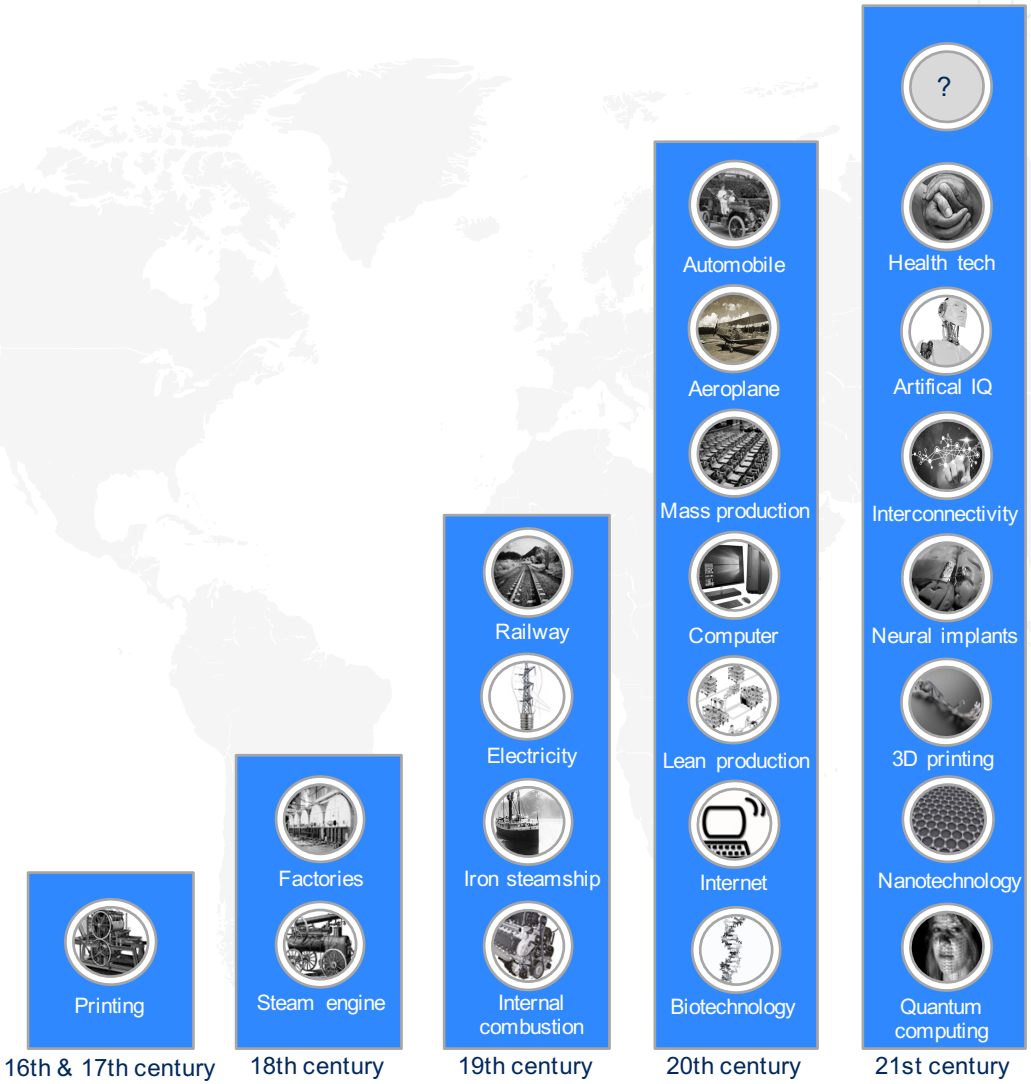
Technology

NON-CONFIDENTIAL AND ENTIRELY SHAREABLE
Purpose+, Amstel 95, Amsterdam, The Netherlands

PURPOSE+

Visual 59: Technology will shape the 21st century in new ways

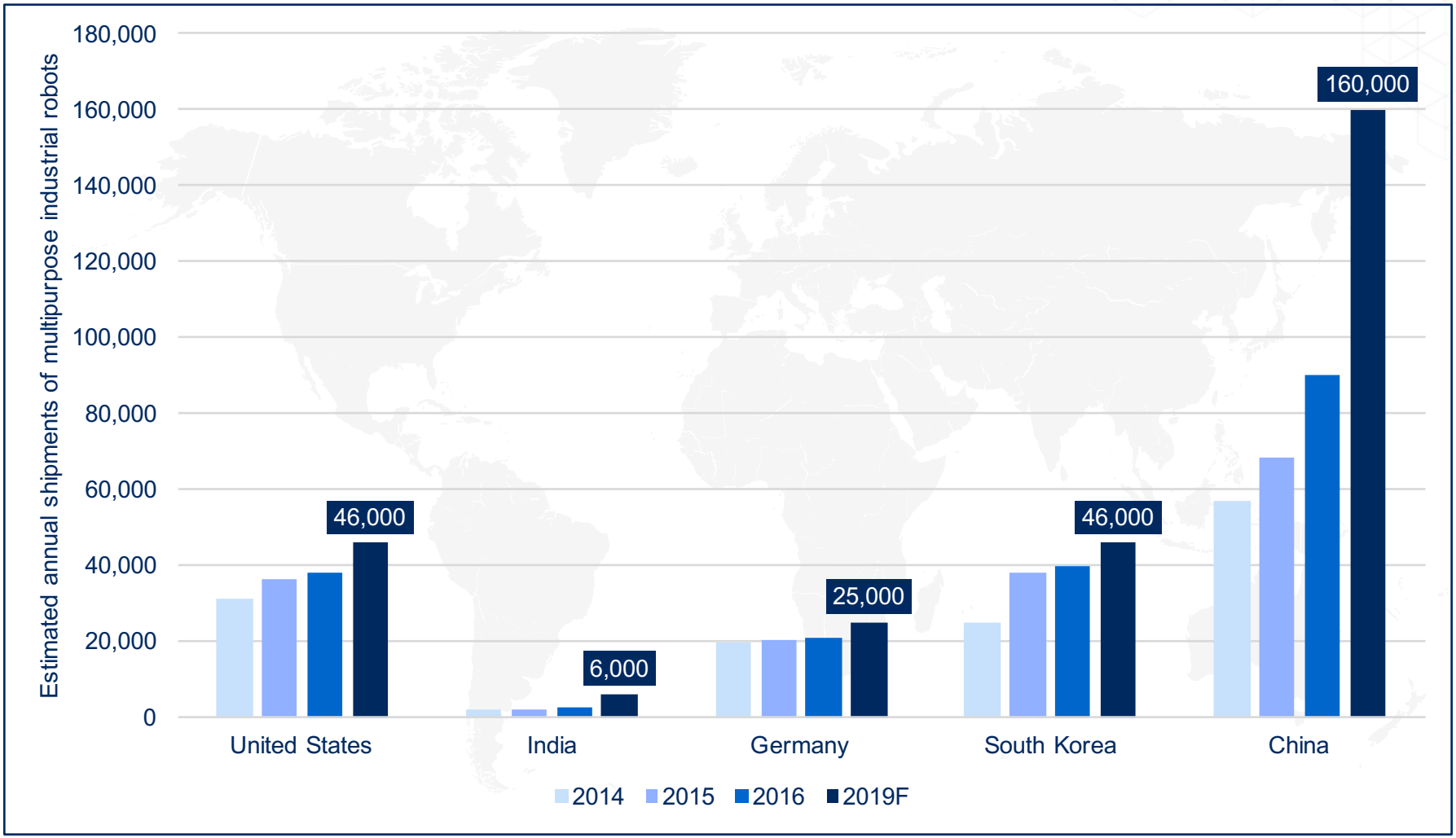
Critical inventions over time, including the 21st century



