k is capital

Key property: productivity is *multiplicative* across tasks — improving one step raises the *marginal return* to improving every other step.

AI as a Skill Augmenter in the O-Ring Model

Suppose AI raises the effective skill at a subset $\mathcal{A} \subseteq \{1, \ldots, n\}$ of automatable tasks from q_i to $\tilde{q}_i = q_i + \delta_i$. Then:

$$\frac{\tilde{y}}{y} = \prod_{i \in \mathcal{A}} \frac{q_i + \delta_i}{q_i} = \prod_{i \in \mathcal{A}} \left(1 + \frac{\delta_i}{q_i}\right) \tag{2}$$

Amplification mechanism
Because the product runs over *all* improved tasks simultaneously, the aggregate output gain is **super-additive** relative to a task-by-task linear model. Acemoglu's framework is closer to additive — hence the underestimate.

Why Acemoglu's Estimates Are Too Conservative

Acemoglu (2024) assumptions

- Few tasks exposed to AI in the near term
- Limited within-task productivity gains
- Modest general-purpose spillovers

O-ring critique

- Complementarity *multiplies* gains across tasks
- Even small δ_i at each step compounds to large $\tilde{y}/y$
- Positive assortative matching amplifies inequality *and* aggregate output simultaneously

Implication
Under O-ring complementarities, plausible AI skill upgrades yield aggregate TFP gains **several times** larger than the 0.5% benchmark.

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Back-of-Envelope: O-Ring vs. Acemoglu

Assumptions: $n = 50$ tasks, AI improves $m = 5$ (10%), baseline skill $q = 0.95$, per-task improvement $\delta = 0.05$. *Conservative.*

$$\frac{\tilde{y}}{y} = \left(1 + \frac{\delta}{q}\right)^m = \left(1 + \frac{0.05}{0.95}\right)^5 \approx 1.292 \quad \Rightarrow \quad \textbf{+29\% output gain} \tag{3}$$

Acemoglu (2024)

- TFP gain $\approx$ 0.5% over 10 years
- Additive task-level model
- Few tasks exposed near-term

O-ring estimate

- TFP gain $\approx$ **29%**
- Multiplicative complementarities
- $\approx 58\times$ **larger** than Acemoglu

Tasks improved m	3	**5**	10
O-ring gain	17%	**29%**	67%

The same multiplicative structure that amplifies *aggregate* gains also amplifies *inequality*:

$$w_i \;=\; k\,B\,q_i \prod_{j\neq i} q_j \tag{4}$$

- High-skill workers in AI-exposed sectors experience convex wage gains.
- Workers in low-q tasks or countries without AI access face relative — and potentially absolute — losses.
- The Global South is disproportionately exposed to the *downside* of O-ring dynamics.

DPI, AI and Inclusion

Digital Public Infrastructure: The Inclusion Challenge

- Across the Global South, DPI — identity, payments, and data exchange systems — is **advancing faster than the evidence on inclusion**.
- DPI can deliver large-scale welfare gains, but vulnerable groups face layered barriers: access, affordability, skills, trust, and legal identity.
- Without systematic measurement, course-correction is impossible.

GDN DPI Inclusivity Measurement Programme
Launched February 2026. Convenes Global South research teams to develop a robust survey toolkit, piloted in five countries (incl. Mongolia and Malawi), with scale-up planned. Funded by **Co-Develop**.
Contact: `dpi@gdn.int`

A Causal Framework for DPI Inclusion

Structural Conditions		**Enabling Conditions**		**DPI Engagement**		**Intermediate Outcomes**		**Inclusion Outcomes**
gender, geography, ID, income	$\Rightarrow$	infrastructure, affordability, legal ID	$\Rightarrow$	enrolment, use, non-use	$\Rightarrow$	trust, agency, satisfaction	$\Rightarrow$	participation, belonging, rights

$\longleftarrow$ policy feedback loop $\longleftarrow$

Measuring intermediate outcomes relative to structural and enabling conditions goes beyond monitoring and feeds back into DPI design.

Measuring Inclusion: Key Survey Dimensions

The GDN survey instrument covers **five framework nodes** with 100+ constructs. Highlights by node:

Structural conditions

- Gender, age, ethnicity, disability (Washington Group)
- Foundational ID possession & quality
- Settlement type, education, wealth index

Enabling conditions

- Awareness of DPI system
- Internet access, frequency, outage rate
- Functional digital skills (SMS, search, OTP, payment)
- Affordability of enrolment & transaction costs

DPI engagement

- Enrolment status, channel, date, self vs. assisted
- Barriers: cost, complexity, distrust, language, missing documents, device incompatibility
- Breadth and frequency of service use

Intermediate outcomes

- Multi-dimensional trust (institutional, technology, process, outcome)
- Self-efficacy; perceived data control
- Grievance & redress experience

Inclusion outcomes

- Benefits received, time & money saved
- Dignity, felt respect, self-perceived access
- Workarounds, adaptive exit, denial events

Who Gets Left Behind? Evidence from Mongolia & Malawi

Pilot surveys in **Mongolia** (E-Mongolia platform) and **Malawi** (National ID card) reveal recurring exclusion patterns:

