

Delhi School of Economics University of Delhi

Course: EC 602
Public Economics II
MA Economics – Semester IV

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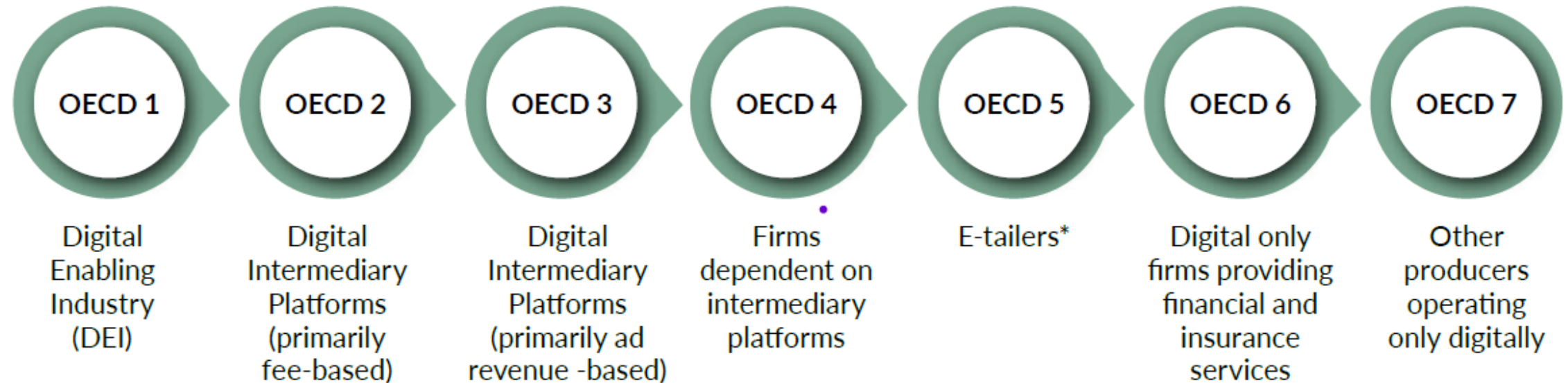
Outline of today's (March 12) lecture

- ❑ Measuring the Size of India's Digital Economy (Including AI)
- ❑ Cross-Country Comparisons of Digitalisation and AI Adoption
- ❑ India's Approach to Digitalisation: A "Third Way"
 - Illustrative case studies of Digital Public Infrastructure (DPI)
- ❑ AI and Jobs: Is This Time Different?
- ❑ Key Takeaways

Measuring the size of India's digital economy



The OECD Framework



This approach is an accounting exercise based on national account estimates and primary survey

Source: Estimation and Measurement of India's Digital Economy. Ministry of Electronics and Information Technology (Meity).

<https://www.meity.gov.in/static/uploads/2025/01/5ff397f9e8152d5562ed4cef1a6b767b.pdf>

Measuring the size of India's digital economy (contd...)

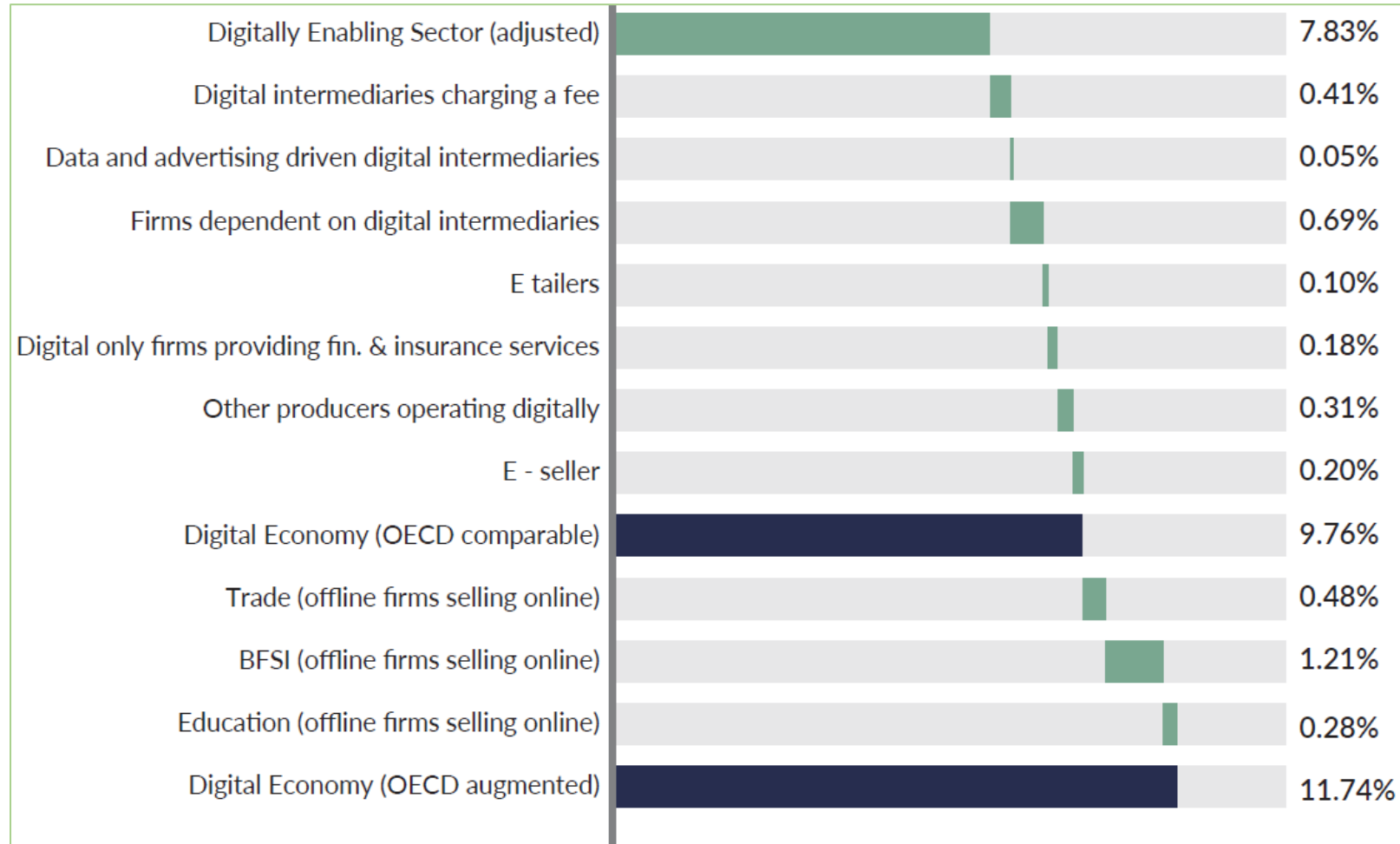
Digital industries as defined by OECD

Other Digital Industries	Description	Examples of firms operating in India	User pays fee	Digitally Ordered	Digitally Delivered	Intermediary
OECD 2	Digital Intermediary Platforms (primarily fee-based)	Amazon, Uber, Urbanclap, Makemytrip	Y	Y	N	Y
OECD 3	Digital Intermediary Platforms (primarily and revenue-based)	Google, YouTube, Meta, Sharechat	N	Y	Y	Y
OECD 4	Firms dependent on Intermediary platforms	MSMEs selling online, uber drivers, delivery partners, content creators	Firms and individuals dependent on intermediary platforms			
OECD 5	E-tailers	Nykaa, Pepperfry, Lenskart, BigBasket	Y	Y	N	N
OECD 6	Digital only firms providing financial and Insurance services	Razorpay, Lending Kart, WazirX, Groww	Pure fintech players			
OECD 7	Other producers operating only digitally	Byju's, SonyLiv, Gaana, PlaySimple	Y	Y	Y	N

Source: Estimation and Measurement of India's Digital Economy. Ministry of Electronics and Information Technology (Meity).

<https://www.meity.gov.in/static/uploads/2025/01/5ff397f9e8152d5562ed4cef1a6b767b.pdf>

India's digital economy accounted for nearly 12% of national income in 2022-23

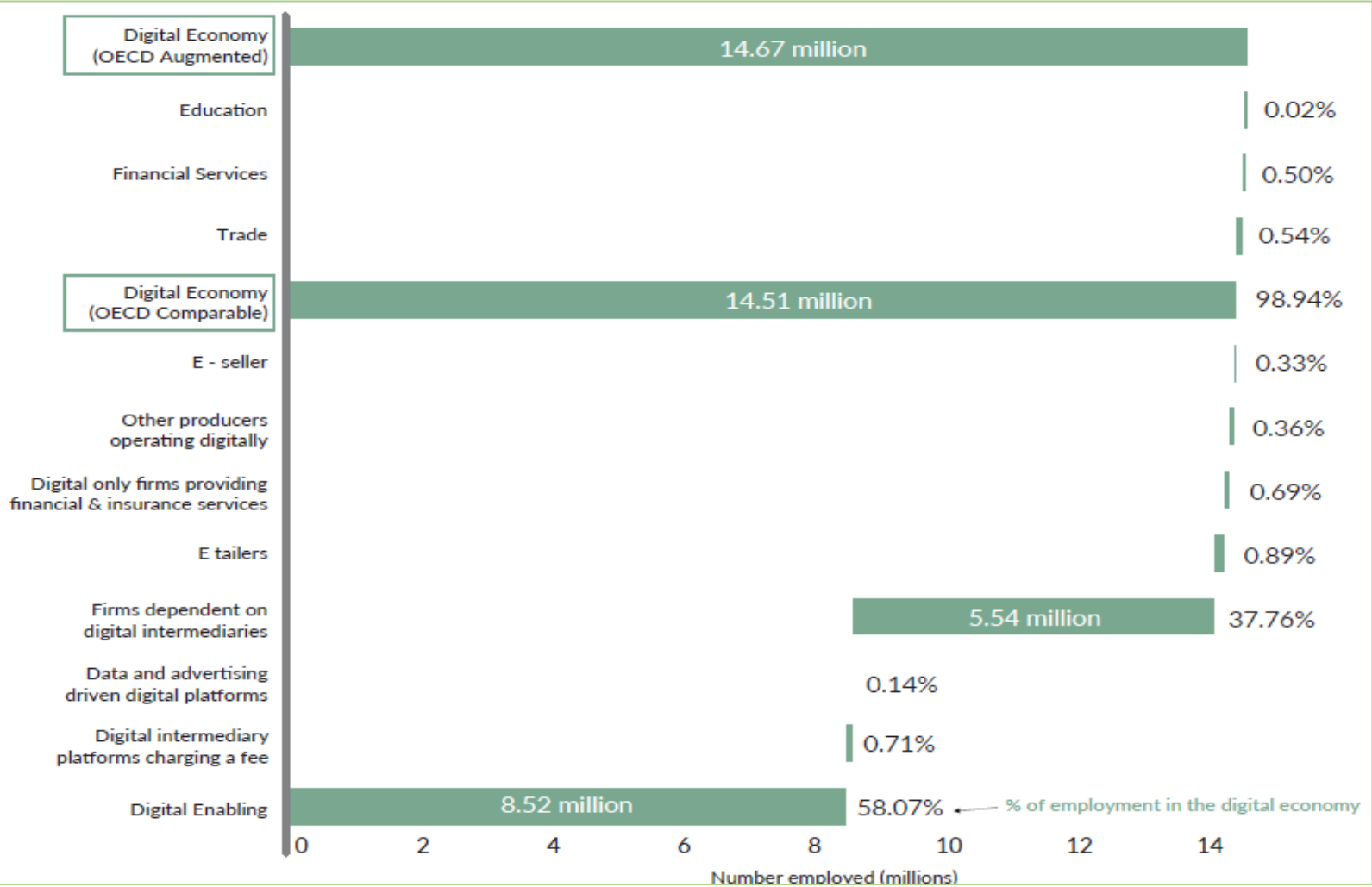


- Digital GVA: Rs. 28.94 lakh crore (USD 368 billion)
- Digital GDP: Rs. 31.64 lakh crore (USD 402 billion)
- 67% from DEI; 3.9% by platforms; and 5.9% by MSMEs
- BFSI is the most digitized sector, with 20% sectoral output is digital

Source: Estimation and Measurement of India's Digital Economy. Ministry of Electronics and Information Technology (Meity).

