

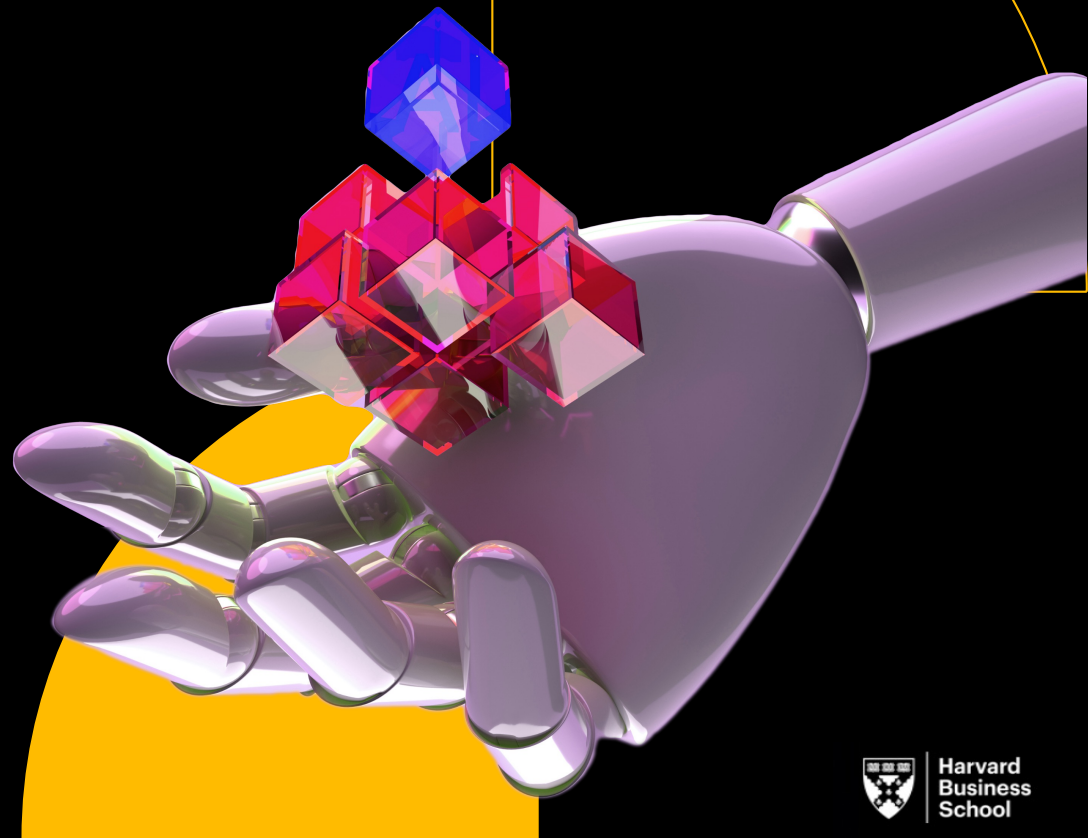


COMPETING IN THE AGE OF AI

Karim R. Lakhani

Co-Founder & Chair
Digital Data Design Institute at Harvard

Dorothy and Michael Hintze Professor of
Business Administration
Harvard Business School



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THE FUTURE CIRCA 1992

The Future Was Not Brought By AT&T

Connected Car



Tablets



Streaming Videos



eCommerce



Messaging



Social



Digital Assistants



Smart Watch



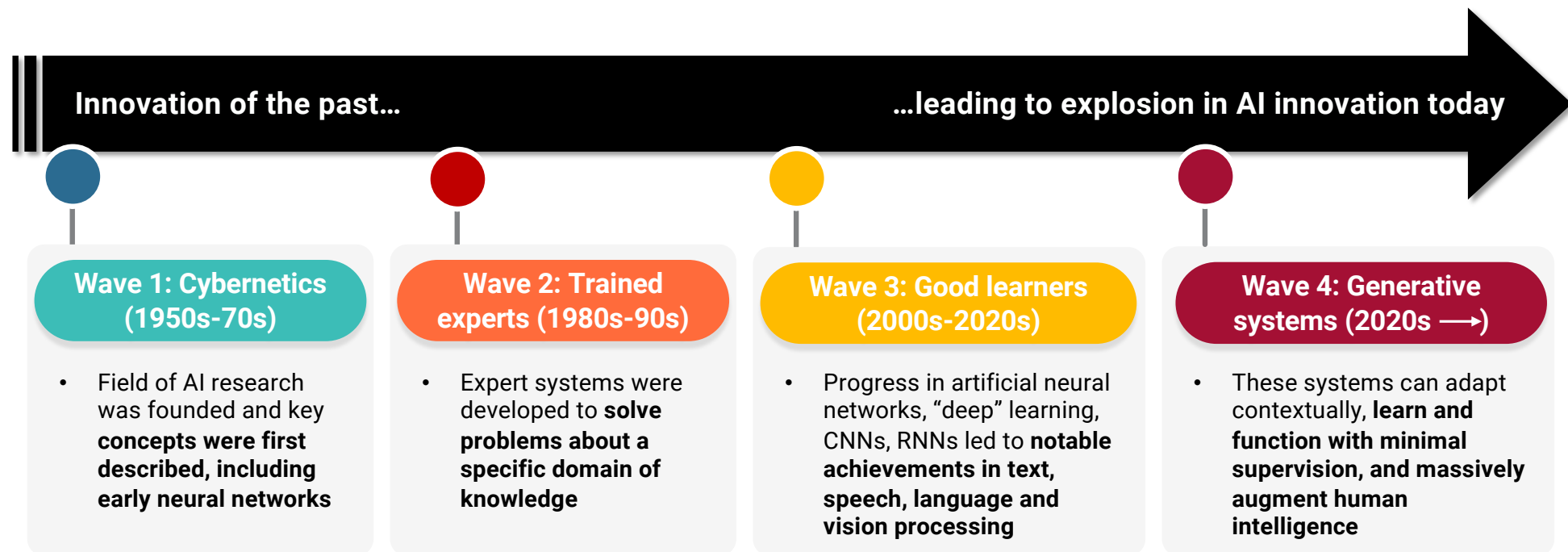


**The future is already here –
it's just not evenly distributed yet.**

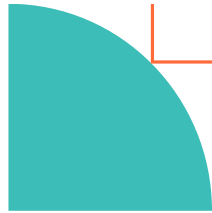
- William Gibson, Author



Artificial Intelligence (AI) Innovation Has Progressed In Waves



In 2022 – Major Breakthroughs in Consumer Awareness of AI's Potential Via Three Key Convergent Trends



**Extraordinary growth
in data generation**

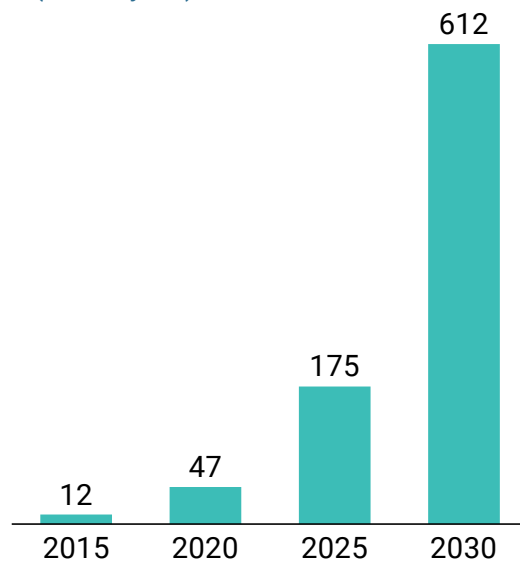


**Ever-increasing
computing power**



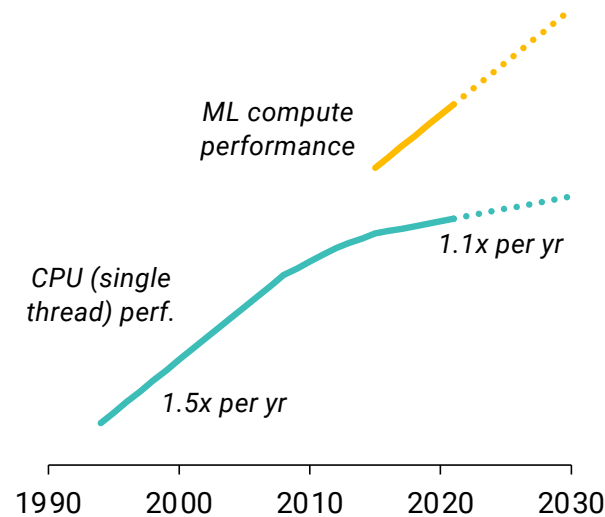
**Significant advances in AI
innovation**

**Global Data Creation Forecast
(Zettabytes)**



Source: Statista Digital Economy Compass

Million X Speed-Up in Ten Years



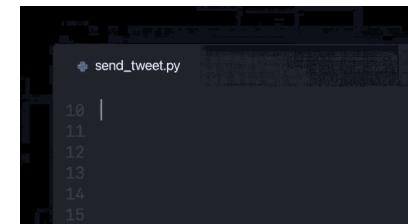
Source: NVIDIA

**Example: Generative AI models have
achieved stunning results**

Text-to-Image Generation with Stable Diffusion



Code Generation with GitHub Copilot



Source: Stability.AI and GitHub/OpenAI

Source: Flagship Pioneering

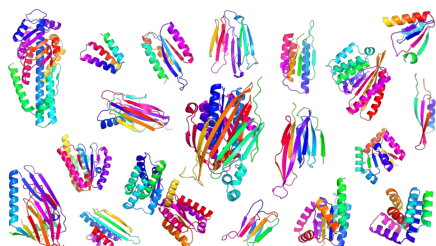
Recent Advances In AI Have Immediate Application To A Range of Industries

Diffusion AI models

Tech example: Stable Diffusion generates realistic and novel images based on text



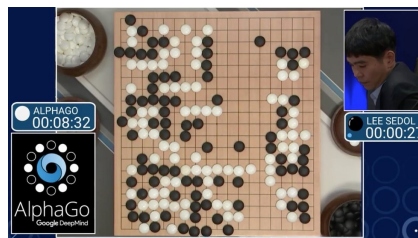
Flagship example: generating novel protein therapeutics faster, cheaper, better



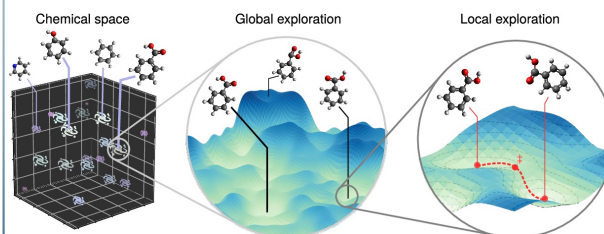
Generate: Biomedicines

Reinforcement learning

Tech example: Google's AlphaGo learns strategies to defeat world's top Go player



Life science example: designing better drugs by efficiently exploring vast chemical space



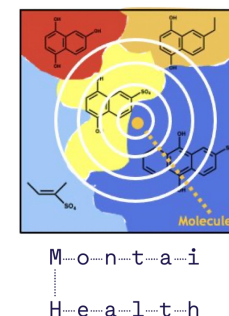
Source: Westermayr et al. J. Chem. Phys. 2021

Large language models (LLMs)

Tech example: OpenAI's GPT-3 generates novel text in response to prompts

Please welcome our LPs to the 2022 Annual Meeting of Flagship Pioneering as they come to Boston to learn about the Future of AI.

