

XII Jornada del Programa Compartim

## Tecnologies exponencials i el seu impacte

**Xavier Ferràs, Universitat de Vic**

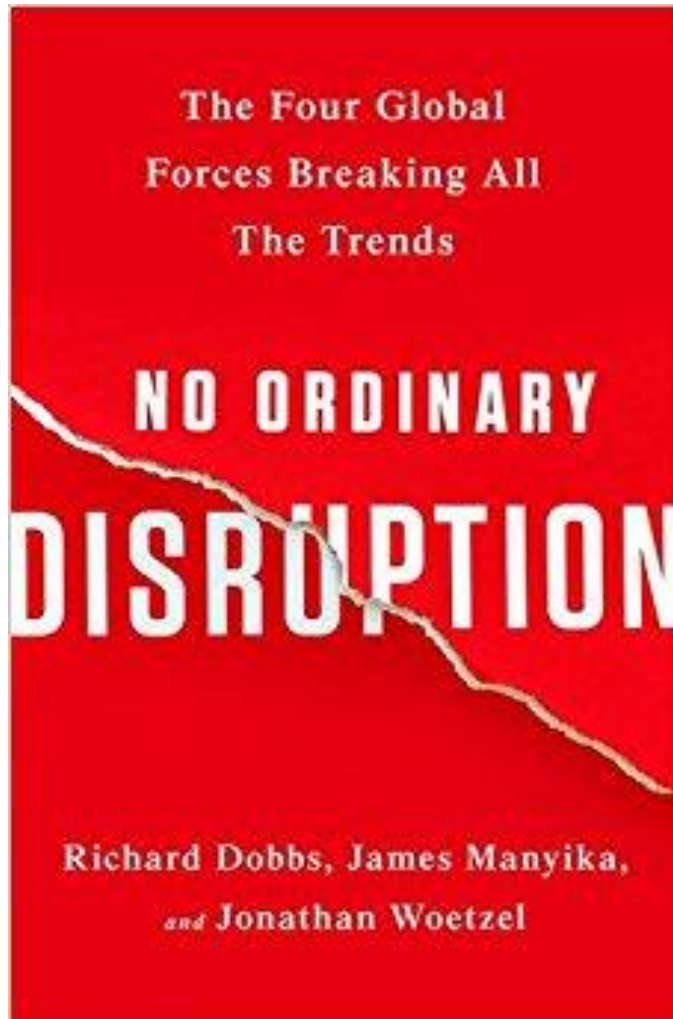
Barcelona, 29 de novembre de 2017



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“Compared with the Industrial Revolution, this change is happening **10 times faster, at 300 times the scale, or 3.000 times the impact**”

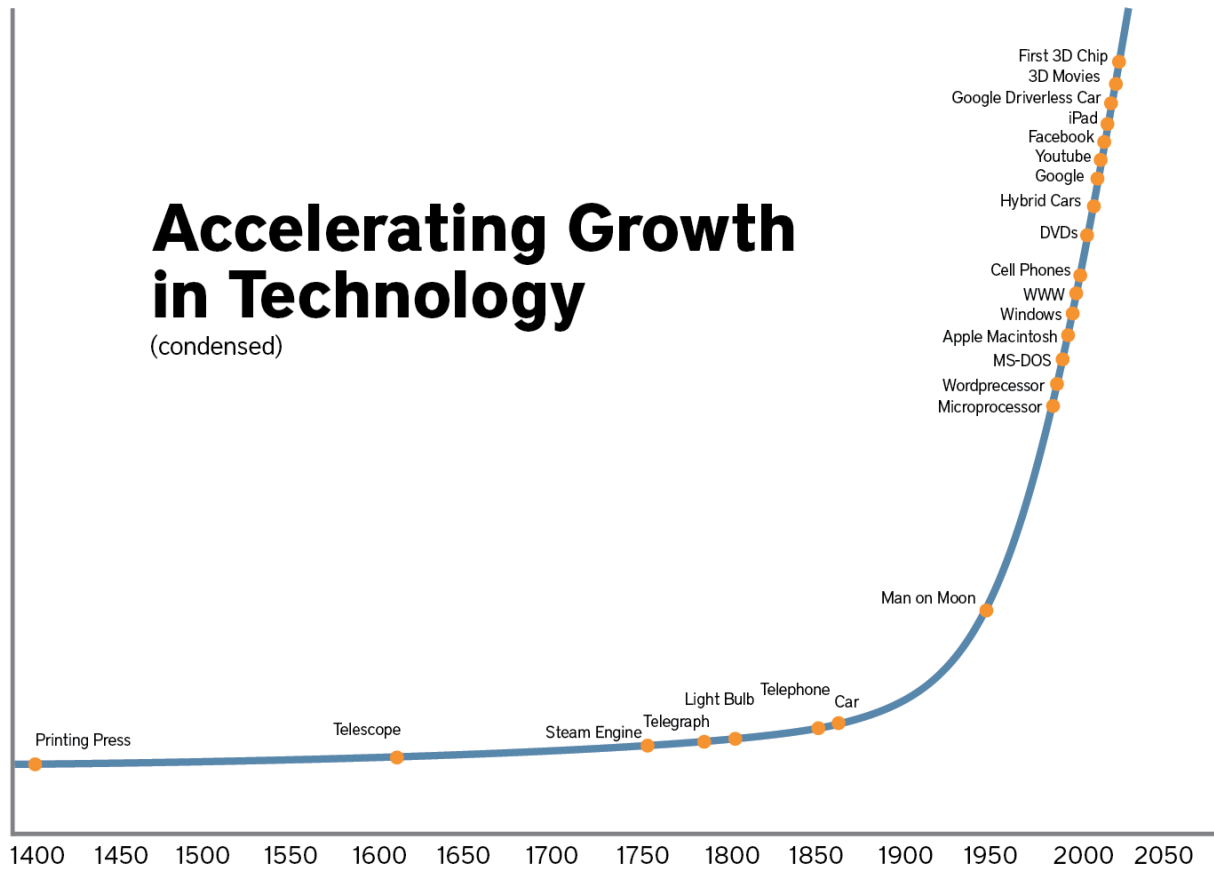
“**65 million people** is added annually to the global urban population”

“**12 disruptive technologies are arriving together**, reinforcing mutually, from advanced robotics to the internet of things, new materials or next-generation genomics”

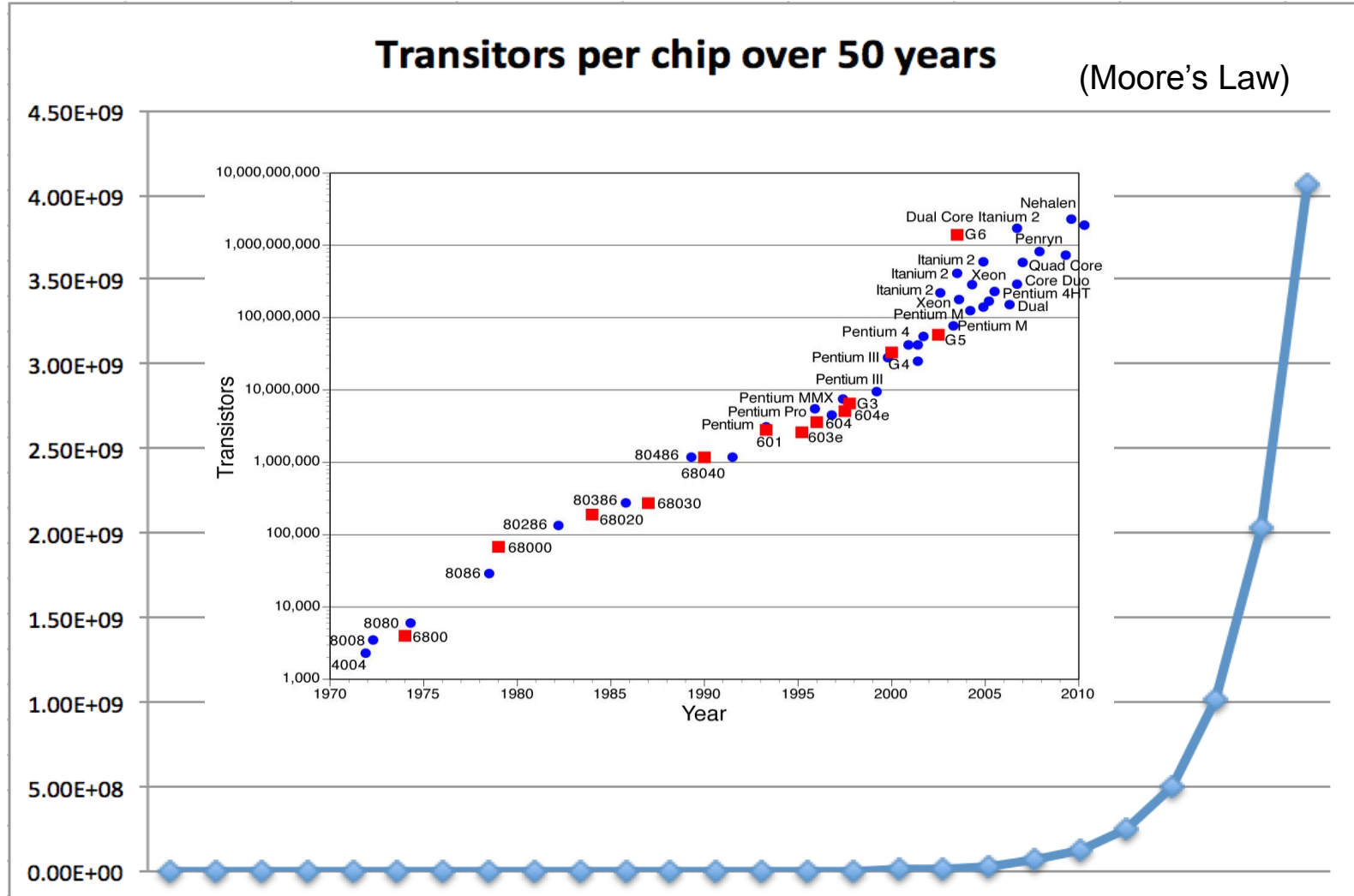
“In Germany, working population will fall from **54 million (2010) to 36 million (2050)**”