<https://www.meity.gov.in/static/uploads/2025/01/5ff397f9e8152d5562ed4cef1a6b767b.pdf>

India's digital economy employs nearly 2.5% of the workforce



- Digital economy accounts for 2.55% of work force.
- Labour productivity (output/labour) in digital economy is five times greater than rest of the economy.
- The composition of labour in digital markets is bi-modal, 58% employment in the digital enabling sectors (relatively formal and high skill) and 37% category of platform workers – OECD 4 (relatively informal and low skill)

Source: Estimation and Measurement of India's Digital Economy. Ministry of Electronics and Information Technology (Meity). <https://www.meity.gov.in/static/uploads/2025/01/5ff397f9e8152d5562ed4cef1a6b767b.pdf>

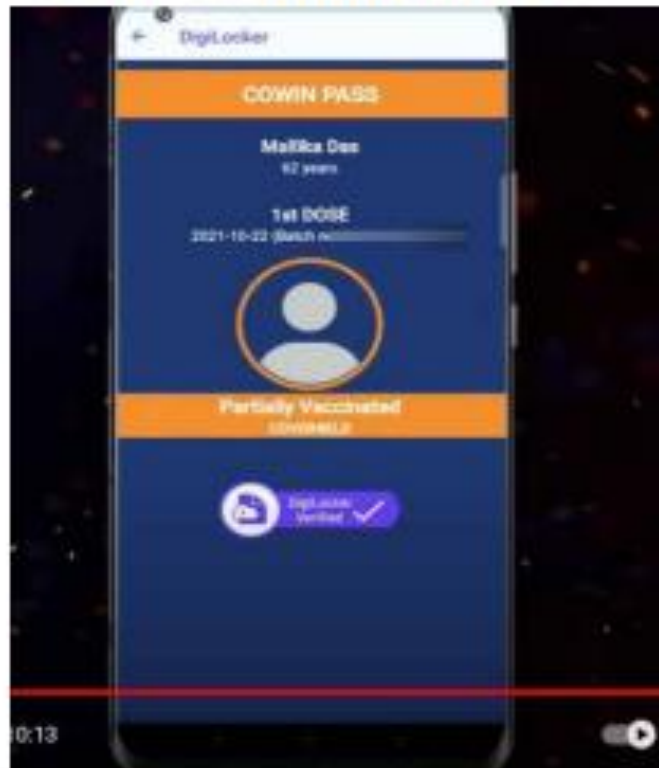
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Digital India, Analogue America?

Figure 1: India has a digital app to register and store vaccination records, while the US has opted for a paper-based system

Co-WIN vaccination certificate in India



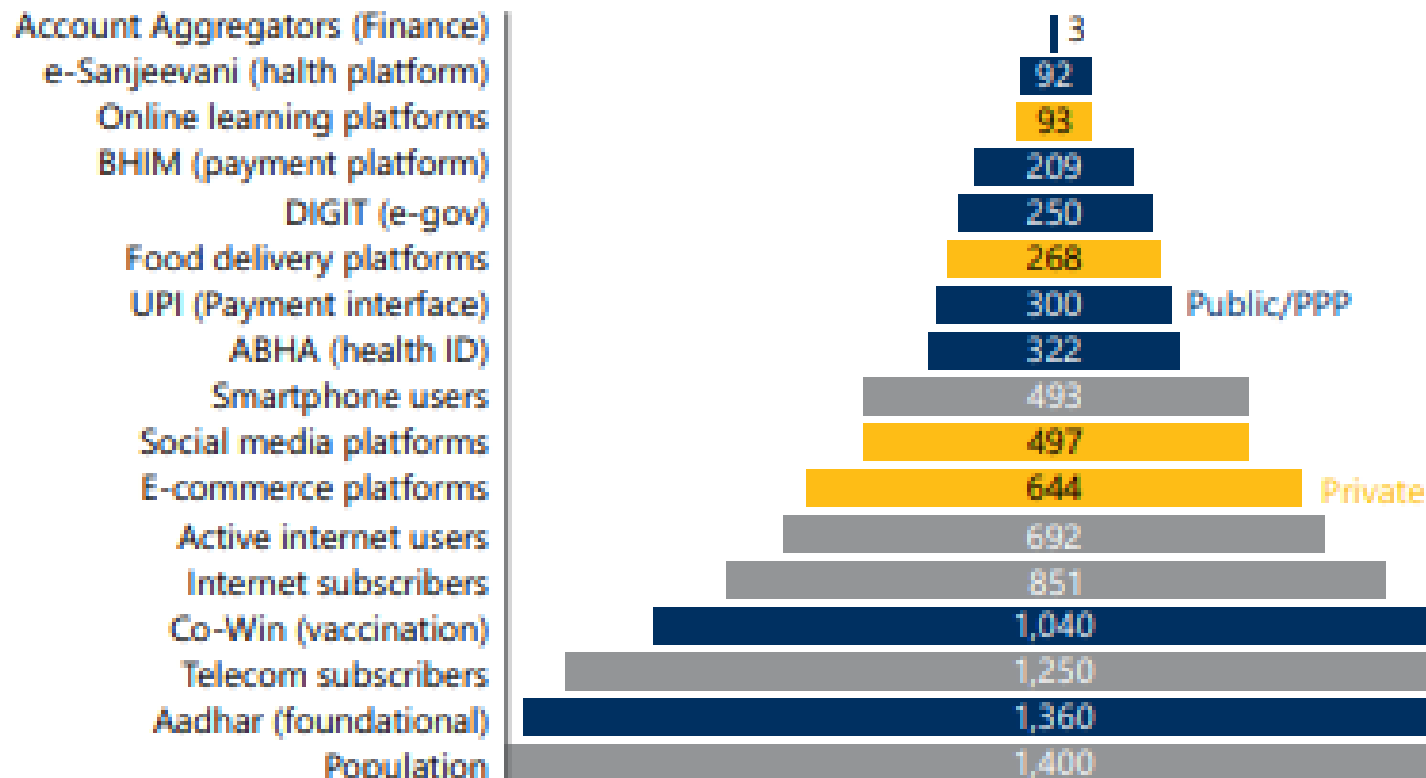
CDC certified vaccination card in the USA



Source: SIDE 2023

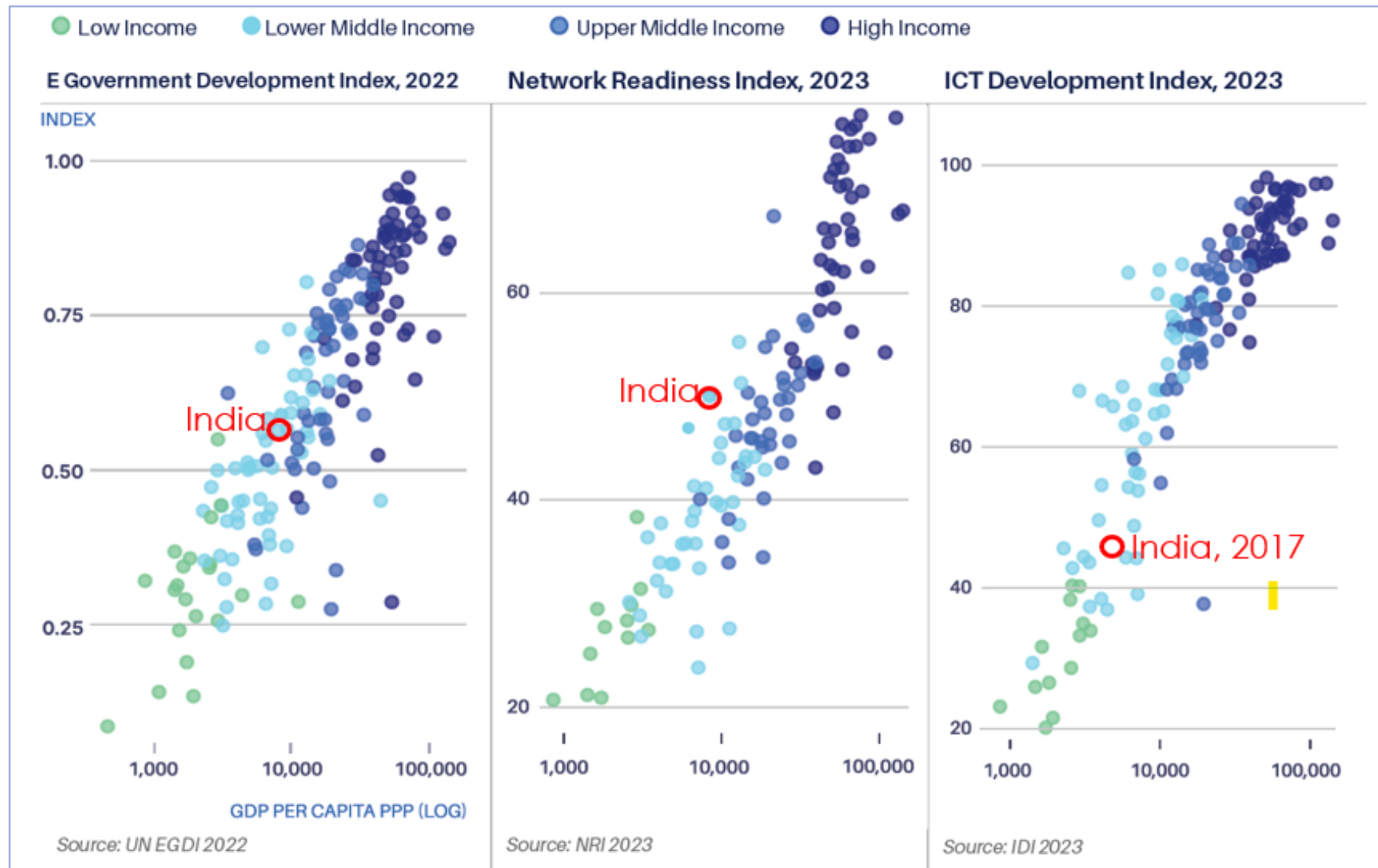
Co-WIN is not an isolated success

Figure 2: India has digital public infrastructure and platforms (DPIPs) along with an array of privately operated platforms (Number of users in million)



Source: SIDE 2023

Yet none of that progress is reflected in global indices measuring the adoption and impact of digital technologies



What's wrong with the existing global indices on digitalization?