Source: Richard Lipsey, Kenneth Carlaw, Clifford Bekhar; Fit for The Future, PwC, (2014), Purpose+ team, Gareth Morgan (Images of Organisations, 1986)

PURPOSE+

Visual 60: China is leading the dance when it comes to robotization



Sources: International Federation of Robotics (2016)

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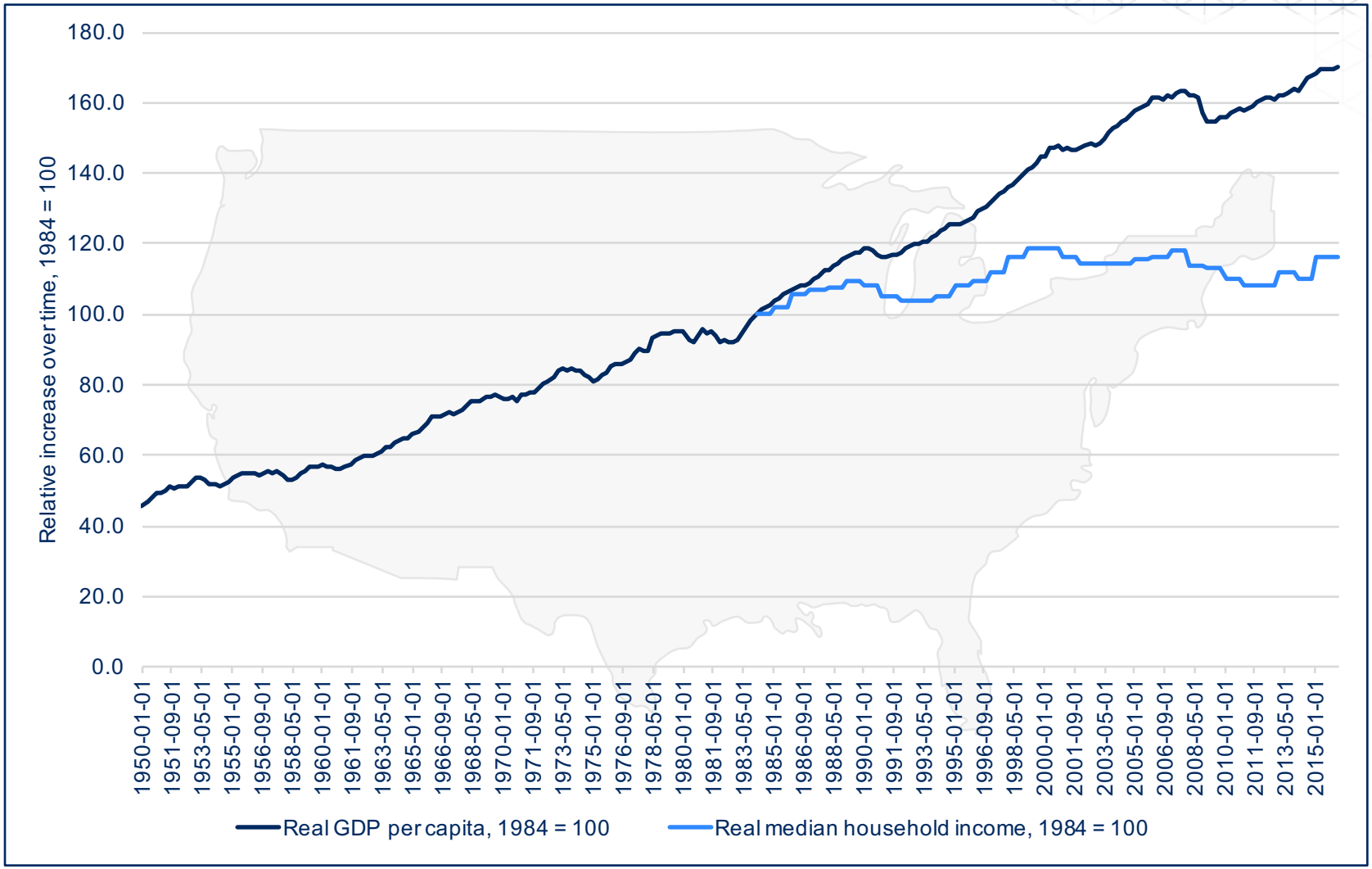
Visual 61: GDP per capita and household incomes have de-coupled