“Capital flows expanded 25 times between 1980 and 2007”

# Exponential technology development

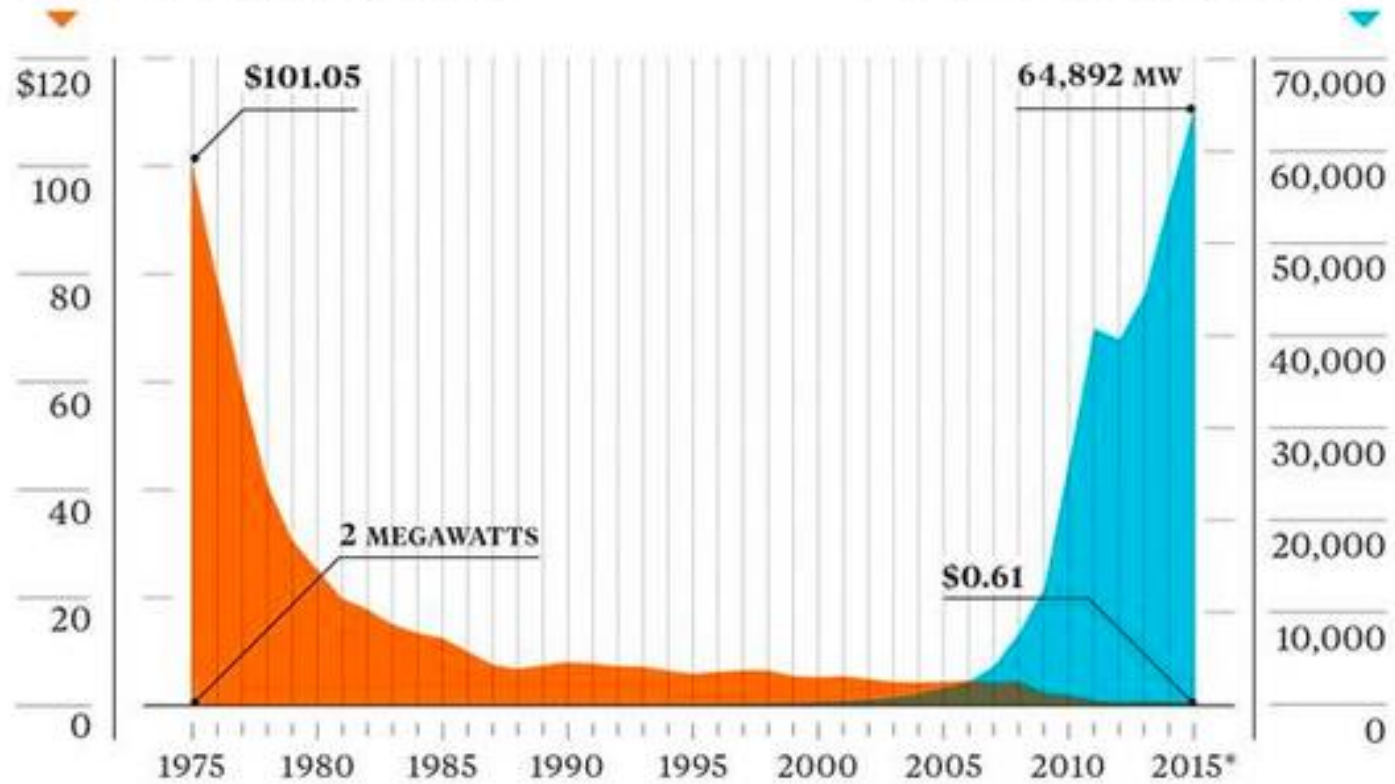


# The digital revolution: the propelling force



Price of a solar panel per watt

Global solar panel installations





**Bloomberg**

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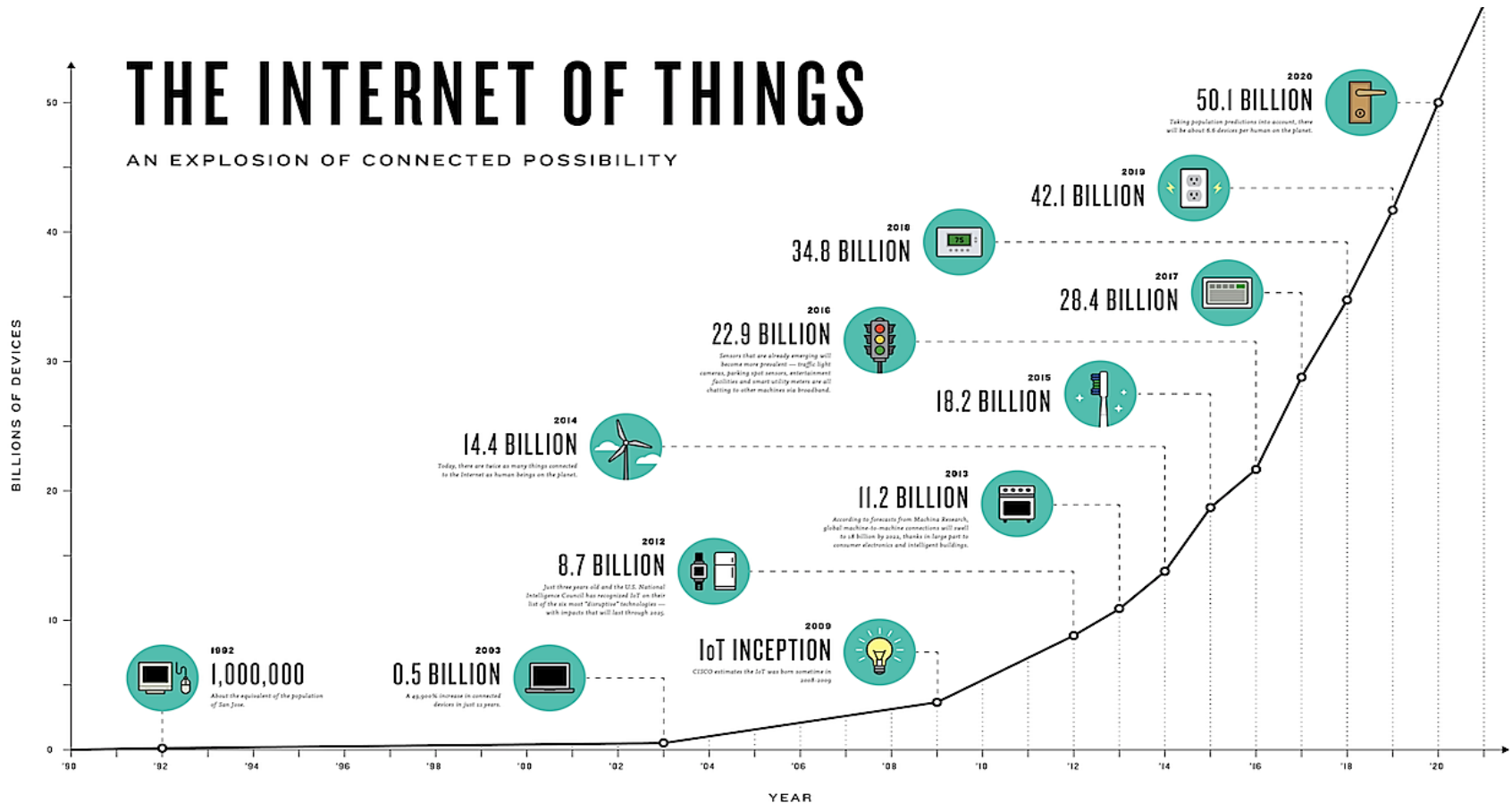
# Germany Just Got Almost All of Its Power From Renewable Energy

Photographer: Kristian Boel/Bloomberg

## Germany Just Smashed an Energy Record, Generating 85% Electricity From Renewables

Earth & Energy

## India Is Scraping a Major Coal Project in Favor of Renewables





# The four stages of the industrial revolution



Connected industry is to a large extent self-organizing. The lubricant of a smart factory is information, which tells the machinery how it should organize itself in order to complete a certain job.