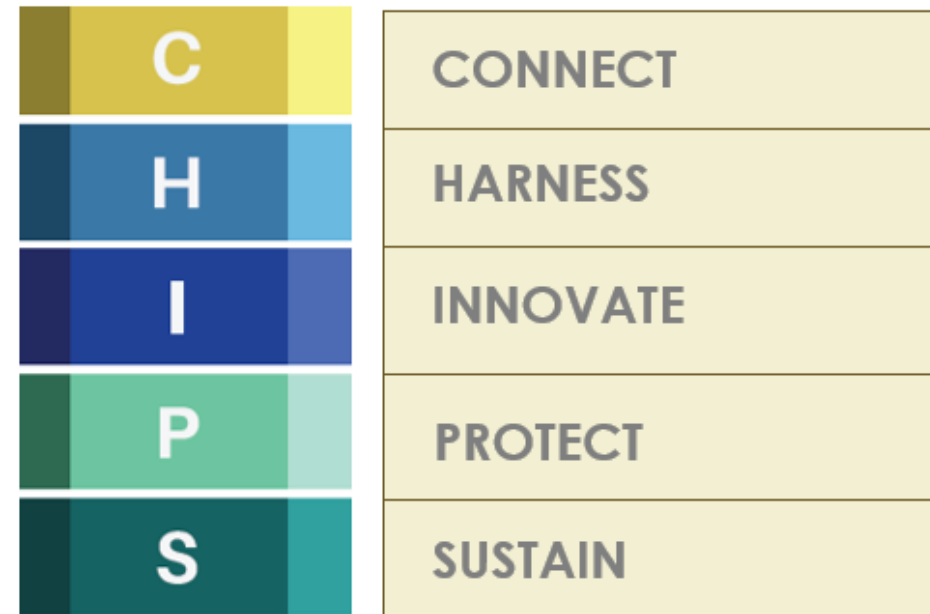
Digitalisation has made dramatic progress, but the way it is being measured has not

Traditional Approach

- Ignores the scale/network effects of digitalization
- Captures a narrow notion of digitalization
- Suffers from double counting

Alternate Framework

The CHIPS Framework



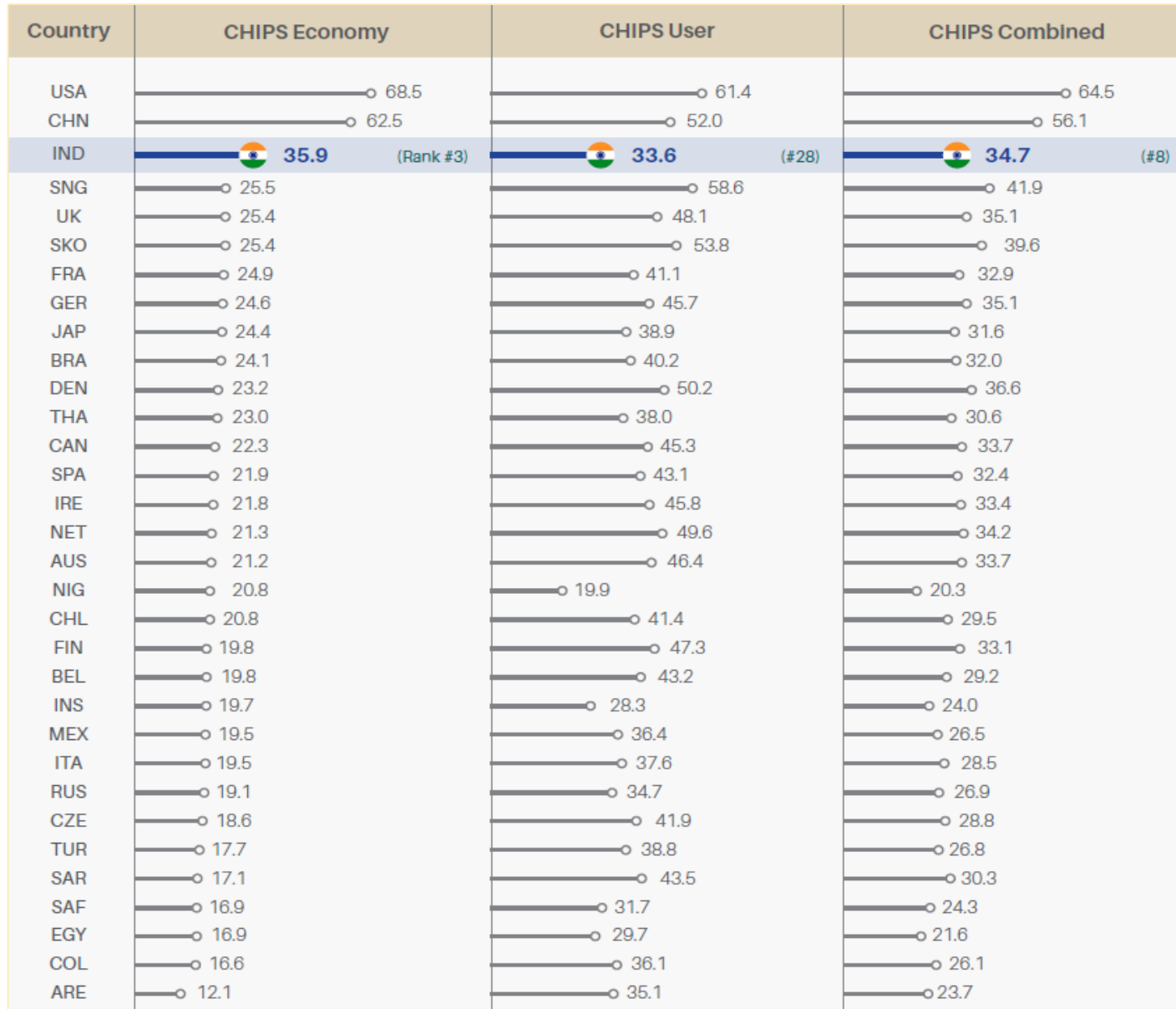
Source: SIDE 2023, 2024, 2025

Benchmarking digitalisation: The SIDE Report



India in 2025:

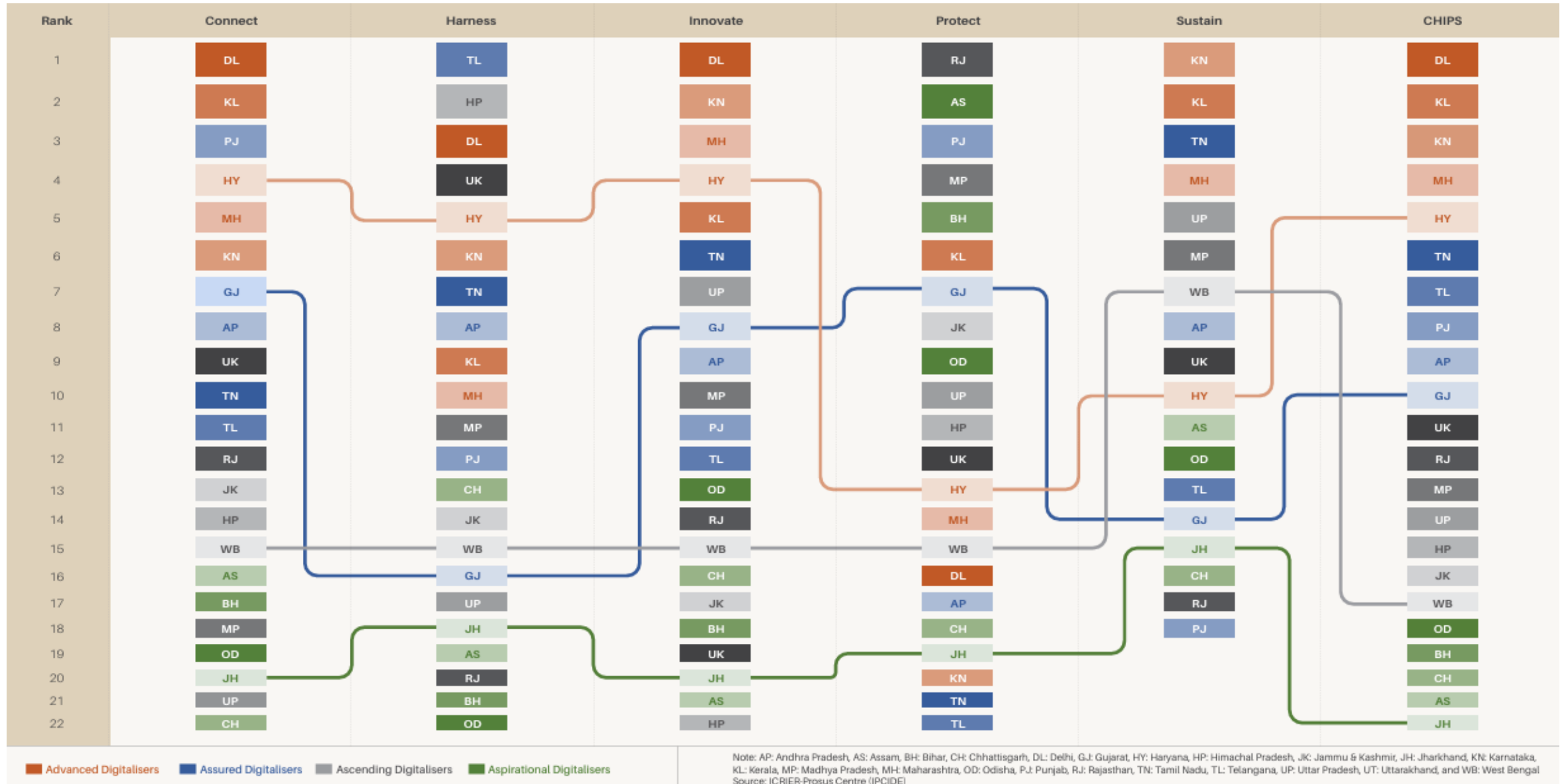
3rd in CHIPS Economy, 28th (out of 32) in CHIPS User, and 8th in CHIPS Combined



□ The rise of India is part of a larger story of the rise of the Global South in the world's digitalization map: China (2nd), Brazil (10th), Thailand (12th) and Nigeria (18th) – all score high on CHIPS Economy

□ Out of the top 10 countries, four are from Asia (China, India, Singapore and South Korea) and only three from continental Europe (Denmark, Germany and Netherlands)

Digitalisation of Indian States



Innovation: Towards a Global Duopoly?

