Digital transformation: implications and priorities

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Today's discussion

- Digitalisation, automation and AI are transforming all sectors of the economy

- However, the gap between 'the best' firms and 'the rest' is growing

- A segmented policy approach is required to maximise the benefits

- **Digitalisation, automation and AI are transforming all sectors of the economy**

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"AI is the new electricity"

Andrew Ng

Adjunct Professor, Stanford University
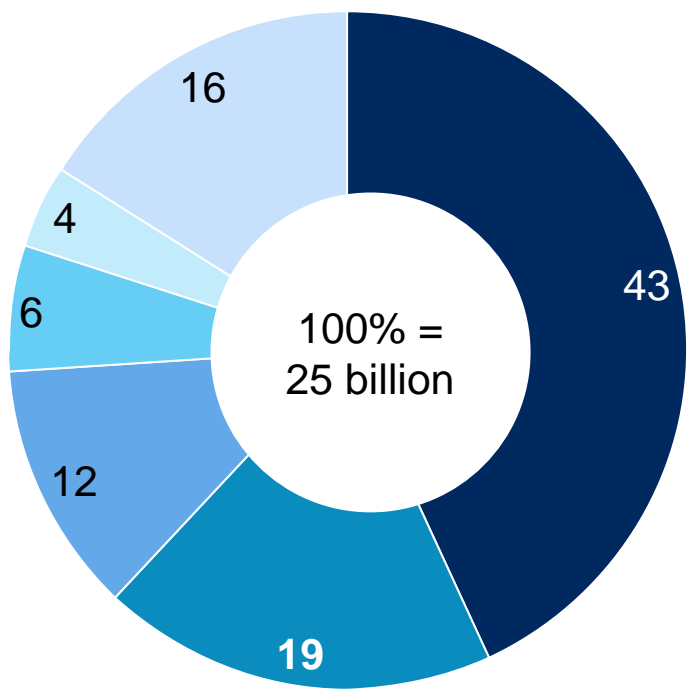**Co-founder and chairman, Coursera**
Former Chief Scientist, Baidu

By 2019, machine-to-machine connections are expected to account for more than 40 percent of global devices and connections

Connections, 2019

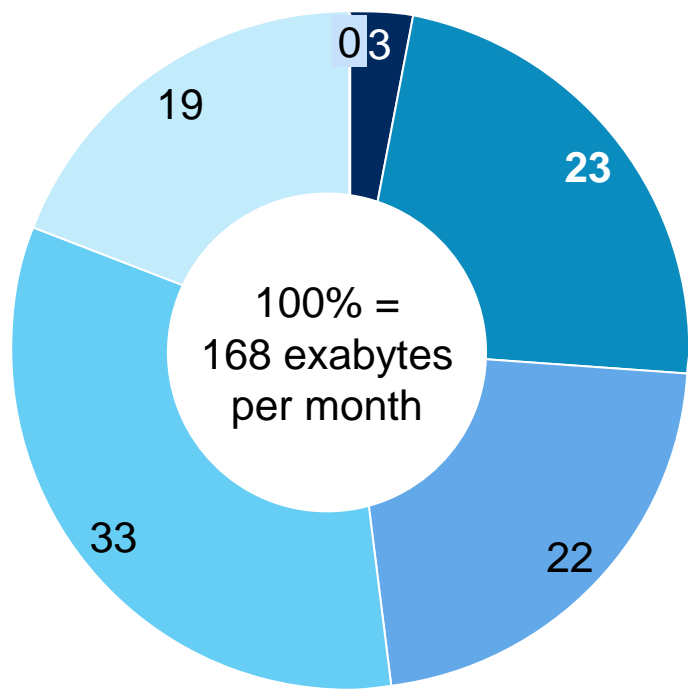Legend: ■ Machine-to-machine (M2M) ■ Smartphones ■ TVs ■ PCs ■ Tablets ■ Other

Global devices and connections

100% = 25 billion

- 43
- 19
- 12
- 6
- 4
- 16

Global IP traffic by devices

100% = 168 exabytes per month

- 0
- 3
- 23
- 22
- 33
- 19

Cross-border data flows are surging and connecting more countries

Used cross-border bandwidth

Regions	**NA** United States and Canada	**EU** Europe	**AS** Asia	**LA** Latin America	**ME** Middle East	**AF** Africa	**OC** Oceania
Bandwidth Gigabits per second (Gbps)	<50	50–100	100–500	500–1,000	1,000–5,000	5,000–20,000	>20,000

