Digitizing Development
Integrating technology in ADB-supported projects and designing technology projects

Thomas Abell

Chief of Digital Technology for Development

SDCC

Outline

- Introduction of ADB's Digital Technology for Development Unit
  - Examples of Technology Projects in ADB
- Background on technology
  - Drivers of technology – exponential growth
  - Amara's Law
  - Technology and economic growth
  - Avoid Hype
- Project Design Considerations for Technology
  - Waterfall to Agile to DevOps
- Lessons for Technology Projects
  - Opportunities and issues of cloud computing
  - Architecture and Enterprise Integration
  - Challenges with Government IT

Introduction

Thomas Abell

Asian Development Bank

Advisor, SDCC and Chief of Digital Technology for Development

Biography

Thomas Abell joined ADB in January 2019. Prior to ADB, Thomas worked for 14 years with Accenture where he supported developing country governments and international development organizations to bring technology driven innovation to the development sector. Thomas has degrees in engineering and business from the Massachusetts Institute of Technology.

Technology Industry Experience
- Accenture, Qualcomm, Hewlett Packard, Google, Microsoft, Samsung, Motorola, United Technologies, Sony, Lenovo

Asian Work Experience
- Philippines, Singapore, Malaysia, China, Indonesia, India, Sri Lanka, South Korea

Development Sector Experience:

Financial Inclusion
1. World Bank/CGAP
2. World Bank/IFC
3. Mastercard
4. Financial Sector Deepening Africa
5. Central Bank of Tanzania
6. Gates Foundation
7. NetHope

Education
1. Stanford Graduate School of Education
2. Inter-American Development Bank
3. World Bank/CGAP
4. Ethiopia Ministry of Education
5. Haiti Ministry of Education
6. Tanzania Ministry of Education
7. Accenture Strategy College
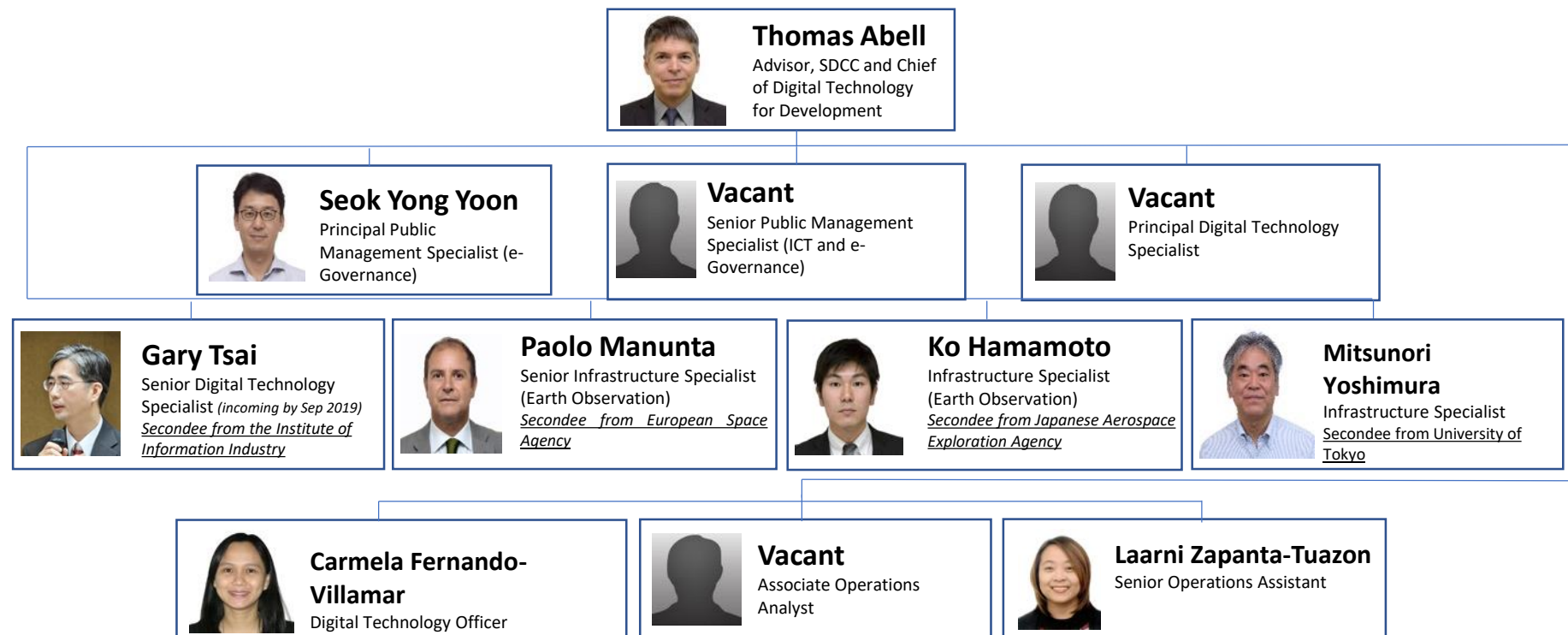8. University of California San Diego

Agriculture
1. CGIAR
2. FSD Tanzania
3. International Livestock Research Institute (ILRI)
4. International Water Management Institute
5. Gatsby Foundation Tanzania

SDCC-Digital Technology for Development Unit

SDCC-DT Unit was established in February 2018 with the charter to advance the effective use of Digital Technology across ADB Programs.

Thomas Abell
Advisor, SDCC and Chief of Digital Technology for Development

Seok Yong Yoon
Principal Public Management Specialist (e-Governance)

Vacant
Senior Public Management Specialist (ICT and e-Governance)

Vacant
Principal Digital Technology Specialist

Gary Tsai
Senior Digital Technology Specialist *(incoming by Sep 2019)*
Secondee from the Institute of Information Industry

Paolo Manunta
Senior Infrastructure Specialist (Earth Observation)
Secondee from European Space Agency

Ko Hamamoto
Infrastructure Specialist (Earth Observation)
Secondee from Japanese Aerospace Exploration Agency