Flagship example: applying LLM to optimize chemistry for molecular nutrition

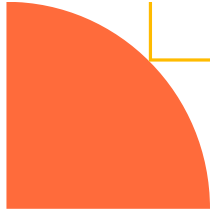


Source: Flagship Pioneering

TIME TRAVEL WITH ME TO 2003



Top Firms By Market Capitalization In 2003

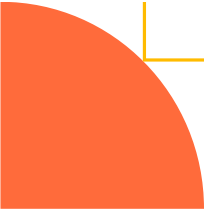












Rank ↕	Name ↕	Country ↕	Primary industry ↕	Market value (USD million) ↕
1	Microsoft	United States	Software industry	▼264,003
2	General Electric	United States	Conglomerate	▼259,647
3	ExxonMobil	United States	Oil and gas	▼241,037
4	Walmart	United States	Retail	▼234,399
5	Pfizer	United States	Health care	▼195,948
6	Citigroup	United States	Banking	▼183,887
7	Johnson & Johnson	United States	Health care	▼170,417
8	Royal Dutch Shell	Netherlands	Oil and gas	▼149,034
		United Kingdom		
9	BP	United Kingdom	Oil and gas	▼144,381
10	IBM	United States	Computer software, computer hardware	▲139,272

LIVING IN THE FUTURE NOW

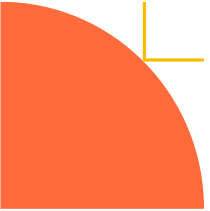


Top Firms By Market Capitalization In 2023

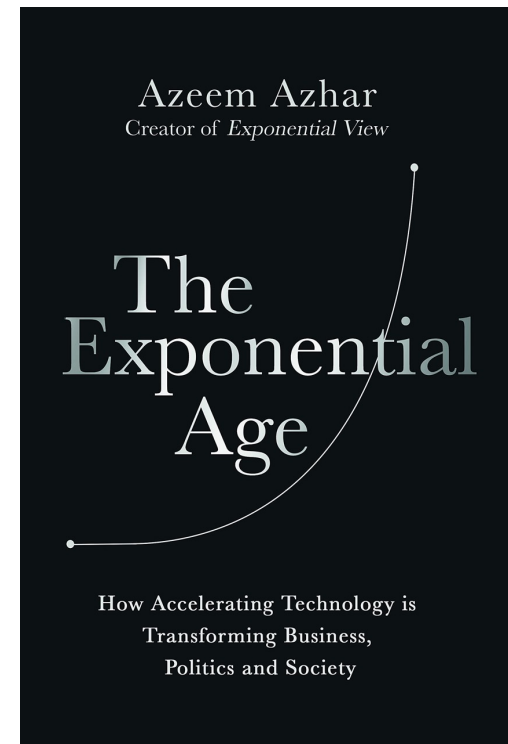
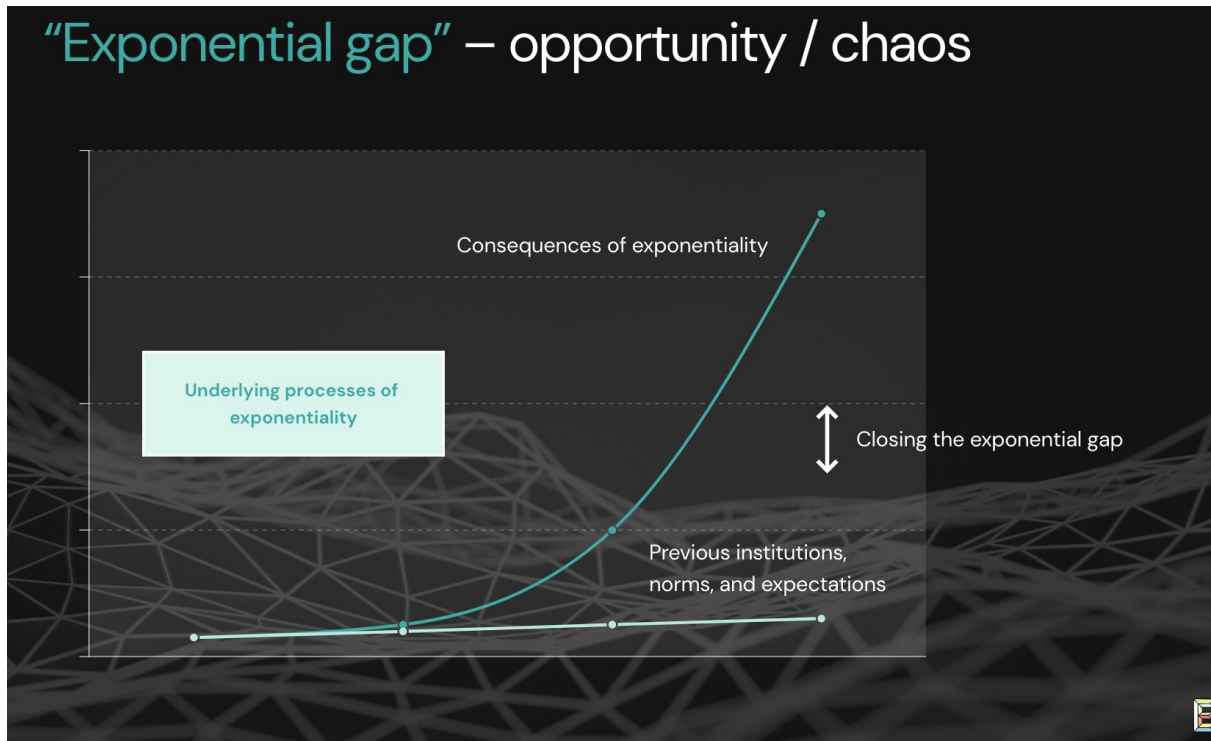


Rank	Name	Market Cap
1	 Apple AAPL	\$2.806 T
2	 Microsoft MSFT	\$2.459 T
3	 Saudi Aramco 2222.SR	\$2.033 T
4	 Alphabet (Google) GOOG	\$1.569 T
5	 Amazon AMZN	\$1.233 T
6	 NVIDIA NVDA	\$962.68 B
7	 Berkshire Hathaway BRK-B	\$699.65 B
8	 Meta Platforms (Facebook) META	\$674.51 B
9	 Tesla TSLA	\$621.14 B
10	 TSMC TSM	\$511.74 B

Winners And Losers In The Exponential Age



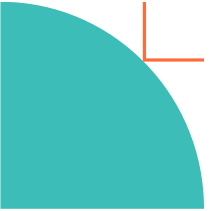
“Exponential gap” – opportunity / chaos



Source: Azeem Azhar

THE AGE OF AI

AI Hype



The Weaponization Of Artificial Intelligence

Invest in AI-based technology or lose the race, Israel's chief scientist warns

A.I. Expert Says Automation Could Replace 40% of Jobs in 15 Years

Firm Led by Google Veterans Uses A.I. to 'Nudge' Workers Toward Happiness

Miners Say They Dig Artificial Intelligence but the Gold Rush Hasn't Come

A 19-year-old developed the code for the AI portrait that sold for \$432,000 at Christie's

As AI evolves, so must VC investment teams

Nasdaq CIO Puts AI to Work

China's application of AI should be a Sputnik moment for the U.S. But will it be?

Why your AI might be racist

China's Baidu Credits Artificial Intelligence for Robust Ad Sales

The Future of Artificial Intelligence In The Workplace

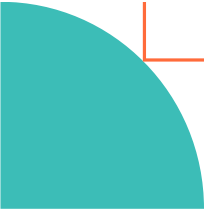
America is split over advancing artificial intelligence

Awaiting the AI-Enabled Revolution, Experts Put in a Good Word for Humans

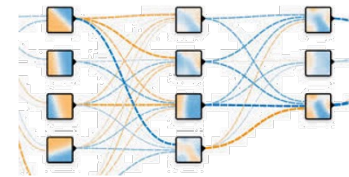
Curbs on A.I. Exports? Silicon Valley Fears Losing Its Edge

Why Canada Believes It Can Lead Global AI Innovation

Definitions of Artificial Intelligence (AI)



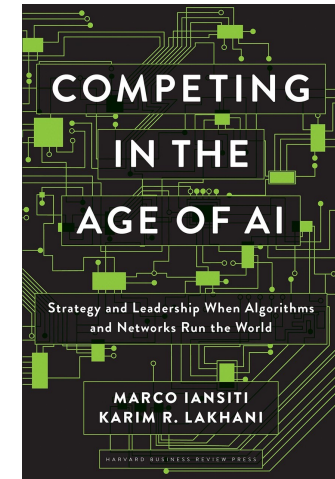
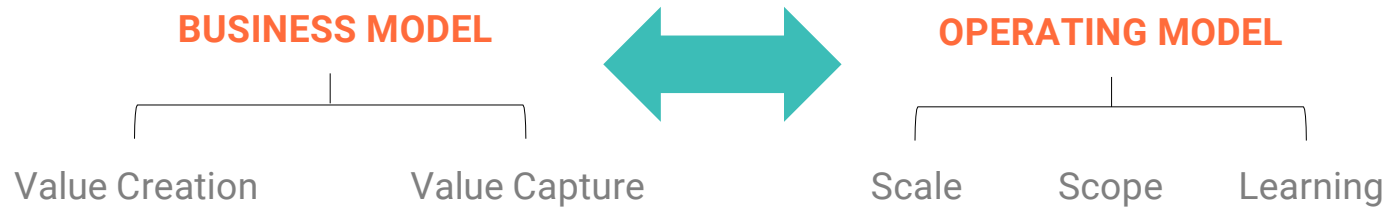
“Machines that can think and act in a way that matches or surpasses human intelligence”
 (“Strong AI”)



Any activity computers are able to perform that humans once performed”
 (“Weak AI”)

Nils J. Nilsson, 2010; Stanford AI 100 report, 2016.

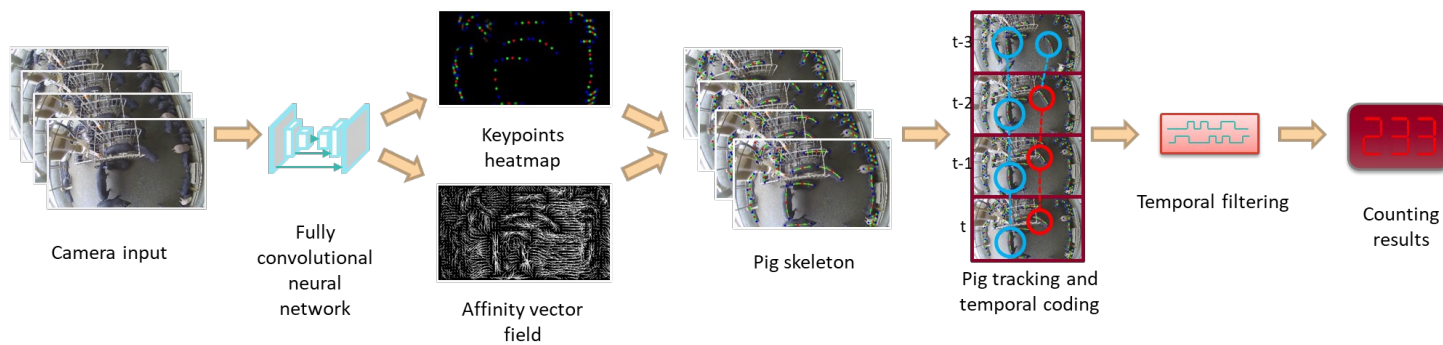
Exponential Organizations Systematically Deploy AI And Digital Platforms



Example: Pig Counting

Difficulties in manual pig counting:

- Pigs have similar appearance and move around quickly
- Large overlapping areas between pigs due to high breeding density
- Potential disease infection from frequent interaction between pigs and humans



Example: Radiation Therapy Targeting

JAMA Oncology

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Original Investigation

April 18, 2019

Use of Crowd Innovation to Develop an Artificial Intelligence-Based Solution for Radiation Therapy Targeting

Raymond H. Mak, MD¹; Michael G. Endres, PhD^{2,3}; Jin H. Paik, MA^{2,4}; Rinat A. Sergeev, PhD^{2,4}; Hugo Aerts, PhD^{1,5}; Christopher L. Williams, PhD¹; Karim R. Lakhani, PhD^{2,4,6}; Eva C. Guinan, MD^{1,2}

» Author Affiliations | Article Information

JAMA Oncol. 2019;5(5):654-661. doi:10.1001/jamaoncol.2019.0159

Machine Learning Website

Editorial Comment

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FIGURES / TABLES

SUPPLEMENTAL CONTENT

REFERENCES

RELATED

Figure 1.