2005
100% = 4.7 Terabits per second (Tbps)
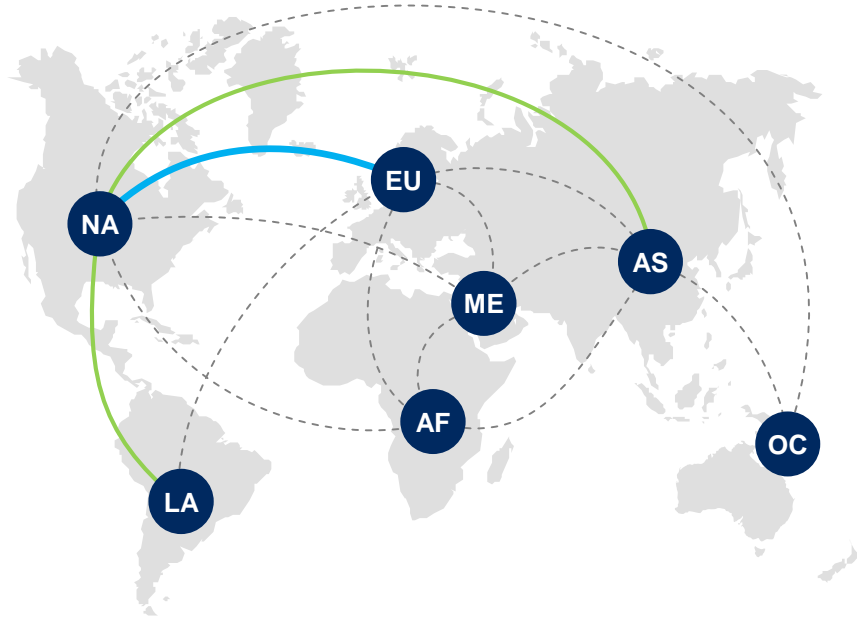
2014
100% = 211.3 Tbps

45x larger
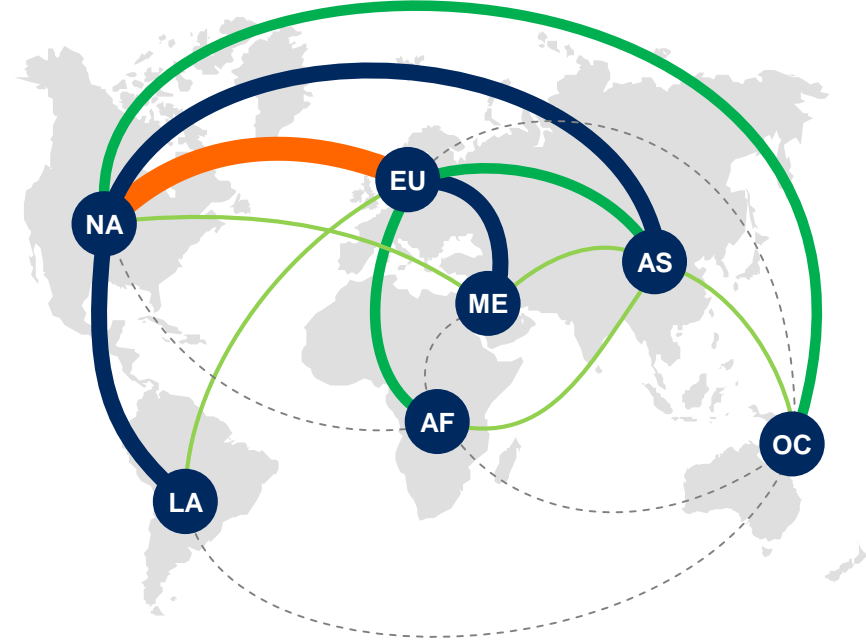
NOTE: Lines represent interregional bandwidth (e.g., between Europe and North America) but exclude intraregional cross-border bandwidth (e.g., connecting European nations with one another).