Mitsunori Yoshimura
Infrastructure Specialist
Secondee from University of Tokyo

Carmela Fernando-Villamar
Digital Technology Officer

Vacant
Associate Operations Analyst

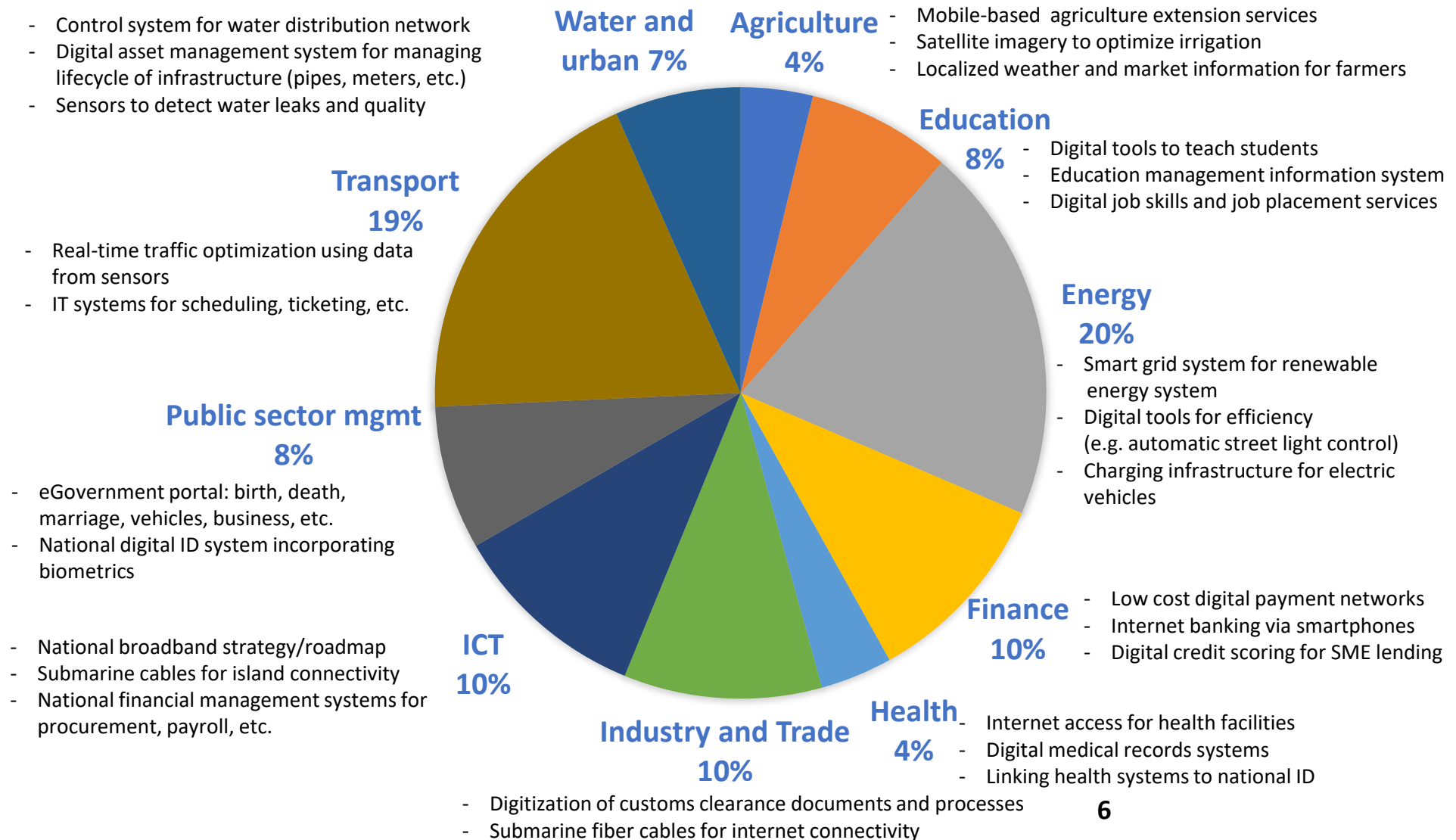**Laarni Zapanta-Tuazon**
Senior Operations Assistant

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SDCC-DT's roles in Implementing Strategy 2030 and 7 Operational Priorities

- **Country-based Digital Technology Roadmaps:** Work with operations and STGs during CPS preparation to help develop country-based DT road maps for DMCs

- **Digital Technology Pipeline Development:** Work with operations and STGs to identify **project opportunities** (standalone DT projects + project components) using digital technologies and develop the pipeline of DT projects

- **Project Design Support:** Help operations, with support from STGs, to incorporate DT into **project design**

- **Knowledge on Digital Technology:** Capture, store, disseminate latest DT knowledge and application in ADB

- **Digital Technology Trends:** Keep up with the latest DT trends and continuously keep management, STGs and operation staff informed of new opportunities

- **Digital Agenda 2030:** Work with OIST to collaborate on Digital Agenda 2030

# Digital Technology Projects per Sector (Loans and Grants) and Example Projects (2010 to 2018)

Water and urban 7%
- Control system for water distribution network
- Digital asset management system for managing lifecycle of infrastructure (pipes, meters, etc.)
- Sensors to detect water leaks and quality

Agriculture 4%
- Mobile-based agriculture extension services
- Satellite imagery to optimize irrigation
- Localized weather and market information for farmers

Education 8%
- Digital tools to teach students
- Education management information system
- Digital job skills and job placement services

Transport 19%
- Real-time traffic optimization using data from sensors
- IT systems for scheduling, ticketing, etc.

Energy 20%
- Smart grid system for renewable energy system
- Digital tools for efficiency (e.g. automatic street light control)
- Charging infrastructure for electric vehicles

Public sector mgmt 8%
- eGovernment portal: birth, death, marriage, vehicles, business, etc.
- National digital ID system incorporating biometrics

ICT 10%
- National broadband strategy/roadmap
- Submarine cables for island connectivity
- National financial management systems for procurement, payroll, etc.

Finance 10%
- Low cost digital payment networks
- Internet banking via smartphones
- Digital credit scoring for SME lending

Industry and Trade 10%
- Digitization of customs clearance documents and processes
- Submarine fiber cables for internet connectivity

Health 4%
- Internet access for health facilities
- Digital medical records systems
- Linking health systems to national ID

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Background on Technology's Role in Development

Economic Foundations:

- Robert Solow: Nobel Prize 1987
  Technology Drives of Economic Growth

  - Developed first endogenous models of economic growth

- Paul Romer: Nobel Prize 2019
  Endogenous Technological Change

  - Increasing human capital and global integration increases growth

  - "Endogenous Technological Change" was published in 1990 and provided a model showing how technological change was driven by the allocation of resources to knowledge creation. It showed that over time, more and more of societies resources should be dedicated to knowledge creation.
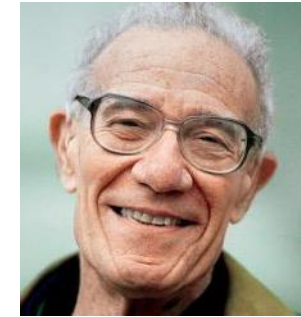
Exponential Growth and International Development