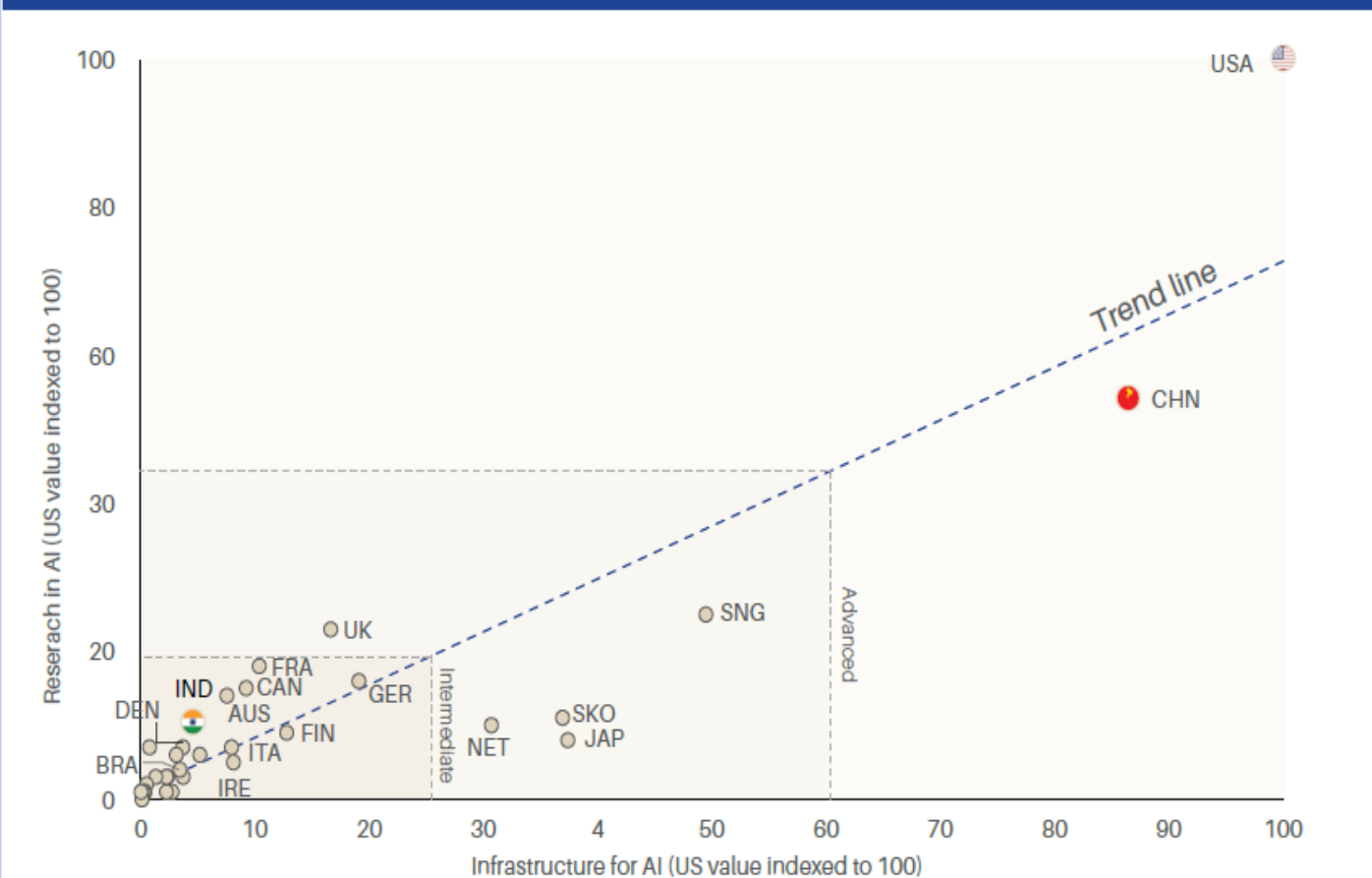
- ❑ US remains the undisputed leader in digital innovation with a score of 81 (rank 1), but is waking up to China's rise
- ❑ China is rapidly evolving from being an imitator to becoming a lead innovator for frontier technologies (rank 2).
- ❑ India's innovation capabilities are greater than its level of development, but nowhere near that of a leading nation. Overall, India ranks 9th among the 32 countries, performing particularly well on investments and startups (rank 4). It however lags in the AI sub-pillar (rank 13) resulting from low infrastructure availability and lack of cutting-edge deep tech research.
- ❑ This situation could significantly change if the announced investments and policies in the Union Budget in 2024-25 and 2025-26 are effectively implemented

Source: *SIDE 2025*

Country	Pillar		Sub-Pillar	
	Innovate	Artificial Intelligence	Investments & Startups	Emerging Technologies
USA	81.0	86.8	81.0	77.7
CHN	39.7	57.3	18.7	48.3
SNG	29.1	28.1	30.8	29.5
SKO	21.7	33.0	3.6	29.4
UK	19.7	16.2	21.0	22.5
GER	18.9	13.2	15.8	28.3
IRE	17.4	5.0	15.1	32.6
NET	17.3	17.3	14.1	21.0
IND	15.3 9 (Rank #9)	6.2 13 (#13)	24.4 4 (#4)	15.7 18 (#18)
FRA	13.1	11.1	8.8	21.7
COL	12.9	0.5	29.8	8.8
JAP	12.1	15.4	0.4	20.8
FIN	11.9	7.8	7.7	20.5
AUS	11.3	7.9	7.1	19.3
CAN	11.0	10.2	5.6	17.5
CZE	10.9	3.7	16.0	13.3
TUR	10.4	1.5	7.5	22.5
ITA	10.4	5.1	3.1	23.3
DEN	9.7	4.4	6.2	18.8
ARE	8.9	0.5	15.0	11.4
RUS	8.3	1.7	NA	15.0
SPA	8.0	4.2	2.5	17.8
BRA	8.0	2.3	12.4	9.4
INS	7.7	3.0	11.8	8.8
MEX	7.4	2.1	12.8	7.6
BEL	7.4	3.2	9.2	10.1
EGY	7.2	0.8	7.6	13.5
NIG	5.8	0.3	10.1	7.2
SAR	4.9	2.2	NA	7.5
CHL	3.5	0.5	2.6	7.5
SAF	3.2	0.9	3.2	5.6
THA	2.6	1.3	1.0	5.5

Is the AI world at risk of being dominated by two countries?

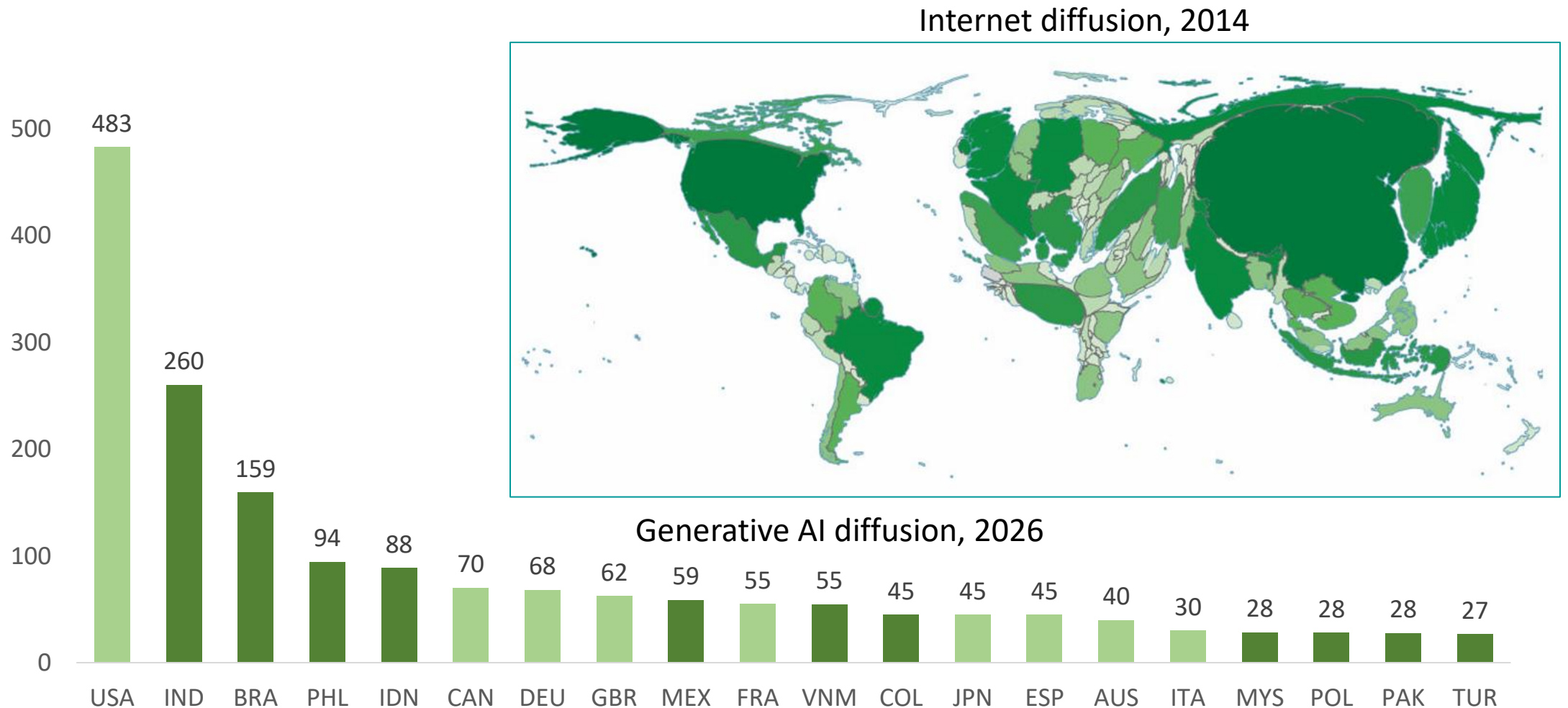
Fig. 5.2 US and China: Hegemons In AI



- ❑ US and China have gained decisive lead over the rest of the world in AI
- ❑ Asian economies like Singapore, South Korea and Japan with high levels of government tech maturity are at the intermediate stage of AI development
- ❑ India ranks 11th on AI research and 16th on AI infrastructure, which is significant, but not enough to make it an important player in the production of AI.
- ❑ With the world's largest AI-skilled workforce and the government's recent efforts, India has the potential to make rapid progress in the coming years.