Machines can now match and even exceed human performance in tasks that were previously considered 'uniquely human'

Image recognition accuracy rate
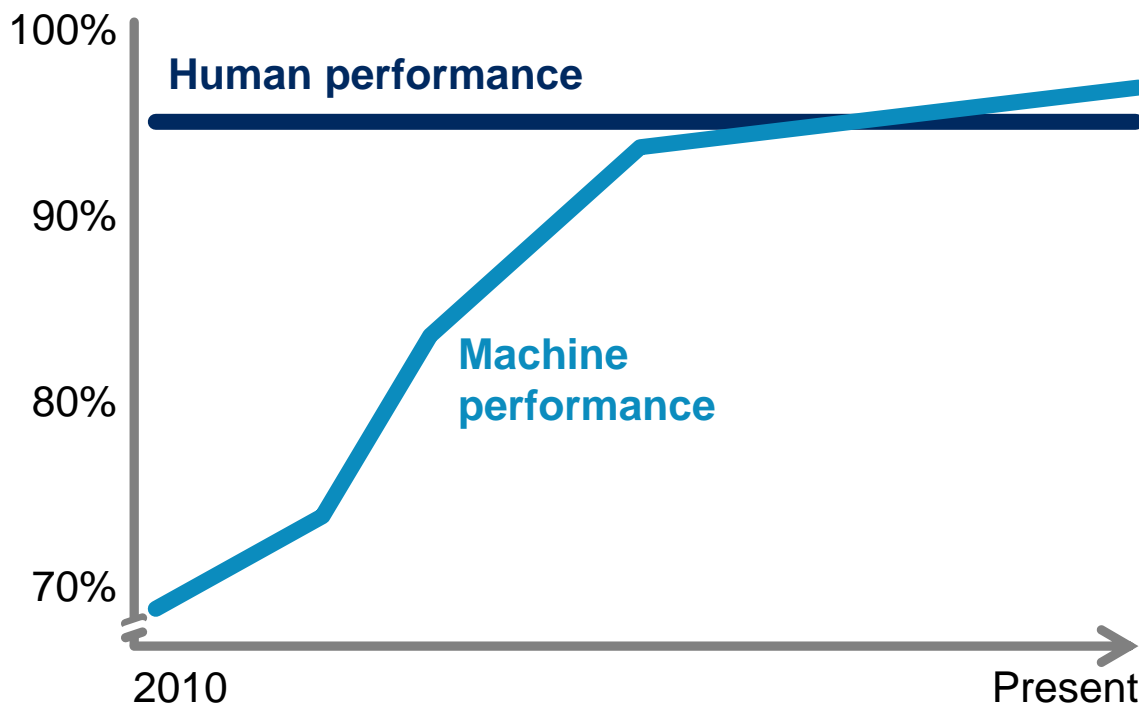
Example of the speed of technology development: advances in genome sequencing have dramatically increased the speed and reduced the costs

Simple chip loading ↓

Intuitive graphical user interface ↓

Innovative semiconductor sequencing chip ↓

State-of-the-art → electronics

Integrated → reagent delivery

From $2.7 billion for sequencing a human genome to $100 in 2 decades

Consumer adoption of new technologies is also accelerating

Time to reach 50 million users

38 years — Radio

13 years — Television

4 years — iPod

3 years — Internet

1 year — Facebook

9 months — Twitter

19 days

Digitalisation, big data, advanced analytics and AI are already having serious business impact

75% reduction in click-to-ship time

$1B revenues from prevented churn

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Even within the same sector and size category, there is a large productivity gap between 'the best' and 'the rest'

Distribution of businesses relative to the expected productivity[1] for a firm of their size in their sub-sector
2013, percentage of firms