Sources: Federal Reserve Bank, dataset August 2017

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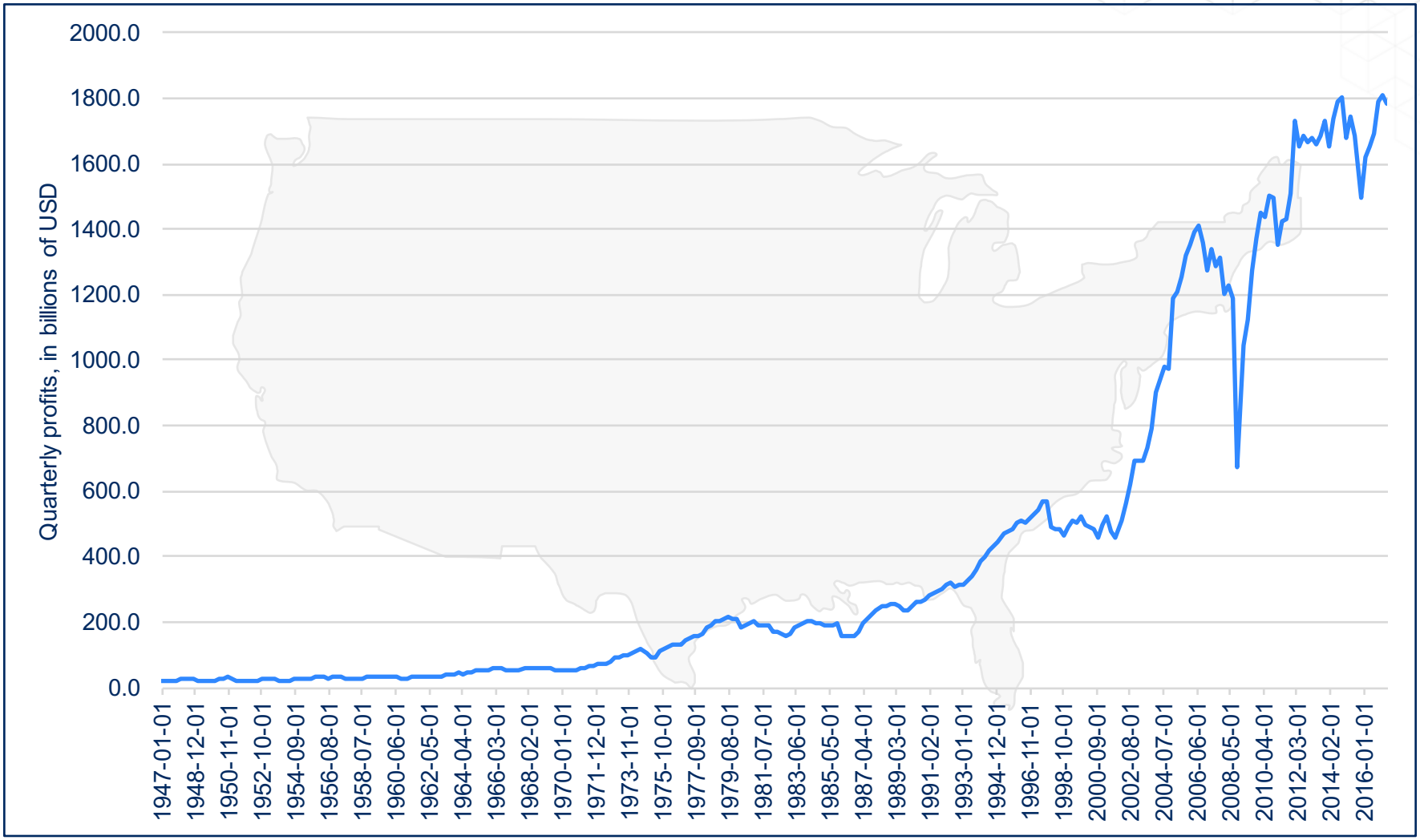
Visual 62: Corporate profits are on the rise



Note: U.S. data
Sources: Federal Reserve Bank, dataset August 2017

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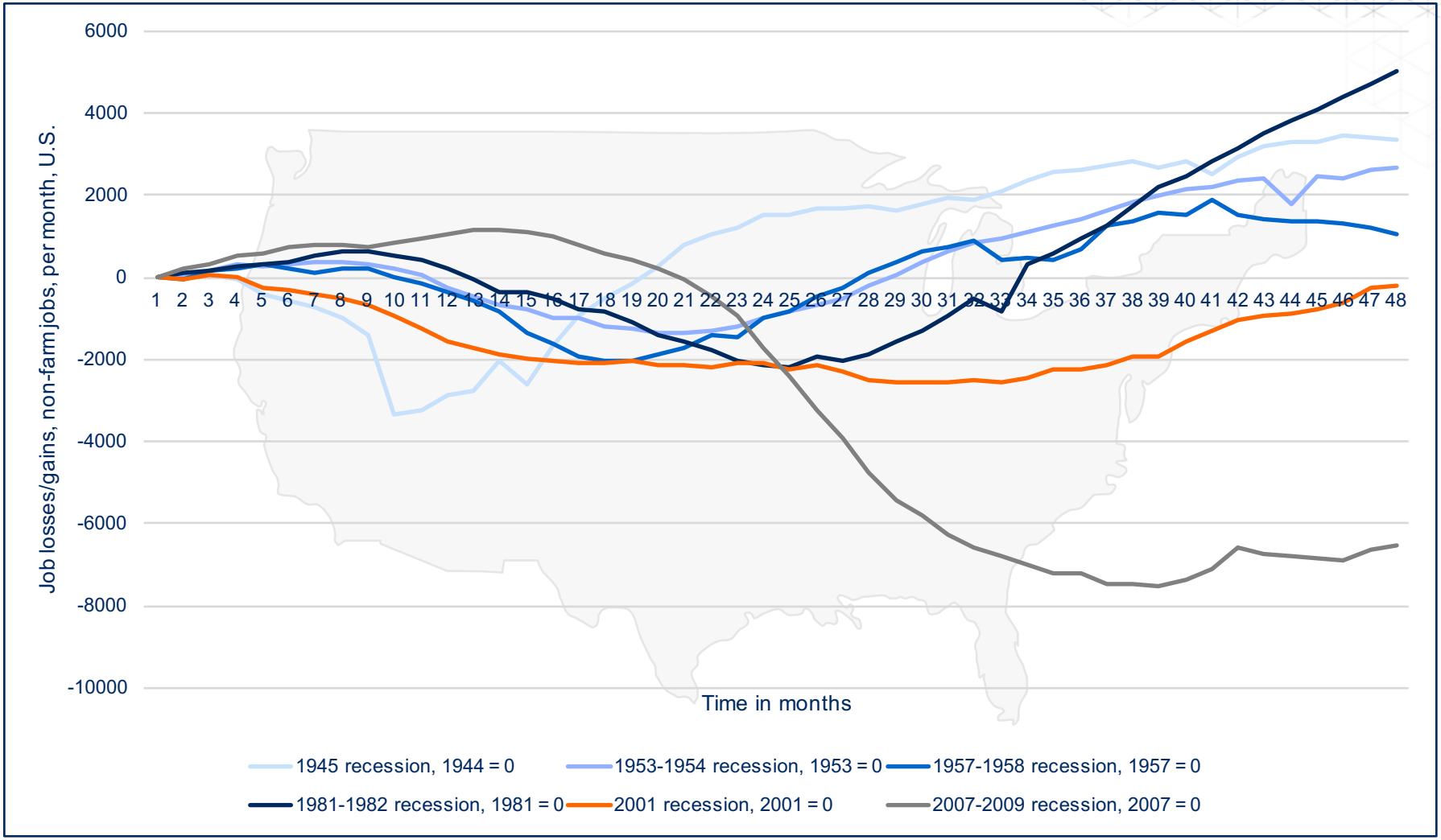
Visual 63: More recent recessions see a slower recovery of jobs