Source: SIDE 2025

Will AI be the first industrial revolution where large developing countries will outcompete the non-US West?



Source: WDR 2016

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India's approach to digitalisation: The third way

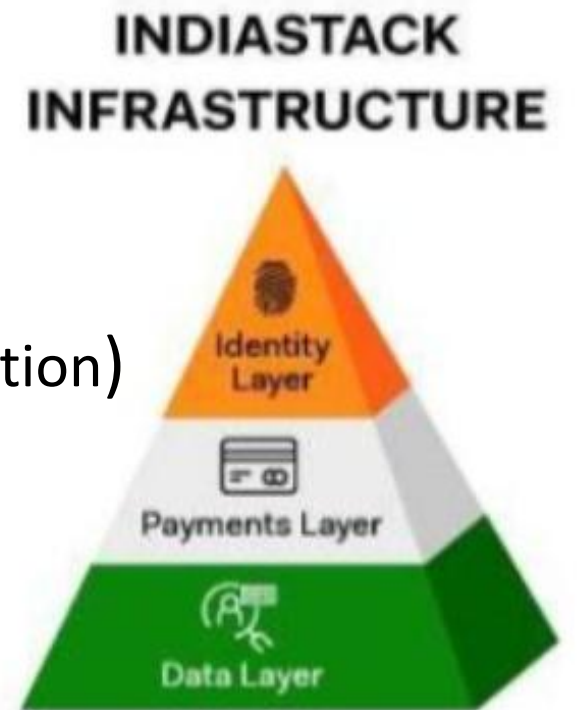
❑ Ownership

US (Private) | China (Public) | India (Public-Private)

❑ Emphasis

US (Innovation) | Europe (Regulation) | India (Techno-Legal Regulation)

❑ India Stack: Digital Public Infrastructure (DPI)

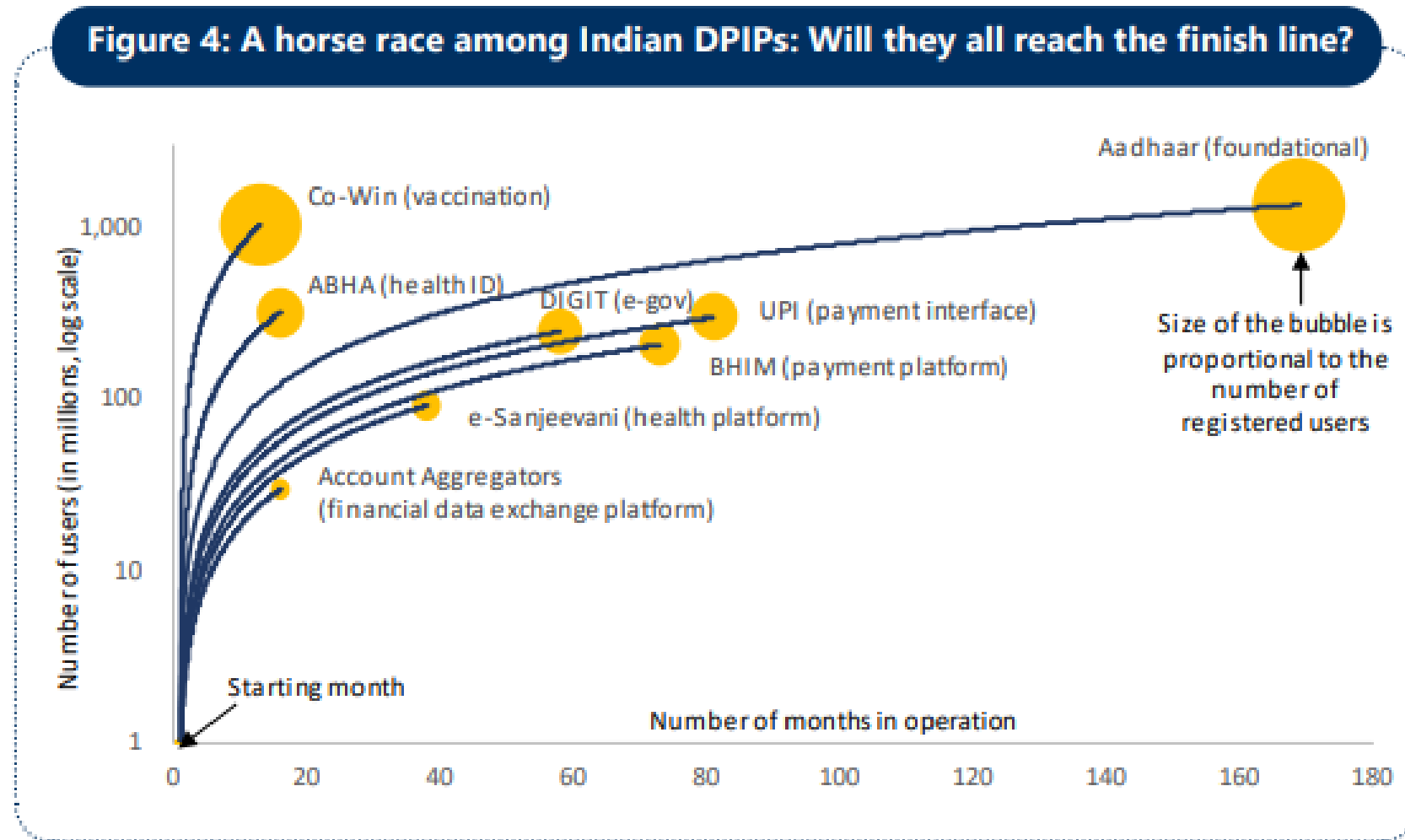


Definition of DPI

“A set of shared digital systems that are secure and interoperable, built on open standards and specifications, to deliver and provide equitable access to public and/or private services at societal scale, governed by applicable legal frameworks and enabling rules to drive development, inclusion, innovation, trust, and competition while respecting human rights and fundamental freedoms.”

Source: G20 Indian Presidency

There are more than 50 DPs operational in India



Source: IPCIDE Team

Impact of Aadhaar on government expenditure, corruption and beneficiary welfare? (Andhra Pradesh)

- Evaluate the impact of biometrically authenticated payments infrastructure ("Smartcards") on beneficiaries of employment (NREGS) and pension (SSP) programs in Andhra Pradesh, using a large-scale randomized experiment.
- The new system delivered a faster, more predictable, and less corrupt NREGS payments process without adversely affecting program access.
- The investment was cost-effective, as time savings to NREGS beneficiaries alone were equal to the cost of the intervention, and there was also a significant reduction in the "leakage" of funds.
- Beneficiaries overwhelmingly preferred the new system for both programs.
- Overall, results suggest that investing in secure payments infrastructure can significantly enhance 'state capacity' to implement welfare programs in developing countries.



The screenshot shows the top portion of a journal article page. At the top left is the American Economic Review logo. To its right, the journal title "American Economic Review" is displayed, along with its ISSN numbers: "ISSN 0002-8282 (Print) | ISSN 1944-7981 (Online)". Below this, there are three navigation links: "About the AER", "Articles and Issues", and "Information for Authors and Reviewers". The main title of the article, "Building State Capacity: Evidence from Biometric Smartcards in India", is prominently displayed. Below the title, the authors' names are listed: Karthik Muralidharan, Paul Niehaus, and Sandip Sukhtankar. To the right of the authors' names, their names are repeated in a larger, blue font. Below the authors' names, the journal information is provided: "AMERICAN ECONOMIC REVIEW VOL. 106, NO. 10, OCTOBER 2016 (pp. 2895-2929)". A red button labeled "Download Full Text PDF" is located below the journal information. Below the authors' names, there is a section titled "Article Information" which contains an "Abstract" section. The abstract text reads: "Antipoverty programs in developing countries are often difficult to implement; in particular, many governments lack the capacity to deliver payments securely to targeted beneficiaries. We evaluate the impact of biometrically authenticated payments infrastructure ("Smartcards") on beneficiaries of employment (NREGS) and pension (SSP) programs in the Indian state of Andhra Pradesh, using a large-scale experiment that randomized the rollout of Smartcards over 157 subdistricts and 19 million people. We find that, while incompletely implemented, the new system delivered a faster, more predictable, and less corrupt NREGS payments process without adversely affecting program access. For each of these outcomes, treatment group distributions first-order stochastically dominated those of the control group. The investment was cost-effective, as time savings to NREGS beneficiaries alone were equal to the cost of the intervention, and there was also a significant reduction in the "leakage" of funds between the government and beneficiaries in both NREGS and SSP programs. Beneficiaries overwhelmingly preferred the new system for both programs. Overall, our results suggest that investing in secure payments infrastructure can significantly enhance 'state capacity' to implement welfare programs in developing countries." Below the abstract, there is a "Citation" section which provides the full citation: "Muralidharan, Karthik, Paul Niehaus, and Sandip Sukhtankar. 2016. "Building State Capacity: Evidence from Biometric Smartcards in India." *American Economic Review* 106 (10): 2895-2929." The DOI is also provided: "DOI: 10.1257/aer.20141346".

Impact of Aadhaar on government expenditure, corruption and beneficiary welfare (Jharkhand)

- Aadhaar-based authentication of transactions had no measurable benefit; it slightly increased mean transaction costs for beneficiaries, excluded a minority who did not have IDs “seeded” to their ration cards at baseline from their benefits altogether, and did not reduce leakage.
- When paired with the new reconciliation protocols, ABBA facilitated a meaningful reduction in government expenditure and leakage but at the cost of concurrent reductions in value received by legitimate beneficiaries.
- Results suggest that most of the adverse effects of the reforms were due to the way the transition was handled, rather than the structural features of the reform itself.
- Mitigations: generous provisions for manual over-rides; more time allowed for universal seeding of Aadhaar numbers to PDS ration cards; and ignoring past leakage and implemented a “clean-slate” reconciliation.