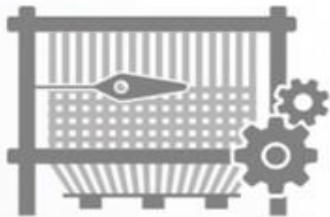
## Stage 1

Late 18th century

First mechanized manufacturing equipment powered by water and steam

1784

First mechanical loom



## Stage 2

Early 20th century

Introduction of mass production with the help of electrical power

1870

First assembly line (Slaughterhouse Cincinnati)



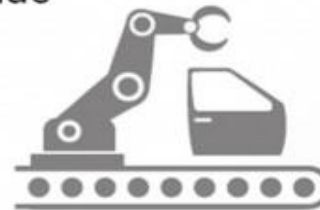
## Stage 3

Early 1970s

Use of electronics and computers to automate manufacturing worldwide

1969

Use of electronics and computers to automate manufacturing world-wide



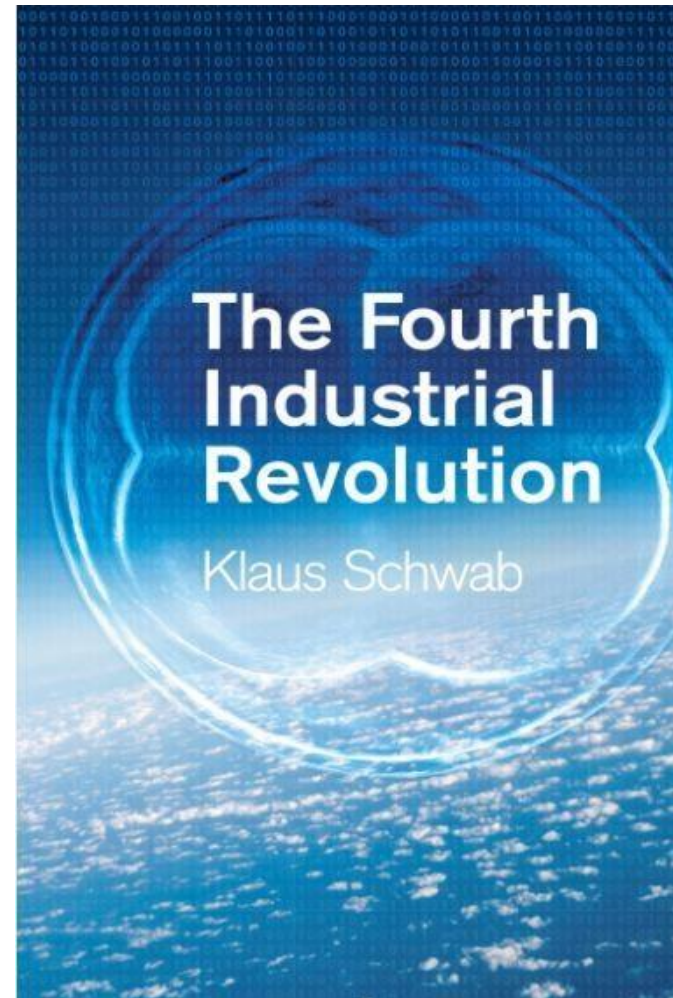
## Stage 4

**“Cyber-physical systems”:**  
real objects and virtual processes are interlinked

**Connected industry – smart factories**



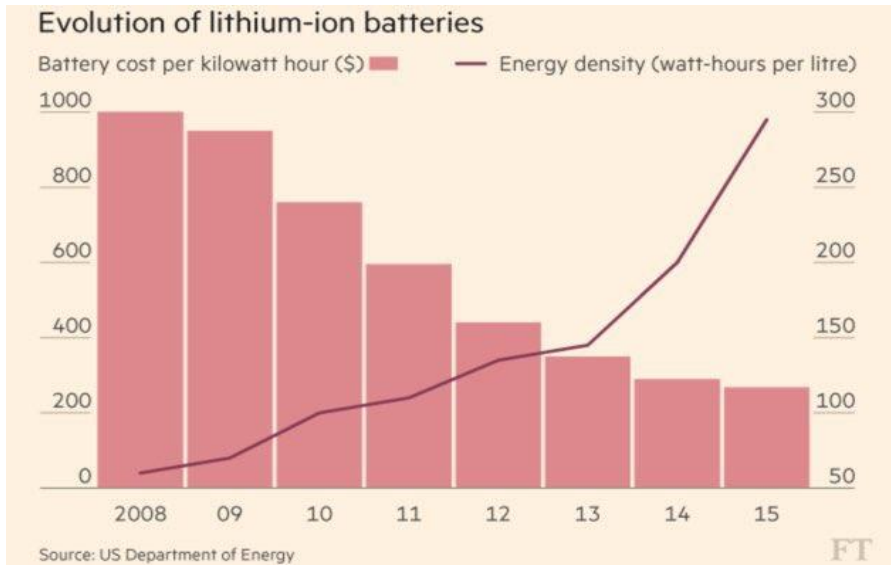
Source: DFKI 2011, Bosch



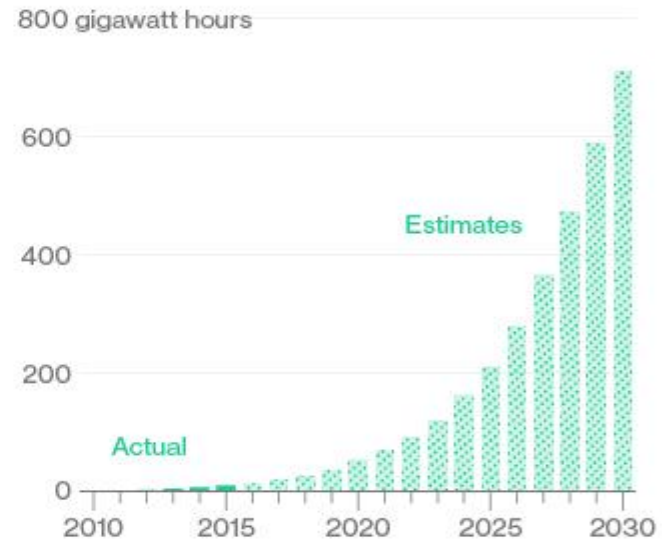
# It's All About the Batteries

Batteries make up a third of the cost of an electric vehicle.  
As battery costs continue to fall, demand for EVs will rise.