* X = 0 means December of previous year is set to 0, e.g. December 1943 for 1944

Source: Federal Reserve Bank, author analysis, based on work by www.calculatedriskblog.com

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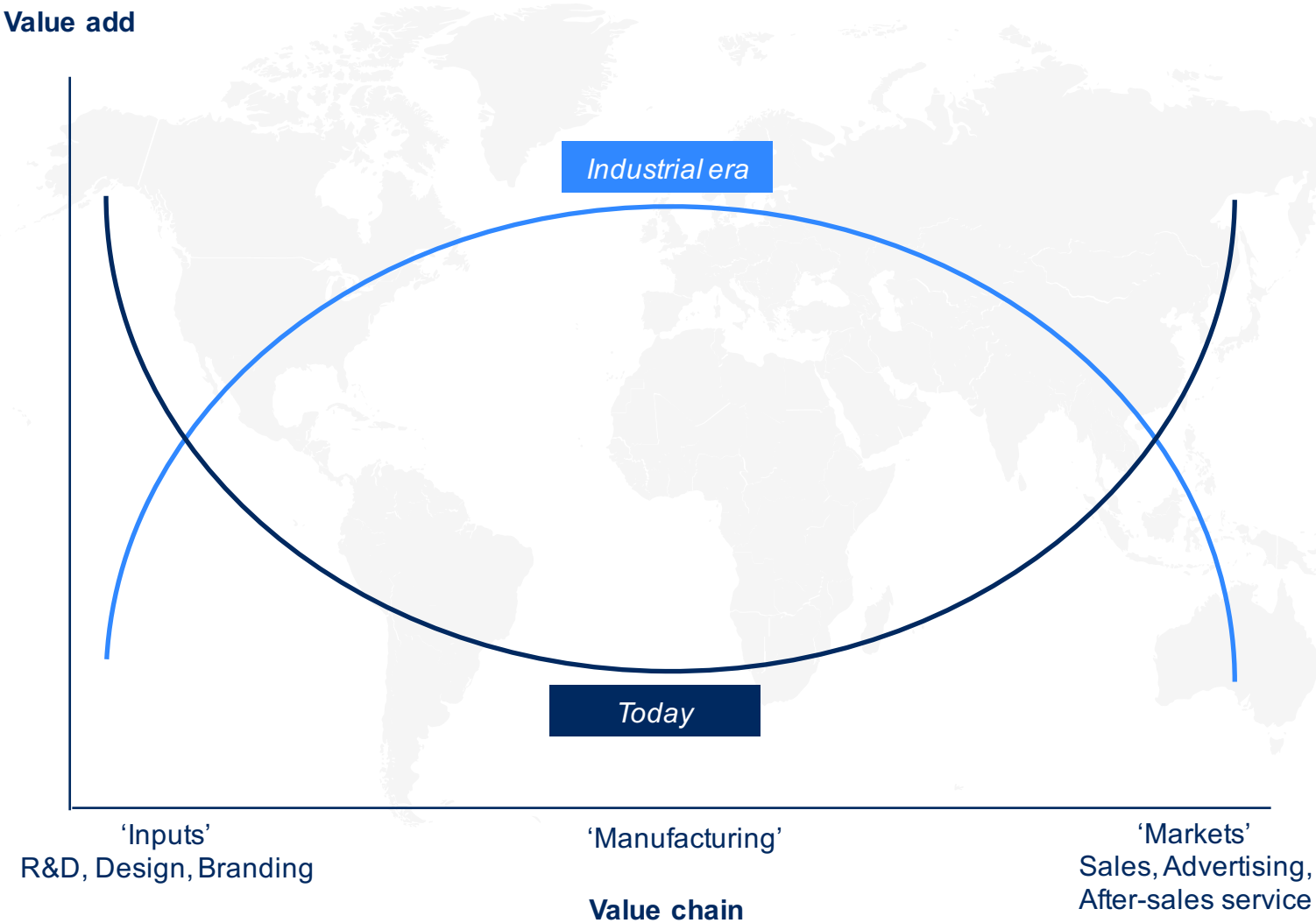
Visual 64: The smile represents the new 'high value' areas



Source: original 'smile curve' from Stan Shih (Founder of Acer)