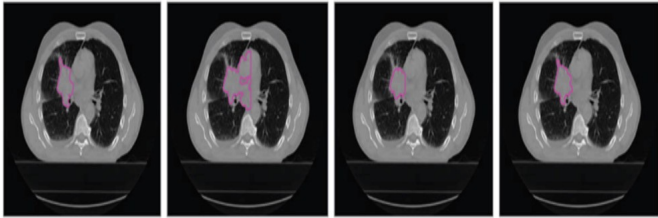
View Large Download

A Expert

B Commercial software

C Commercial software and expert

D Phase 3



Lung Tumor Segmentations

Example of a human expert segmentation (A) compared with automated segmentation from commercially-available region growing-based segmentation technique before (B) and after (C) human adjustment of settings, and automated segmentations from the top artificial intelligence algorithm from phase 3 of the contest (D).



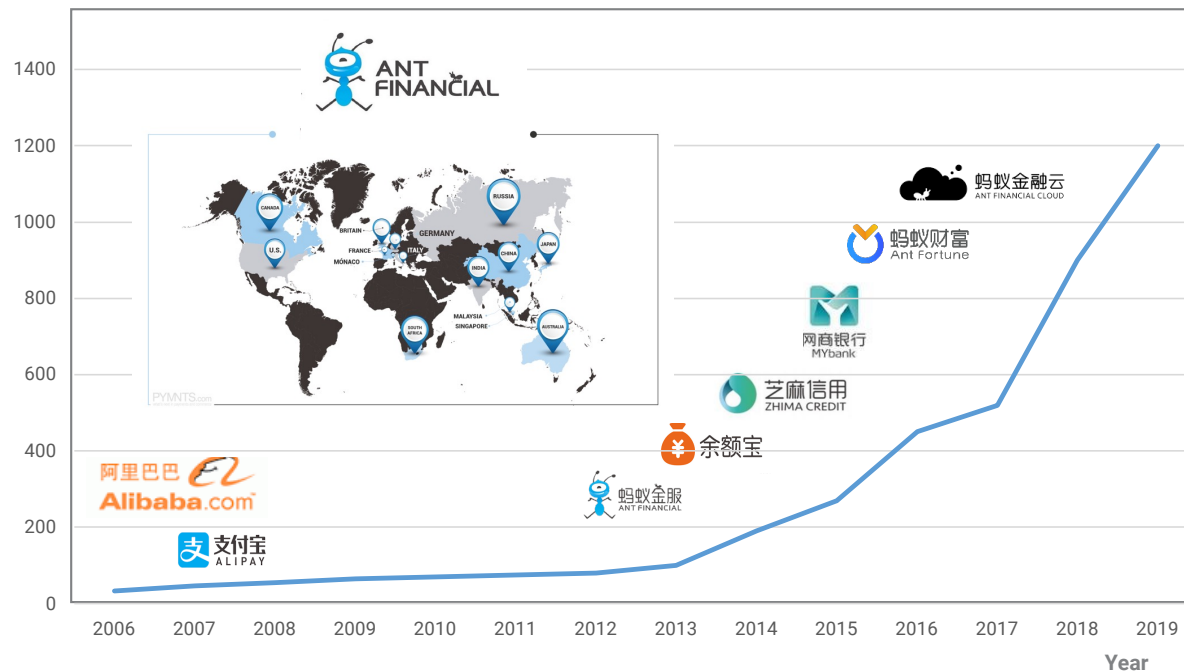
THE EMERGENCE OF THE DIGITAL “AI FIRST” FIRM

19 DIGITAL DATA DESIGN INSTITUTE AT HARVARD

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Data, AI And Digital Networks Are Changing The Nature Of Firms: The Ant Group Story

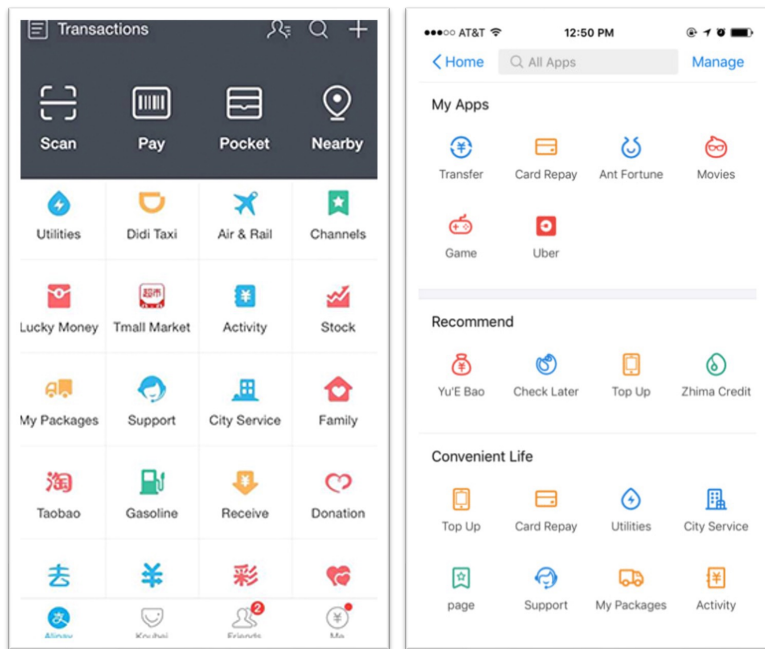
Users (MM)



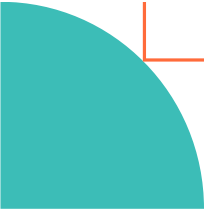
To Understand Companies Like Ant Group We Need To Reflect On How Firms Create, Capture And Deliver Value



Ant Group Aims To Be A “Finlife” Provider



Digital Businesses Exhibit Three Different Kinds Of Value Vectors



PRODUCT VALUE



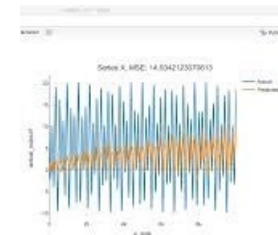
Traditional factors like product design, “object value”, performance, features, reliability, etc.

NETWORK VALUE



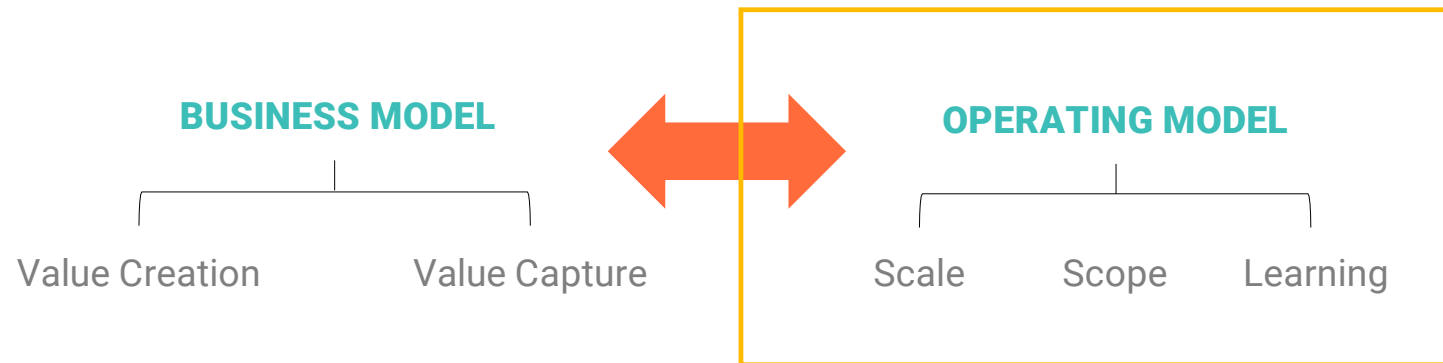
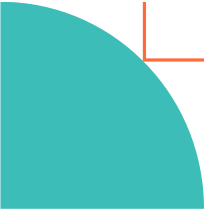
The value contributed by direct and indirect network effects (the more important connections, the higher the value)

DATA VALUE

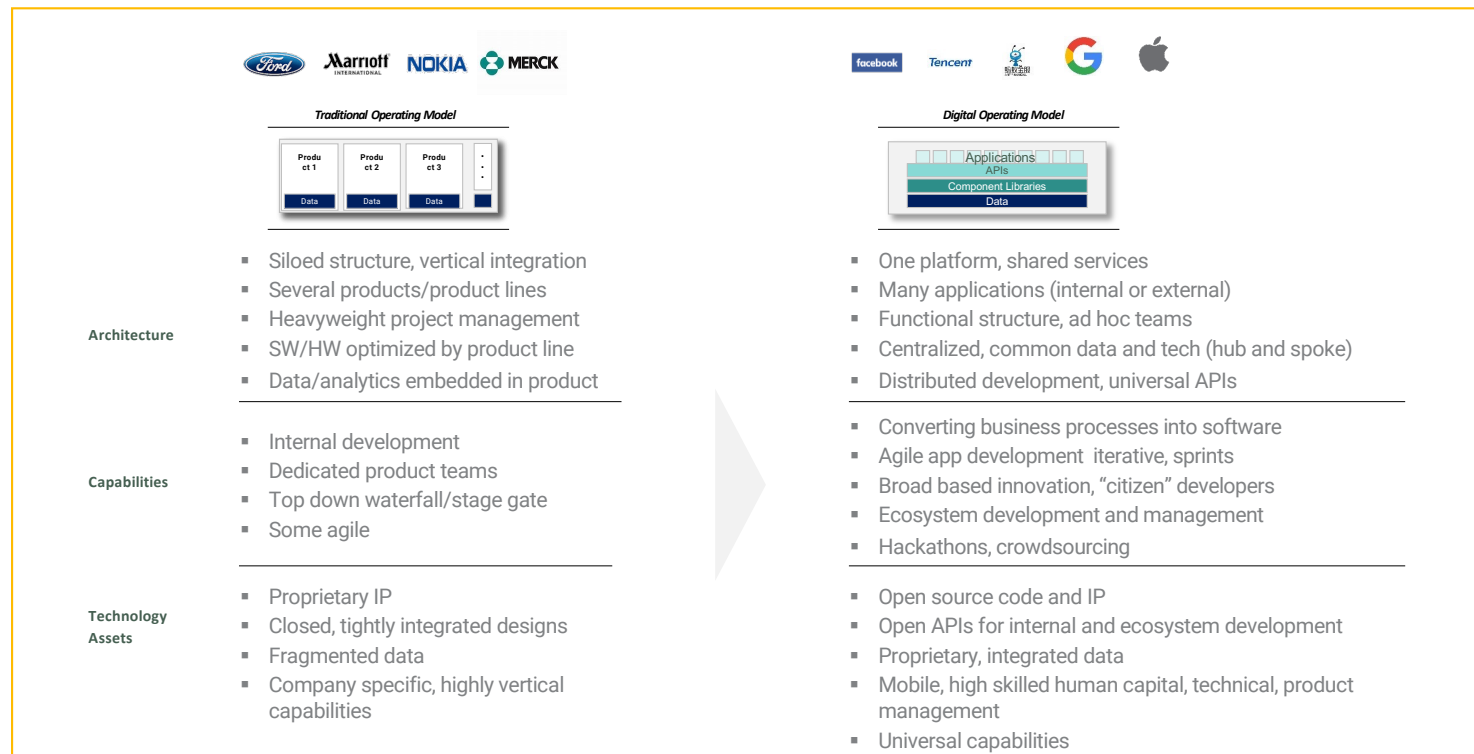


The value contributed by data and “learning effects” (the more data the higher the value delivered)

Competing In The Age Of AI

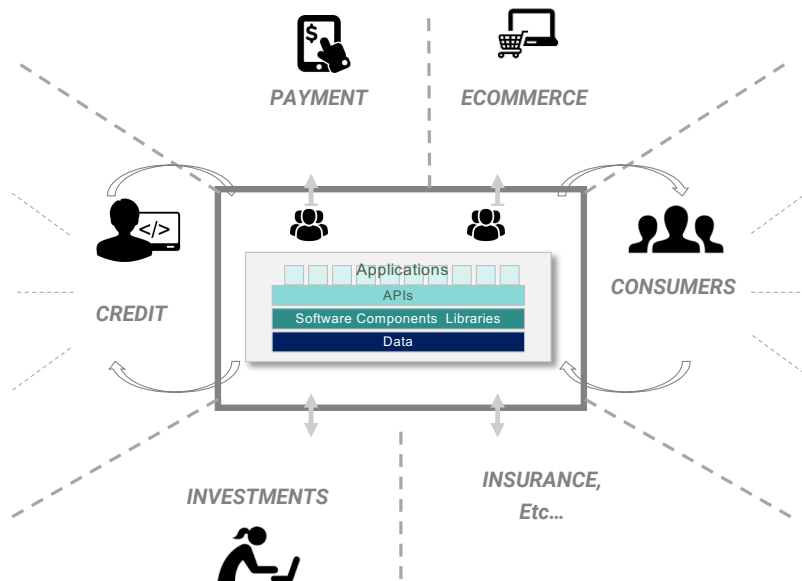
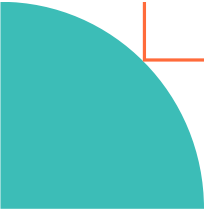


The Difference Hinges On Architecture, Capabilities And Technology Assets



+ culture, skills, leadership, ...