Legend: UK, Germany, France

Expected value

Productivity[1], difference from expected value as a proportion of peer group median
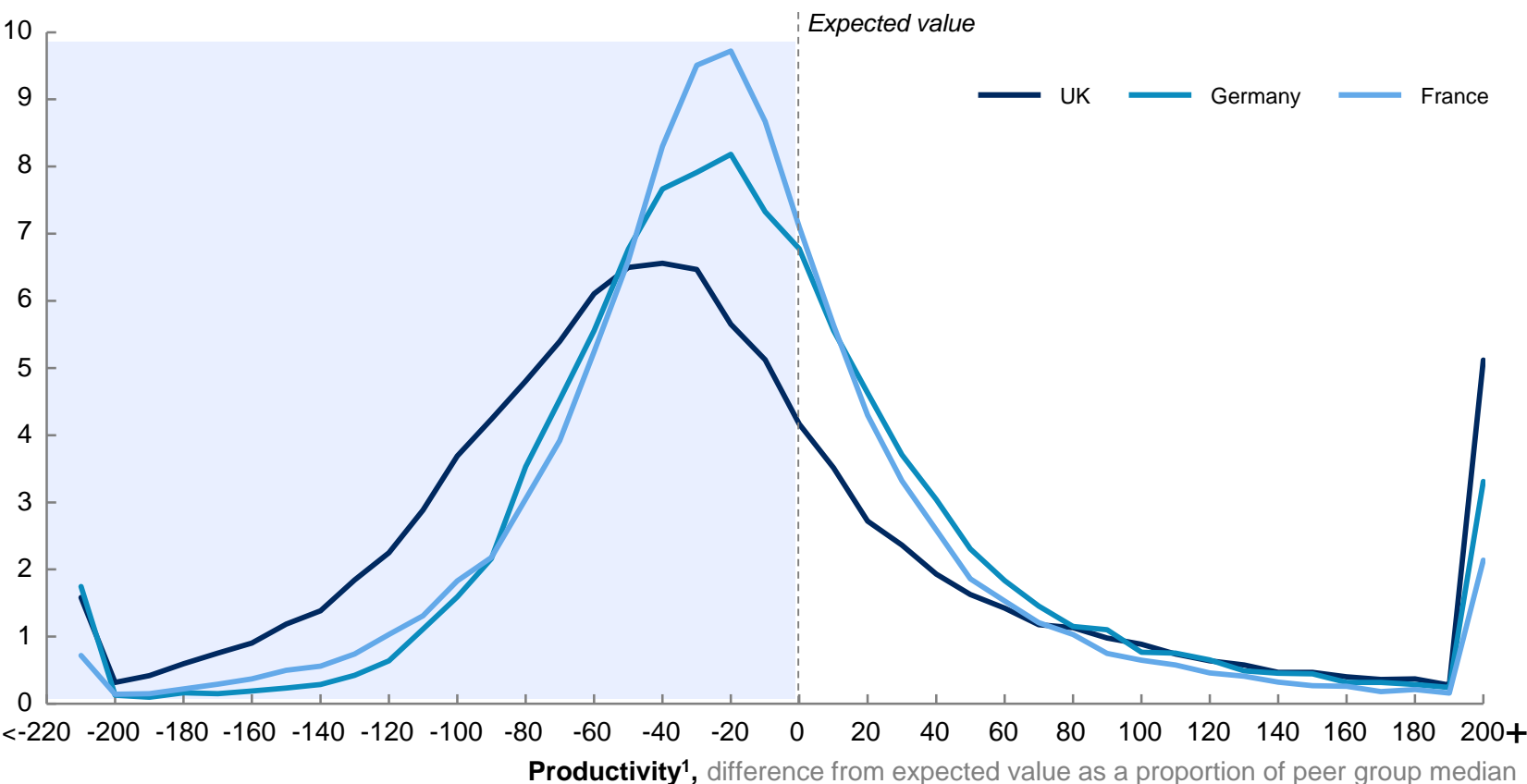
1 Estimated GVA (EBIT + employee costs) is regressed on a range of variables to control for sub-sector and number of employees using a Weighted Least Squares method (with employee numbers as the weighting). The output of this regression is used to compute an expected productivity, representing the average for a firm of that size in that sub-sector. The residual for each firm is plotted as a percentage of the median productivity for a firm in the same size bracket in the same sub-sector

And the gap may be growing: for example, tech giants dominate investment in artificial intelligence

AI investments in 2016

Corporate investments (tech giants)

$20–30B

External investments (VC, PE)