Cost for lithium-ion battery packs



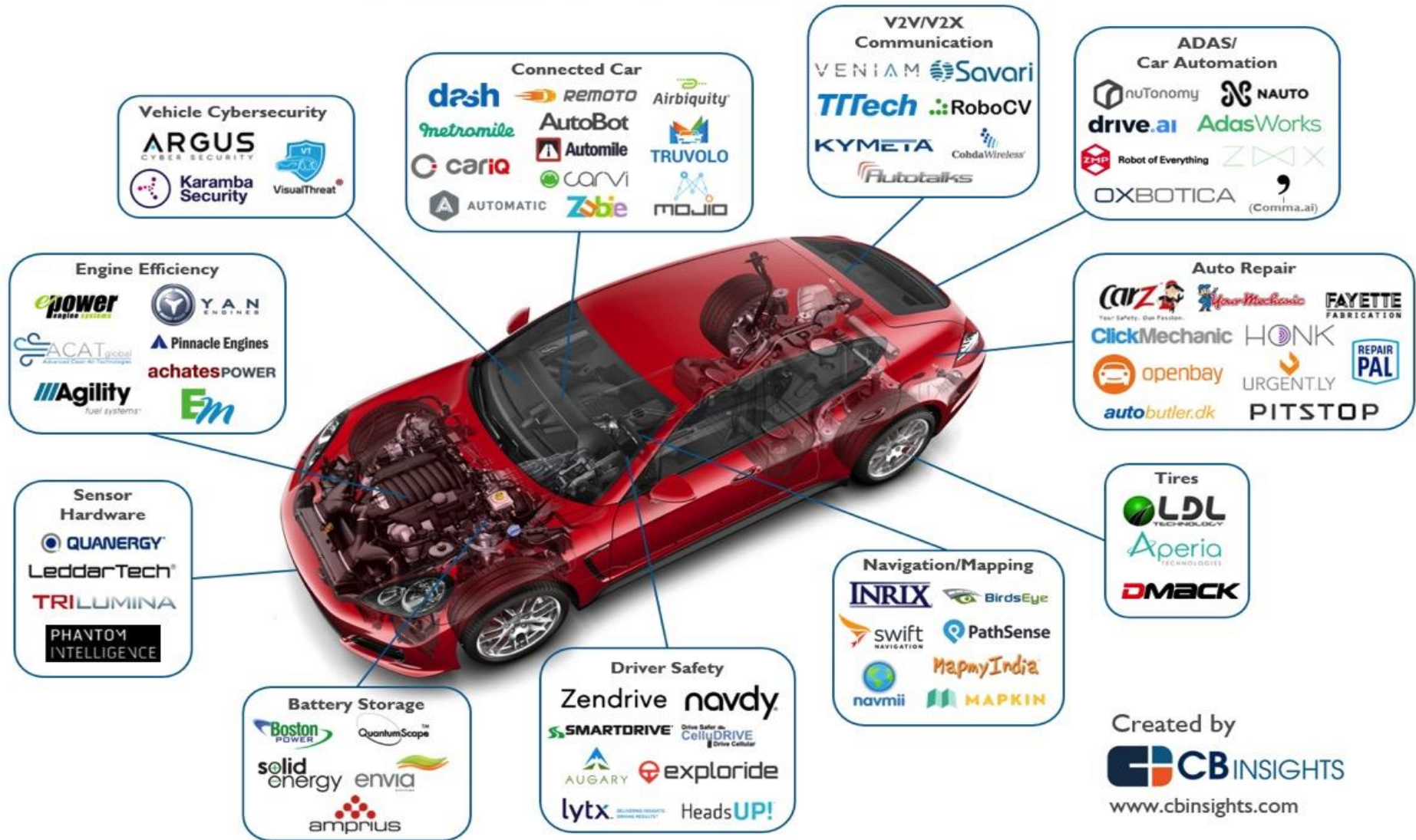
Yearly demand for EV battery power



Source: Data compiled by Bloomberg New Energy Finance



# Unbundling The Automobile

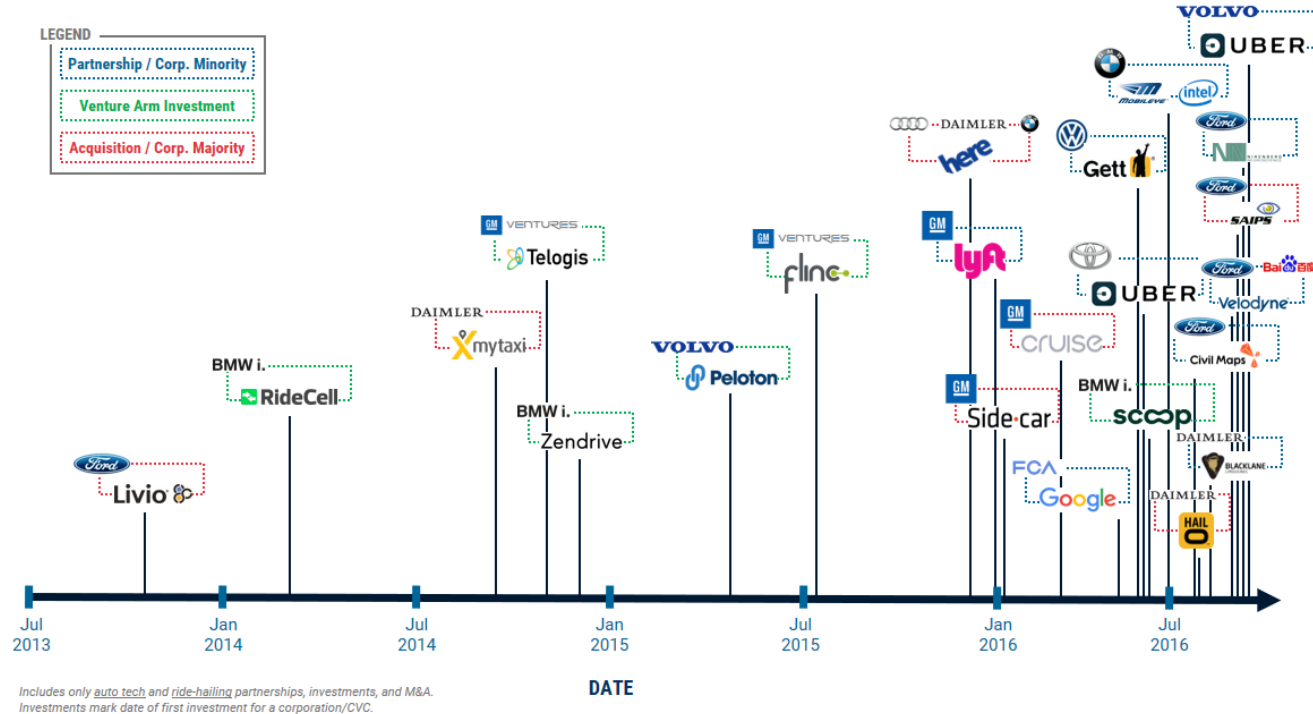


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## BIG AUTO'S MOVES IN AUTO TECH AND RIDE-HAILING

MAJOR TECH PARTNERSHIPS, INVESTMENTS, & ACQUISITIONS



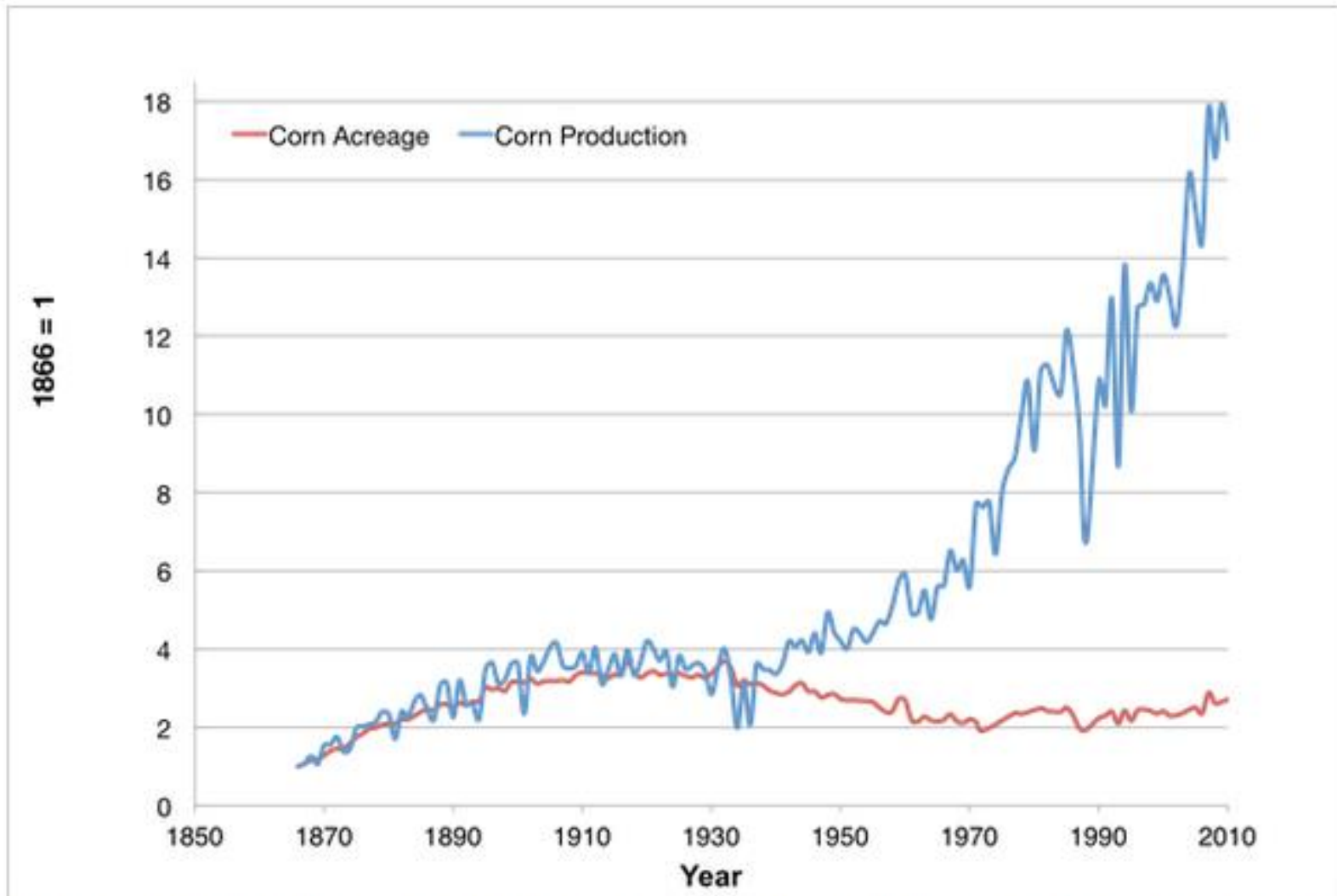
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[www.cbinsights.com](http://www.cbinsights.com)

### First Self-Driving Cars Debut in Singapore

The city-state's collaboration with a U.S. startup is ahead of initiatives by Uber and other companies.