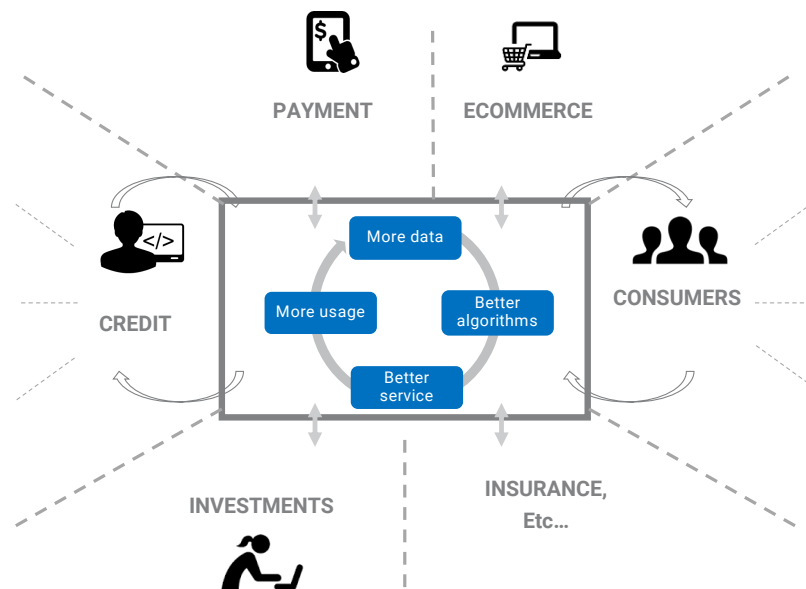
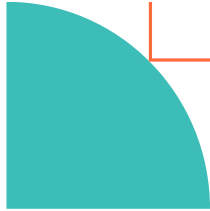
Ant Uses AI To Drive Digital Scale, Scope, And Learning



At Ant traditional human centered processes are digitized to connect with market opportunities at near zero marginal cost. Operational bottlenecks are digitized.

“AI is the new runtime that is going to shape all that we do”
- Satya Nadella

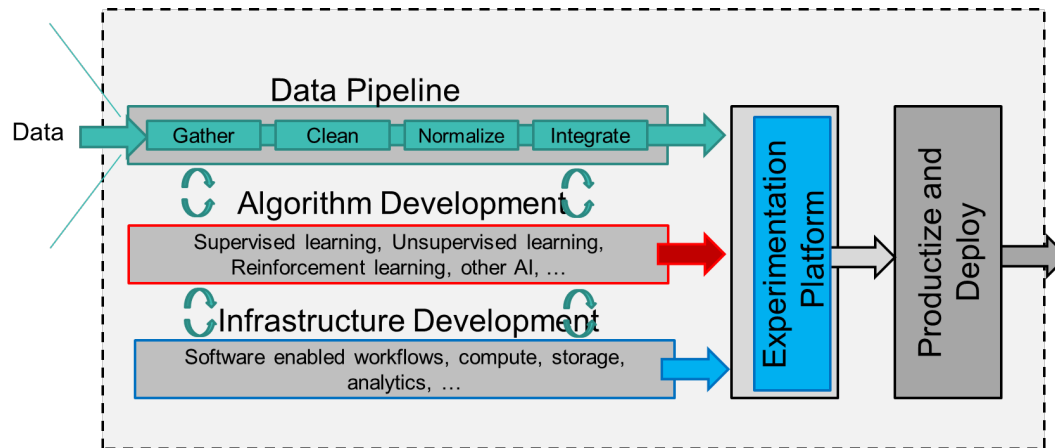
Firms Like Ant Use AI To Drive Digital Learning



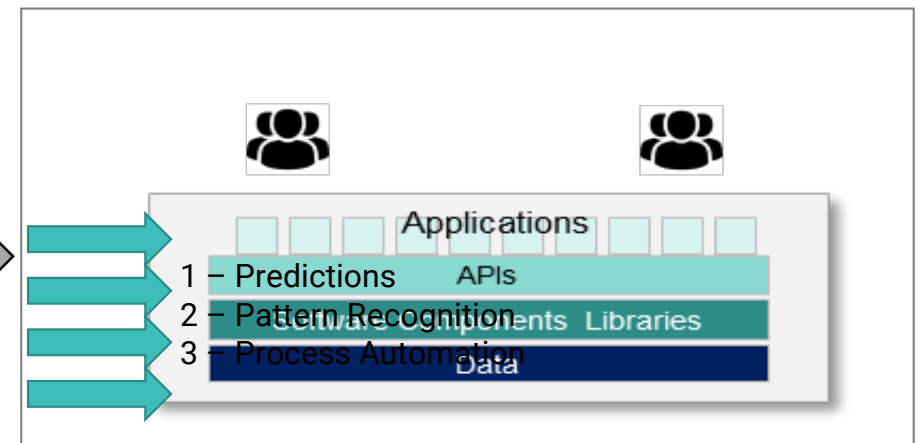
The data accumulated drives improvement, experimentation, innovation, and personalization.

The AI Factory Feeds Data And Insights Into The Software Enabled Operating Core

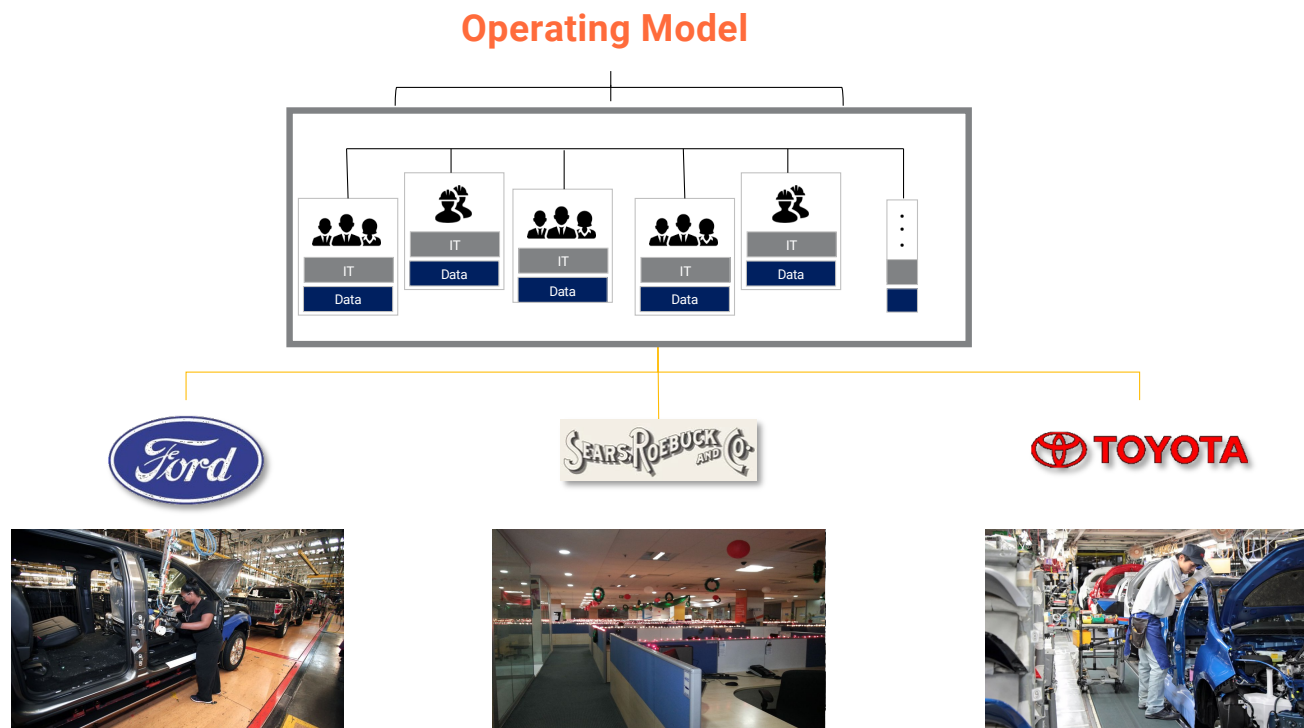
AI Factory



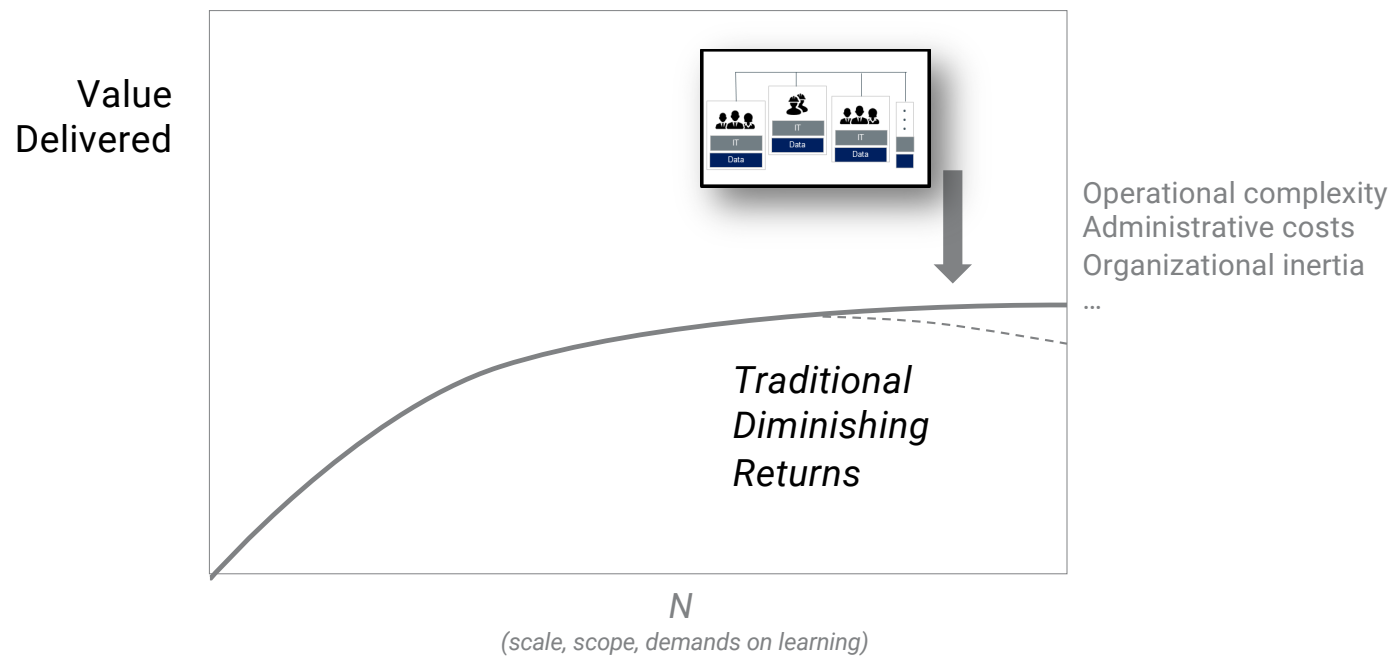
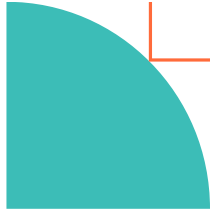
Operating Model Core