Per Capita GDP (UK 1270 to 2016)
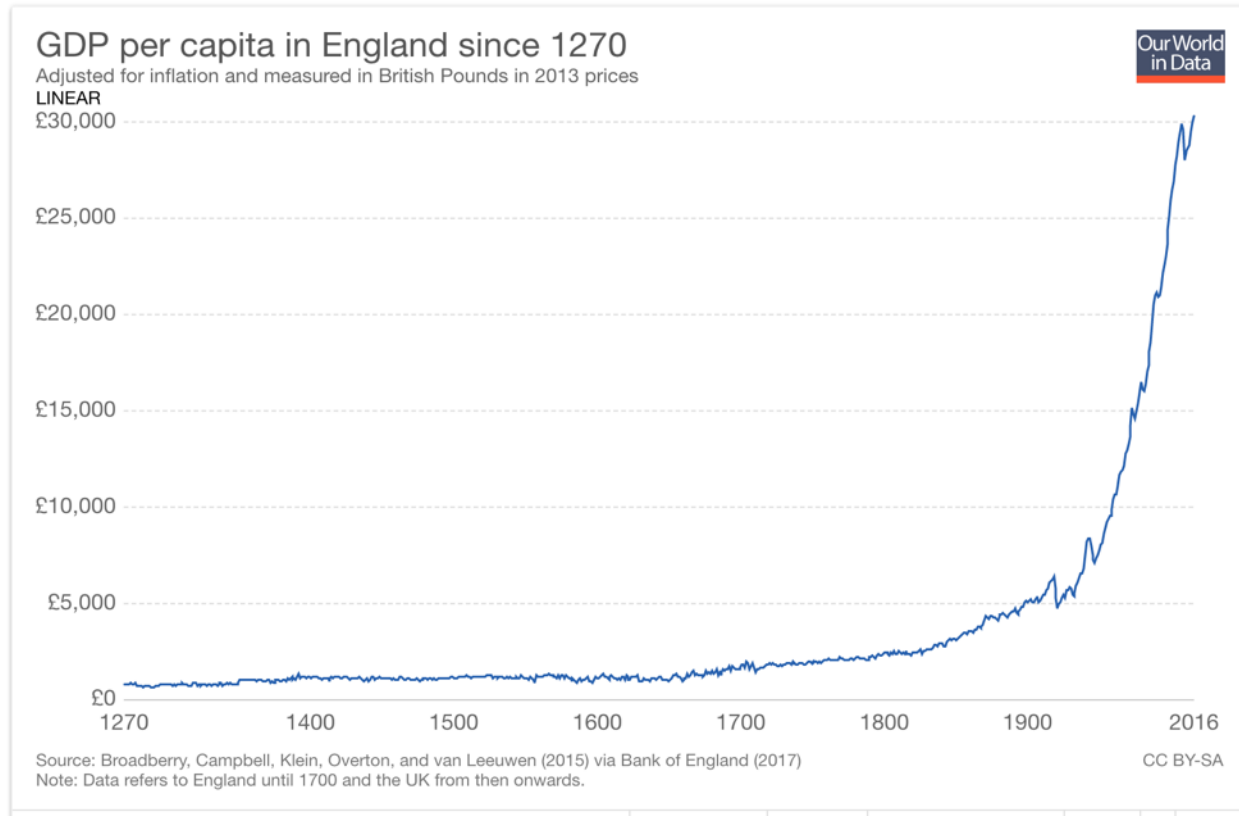
Computing Speed GFLOPS/$ (1900-2018)
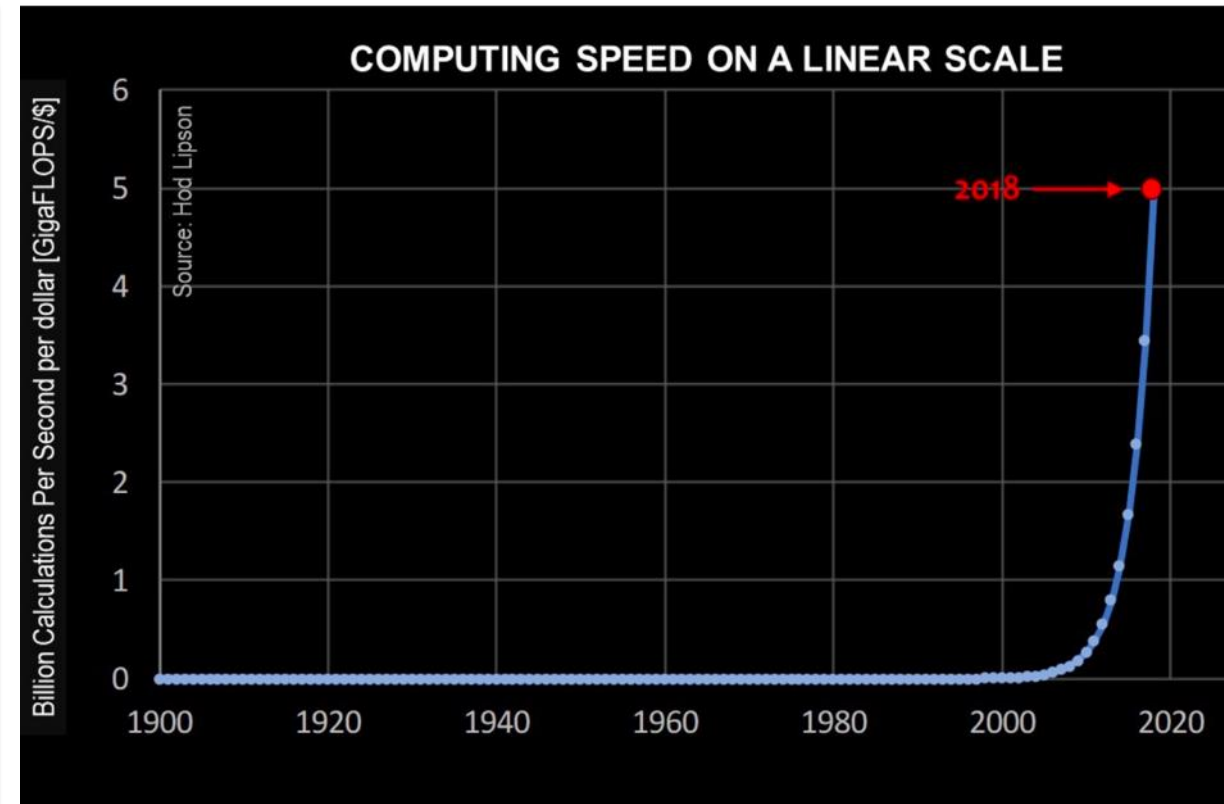
What are Digital Technologies?

These digital technologies are likely to be important for ADB operations.