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IDENTITY VERIFICATION STANDARDS IN WELFARE PROGRAMS:
EXPERIMENTAL EVIDENCE FROM INDIA

Karthik Muralidharan
Paul Niehaus
Sandip Sukhtankar

Working Paper 26744
<https://www.nber.org/papers/w26744>

Karthik Muralidharan

Paul Niehaus

Sandip Sukhtankar

We thank Prashant Bharadwaj, Michael Callen, Gordon Dahl, Lucie Gadenne, Siddharth George, Roger Gordon, Ashok Kotwal, Lee Lockwood, Aprajit Mahajan, Ted Miguel, Yusuf Neggers, Monica Singhal and participants in various seminars for comments and suggestions. This paper would not have been possible without the continuous efforts and inputs of the J-PAL/UCSD project team including Avantika Prabhakar, Burak Eskici, Frances Lu, Jianan Yang, Kartik Srivastava, Krutika Ravishankar, Mayank Sharma, Sabareesh Ramachandran, Simoni Jain, Soala Ekine, Thomas Brailey, Vaibhav Rathi, and Xinyi Liu. Finally, we thank the Bill and Melinda Gates Foundation (especially Dan Radcliffe and Seth Garz) for the financial support that made this study possible. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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More readings on DPI

DPI

DIGITAL PUBLIC INFRASTRUCTURE AND DEVELOPMENT: A WORLD BANK GROUP APPROACH

DIGITAL TRANSFORMATION WHITE PAPER, VOLUME 1
MARCH 2025

WORLD BANK GROUP ID4D G2Px PROJECT FAST

The Economics of Shared Digital Infrastructures: A framework for assessing societal value

Policy Report — March 2025

David Eaves
Co-Deputy Director and Associate Professor in Digital Government | UCL Institute for Innovation and Public Purpose (IIPP)

Diane Coyle
Co-Director and Bennett Professor of Public Policy | Bennett Institute for Public Policy at Cambridge University

Beatriz Vasconcellos
Policy Fellow | UCL Institute for Innovation and Public Purpose (IIPP)

Sumedha Deshmukh
Research Fellow | Bennett Institute for Public Policy at Cambridge University

IIPP Institute for Innovation and Public Purpose

Bennett Institute for Public Policy Cambridge

T20 Policy Brief

Task Force 2:
Our Common Digital Future: Affordable, Accessible and Inclusive Digital Public Infrastructure

EXPLORING DIFFERENT FINANCING MODELS FOR DIGITAL PUBLIC INFRASTRUCTURE AND WHY THEY MATTER

June 2023

David Eaves, Associate Professor in Digital Government at the UCL Institute for Innovation and Public Purpose (IIPP)

Mansi Kedia, Senior Fellow, Indian Council for Research on International Economic Relations (ICRIER)

वसुधैव कुटुम्बकम्

ONE EARTH • ONE FAMILY • ONE FUTURE

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Whose prediction would you trust?



Dario Amodei
Co-founder and CEO of Anthropic

AI could wipe out half of all entry-level white-collar jobs and spike unemployment to 10-20% in the next one to five years



Daron Acemoglu
Nobel Prize in Economics

Estimates that only about 5% of current jobs are at risk of being replaced or heavily impacted by AI over the next decade

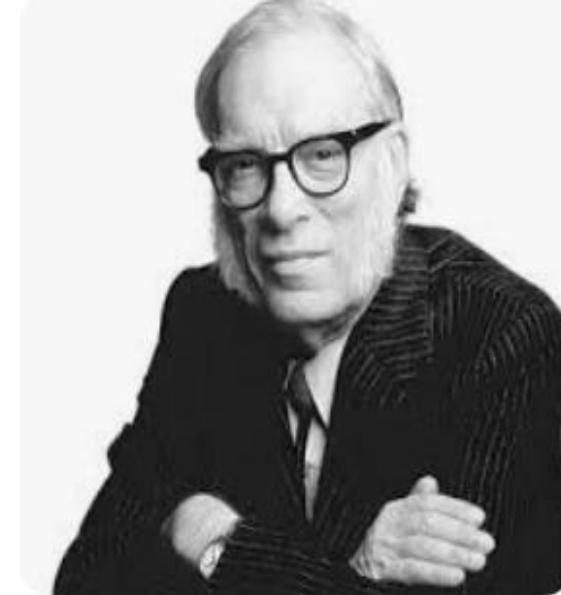
In my view, neither!



John Maynard Keynes

Economic Possibilities for Our Grandchildren, 1931

Economists, techies and science-fiction writers have been more wrong than right when it comes to predicting the impact of technology on jobs



Isaac Asimov

Visit to the World's Fair of 2014, 1964

We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come—namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour.

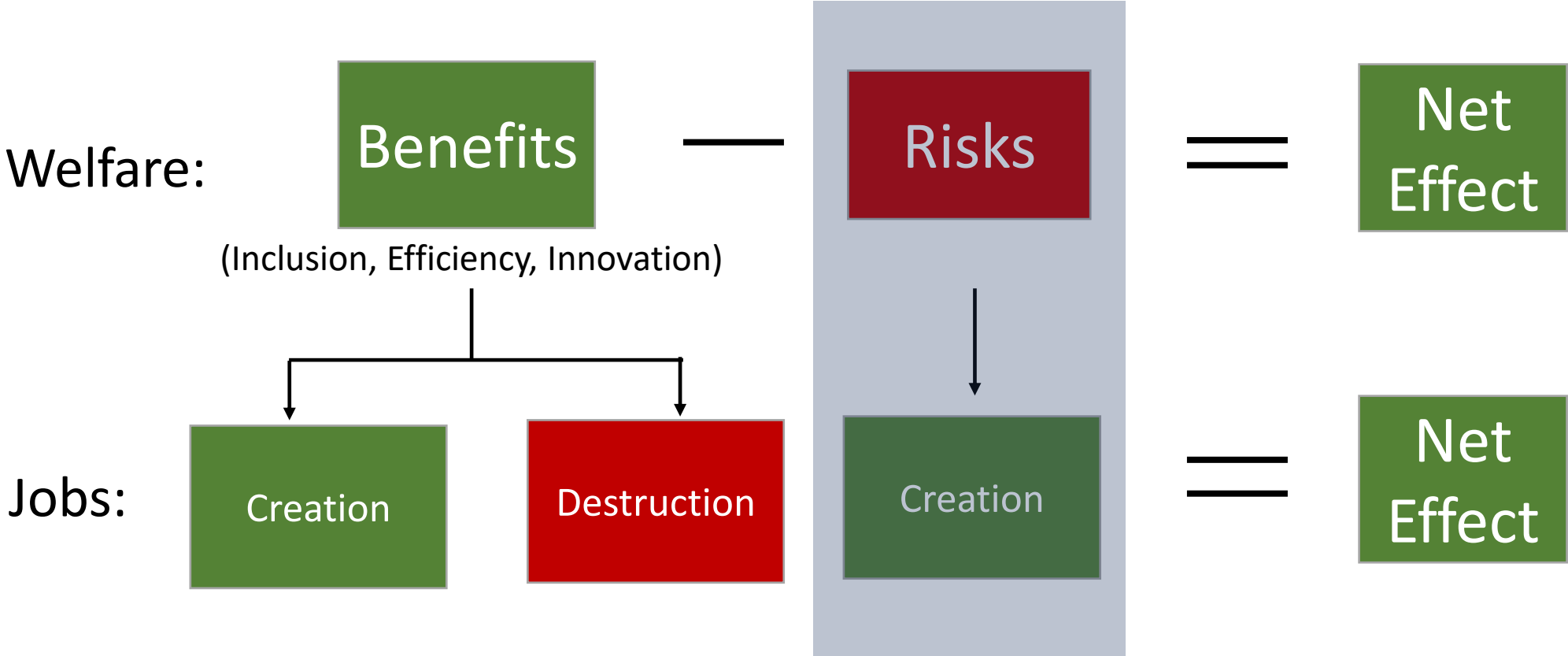
The situation will have been made the more serious by the advances of automation. The world of A.D. 2014 will have few routine jobs that cannot be done better by some machine than by any human being..... mankind will suffer badly from the disease of boredom . . . The lucky few who can be involved in creative work of any sort will be the true elite of mankind, for they alone will do more than serve a machine.

What's the experience on the ground?

- A majority of firms report significant productivity gains following AI adoption, reflected in higher and better-quality output, as well as time and cost savings.
- But no evidence of large-scale job losses following AI adoption in India's IT sector.
- Gen AI adoption has been associated with a moderation in overall hiring, but total employment in the sector has continued to grow.
- AI has led to slower hiring at the entry level, increased demand for skilled mid-level workers, and relative stability at the senior level.
- Occupations most exposed to AI are experiencing the strongest growth in demand. Roles such as software analysts and developers, application developers, and statisticians and mathematicians are seeing increased demand.



Why many of us fall into the fallacy of predicting mass unemployment with the arrival of new technologies?



.... it's not just the "benefits" of technology that generate jobs — the "risks" do as well

Perhaps the best example of risk mitigation creating plentiful jobs is India's IT industry