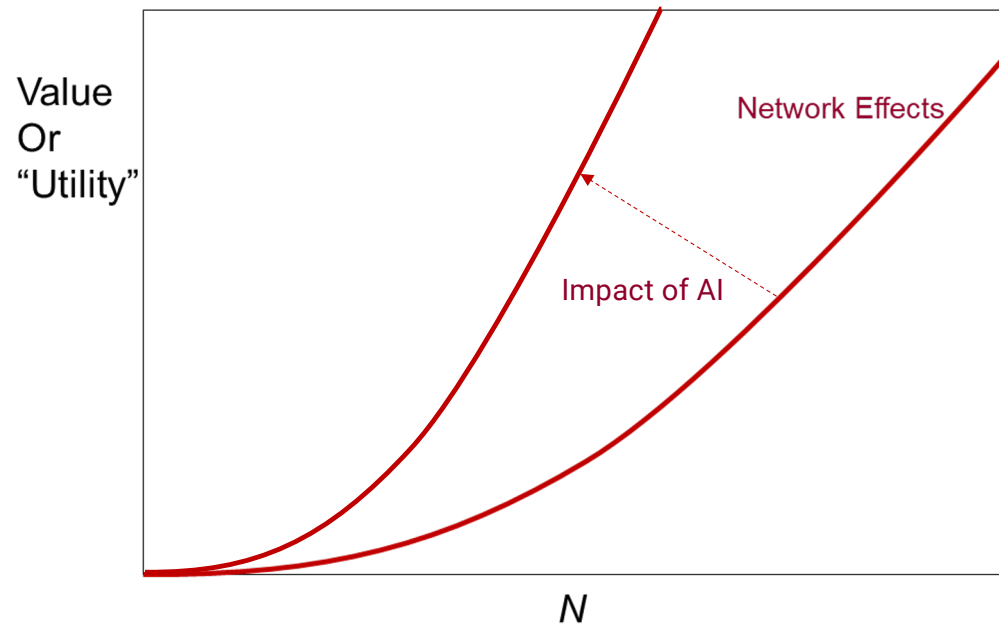
Traditional Operating Performance Drivers



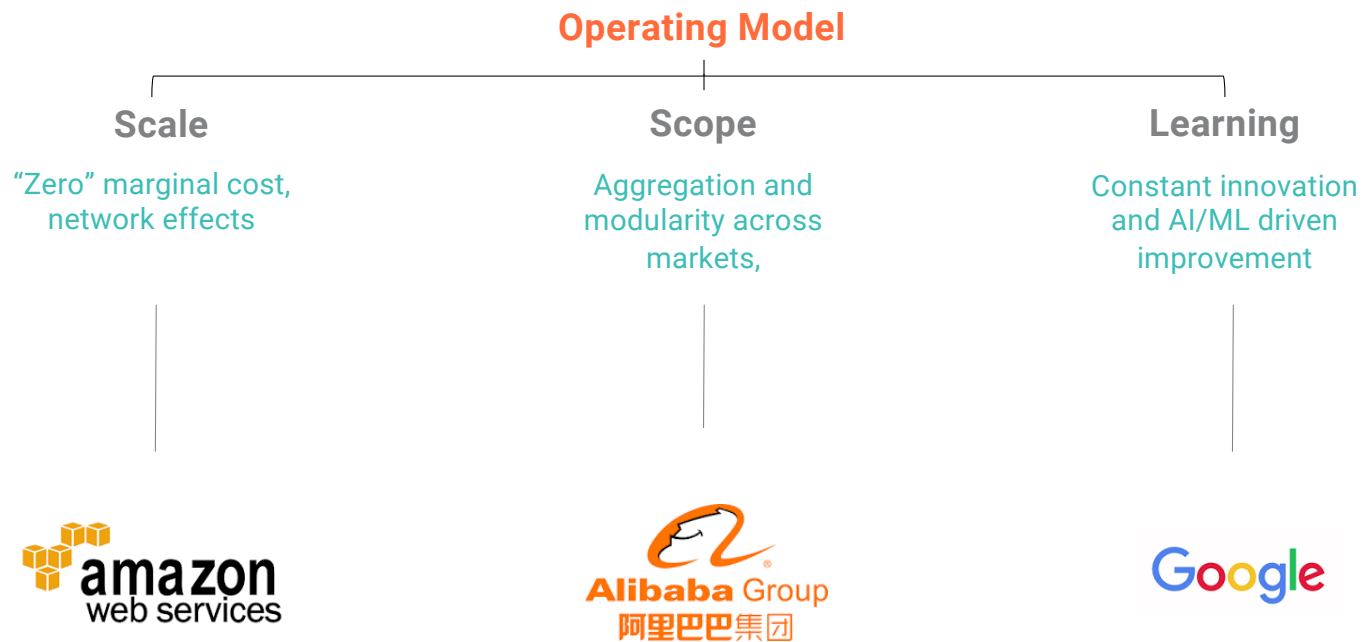
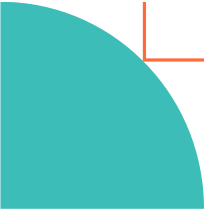
Traditional Operating Models Can Constrain the Value of the Firm



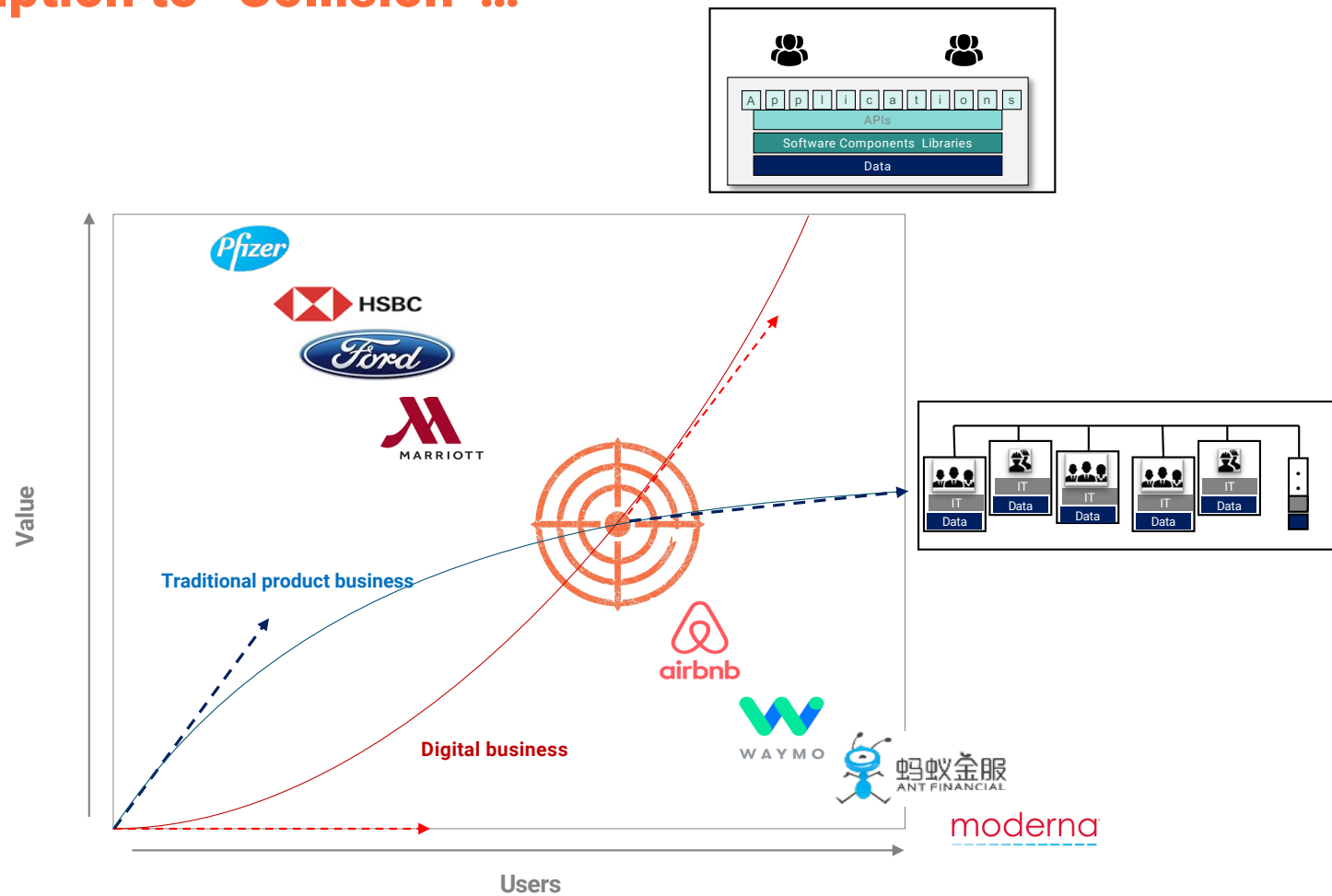
Near Zero Marginal Costs, “Network” and “Learning” Effects



Remove Traditional Constraints To Scale, Scope And Learning

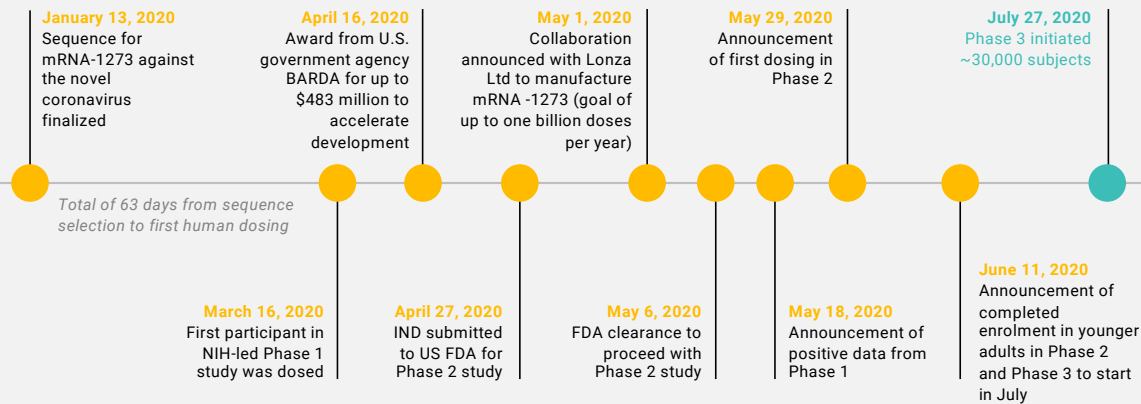


From Disruption to “Collision”...



AI And Digital Reshape The Biopharmaceutical Industry

mRNA-1273 program timeline | Research and development of SARS-CoV-2 vaccine



What other industries will experience the same transformation?