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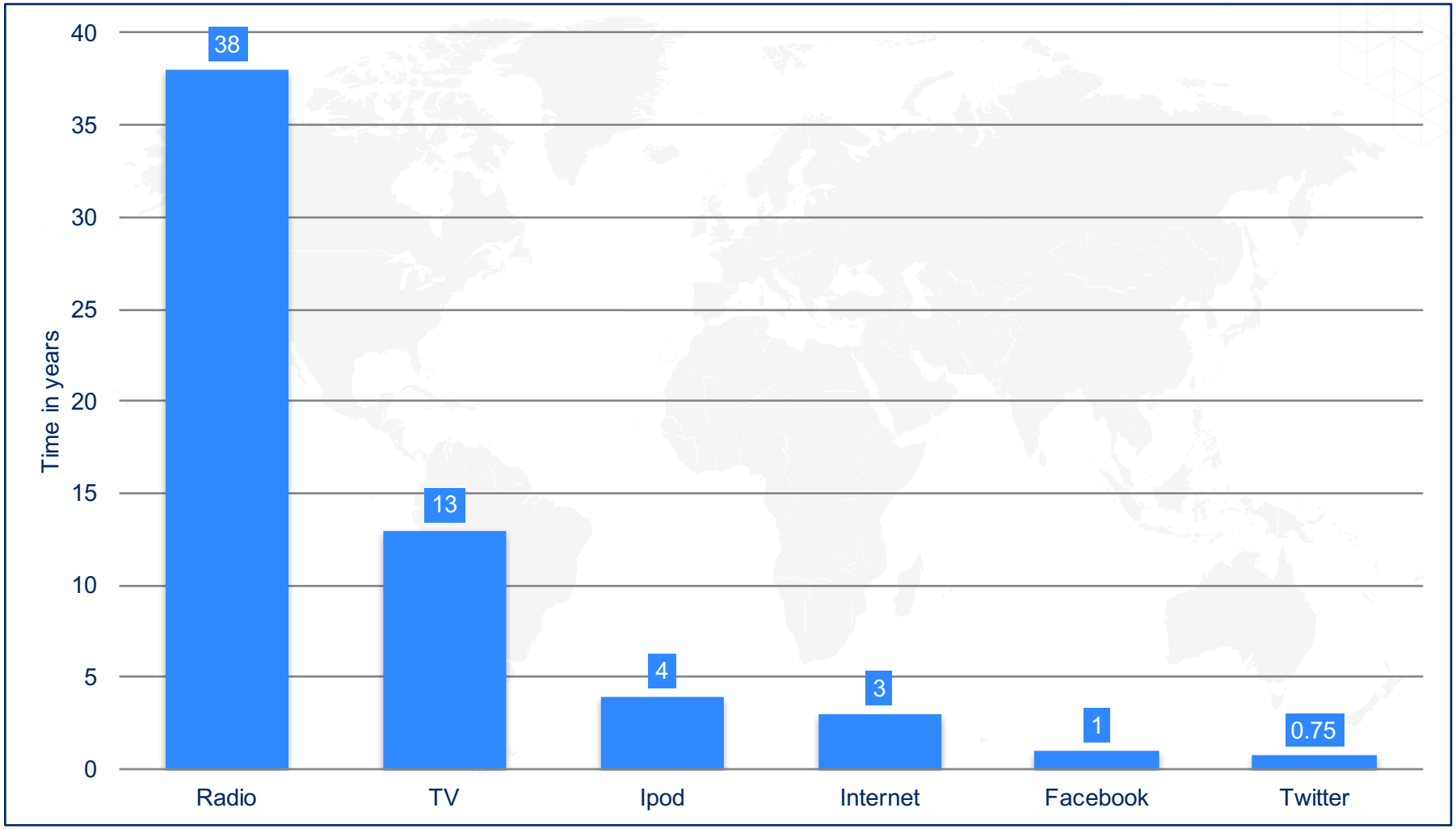
Visual 65: Time to reach 50M users has dramatically shortened



Sources: OECD Insights – Economic Globalisation: Origins and Consequences; McKinsey, No Ordinary Disruption; The Zero Marginal Cost Society (Jeremy Rifkin, 2014); Rise of the Robots (Martin Ford, 2015)

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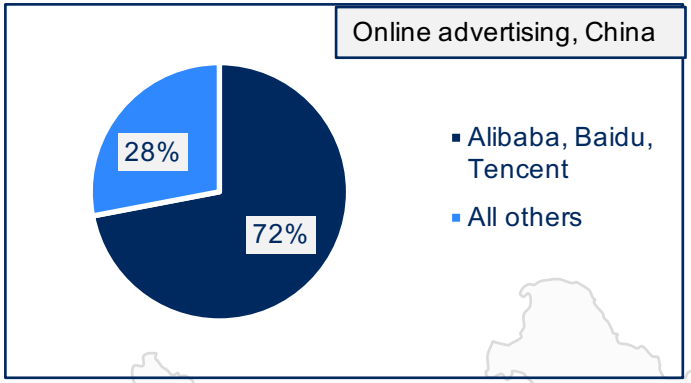
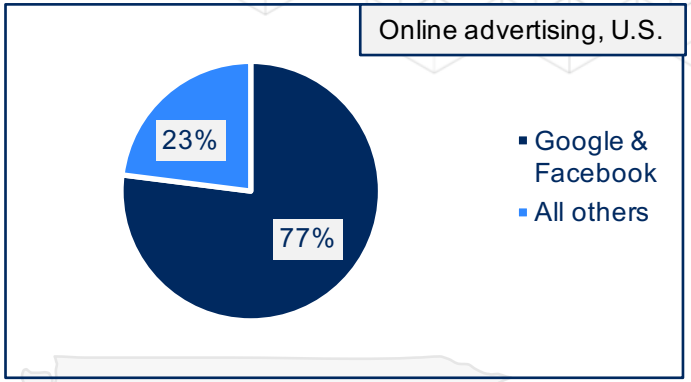
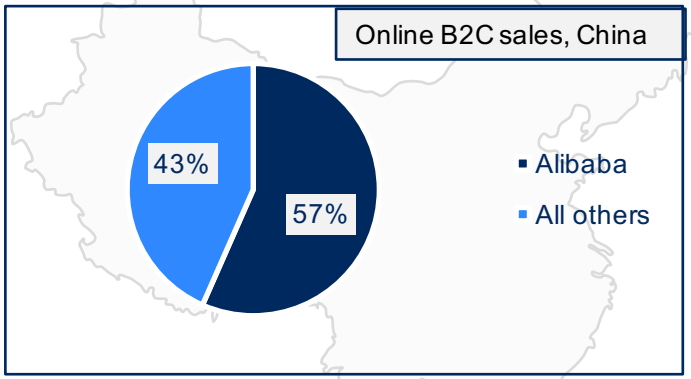
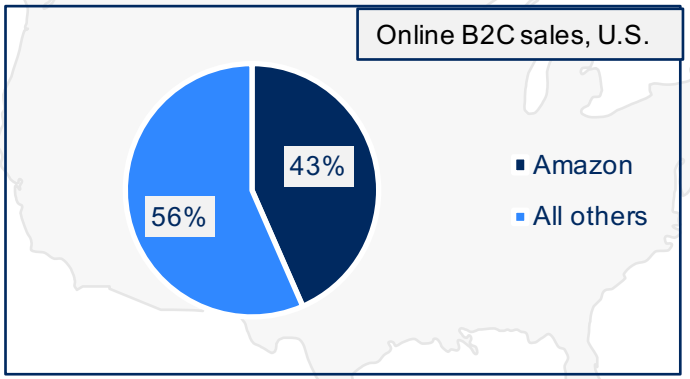
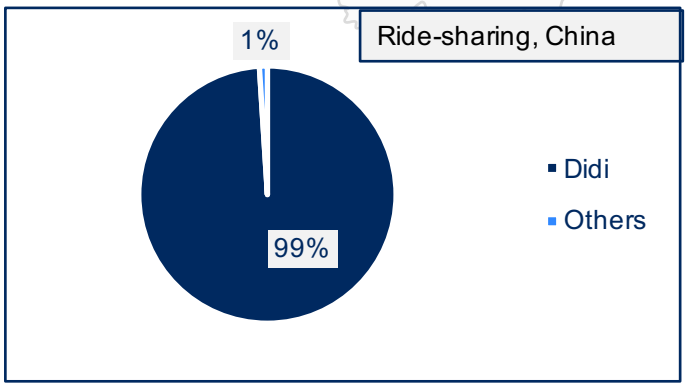
Visual 66: 'Winner takes all' models increasingly influence markets