# Uber Debuts Self-Driving Cars in Pittsburgh



**Figure 1:** Decoupling of US corn production from area farmed. Data source: US Census Bureau (1975, 2012).



# *A Lab-Grown Burger Gets a Taste Test*

By HENRY FOUNTAIN AUG. 5, 2013



Mark Post, a Dutch researcher at the University of Maastricht, held a sample of in-vitro, or cultured meat. The project



1 MINUTE READ

# The \$325,000 Lab-Grown Hamburger Now Costs Less Than \$12

A real burger made without the cruelty and pollution is now within reach.







# Bill Gates and Richard Branson Back Startup That Grows 'Clean Meat'

By **Shruti Singh**

23 de agosto de 2017 18:01 CEST *Updated on* 24 de agosto de 2017 6:00 CEST

- 
- Memphis Meats produces beef, chicken from animal cells
  - Branson sees all meat 'clean' or plant-based in 30 years
-

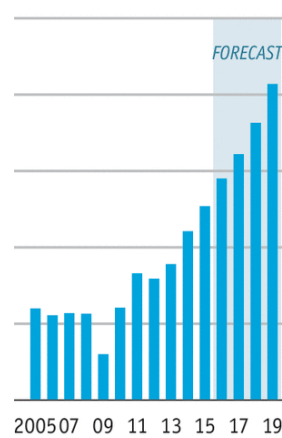


## The life robotic

Global industrial robots

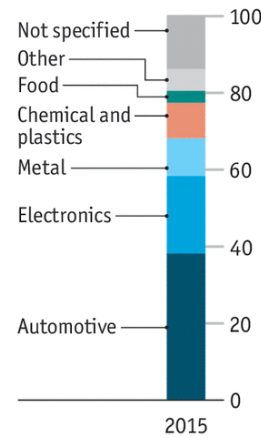
### Sales

'000 units



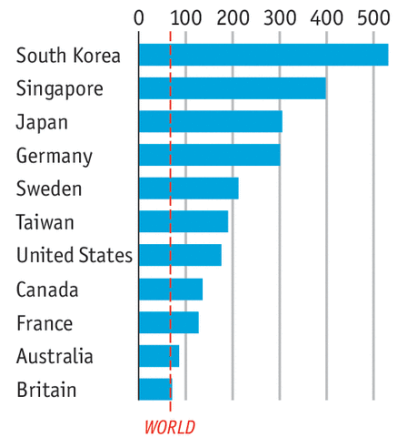
### By industry

% of total



### Number of robots

Per 10,000 manufacturing employees, 2015



## Artificial Intelligence: The Next Big Thing





# Feature: MIT Techr <sup>soul</sup> machines

*In the news today on MIT Technology Review:*

**"Customer Service Chatbots Are About to Become Frighteningly Realistic"**

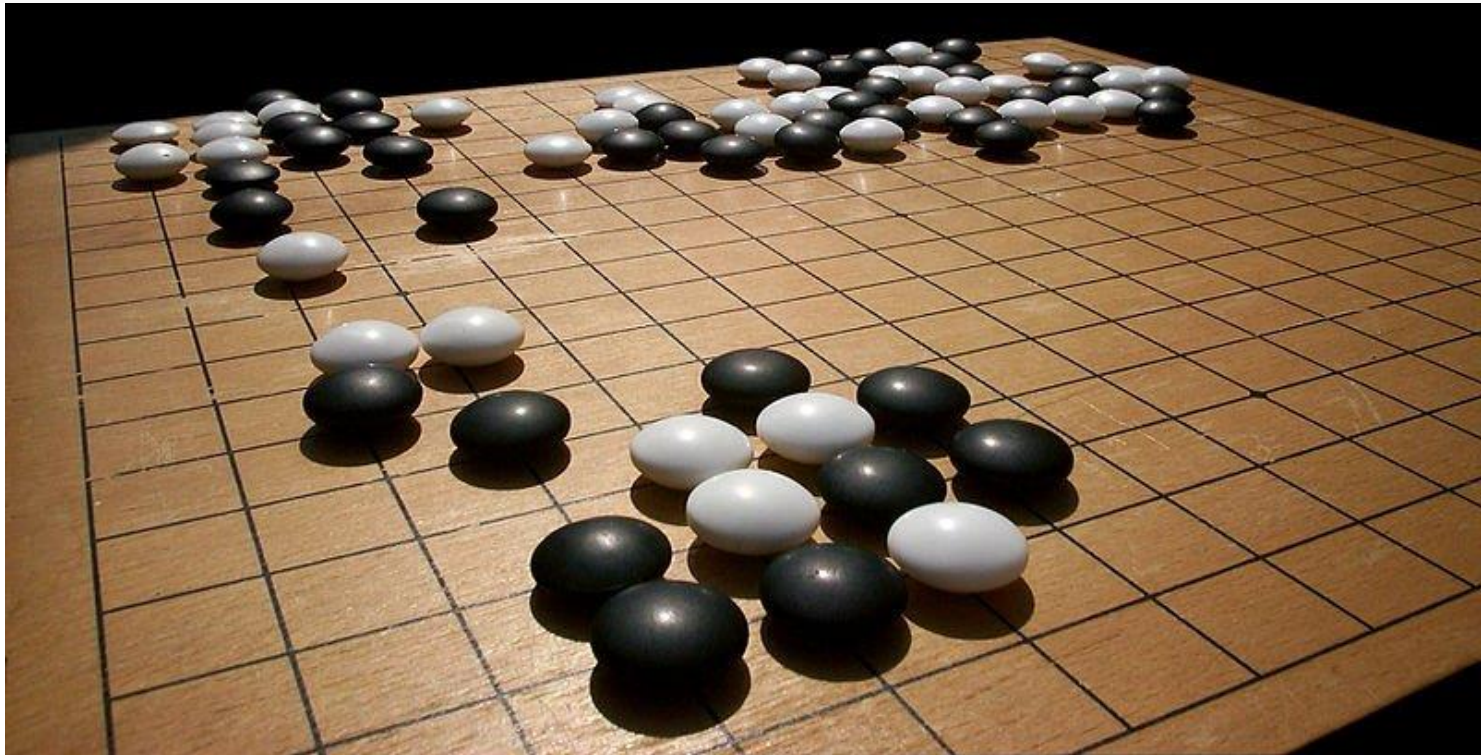
By: Tom Simonite // March 22, 2017





# Google AI beats Go world champion again to complete historic 4-1 series victory

Posted Mar 15, 2016 by [Jon Russell \(@jonrussell\)](#)





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Intelligent Machines

# Deep-Learning Machine Listens to Bach, Then Writes Its Own Music in the Same Style

Can you tell the difference between music composed by Bach and by a neural network?

by Emerging Technology from the arXiv    December 14, 2016

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**Johann Sebastian Bach is widely considered one of the great composers** of baroque music. Bach lived and worked in Germany during the 18th century and is revered for the beauty of his compositions and his

NEWS

# AI just 3D printed a brand-new Rembrandt, and it's shockingly good

The Next Rembrandt project used data and deep learning to produce uncanny results



---

*there is no one else in the world.  
there is no one else in sight.  
they were the only ones who mattered.  
they were the only ones left.  
he had to be with me.  
she had to be with him.  
i had to do this.  
i wanted to kill him.  
i started to cry.  
i turned to him.*

*this was the only way.  
it was the only way.  
it was her turn to blink.  
it was hard to tell.  
it was time to move on.  
he had to do it again.  
they all looked at each other.  
they all turned to look back.  
they both turned to face him.  
they both turned and walked away.*

*i dont like it , he said.  
i waited for what had happened.  
it was almost thirty years ago.  
it was over thirty years ago.  
that was six years ago.  
he had died two years ago.  
ten , thirty years ago.  
“ it 's all right here.*

---



# Apple joins research group for ethical AI with fellow tech giants

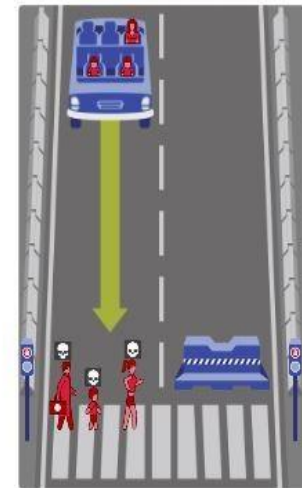
by James Vincent | @jjvincent | Jan 27, 2017, 7:02am EST



What should the self-driving car do?