Technology	Description
1. Broadband Communications	Mobile networks (5G), undersea cables, satellite networks, etc.
2. Smartphones	Low-cost personal devices for broad public internet access
3. Digital Identification	Critical for deploying personal digital services
4. Digital Payments	Critical for enabling digital commerce
5. Cloud Computing	Enables data storage and processing without physical infrastructure
6. Internet of Things (IoT)	Low cost sensors that collect data from everyday life and are connected to the internet to enable digital services
7. Artificial Intelligence	Using big data, collected from a variety of data sources such as sensors and social media, to build intelligent systems for development projects
8. Robotics/Drones	Using intelligent systems to power autonomous machines
9. Cybersecurity	Improving the privacy and security of users
10. Geospatial Information Systems (GIS)	Digital location, mapping and routing services (e.g. ridesharing apps enabled by GPS, digital maps and digital routing)
11. Earth Observation	Using satellite and drone imagery for planning and analysis tasks
12. Genetics	Genetic sequencing and editing for health and agriculture

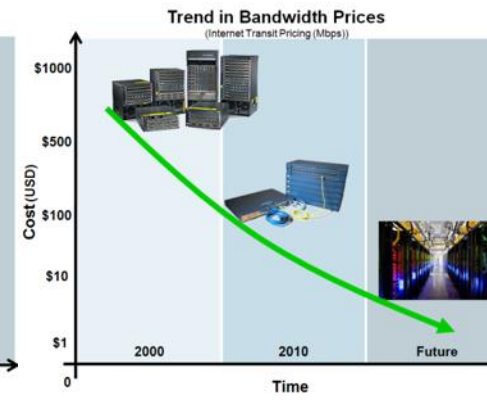# Fundamental Technology for Development Trends: Exponential Improvement across Multiple Dimensions
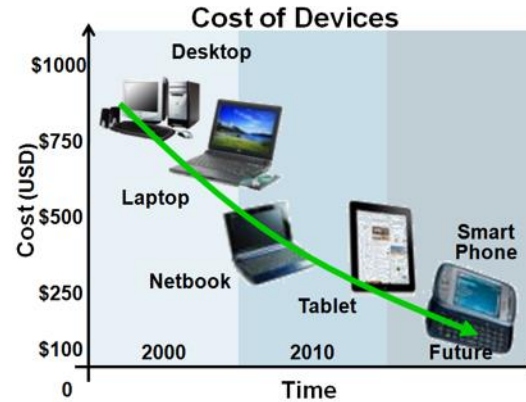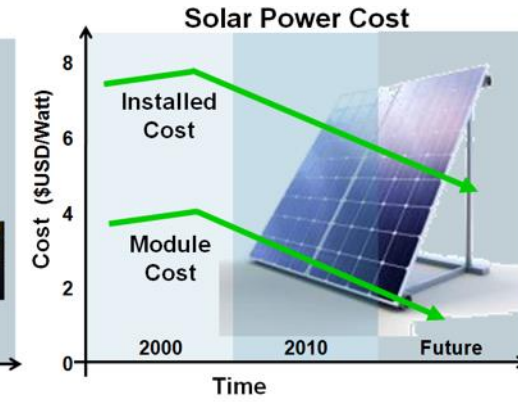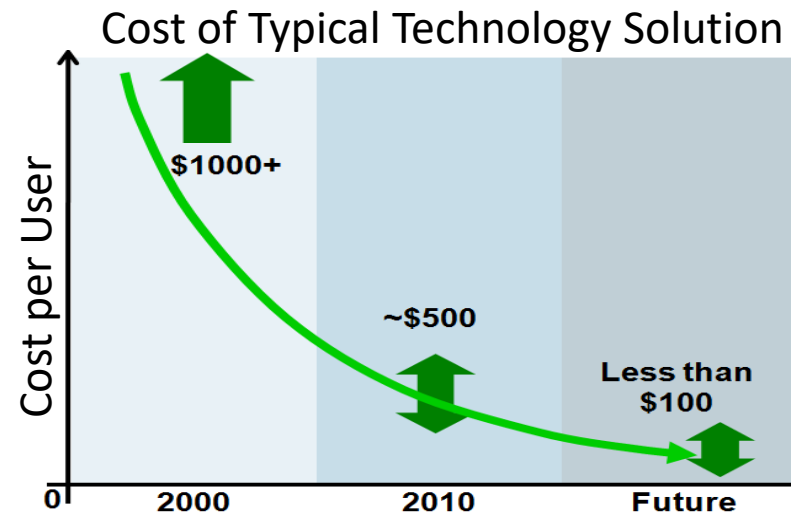

1. Cost of Devices
2. Power Consumed
3. Internet Bandwidth
4. Solar Power
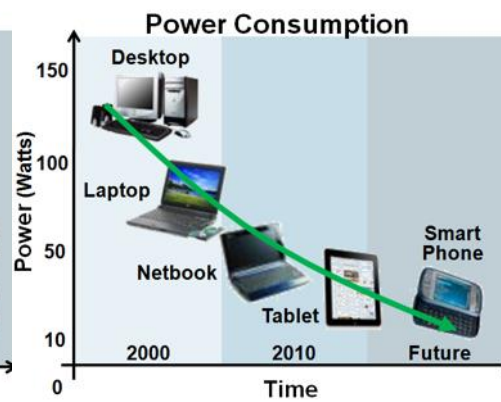
Cost of Typical Technology Solution

Cost of Typical Solution Infrastructure…

…Is Declining Exponentially

Technology Adoption: Key Questions

<u>Amara's Law</u>: *"We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten."*

<u>Corollary</u>: *"We overestimate the change that we can make directly and underestimate the change that will occur in our environment."*

<u>It is important for successful technology strategies to consider these questions:</u>

| **What technology changes will occur in your environment?**	**What technology adoption will your organization drive directly?**	**What changes will require cross-sector collaboration?**
• Mobile broadband adoption • Mobile money adoption • National ID rollouts • Weather/agriculture data • Low-cost smartphones • Low-cost online education • Online social networking • GIS mapping of all infrastructure	• How to deliver via mobile • Payment models • Customer identity mgmt • Use of weather/ag info. • Devices for users • Training plans • CRM solutions • Leverage of mapping data/solutions	• Broadband to underserved • Payment alliances • Customer identity standards • Data standards • Device standards • Training standards • Privacy standards, localization • Data standards
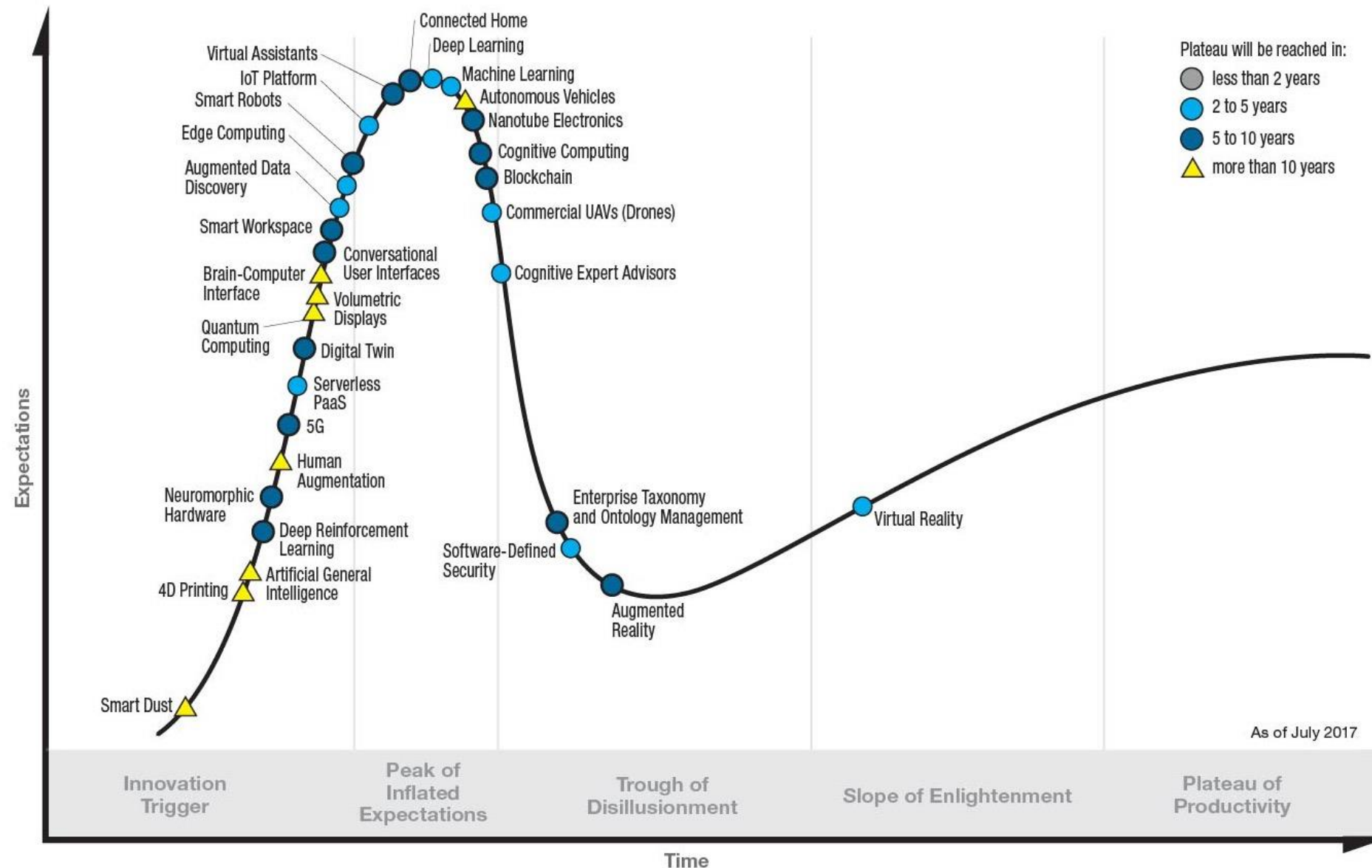
Hype Cycles: Hype and Anti-Hype