$6–9B
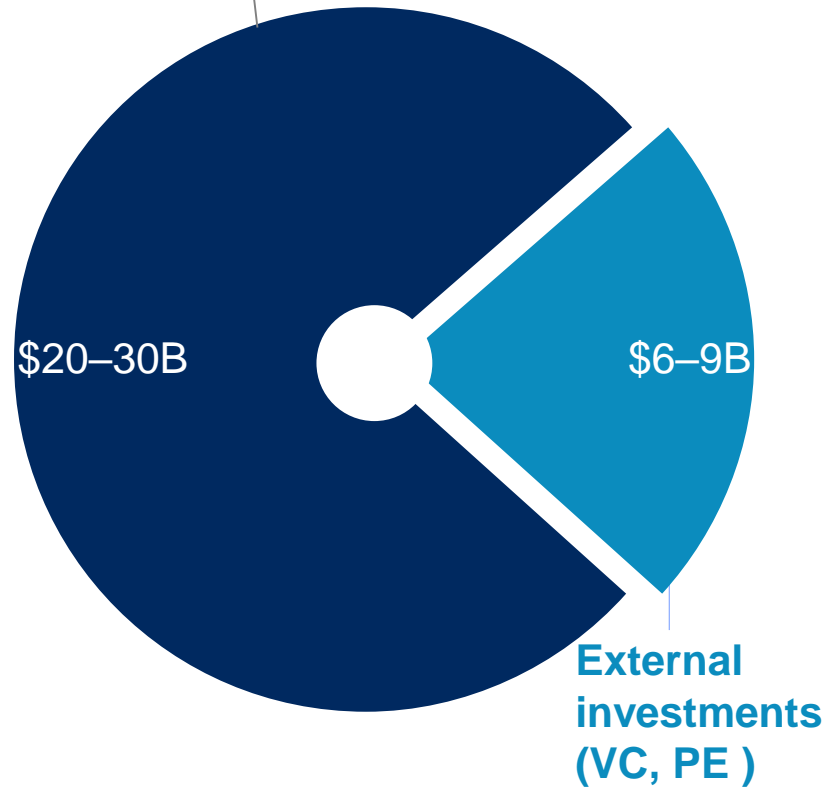
Number of AI acquisitions

2010	11	12	13	14	15	2016
7	9	9	13	14	19	42

AI adoption is occurring faster in more digitized sectors across the whole value chain, not just in pockets

AI Index

Relatively low ▭▭▭ Relatively high

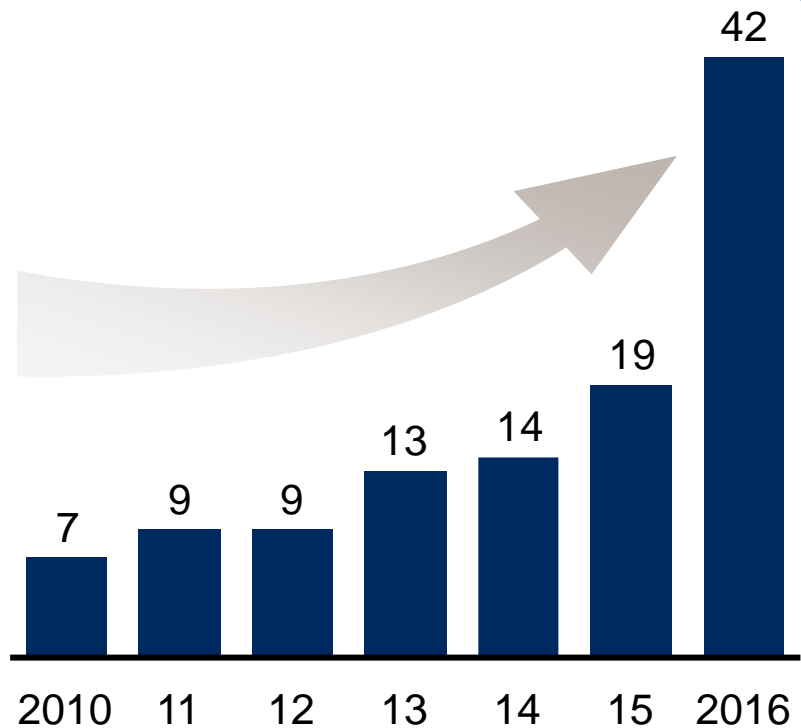|	Overall AI index	MGI Digitization Index [1]	Assets			Usage						Labor	
			Depth of AI technologies	AI spend	Supporting digital assets	Product development	Operations	Supply chain and distribution	Customer experience	Financial and general management	Workforce management	Exposure to AI in workforce	AI resources per worker
High tech and telecommunications													
Automotive and assembly													
Financial services													
Resources and utilities													
Media and entertainment													
Consumer packaged goods													
Transportation and logistics													
Retail													
Education													
Professional services													
Health care													
Building materials and construction													
Travel and tourism													

1 The MGI Digitization Index is GDP weighted average of Europe and United States. See Appendix for full list of metrics and explanation of methodology.