Show Description

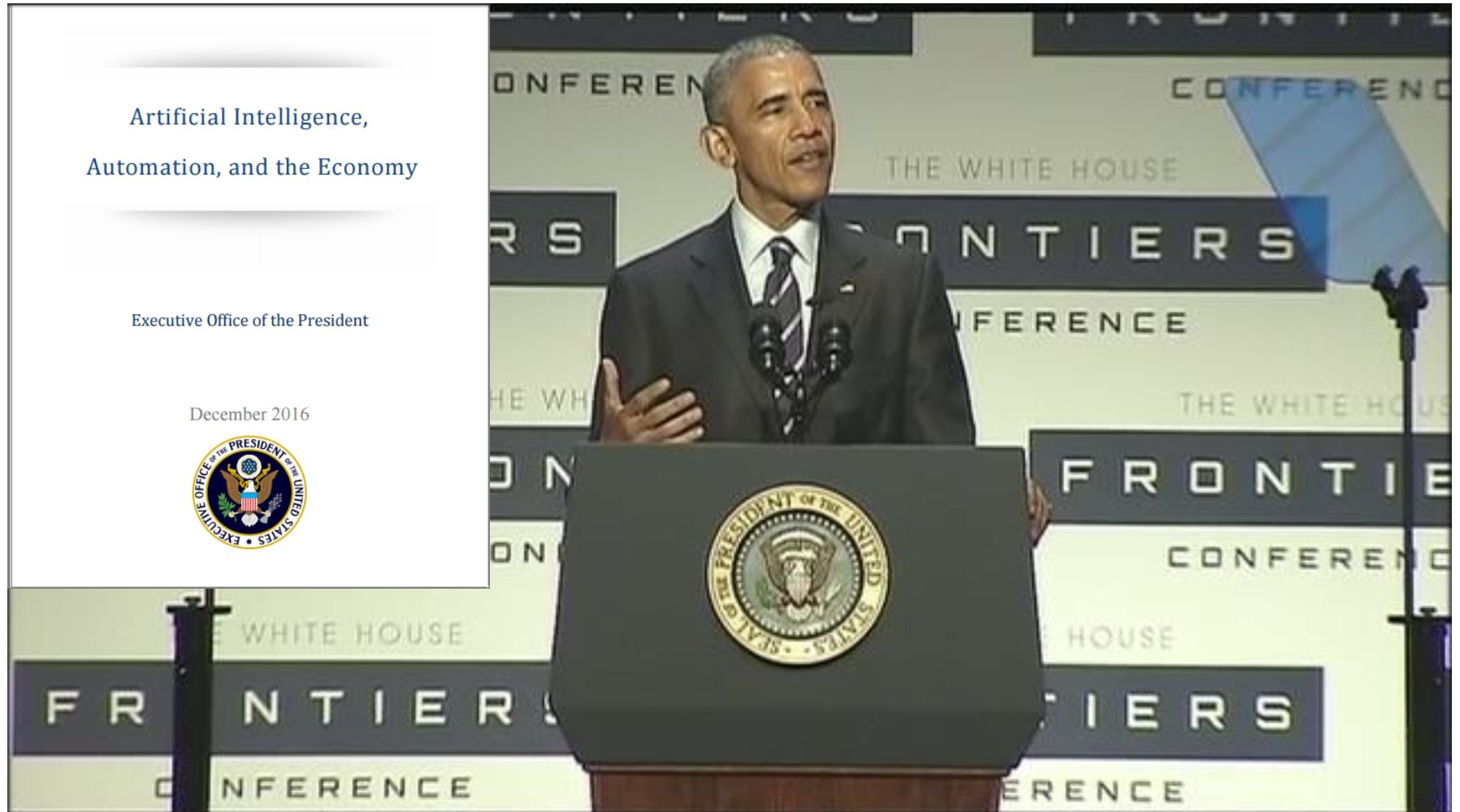


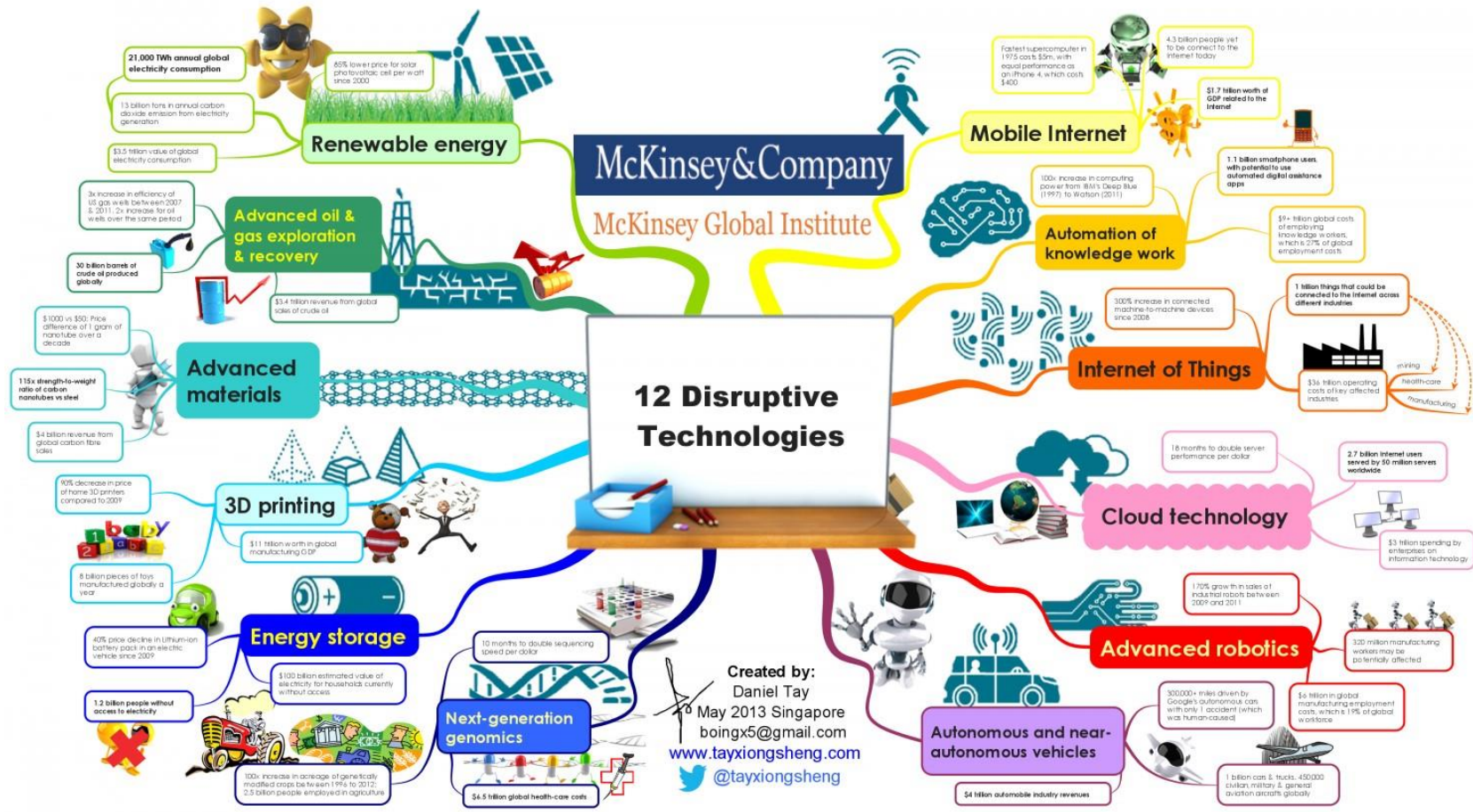
Show Description

Artificial Intelligence,  
Automation, and the Economy

Executive Office of the President

December 2016





Created by:  
Daniel Tay  
May 2013 Singapore  
boingx5@gmail.com  
www.tayxiangsheng.com  
@tayxiangsheng

The source of information in this Mind Map comes from [http://www.mckinsey.com/insights/business\\_technology/disruptive\\_technologies](http://www.mckinsey.com/insights/business_technology/disruptive_technologies)



In 100 years:

Average human lifespan  
x2

Average per capita  
incoming x3

Childhood mortality /10

Cost of food /10

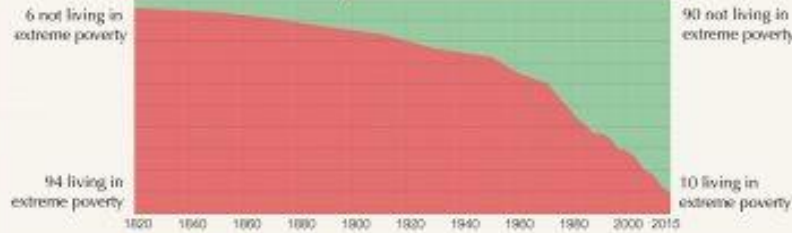
Cost of electricity /100

Cost of communications  
/1000

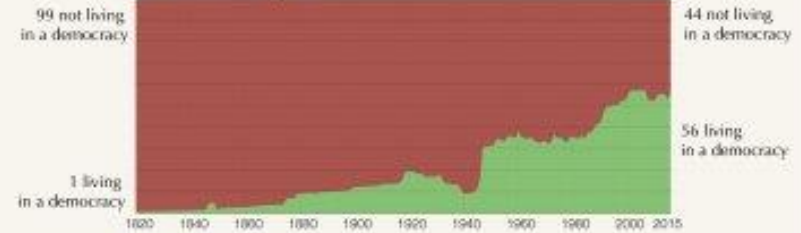
# The World as 100 People over the last two centuries