Typical Hype: US Online Grocery Market

US Online Grocery Market
Market Estimates vs. Actual
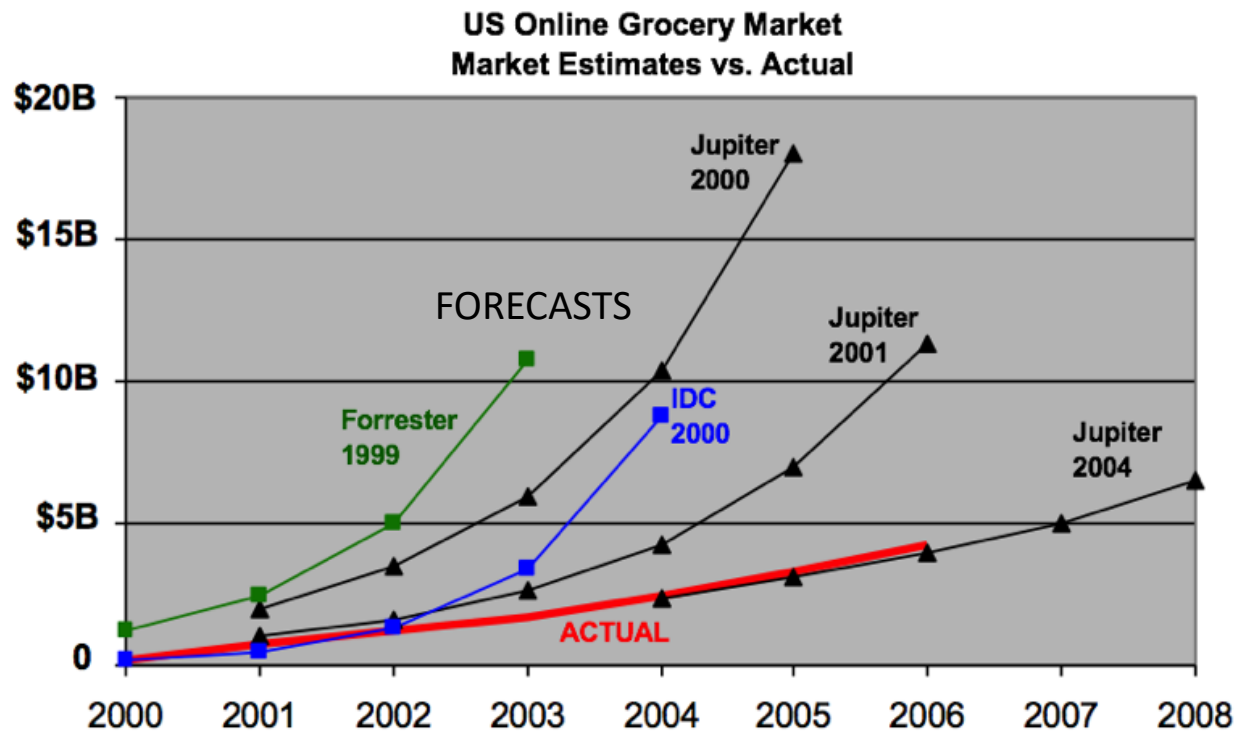
Anti-Hype: Global Solar Power Market