Market

Personal Finance

Business

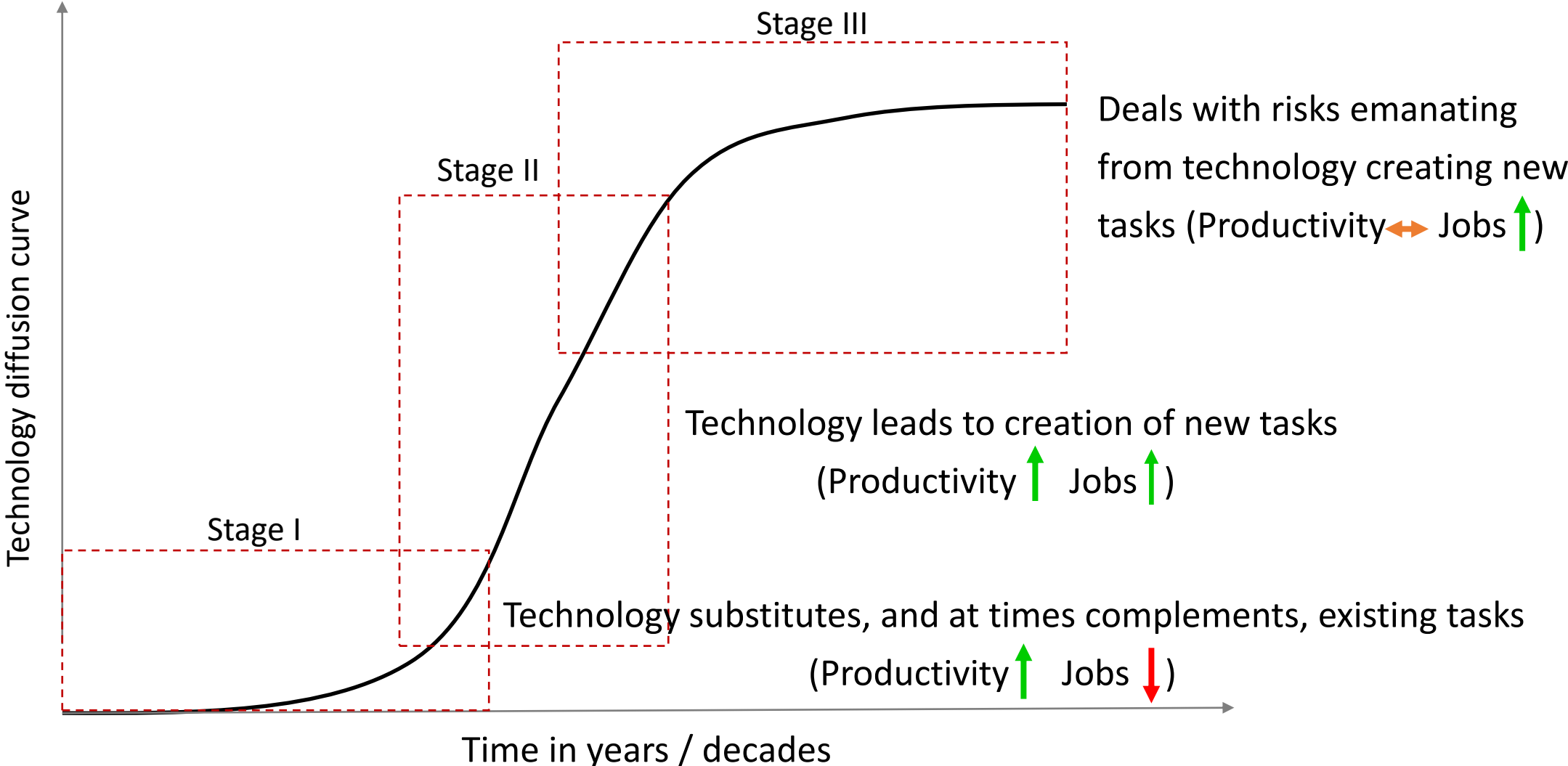
Economy

Engage 

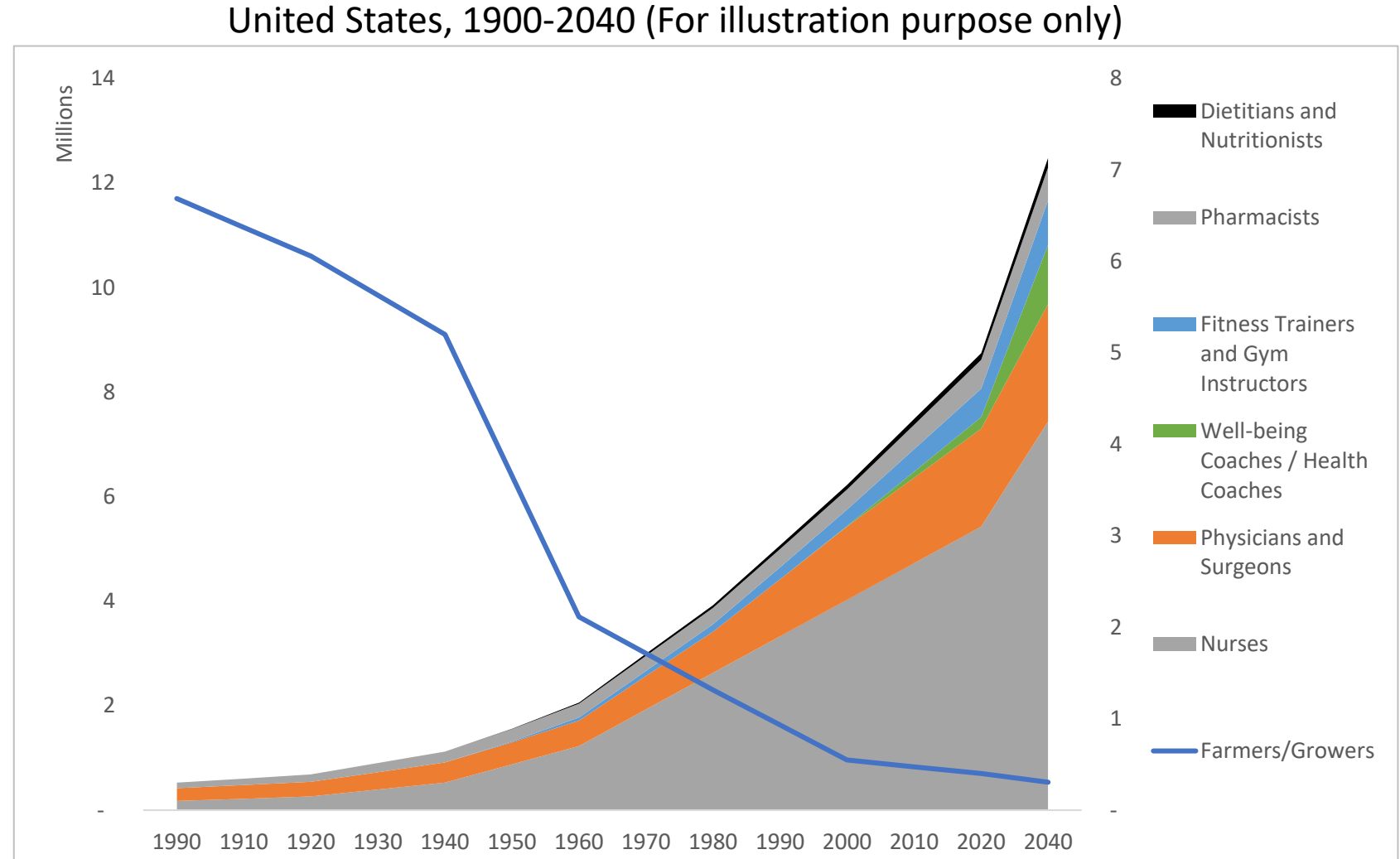
Backstory: How Y2K triggered a boom for Indian IT

India's \$200 billion IT industry received its biggest boost ironically at a time of great anxiety for businesses across the world. This came from the so-called "Millennium Bug", a flaw in the original code written for computers through the 1960s, when programmers used a two-digit code for the year, instead of the now-standard four-digit one. With data storage costs high, the coders left out "19" believing it was superfluous. But as the year 2000 approached, there were fears that the "00" date that would start from the last midnight of 1999 could cause computers to malfunction since they might interpret that as the 00 for 1900.

Jobs creation and destruction across the technology lifecycle

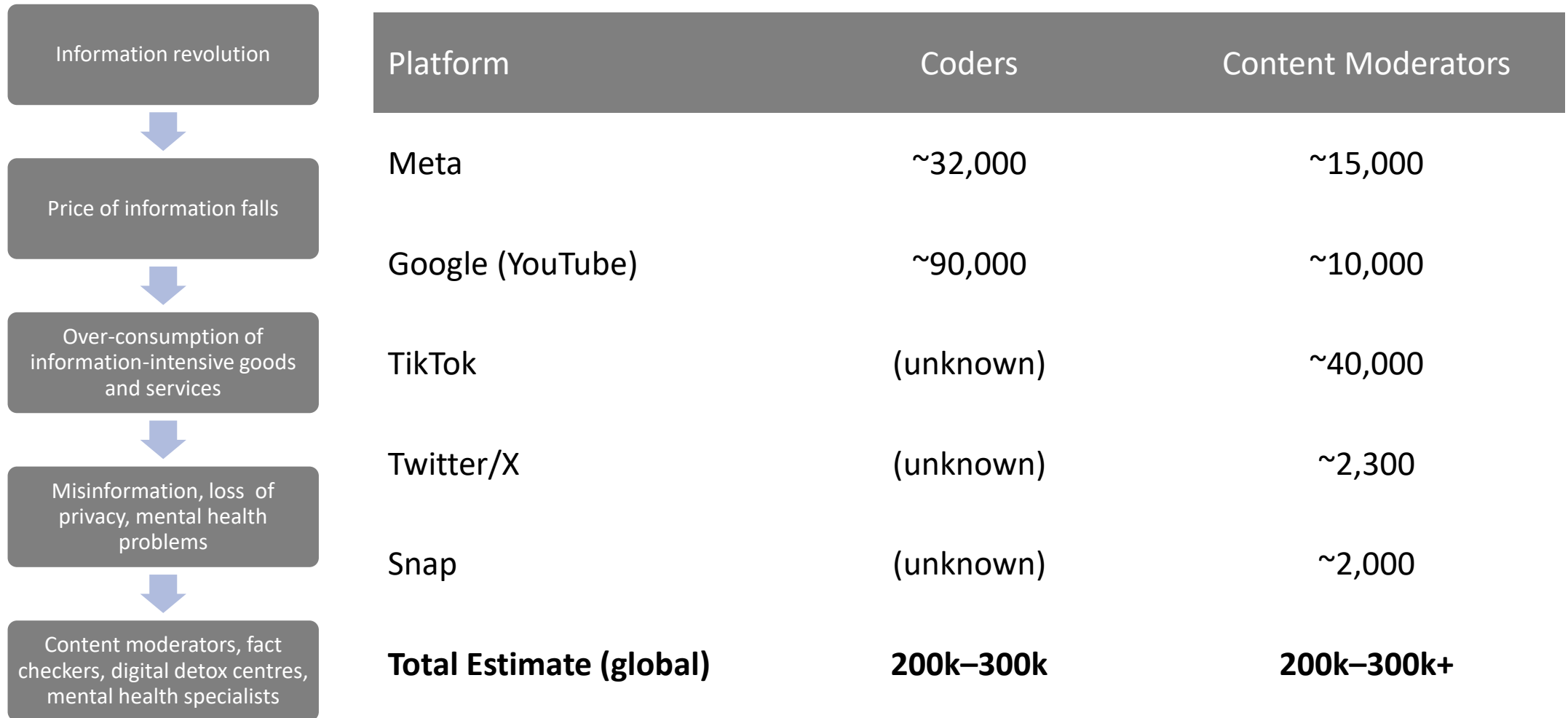


New roles emerging to manage the risks emanating from the agriculture and food revolution