Case Study: SHEIN



SHEIN

SHEIN Outperforms Traditional Fast Fashion Retailers



	SHEIN		Traditional fast fashion retailers
New designs every year	1M-2M	VS	20K-40K
Time from design to product	3-5 days	VS	14-60 days
Minimum order size	≤ 100	VS	10,000

Source: SHEIN vs. Zara: Digital Transformation in the fast-fashion industry (HKU Business School, 2021), [Business Insider](#)

Digital Platform And Software Algorithms Create A New Consumer Experience



~6000 small & medium factories in China



SHEIN

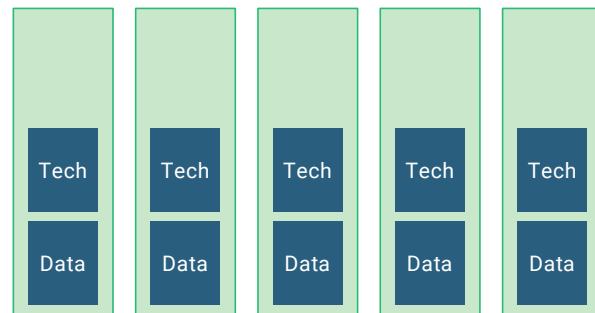


74.7 million active shoppers, 13.7 million are based in the US¹

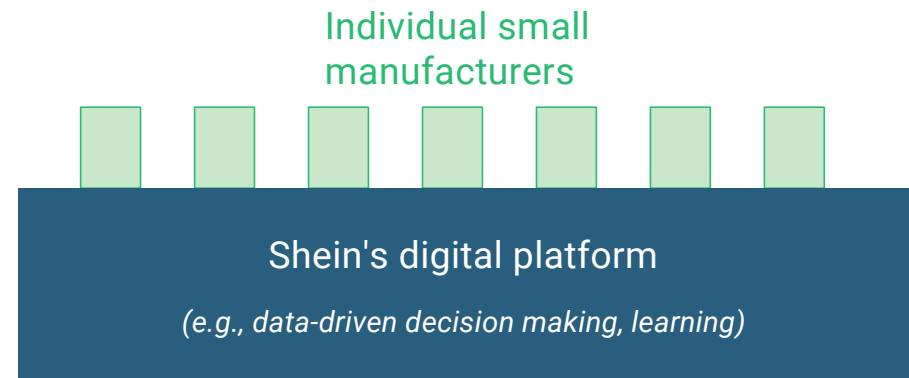
-
- Digital platform for supply chain & ops excellence
 - Data-driven coordination (match in-demand designs to the capabilities of specific manufacturers)
 - Digital marketing
 - Social media

1. <https://www.businessofapps.com/data/shein-statistics/>

SHEIN Provide Virtual Software And Data Integration With Its Manufacturing Partners



vs



Factory owners

- Receive new orders from their phones – like Uber
- Track production progress, capacity, profitability, KPIs, feedback
- Place orders for raw materials

Manufacturing Execution System

AI-first Companies Are Facing Backlash



THE NEW YORKER

THE MORAL BANKRUPTCY OF FACEBOOK

*The whistle-blower Frances
Haugen hoped that her revelations
would prompt a reckoning.
Instead, the company has
doubled down.*

Forbes

Artificial Intelligence Has Caused A 50% To 70% Decrease In Wages— Creating Income Inequality And Threatening Millions Of Jobs

The New York Times

Pressure Grows on U.S. Companies to Share Covid Vaccine Technology

Moderna accepted \$2.5 billion in taxpayer money to develop its Covid-19 vaccine. But officials in the U.S. and overseas are having trouble persuading the company to license its technology.

THE WALL STREET JOURNAL

Facial Recognition Tool Used by Police Faces Civil Lawsuit in California

Immigrant-rights activists say Clearview's technology violates their privacy rights; Clearview says its conduct is protected by the First Amendment

Bloomberg Wealth

Zillow Shuts Home-Flipping Business After Racking Up Losses

- Decision comes after company overpaid for homes across U.S.
- Widening losses in Zillow Offers unit leads to big writedowns

Incumbent Firms Face Problems With The Transition To Digital



The Washington Post

Racial bias in a medical algorithm favors white patients over sicker black patients

The problem was caught in an algorithm sold by a leading health services company, called Optum, to guide care decision-making for millions of people.

THE WALL STREET JOURNAL.

'We Need to Be a Technology Company.'
Wells Fargo Struggles With Aging Systems.

The bank has struggled to update old systems, making it harder to satisfy regulators and hampering key businesses

WIRED

Walmart Employees Are Out to Show Its Anti-Theft AI Doesn't Work

The retailer denies there is any widespread issue with the software, but a group expressed frustration—and public health concerns.

Forbes

Artificial Intelligence In Automotive Industry: Surprisingly Slow Uptake And Missed Opportunities

Bloomberg

Peacock Is the Perfect Streaming Service to Stuff in Your Pantry

- Like canned tuna, NBC's new service will taste great if everything else runs out

The New Ethics Of Digital Scale, Scope, And Learning



*How Each Big Tech Company
May Be Targeted by Regulators*

Facebook has suspended tens of thousands of apps after Cambridge Analytica investigation

PUBLISHED FBI, SEP 20 2019-2:48 PM EDT

Amazon Wants to Surveil Your Dog

“Amazon is building the infrastructure to monitor us all,” a privacy advocate says.

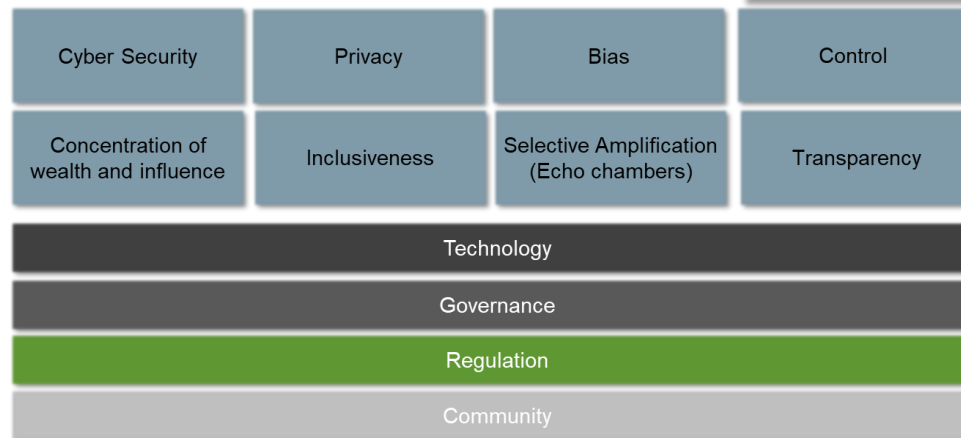
Tech Firms Need More Regulation

The industry must cooperate to solve problems—but government must take a more active role as well.

SEP 9, 2019

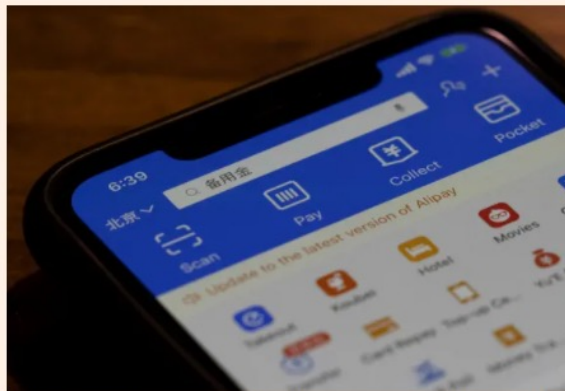
How the Algorithms Running Your Life Are Biased

FBI Issues ‘High-Impact’ Cyber Attack Warning—What You Need To Know



Ant Group poised for one of 2020's biggest IPOs

Alibaba payments arm was last valued at \$150bn and plans to list in Shanghai and Hong Kong



Ant's Alipay app has turned into a hub for its growing ecosystem of services, from payments to online shopping on Alibaba's Taobao marketplace © AP

China's President Xi Jinping Personally Scuttled Jack Ma's Ant IPO

MARKETS | FINANCE

Senior government leaders were furious about wealthy entrepreneur's criticisms of regulators; rebuke was the culmination of years of tense relations



China's President Xi Jinping, left, and Jack Ma, then executive chairman of Alibaba, in 2015. TED S. WARREN/PRESS POOL



**Many of Us Are Leading AI and Digital
Transformation Journeys Inside Our
Organization....Its Not Easy!**



Transformation Has Many Definitions

Common understanding

a thorough or dramatic change in form or appearance.

Biology

a metamorphosis during the life cycle of an animal.

Physics

the induced or spontaneous change of one element into another by a nuclear process.

Mathematics

a process by which one figure, expression, or function is converted into another that is equivalent in some important respect but is differently expressed or represented.



Leading Organizations Continue To Invest In Transformation

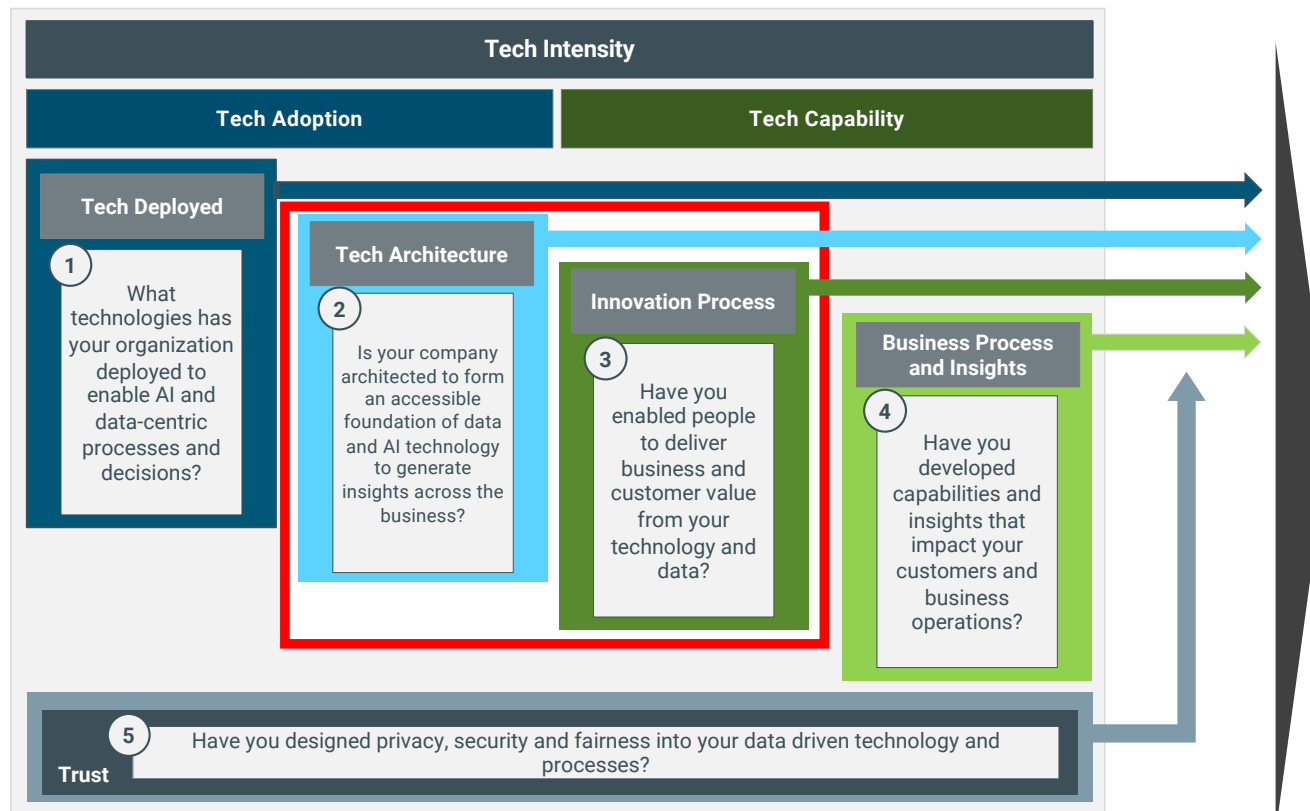
**DIGITAL
TRANSFORMATION**
is central to the
strategies of the
world's most
successful
organizations



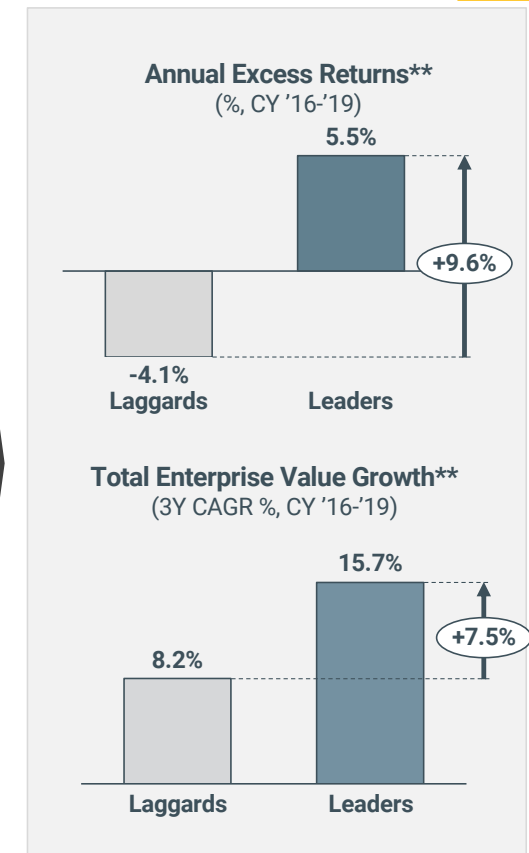
Ramped up research program to assess digital transformation progress across the economy