Annual PV additions: historic data vs IEA WEO predictions
In GW of added capacity per year - sources World Energy Outlook and PVMA
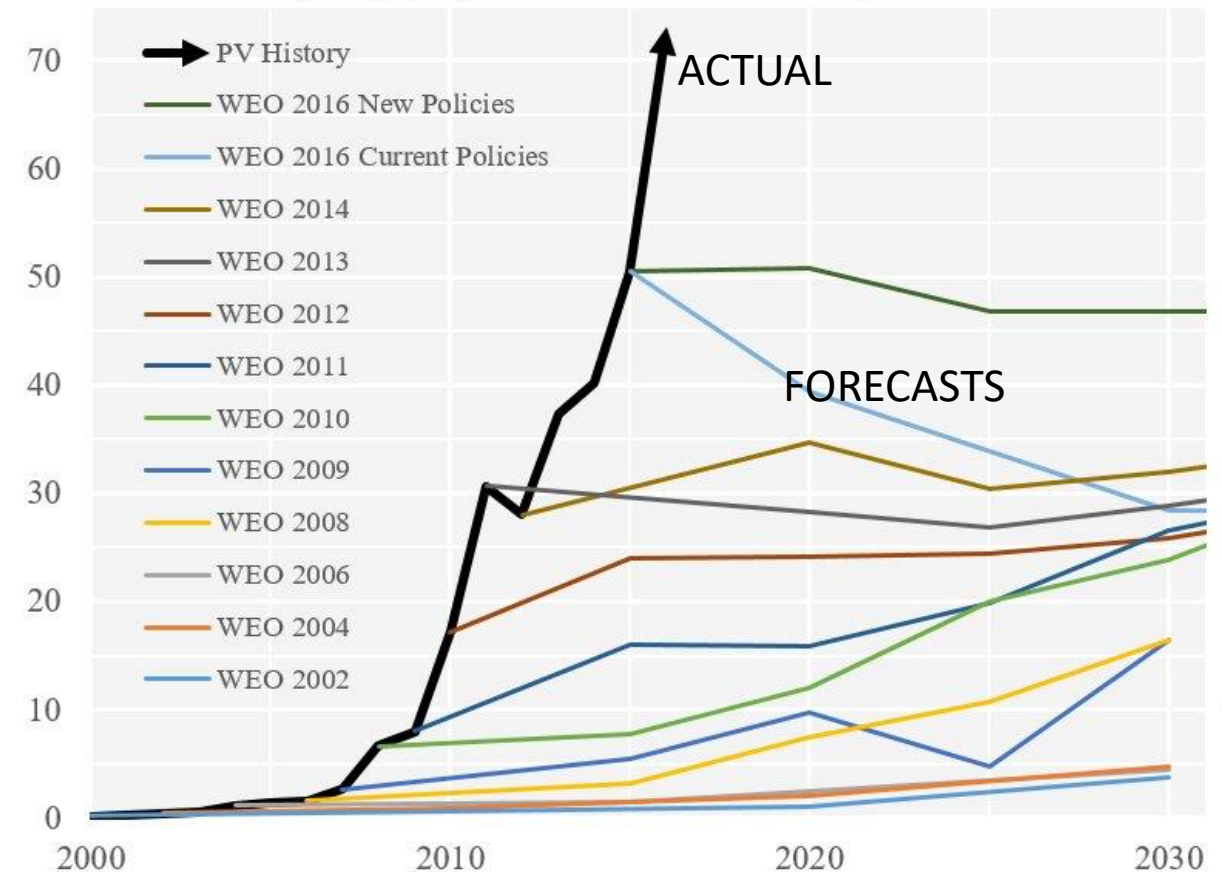
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Evolution of IT Development Methodologies

Waterfall Development

Internet Era (2001)
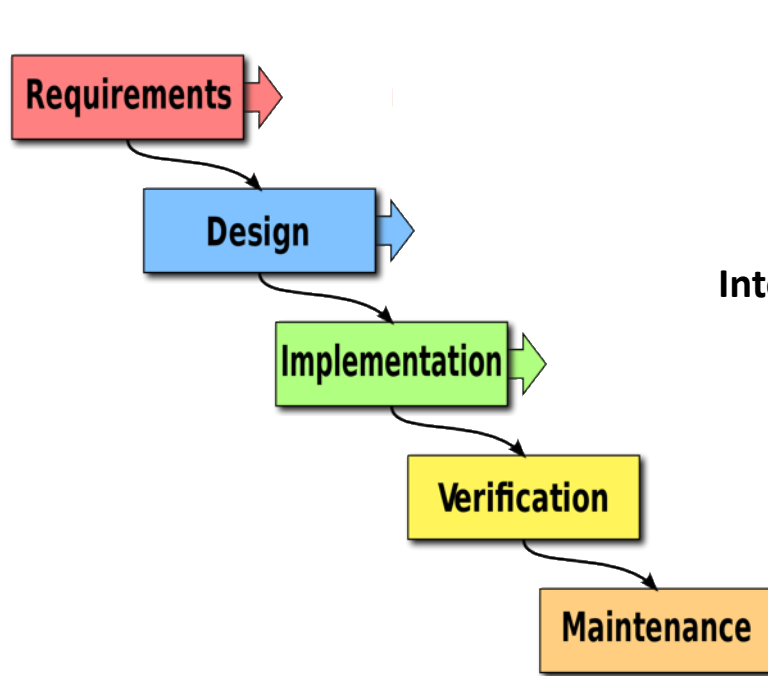
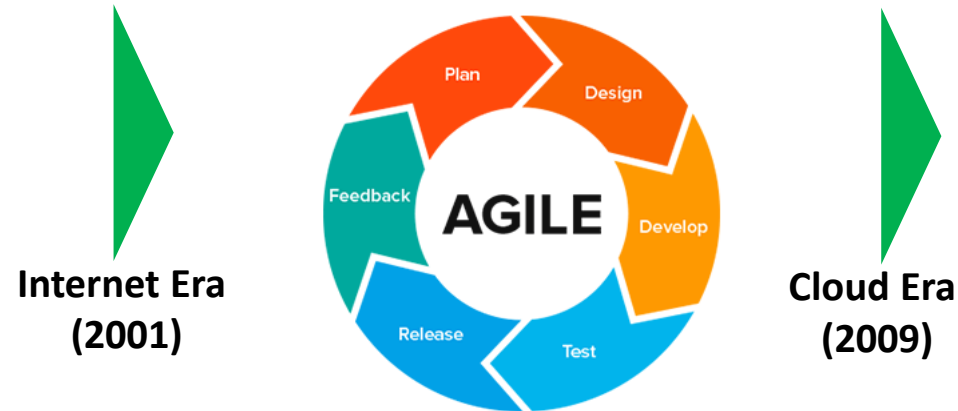**Linear Process,** typically using Gantt Chart approaches (MS Project)
Long-term Projects - 3 months to 3+ years
Requirements Fixed Early in Process
Design completed before build started
Focused on meeting fixed plans

Agile Development


Cloud Era (2009)

Individuals and Interactions over processes and tools
Working Software over comprehensive documentation
Customer Collaboration over contract negotiation
Responding to Change over following a plan

The Manifesto for Agile Software Development: twelve principles
1. Customer satisfaction through **continuous delivery**
2. **Welcome changing requirements**, even in late development.
3. **Deliver working software frequently**
4. **Close cooperation** between business and developers
5. Projects built around **motivated/trusted individuals**
6. **Face-to-face interactions**
7. **Working software** is the primary measure of progress
8. **Sustainable development**, to maintain a constant pace
9. **Technical excellence** and good design
10. **Simplicity**—maximize the amount of work not done
11. **Self-organizing** teams
12. Regular **reflection and adjustment**