Our World  
 in Data

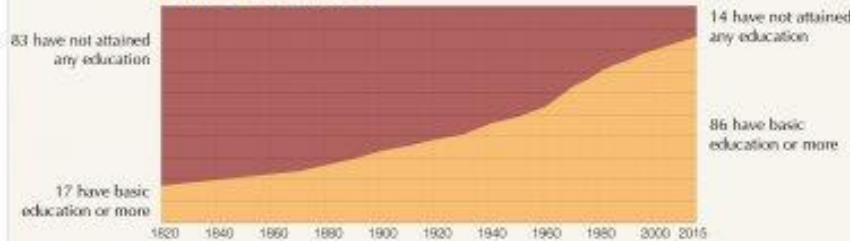
## Extreme Poverty



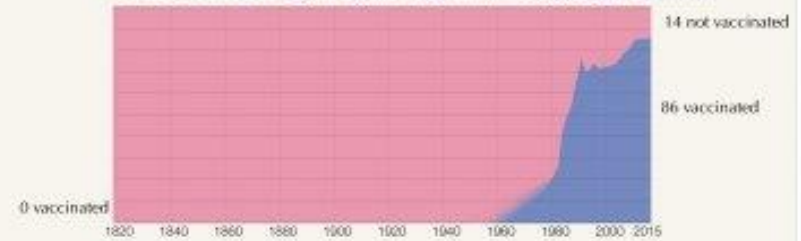
## Democracy



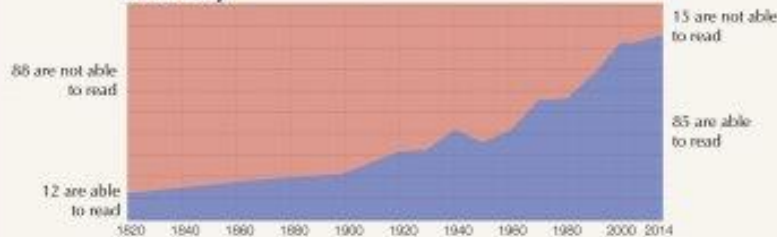
## Basic Education



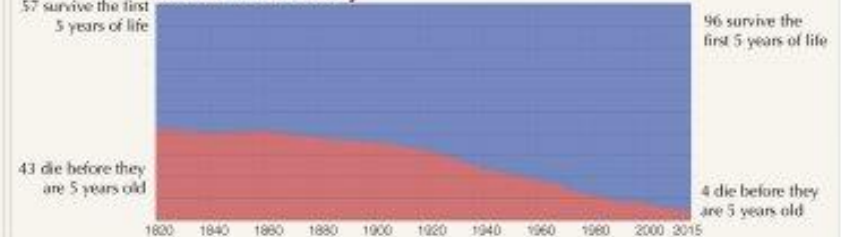
## Vaccination against diphtheria, pertussis (whooping cough), and tetanus



## Literacy



## Child Mortality



Data sources:  
 Extreme Poverty: Bourguignon & Morrison (2002) up to 1970 – World Bank 1981 and later (2015 is a projection).  
 Vaccination: WHO (Global data are available for 1980 to 2015 – the DPT3 vaccination was launched in 1999).  
 Education: OECD for the period 1820 to 1940, IASA for the time thereafter.  
 Literacy: OECD for the period 1820 to 1990, UNESCO for 2004 and later.

Democracy: Polity IV Index (own calculation of global population share)  
 Colonization: Winzler and Nix (own calculation of global population share)  
 Coauthors: HYDE database  
 Child mortality: up to 1960 own calculations based on Gapminder, World Bank thereafter



All these visualizations are from OurWorldInData.org an online publication that presents the empirical evidence on how the world is changing.

Licensed under CC-BY-SA by the author Max Roser.



# The Economist

OCTOBER 4TH-10TH 2008

www.economist.com

**Our guide to America's election**

Europe's Schadenfreude

Music on your phone

Reassessing China

Somalia's pirates

## World on the edge



Albania..... \$2.00 Austria..... \$9.00 Brazil..... \$5.00 Canada..... \$5.00 Chile..... \$5.00  
 China..... \$5.00 Colombia..... \$5.00 Costa Rica..... \$5.00 Czech Rep..... \$5.00 Denmark..... \$5.00  
 France..... \$5.00 Germany..... \$5.00 Greece..... \$5.00 Hong Kong..... \$5.00 India..... \$5.00  
 Italy..... \$5.00 Japan..... \$5.00 Korea..... \$5.00 Mexico..... \$5.00 New Zealand..... \$5.00  
 Norway..... \$5.00 Pakistan..... \$5.00 Philippines..... \$5.00 Poland..... \$5.00 Portugal..... \$5.00  
 Singapore..... \$5.00 South Africa..... \$5.00 Spain..... \$5.00 Sweden..... \$5.00 Switzerland..... \$5.00  
 Taiwan..... \$5.00 Thailand..... \$5.00 Turkey..... \$5.00 UK..... \$5.00 USA..... \$5.00

OCTOBER 13, 2008

**How Sarah Palin Took On Big Oil—And (Sort of) Won**

**The Extreme TB Epidemic: Photos**  
By James Nachtwey

**Robert Redford Remembers**  
Paul Newman

# TIME

## The New Hard Times

**No, this isn't Depression 2.0. How history can help us avoid it**  
BY NIALL FERGUSON

**The Leadership Deficit**  
BY MICHAEL GRUNWALD

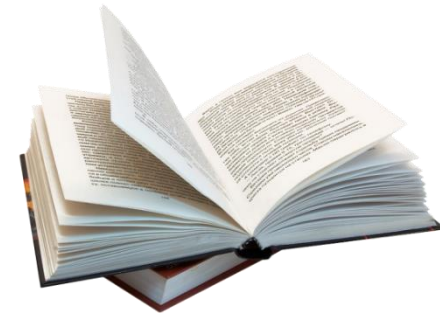
**The Virtues of Thrift**  
BY NANCY GIBBS

www.time.com

# Technology kills business models



**NOKIA**





And the winners are...

## VENTAJAS COMPETITIVAS DE LAS PLATAFORMAS DIGITALES:

- Scale economies
- Scope economies
- Zero-marginal cost
- User-customized response
- Data-driven decisions
- Huge investments in AI
- Global network
- Recognized brand



## Delivering

Amazon

Employees  
'000s

Market  
capitalisation, \$bn



Sources: Bloomberg; Thomson Reuters

1

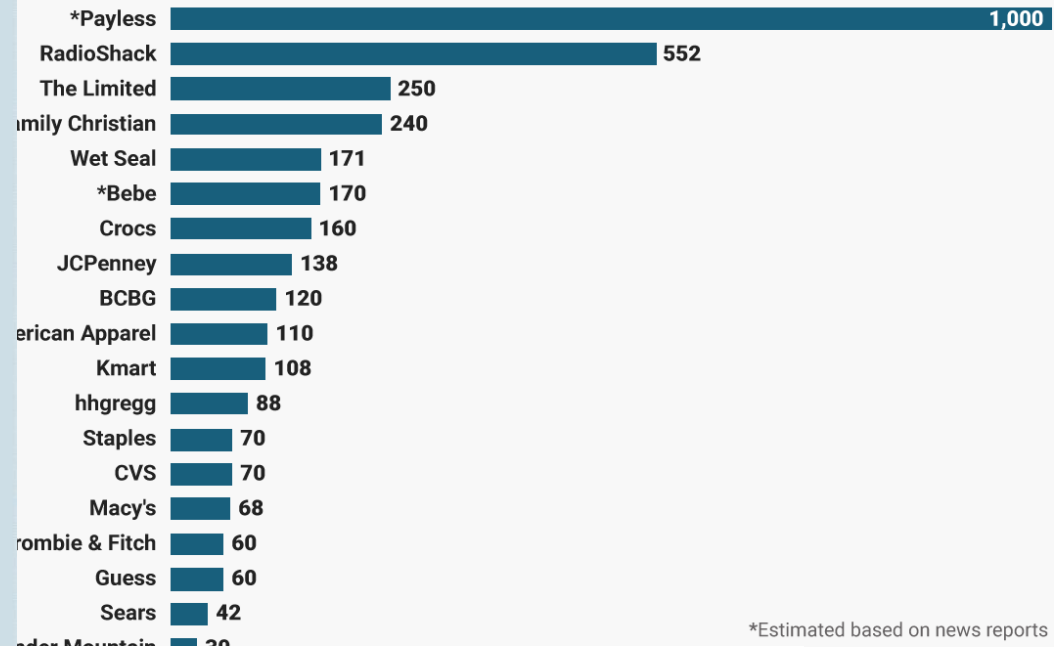
# The retail apocalypse is creating a 'slow-rolling crisis' that is rippling through the US economy



Hayley Peterson  
 Apr. 17, 2017, 7:50 PM 1,091

- FACEBOOK
- LINKEDIN
- TWITTER
- EMAIL
- PRINT

## NUMBER OF RETAIL STORES CLOSING IN EARLY 2017



\*Estimated based on news reports

FORTUNE | Finance

800 1,000

BUSINESS INSIDER

## Amazon and the Race to Be the First \$1 Trillion Company

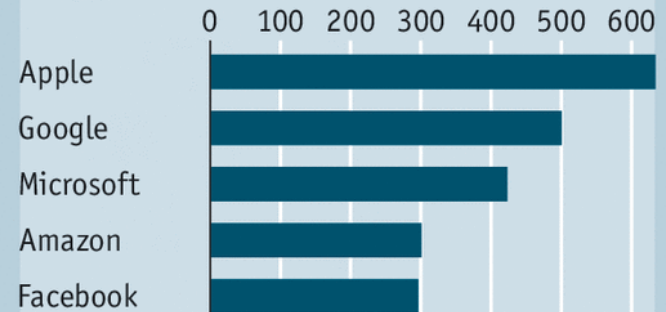
# A world of inequality?