Our research shows a strong relationship between data centricity and AI deployment capabilities and enterprise performance

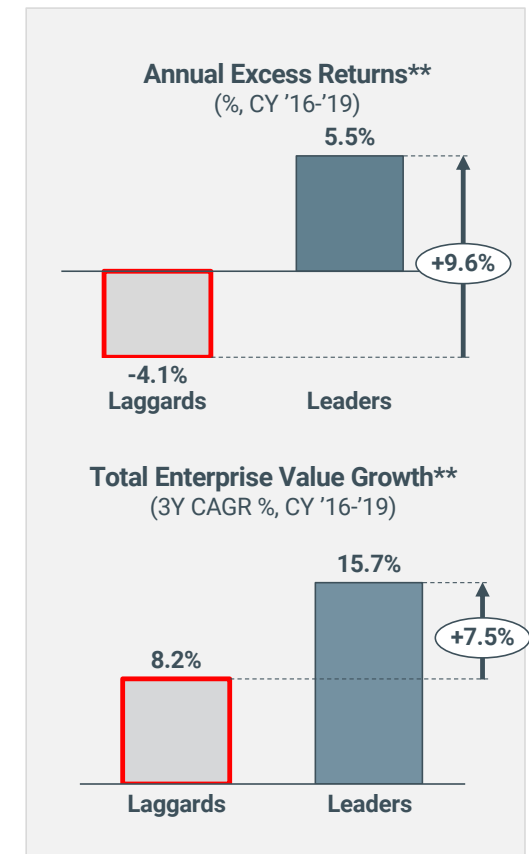
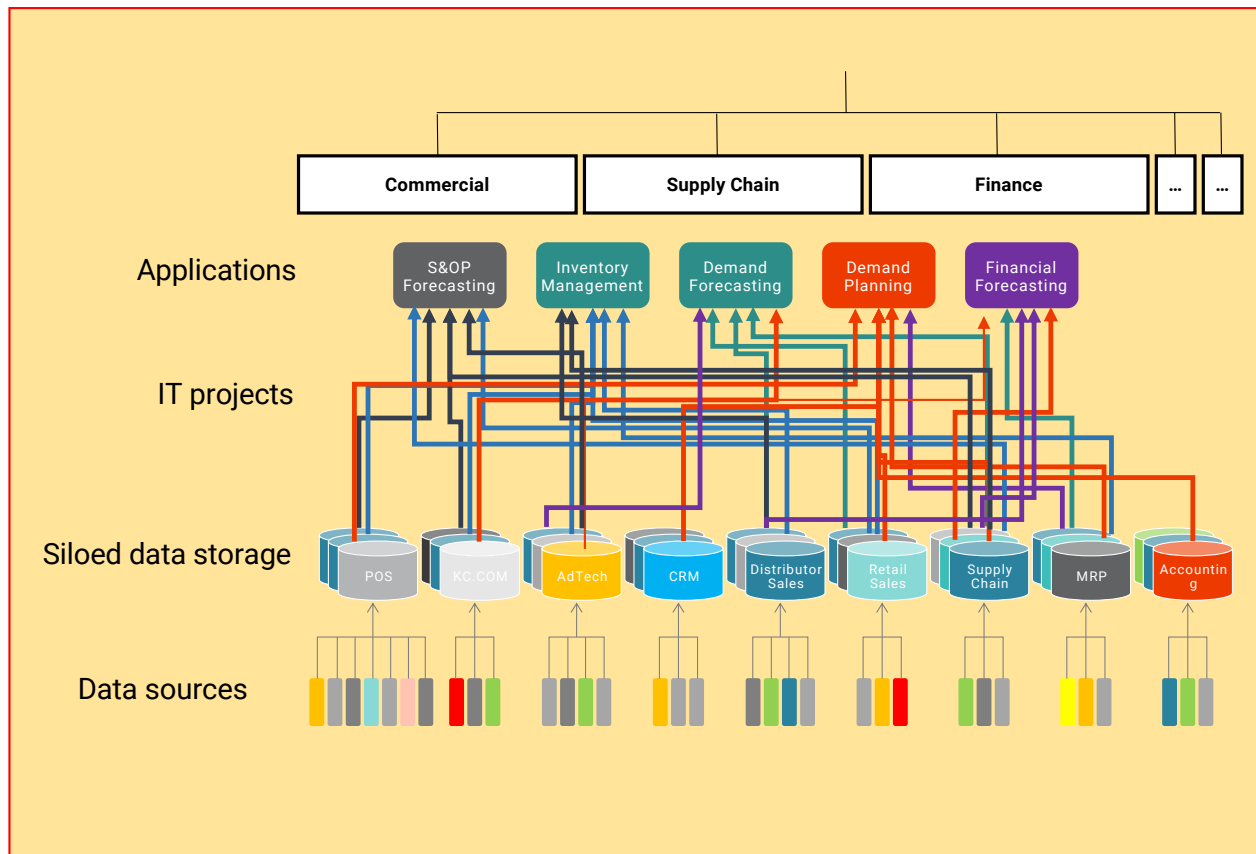


Source: Keystone Strategy LLC and Microsoft Corporation

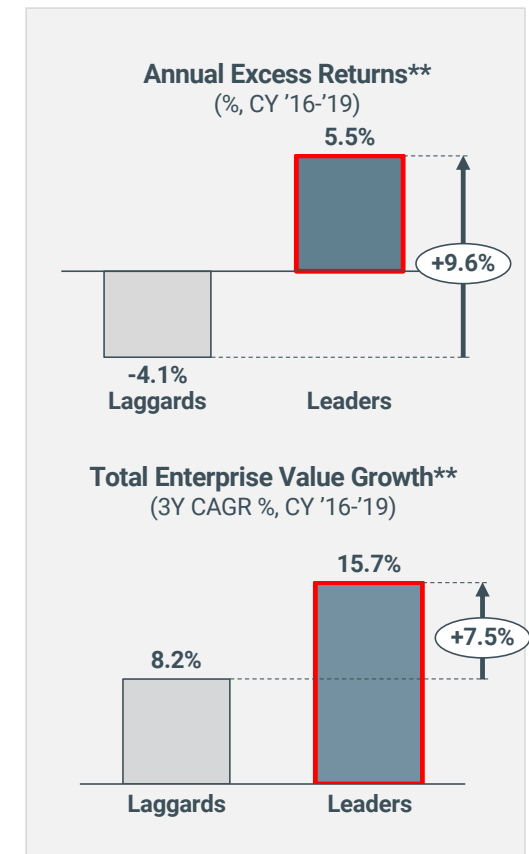
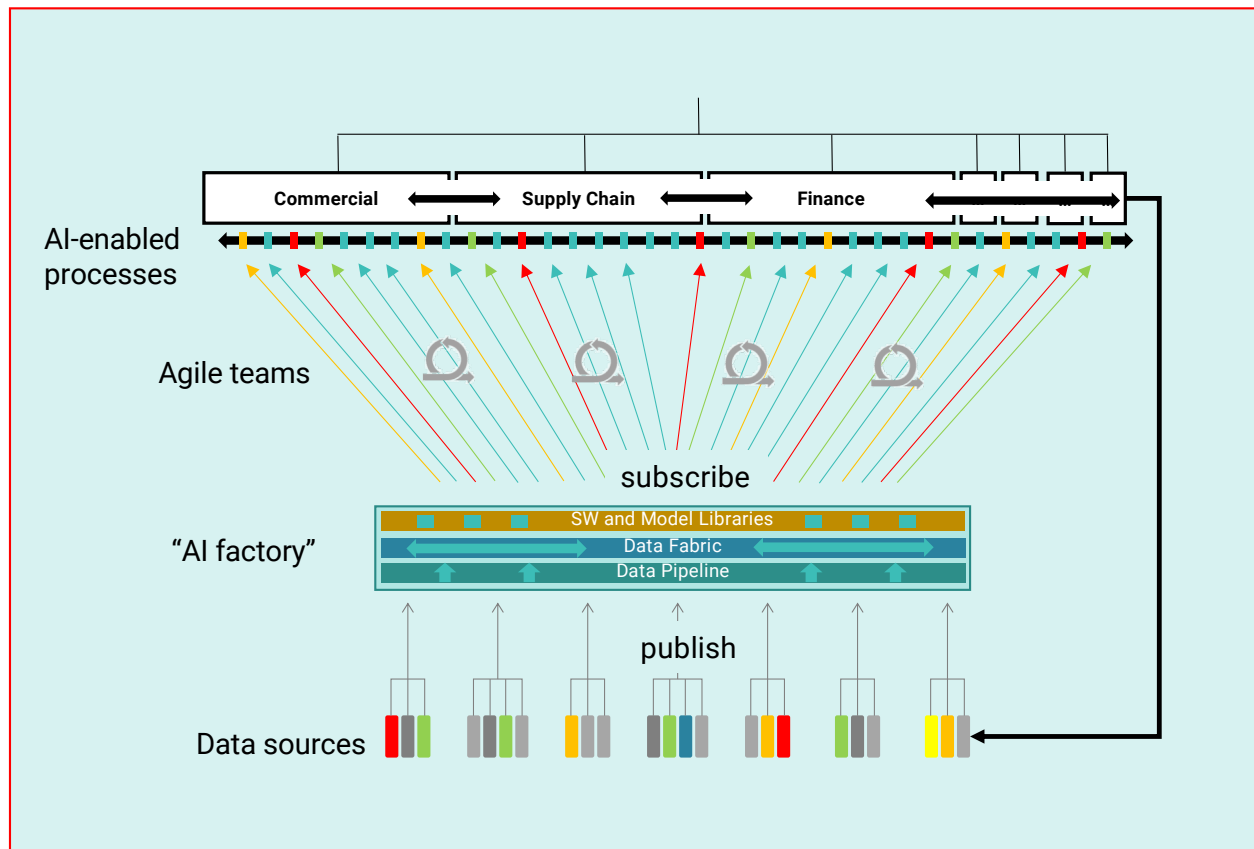


©Marco Iansiti 2020

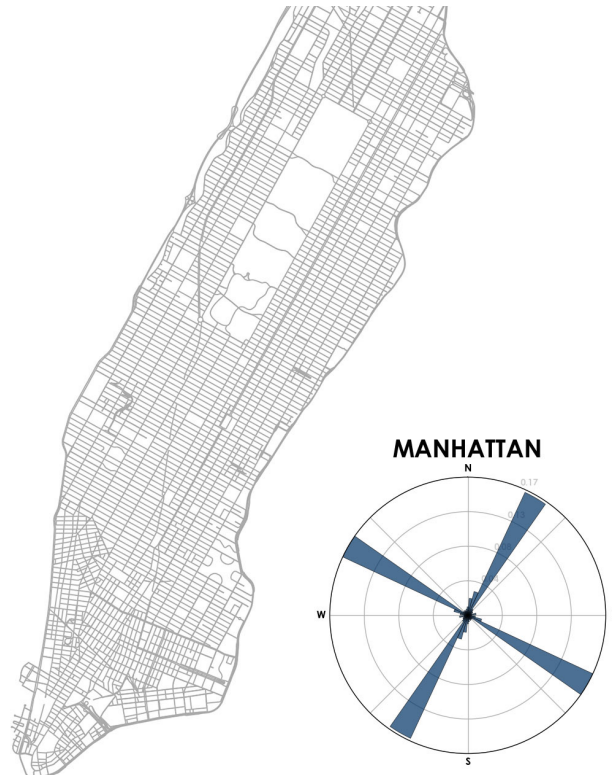
The laggards...