Sectors leading in AI adoption today also intend to grow their investment the most

Future AI demand trajectory[1]
Average estimated % change in AI spending, next 3 years, weighted by firm size[2]

Leading sectors

Financial services

High tech and telecommunications

Transportation and logistics
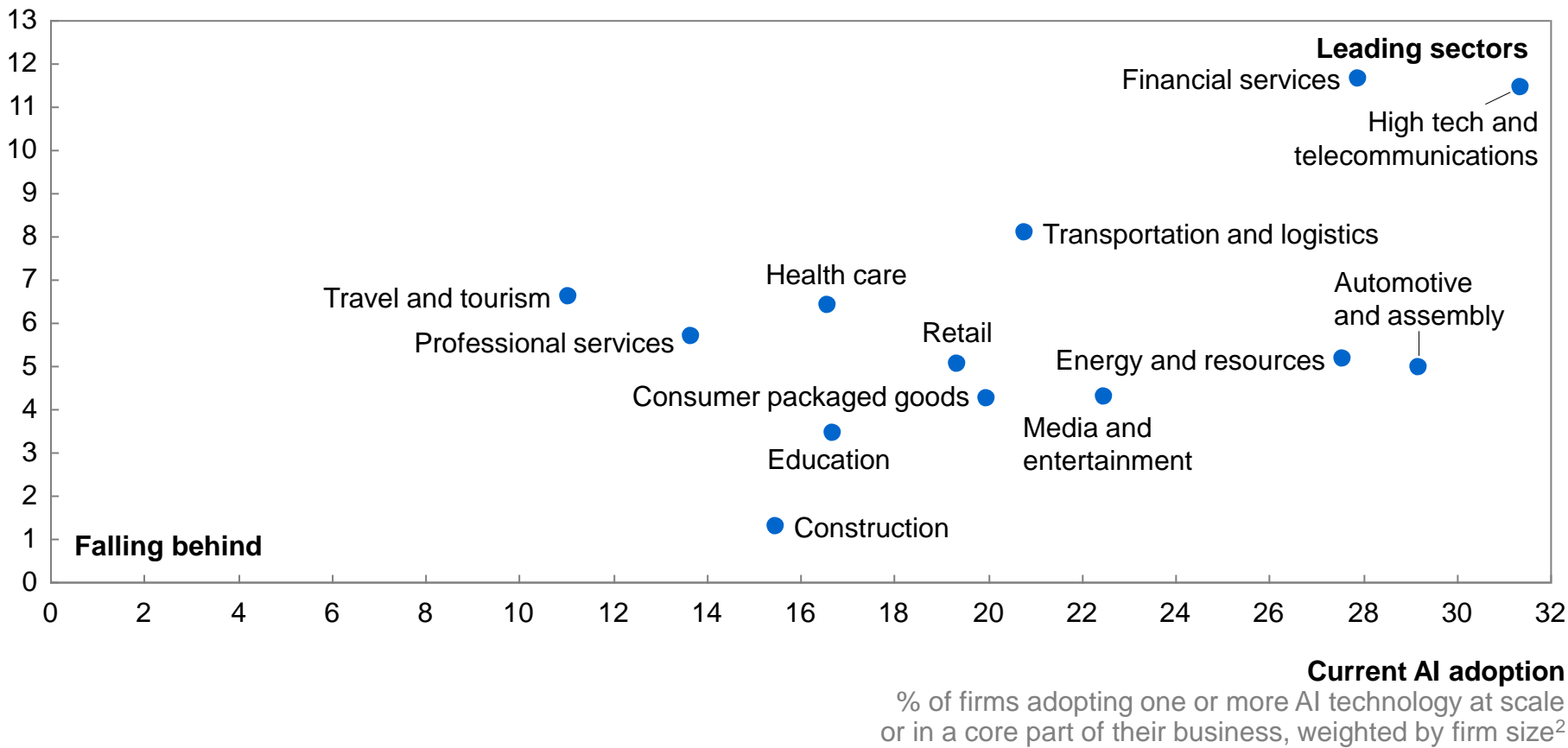
Automotive and assembly