Barriers to enrolment

- Missing prerequisite documents (birth certificate, proof of address)
- Costs: fees, travel, internet data
- Complex or time-consuming process
- Low trust — data security concerns
- Language not supported
- Device incompatibility

Barriers to use

- Intermediated use: another person acts on the respondent's behalf — masking true exclusion
- Credential damaged / out of date
- Biometric failure rates
- Connectivity outages
- Perceived surveillance / distrust
- *Adaptive exit*: stopped trying after prior failure

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AI, DPI and the Risk of Compounding Exclusion

- AI is being integrated into DPI pipelines: biometric verification, automated eligibility checks, chatbot interfaces.
- For those already on the *wrong side* of structural and enabling conditions, AI integration can amplify exclusion — not reduce it.

The O-ring echo in DPI

Each layer of the inclusion framework is a “task” in the O-ring sense. A person excluded at the *enabling conditions* stage (no affordable internet) is excluded from every downstream benefit — the multiplicative logic of exclusion mirrors the multiplicative logic of productivity.

Policy implication: measuring and fixing the *weakest link* in the inclusion chain yields super-additive welfare gains — the same logic that makes AI’s aggregate impact larger than Acemoglu estimates.

AI in Academia and the Global Research Divide

AI and Development: A Skewed Promise

- AI offers genuine promise for the Global South: leapfrogging infrastructure deficits, extending expertise to under-served communities, compressing institutional learning.
- Yet AI use in the Global South is deeply uneven — gaps in skills, infrastructure, and innovation capacity mean most gains accrue elsewhere.
- AI could add up to $15.7 trillion to the global economy by 2030 — but the overwhelming share is projected to flow to wealthier countries.

Distributional risk

Without strong policy action, AI risks **reversing the long trend of narrowing development inequalities**. Women, rural communities, and informal-economy workers are disproportionately vulnerable; jobs held by women are nearly **twice as exposed** to automation.

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The Real Research Divide Is Not About Access to Models

The dominant narrative is wrong
ChatGPT, Claude, Gemini are free at the basic tier globally. **Raw access is not where the disparity lives.**

The gap sits in **three specific places**:

1. **Complementary capital** — institutional subscriptions, API credits, GPU access, clean local-language data.
2. **Institutional norms** — Northern universities are piloting AI workflows and training PhDs. Southern institutions are mostly observing.
3. **Peer networks & practice** — what matters in five years is whether your community has worked out *how to do research with AI in your field*.

AI and Economics Research: An O-Ring Echo

The O-ring logic resurfaces at the level of *academic production*:

$$y_{\text{res}} = kB \underbrace{q_{\text{data}}}_{\text{data}} \cdot \underbrace{q_{\text{code}}}_{\text{coding}} \cdot \underbrace{q_{\text{lit}}}_{\text{lit.}} \cdot \underbrace{q_{\text{net}}}_{\text{network}} \cdot \underbrace{q_{\text{pub}}}_{\text{journals}} \tag{5}$$

Key insight

AI raises q_i multiplicatively for those with complementary capital — and runs *in reverse* for those without.

AI Widens the Global Research Divide

- Researchers with complementary capital (subscriptions, GPU, peer networks) see *multiplicative* productivity gains.
- A Global South researcher missing even one input sees the **multiplicative effect work in reverse**.
- Result: AI widens the productivity gap between rich-country and Global South economists.
- Rural and indigenous communities invisible in training data — algorithmic bias compounds exclusion.

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What Would Have to Be True for AI to Narrow the Gap?

Current trajectory

- Global South researchers invisible in training data
- Developmental priorities absent from international agenda
- Publication gap widens as Northern researchers iterate faster
- AI governance designed in Europe & North America, without LMIC input
- No good baseline data on how Global South researchers use AI

What needs to change (GDN AI Thematic Window)

- Redistributive AI access facilities (compute credits, APC subsidies, database subscriptions)
- Community of practice: peer learning, shared tooling, advocacy
- Research *on* AI in LMIC contexts (informal labour, public services, governance fit-for-purpose)
- Southern researchers developing *their own* AI-augmented workflows — not catching up to Northern ones

Policy Implications

Policy Implications

1. **Revise impact estimates upward**
   Policymakers and international institutions should use O-ring-consistent models; the stakes of getting AI governance right are higher than Acemoglu's benchmark suggests.
2. **Invest in DPI as AI infrastructure**
   Open, interoperable digital public infrastructure is a prerequisite for inclusive AI access.
3. **Global South AI research fund**
   Subsidised access to frontier AI tools for researchers in LMICs; differential pricing by institution.
4. **Representation in training data and benchmarks**
   Mandate inclusion of Global South languages, contexts, and economic data in major AI model training pipelines.

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Conclusion

- The O-ring framework suggests AI's aggregate economic impact is substantially larger than consensus estimates — and so are the consequences of unequal access.
- DPI is the critical mediating layer between AI potential and inclusive outcomes.
- AI is reshaping *who produces knowledge* — with worrying implications for the Global South.
- The window for inclusive AI governance is **now**.

Thank you.

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