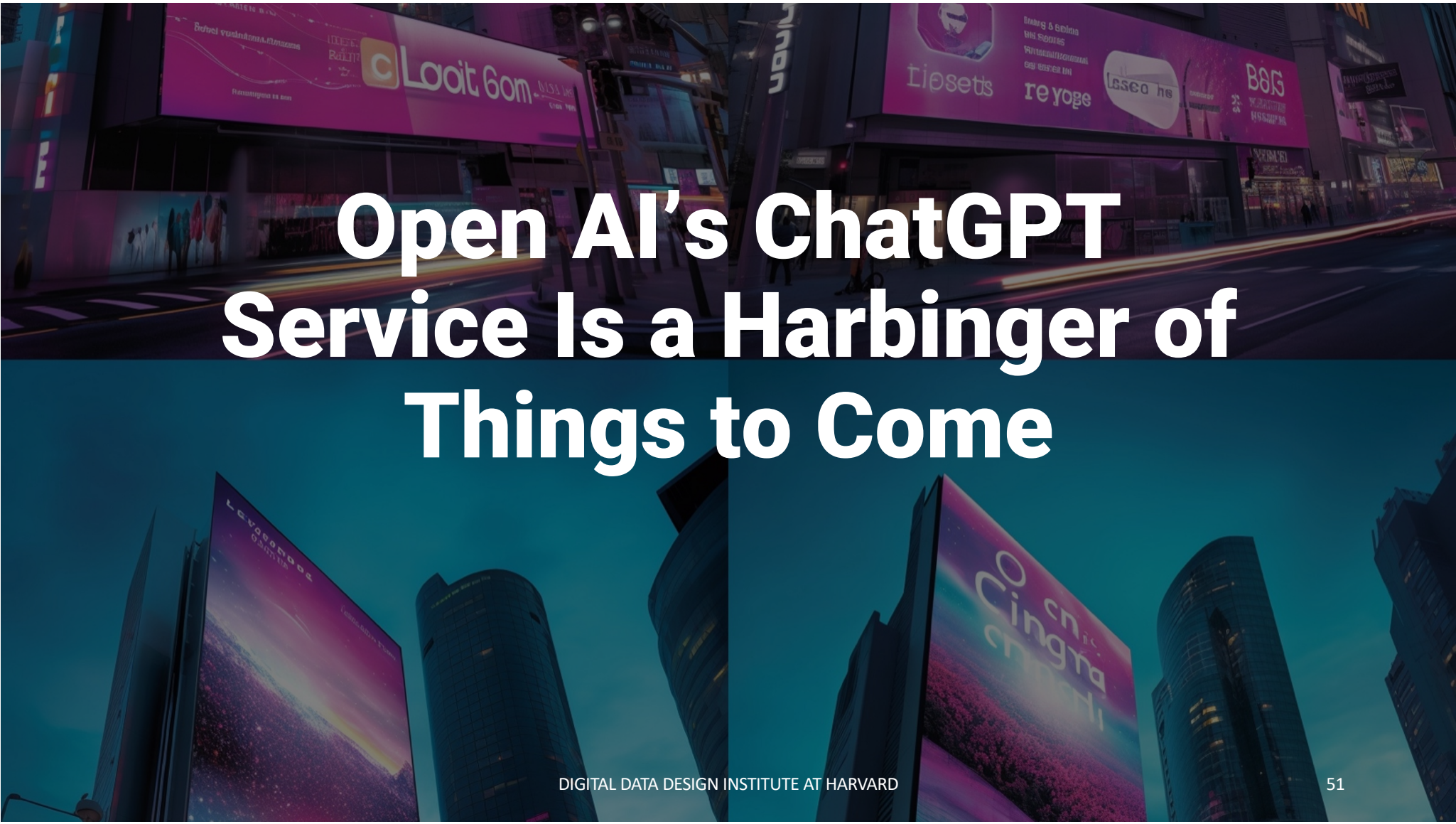


The leaders...



Process And Organizational Change Essential to Digital/AI Success





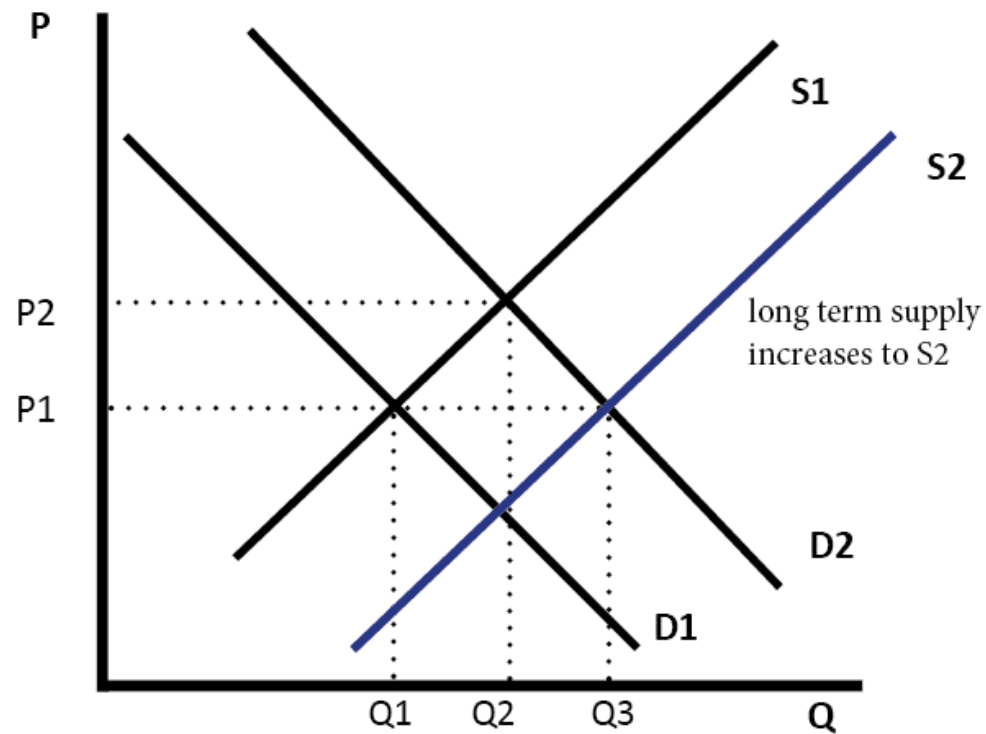
Open AI's ChatGPT Service Is a Harbinger of Things to Come

DIGITAL DATA DESIGN INSTITUTE AT HARVARD

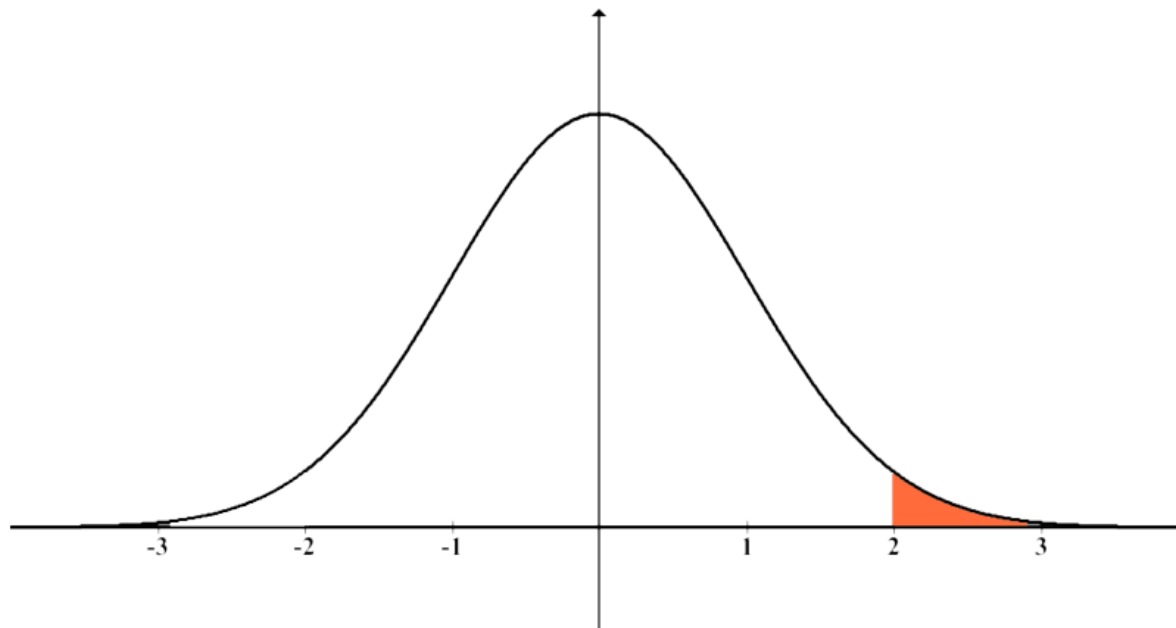
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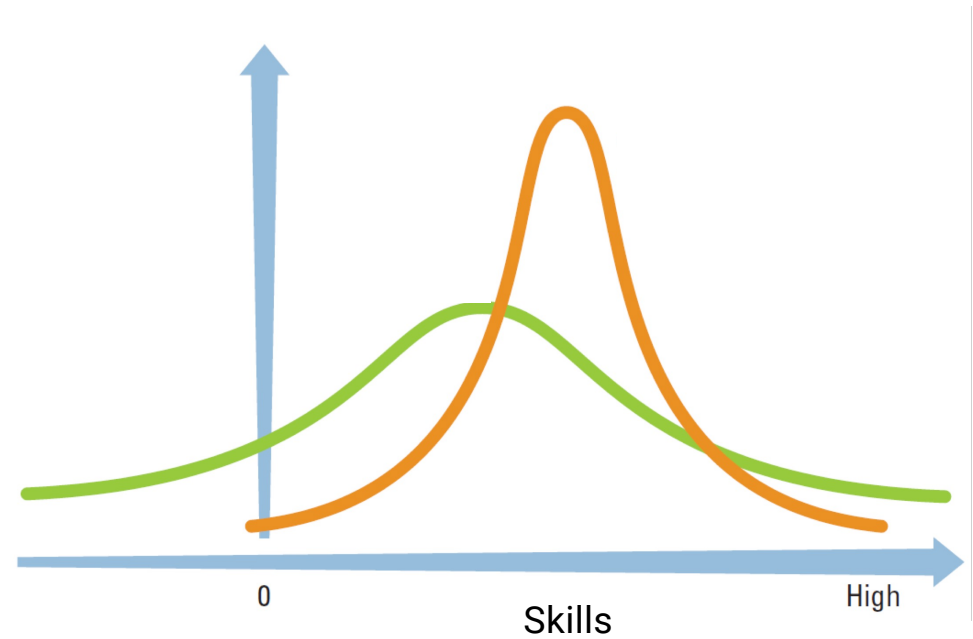
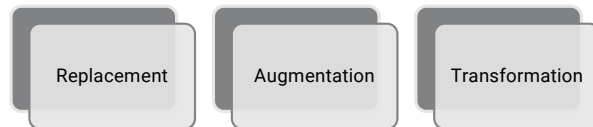
What happens when the cost/price of knowledge work drops and quality also increases?



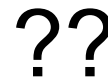
What might be the impact of AI on knowledge worker skill distribution and capabilities?



Potential impact on knowledge workers → firms



Technological and architectural innovation can have a massive impact on companies and their viability



The background of the slide is a complex, abstract pattern. It features a series of concentric circles that are filled with a dense, overlapping grid of small, multi-colored squares. The colors are primarily red, green, and brown, with some darker and lighter shades. The pattern is more organized on the left side, where the circles are more distinct, and becomes more chaotic and fragmented towards the right side, where the squares are more scattered and the circular structure is less apparent.

Generative AI As A Copilot

Generative AI – Reimagine the possibilities



Internet

Borders/Barnes & Noble

Added ecommerce, but didn't fundamentally change processes

BORDERS
Beyond Books

BARNES & NOBLE

Amazon

Reimagined opportunities, changed the entire shape of its firm

amazon

Thank You!