Health care

Travel and tourism

Professional services

Retail

Energy and resources

Consumer packaged goods

Media and entertainment

Education

Construction

Falling behind

Current AI adoption
% of firms adopting one or more AI technology at scale or in a core part of their business, weighted by firm size[2]

1 Based on the midpoint of the range selected by the survey respondent.
2 Results are weighted by firm size. See Appendix for an explanation of the weighting methodology.

Eight of the world's major cities are hubs for at least four of the five major flows

City participation in major flows by rank and change over previous year in each flow[1]

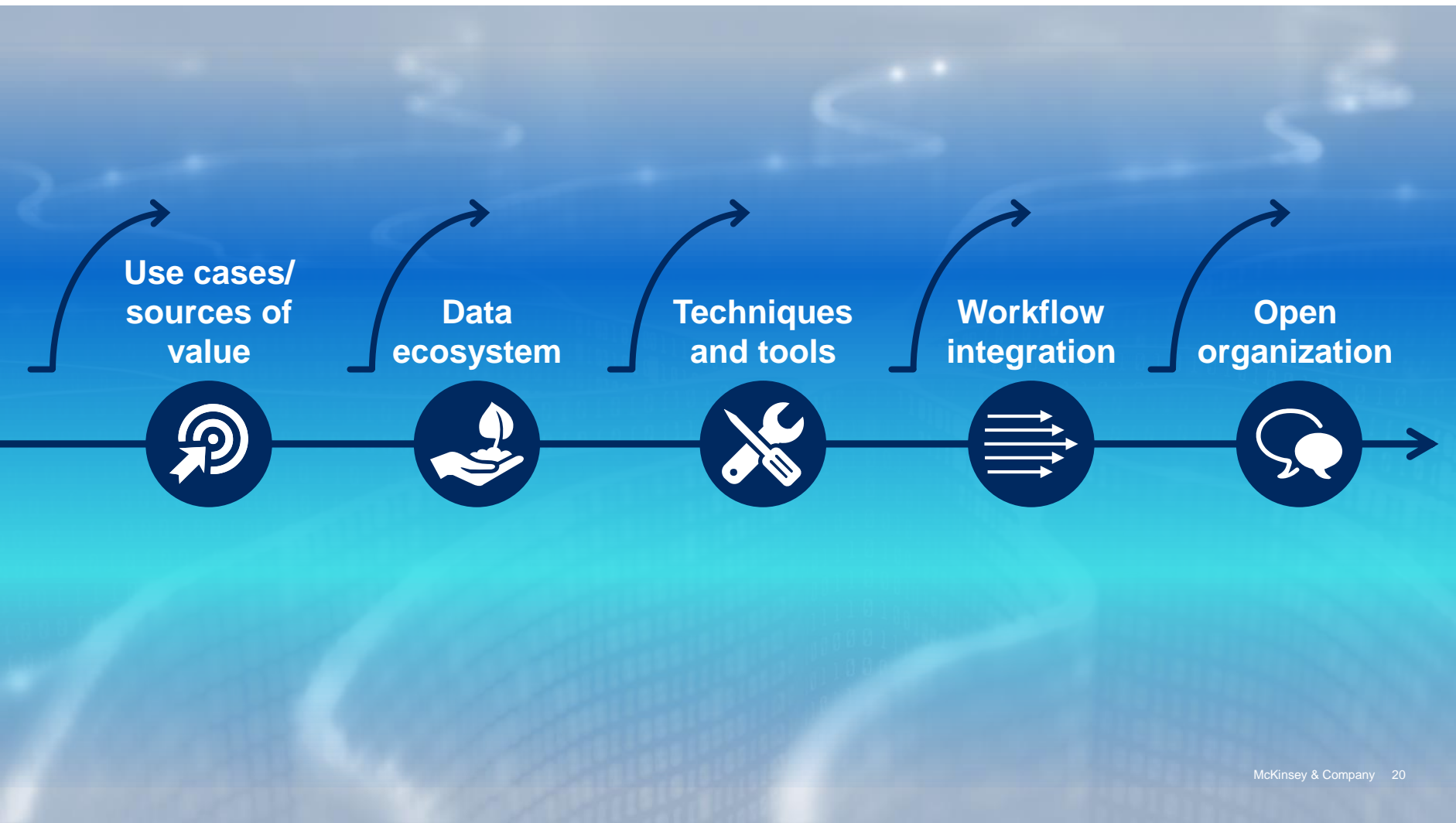| Rank[2]	Goods	Goods, services, people	Financial	People	Data and communication
1	Shanghai	Atlanta	London	New York	Frankfurt
2	Singapore	Beijing	New York	Los Angeles	London
3	Shenzhen	London	Hong Kong	London	Amsterdam
4	Hong Kong	Tokyo	Singapore	Hong Kong	Paris
5	Ningbo	Los Angeles	Tokyo	Toronto	New York
6	Busan	Dubai	Seoul	Paris	Los Angeles
7	Guangzhou	Chicago	Zurich	Miami	Miami
8	Qingdao	Paris	Toronto	Sydney	Stockholm
9	Dubai	Dallas/Fort Worth	San Francisco	Chicago	San Francisco
10	Tianjin	Hong Kong	Washington, DC	Singapore	Singapore
11	Rotterdam	Frankfurt	Chicago	San Francisco	Hong Kong
12	Port Klang	Jakarta	Boston	Melbourne	Tokyo
13	Kaohsiung	Istanbul	Geneva	Moscow	Moscow
14	Dalian	Amsterdam	Frankfurt	Houston	Milan
15	Hamburg	Guangzhou	Sydney	Dubai	Vienna
16	Antwerp	Singapore	Dubai	Riyadh	Washington, DC
17	Xiamen	Denver	Montreal	Washington, DC	Hamburg
18	Tanjung Pelepas	New York	Vancouver	Dallas	Beijing
19	Los Angeles	Shanghai	Luxembourg	Jeddah	Marseille
20	Long Beach	Kuala Lumpur	Osaka		Copenhagen
21	Laem Chabang	San Francisco	Shanghai		Brussels
22	Tanjung Priok	Bangkok	Qatar		Warsaw
23	Ho Chi Minh City	Incheon	Shenzhen		Shanghai
24	Bremen	Charlotte	Busan		São Paulo
25	New York	Las Vegas	Tel Aviv		Madrid