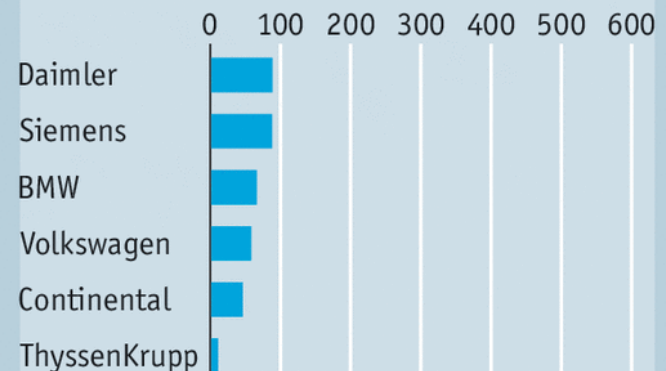
## Tech titans, manufacturing midgets 2

Company valuations\*, \$bn

### US technology firms



### German manufacturing firms

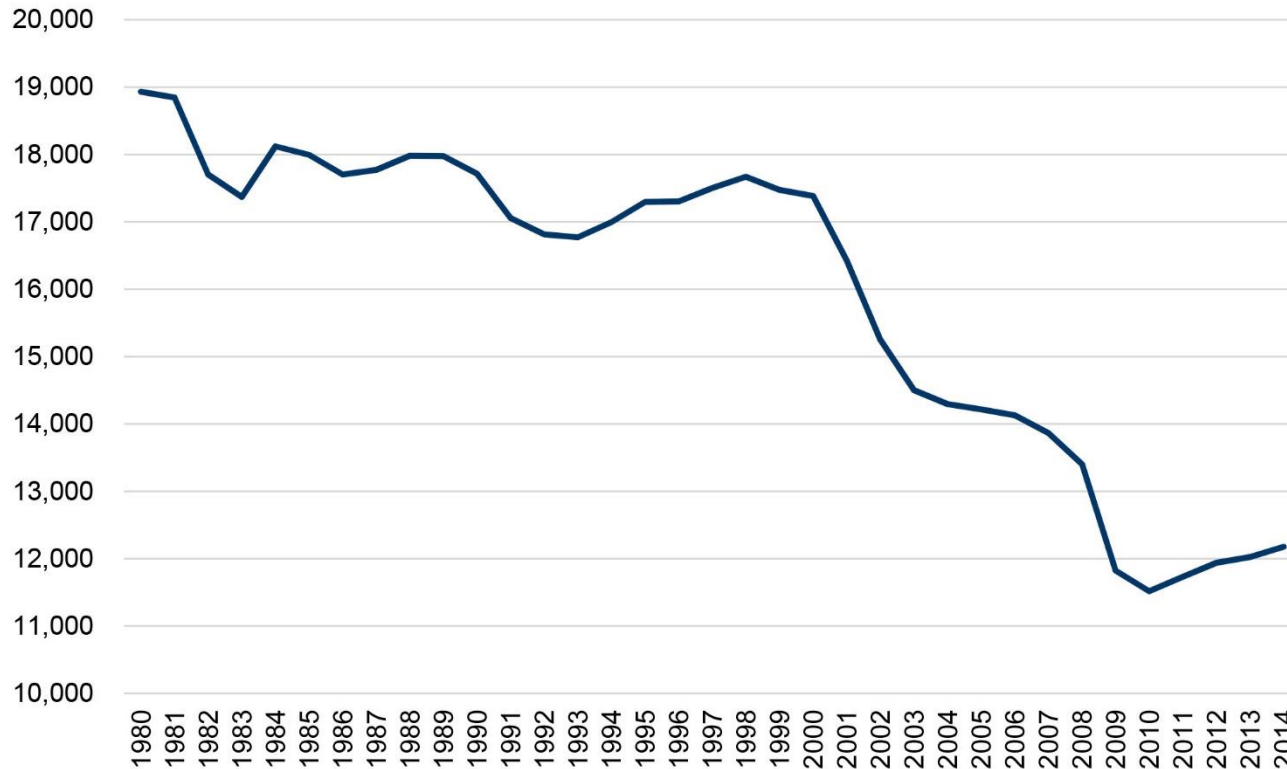


Source: Thomson Reuters

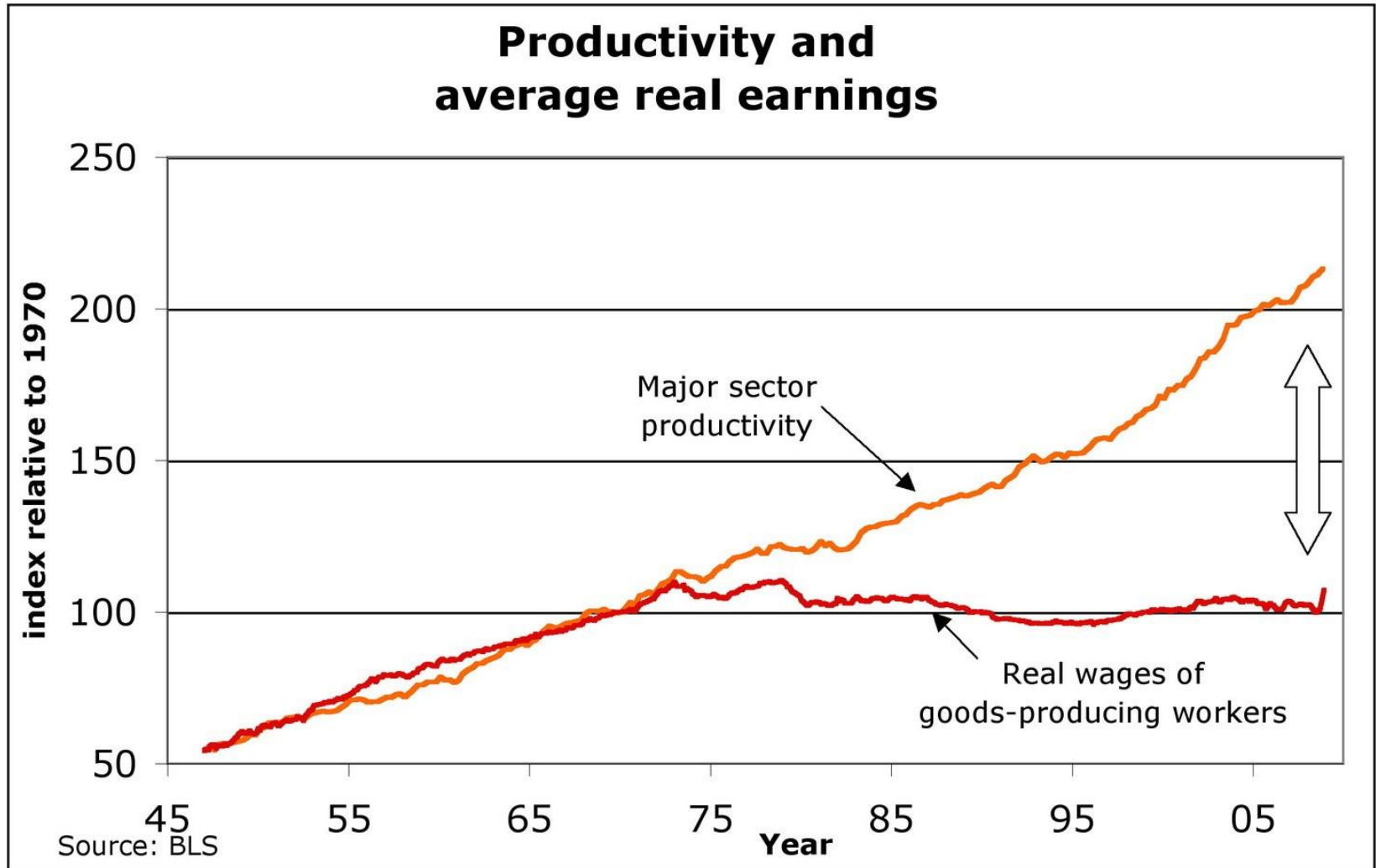
\* At November 17th 2015

## U.S. Employment in Manufacturing Industries

Thousands of Jobs, 1980-2014



Source: Brookings Analysis of Moody's Analytics Data







**Thanks for your attention!**

**Xavier Ferràs**

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**@XavierFerràs**

**LinkedIn Me!!!!**