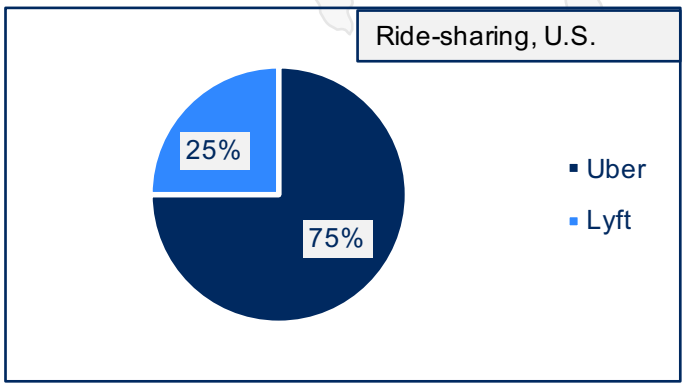












Sources: Statista, Business Insider, South China Morning Post

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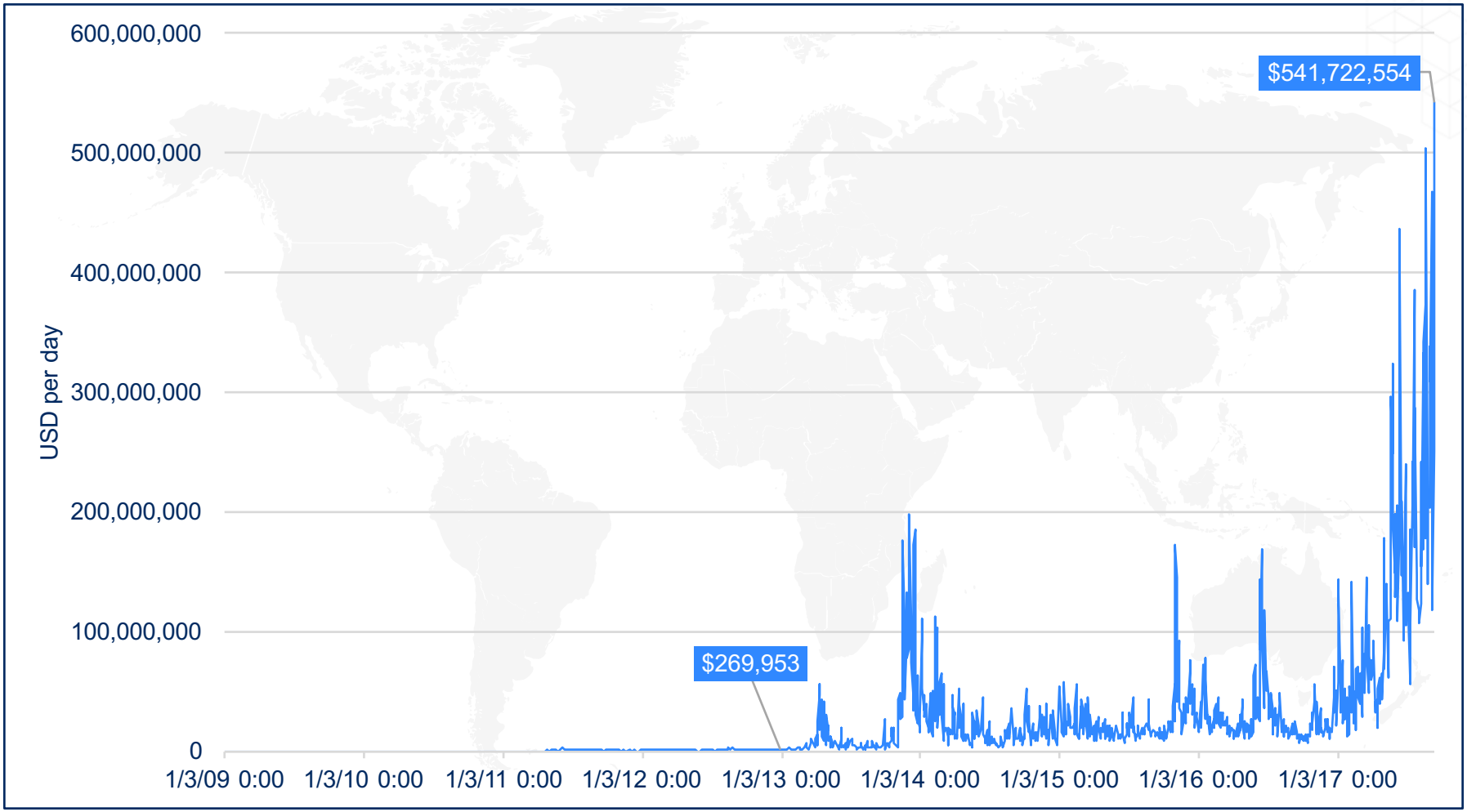
Visual 67: Cryptocurrencies are becoming accepted payments