1 Metropolitan areas with at least 1 million foreign-born residents. Exact foreign-born population of Jeddah not known, so it is included at the bottom of the list.

2 Rankings come from different years: ports (2014), airports (2014), financial centers (2014), migration (2011), and online traffic (2015).

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To benefit from digitalisation, big data, advanced analytics and AI, businesses need to build on five enablers

Use cases/ sources of value → **Data ecosystem** → **Techniques and tools** → **Workflow integration** → **Open organization**

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Governments can accelerate developments through broad-based support

Skills

Support and incentives

Regulation

But a segmented approach will be required to optimise policy between 'the best' and 'the rest'

Illustrative segmentation of the business population

Relative competi-tiveness potential[1]	Growth and size			
	Stagnant, small	**Stagnant, large**	**High growth, small**	**High growth, large**
Very high	N/A [unlikely to exist]	N/A [unlikely to exist]	Holistic **scale-up** support, e.g., **patient capital, export support, innovation grants, skill building, networks**	**Science collaboration, R&D support, enabling regulation**
Average	Holistic **training, funding and collaboration** to embed best technology and practices	N/A [rely on competition or markets to address]	N/A [unlikely to exist]	N/A [unlikely to exist]
Very low	N/A [encourage exit or change in mgmt, e.g. by changing taxation, bank capital req's]	N/A [ensure competitive markets, incl. for corporate control]	N/A [unlikely to exist]	N/A [unlikely to exist]

1 Small, young firms tend to be less productive than 'the average firm' due to lack of economies of scale but they could still be highly competitive or have significant potential relative to firms in their sector