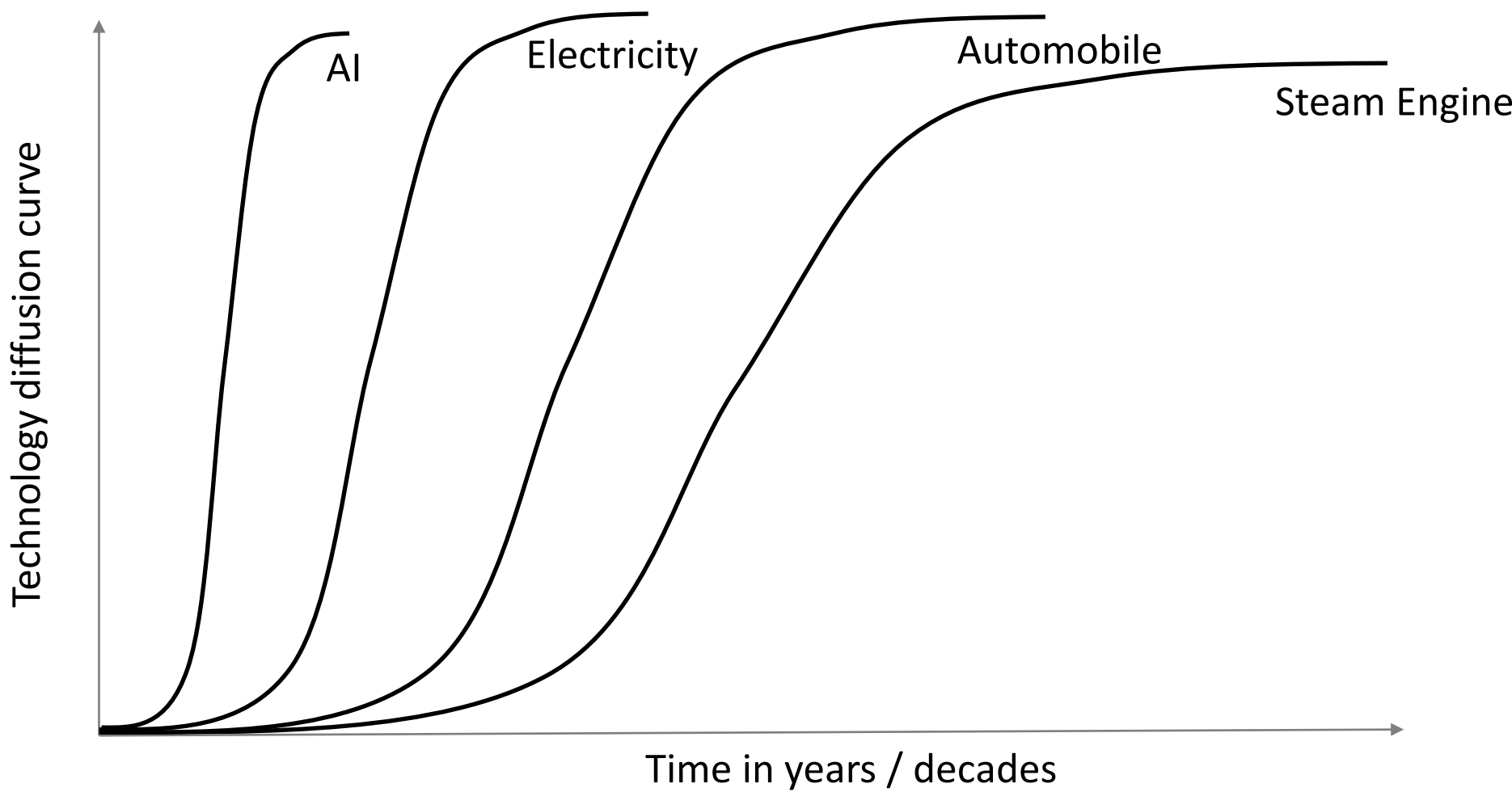
Source: Bureau of Labour Statistics, Internet search, and ChatGPT

New roles emerging to manage the risks emanating from the information revolution



Source: Internet search, and ChatGPT

As technologies diffuse more rapidly, jobs focused on risk mitigation will be needed sooner—and in greater numbers



Emerging “LinkedIn” job titles focused on mitigating AI-related risks globally

- 1) AI Risk Auditor
- 2) Prompt Safety Specialist
- 3) Bias and Fairness Analyst
- 4) AI Policy Compliance Officer
- 5) AI-powered Fraud Detection Specialist
- 6) Digital Asset Guardian
- 7) AI Copyright & IP Advisor
- 8) AI Ethics Ombudsperson
- 9) AI Literacy Coach
- 10) Trust Architect for AI Interfaces
- 11) Digital Reputation Manager
- 12) Synthetic Data Validator
- 13) AI-forensics Expert
- 14) Regenerative Content Inspector

Topic for another seminar:

What are the policy reforms required to unlocking these jobs at scale?

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Key takeaways from today's lecture

- ❑ India's digital and AI economy now accounts for nearly 12% of GDP and employs about 2.5% of the labour force.
- ❑ Digitalisation and AI have advanced rapidly, but the metrics used to measure their impact have lagged behind, leaving considerable scope for new research.
- ❑ India has also pursued a distinct model of digitalisation, centred on Digital Public Infrastructure (DPI), which holds significant promise for accelerating innovation and inclusion.
- ❑ However, while DPIs can serve an important role, their analogue foundations—institutions, regulation, and administrative capacity—need strengthening.
- ❑ AI is transforming tasks and reshaping jobs, but it is too early to determine its net impact on total employment. History suggests that technological advances have almost always created more jobs than they destroyed.

Thank You!

DEEPAK MISHRA

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MARCH 10, 2026



Guest Lecture at Delhi School of Economics,
University of Delhi

AI and Public Economics



Recommended

Deepak Mishra

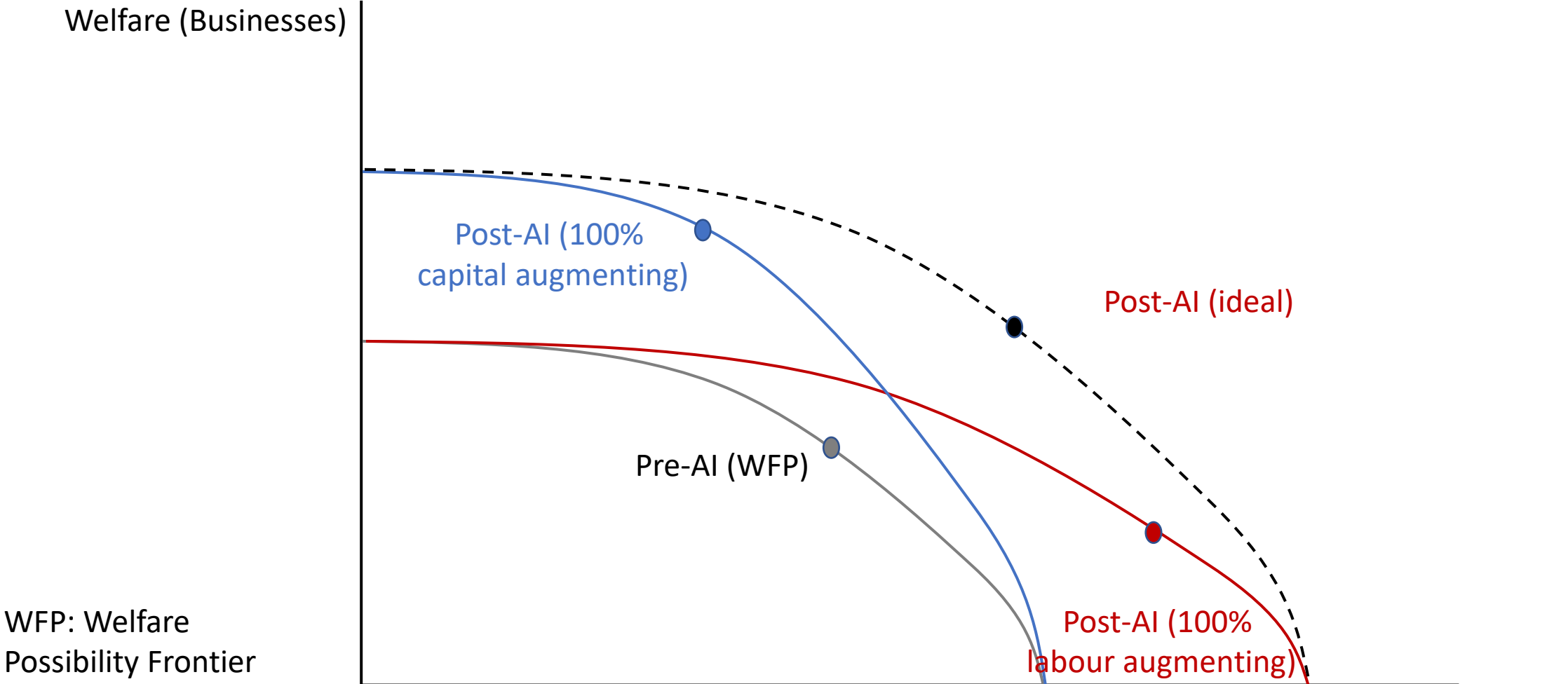
<http://mishradeepak.com>



Deepak Mishra

New economy, old economics.

How AI can promote development?



WFP: Welfare
Possibility Frontier

Source: WDR 2026 (AI for Development)

Online free courses on AI

The screenshot shows the Stanford Online website. The top navigation bar includes 'Stanford | ONLINE' on the left and a user profile 'mystanfordconnection' on the right. Below the navigation bar are links for 'Explore', 'Topics', 'Programs', 'Free Content', 'Schools & Centers', and 'About Us', along with a 'GET COURSE UPDATES' button. The main content area is titled 'Artificial Intelligence Courses and Programs' and includes a welcome message: 'Welcome to Stanford Online's hub for Artificial Intelligence education. Whether you're a seasoned professional or just beginning your journey, we have options for every level. Dive into the forefront of AI with industry insights, practical skills, and deep academic expertise of this transformative field.' A sidebar on the left lists 'Artificial Intelligence' and 'AI Courses and Programs' with sub-categories: 'AI for Engineers and Technical Professionals', 'AI for Business Professionals', and 'AI for Professionals in Healthcare'. Social media icons for Facebook, Twitter, LinkedIn, and Email are visible in the top right of the main content area. A vertical 'FEEDBACK' button is on the right side of the main content area.

<https://online.stanford.edu/artificial-intelligence/courses-and-programs>

The screenshot shows the Harvard University website for the course 'CS50's Introduction to Artificial Intelligence with Python'. The top navigation bar includes the Harvard University logo, a search bar, and a 'VIEW ALL COURSES' button. The main content area features the course title and a description: 'Learn to use machine learning in Python in this introductory course on artificial intelligence.' A red 'LEARN MORE' button is located below the description, with 'on edX' next to it. To the right of the text is a graphic with the text 'CS50AI' repeated four times and a 3x3 tic-tac-toe grid with 'X' and 'O' characters. Below the graphic, the course duration is listed as '7 weeks long'.

<https://pll.harvard.edu/course/cs50s-introduction-artificial-intelligence-python?>