Total value in USD of trading volume on major bitcoin exchanges, per day



Sources: www.blockchain.info

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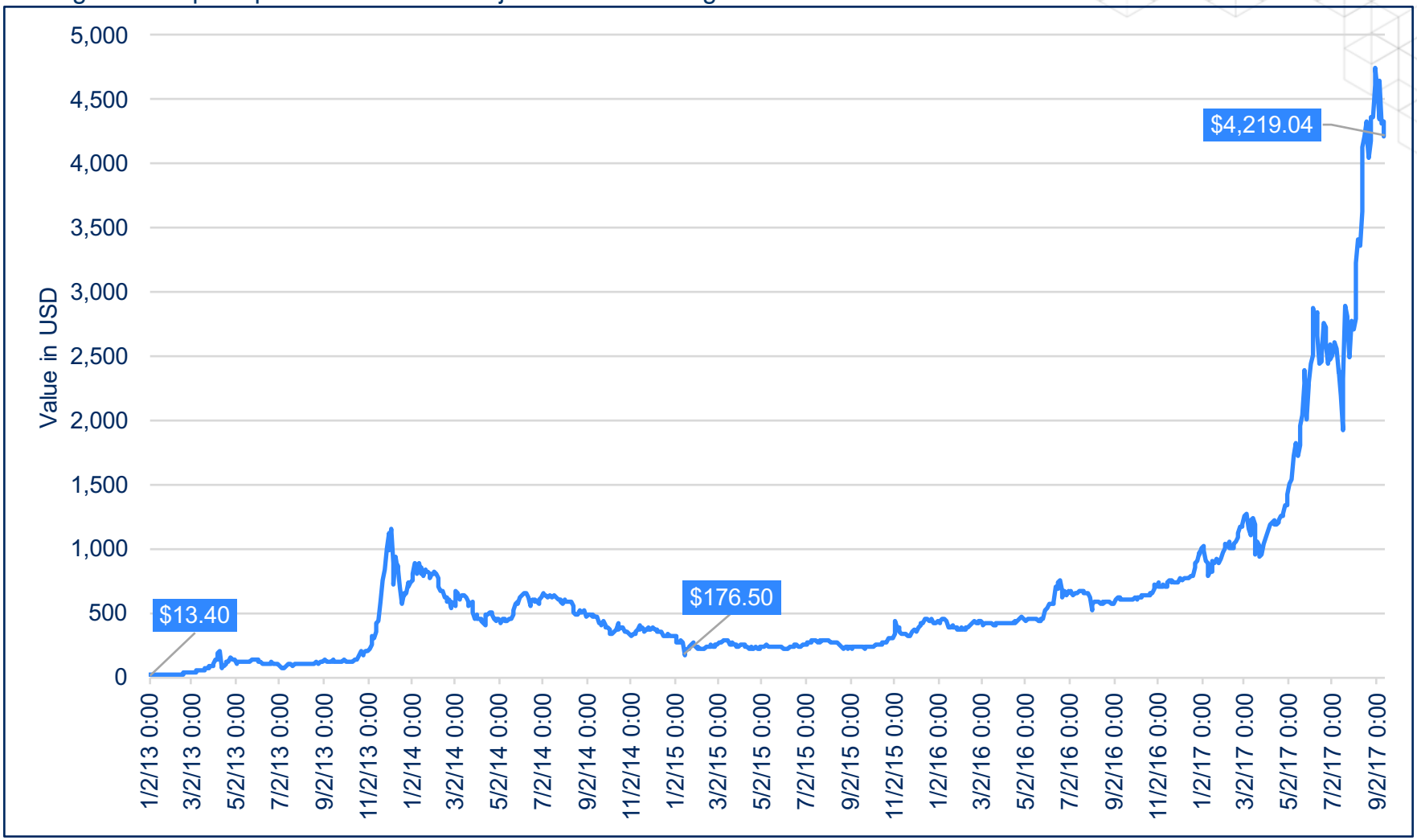
Visual 68: The value of cryptocurrency coins has yet to stabilize

Average market price per bitcoin across major bitcoin exchanges



Sources: www.blockchain.info

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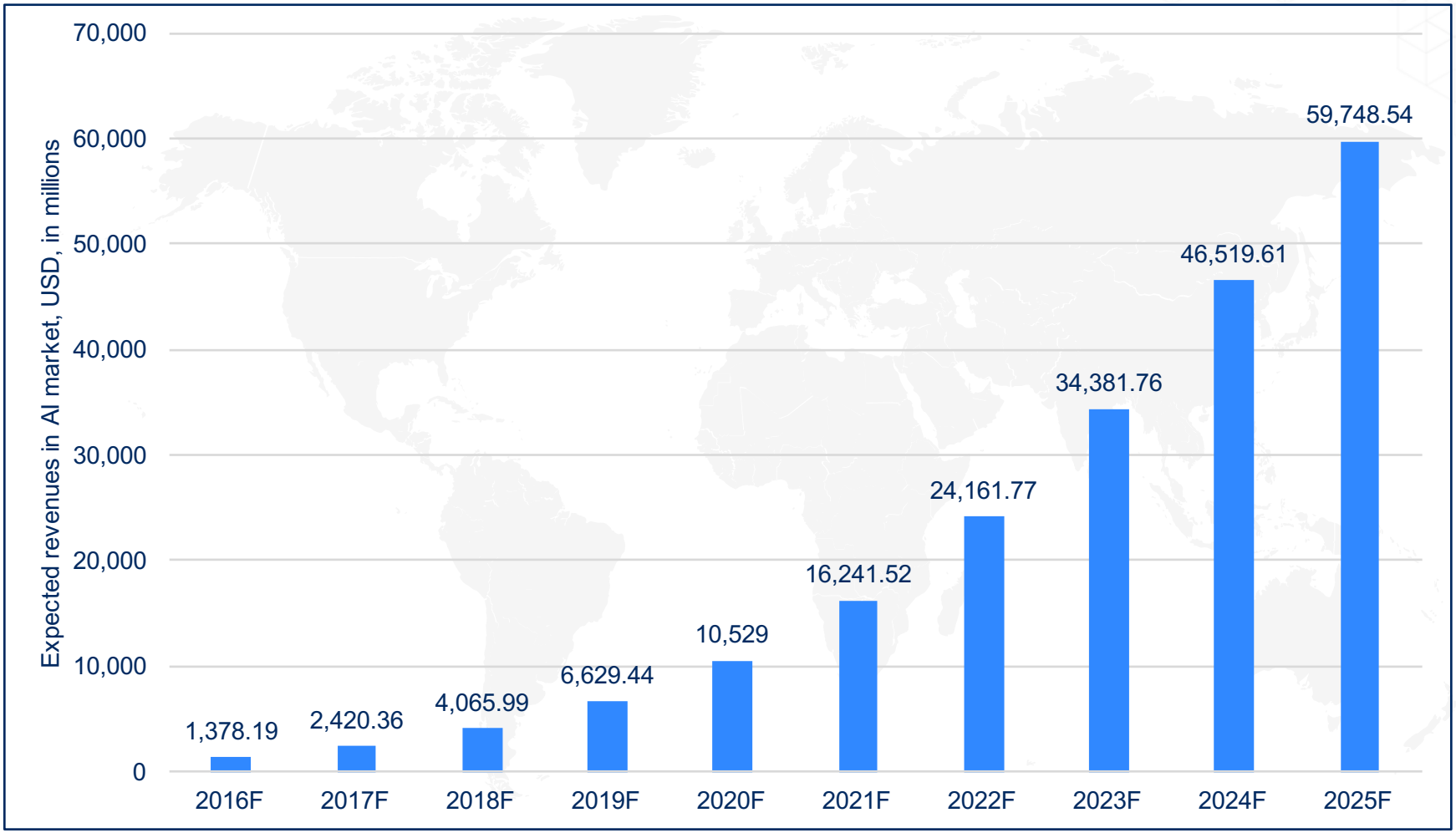
Visual 69: Artificial intelligence represents major business opportunity