DevOps
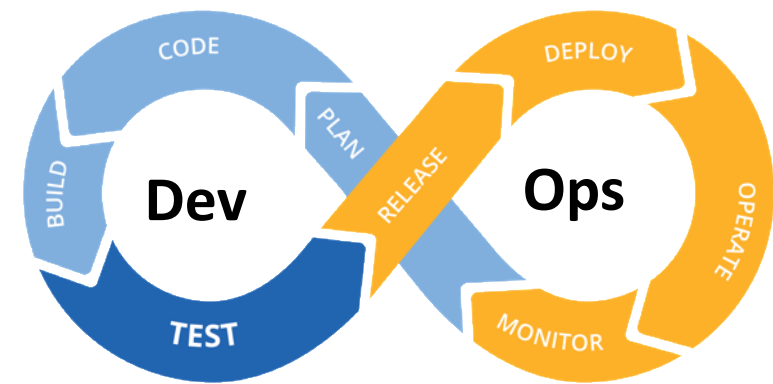
Development and Operations are inseparable and continuously evolving based on always on cloud/mobile platforms
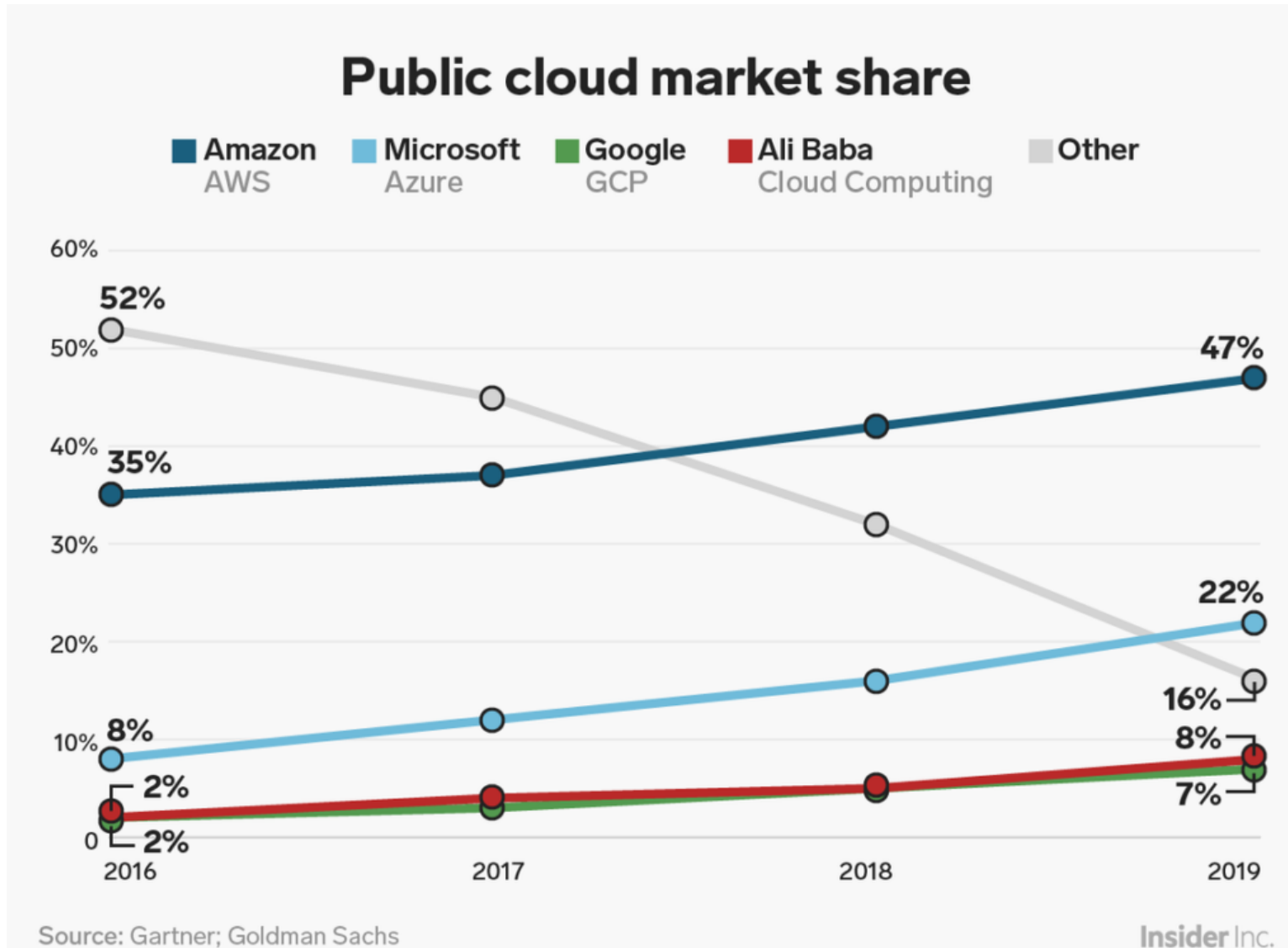
1. **Coding** – code development and review, source code management tools, code merging
2. **Building** – continuous integration tools, build status
3. **Testing** – continuous testing tools that provide quick and timely feedback on business risks
4. **Packaging** – artifact repository, application pre-deployment staging
5. **Releasing** – change management, release approvals, release automation
6. **Configuring** – infrastructure configuration and management, infrastructure as code tools
7. **Monitoring** – applications performance monitoring, end-user experience

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  - Digital Agriculture Example

Implications of Cloud Computing

Public cloud market share

- Amazon AWS
- Microsoft Azure
- Google GCP
- Ali Baba Cloud Computing
- Other

2016: Other 52%, Amazon 35%, Microsoft 8%, Google 2%, Ali Baba 2%
2019: Amazon 47%, Microsoft 22%, Other 16%, Ali Baba 8%, Google 7%

Source: Gartner; Goldman Sachs

Insider Inc.

- Amazon (AWS) dominance, especially with startups

- Most new business services are built on cloud platforms

- Cloud dramatically increases the ability to deploy new solutions with very low up front investments that scale effectively