Sources: forecast by Tractica, Statista

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Visual 70: AI will grow to outsmart humans on every dimension

	Human level intelligence...	...computing power today...	...and expected winner**
Speed of computing elements	Biological neurons operate at a peak speed of only **~200Hz**; but is compensated by massive **parallelization** and energy efficiency of operations.	Today's processors operate at over ~3GHz, already **seven orders of magnitude larger**. Parallel 'neural network' computation is on the rise.	
Speed of communication	Biological axons can achieve speeds of **120m/sec** through pathways in the human body.	Computers can theoretically send signals through photons – reaching the speed of light: **300.000.000m/sec.**	
Number of computational elements	Humans brains are limited by cranial volume and have **~100 billion neurons**. But: humans **could theoretically be linked** to each other.	Computer hardware is **indefinitely scalable**. Supercomputers can be warehouse-sized, and **are already linked** to each other through internet.	
Storage capacity	Human beings can hold **no more than 4-5 chunks of information** in their working memory. Size of long term memory is estimated to be 10^15 bits*.	Computer **RAM can theoretically expand indefinitely**, as well as the long term storage capacity.	
Reliability	Biological neurons are **not very reliable** when tired. Brains decay after a few decades. Restoring brain tissue is notoriously hard, or even impossible.	Transistors are **more reliable than neurons**, can be replaced easily and reverse engineered with similar content as previous transistors when damaged.	

* Based on a study by Landauer (1986); assumption is ~1 bit per synapse in the brain. Note that the total storage capacity calculated is less than is currently stored on a smartphone.
** For the long term. Short-term, human brains are still superior to computers in at least some aspects.

Source: Superintelligence, Nick Bostrom (2014); Whole Brain Emulation, Bostrom and Sandberg (2008)

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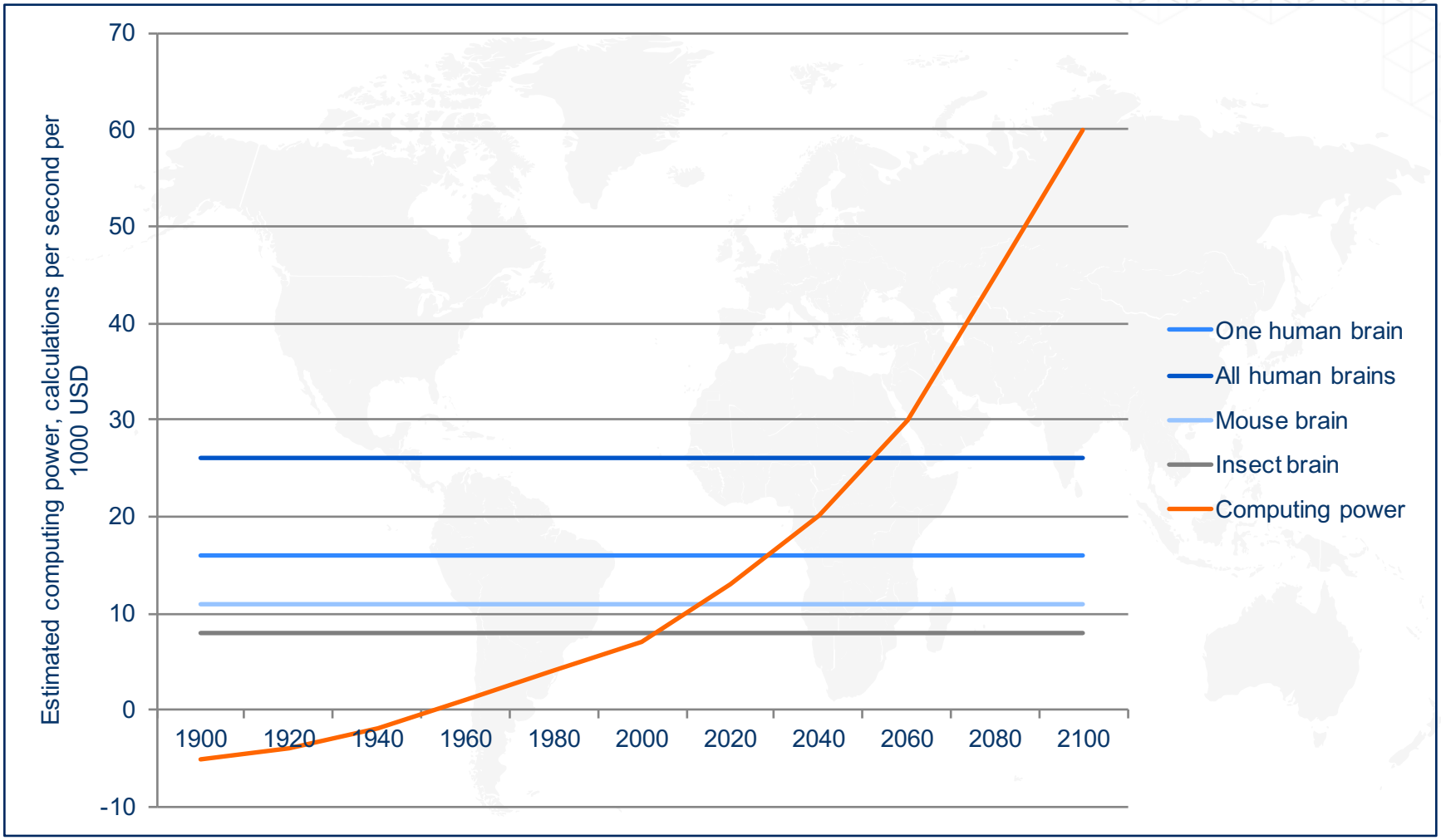
Visual 71: The 21st century may see the rise of 'superintelligence'



Source: Ray Kurzweill, www.kurzweilai.net, The Singularity is Near (2005)

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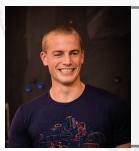
For more information



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