- Data privacy and regionalization are difficult for government implementations
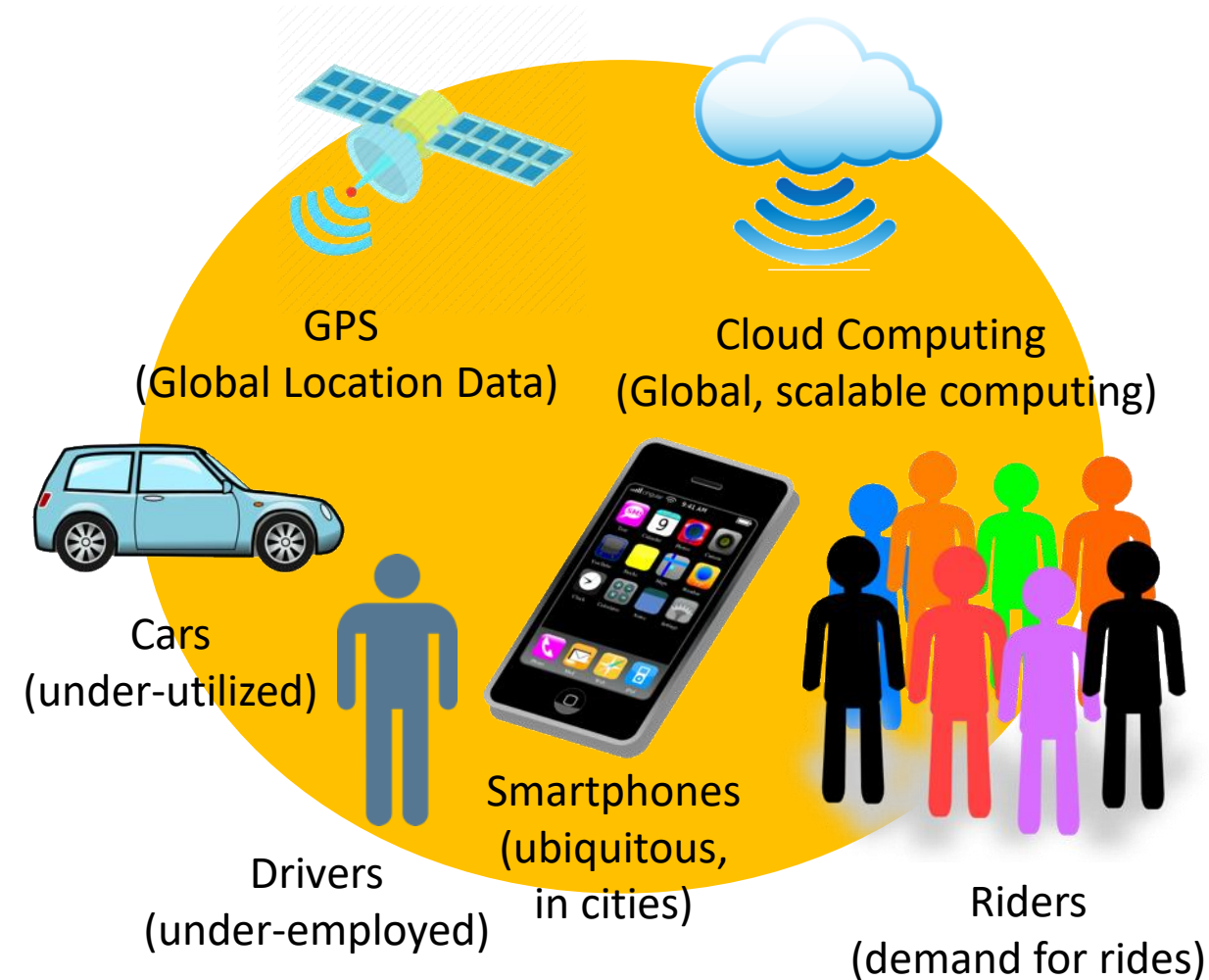
Challenges of Government IT Projects

- Capacity Limitations
  - Gov't career paths are typically not well-suited for IT careers

- On-premise Data Hosting
  - Regulatory/reputations issues in moving to cloud solutions
  - Cloud providers resist putting data centers in every country

- Limited Ability to Focus on Speed and Efficiency
  - Lack of pressure to move to new solutions
  - Lack of market competition

- Difficult to Cut and Paste Solutions from One Country to Another
  - Wide range of capacity/constraints from leading countries to DMCs

- Need New Models like PPP's
  - Opening up gov't solutions to innovation
  - Rotating people between gov't and private sector roles
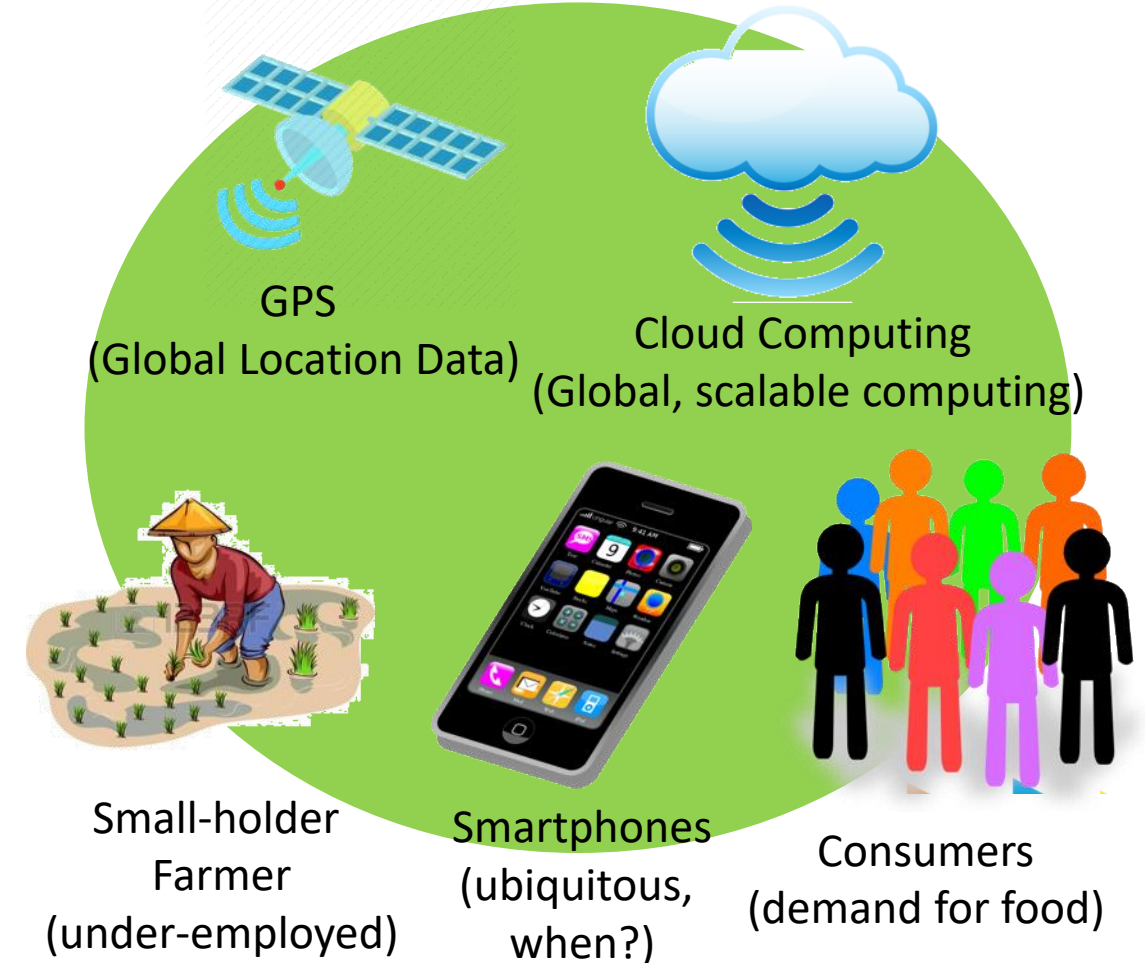 - Funding of gov't IT is very difficult to plan in advance

Digital Development Example: The Uber Story Applied to Digital Agriculture

Uber: Example of Digital Disruption

Digital Agriculture: Digital Disruption Opportunity

GPS (Global Location Data)

Cloud Computing (Global, scalable computing)

Cars (under-utilized)

Drivers (under-employed)

Smartphones (ubiquitous, in cities)

Riders (demand for rides)

Small-holder Farmer (under-employed)

Smartphones (ubiquitous, when?)

Consumers (demand for food)

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Thank You!

Q&A

Thomas Abell

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SDCC