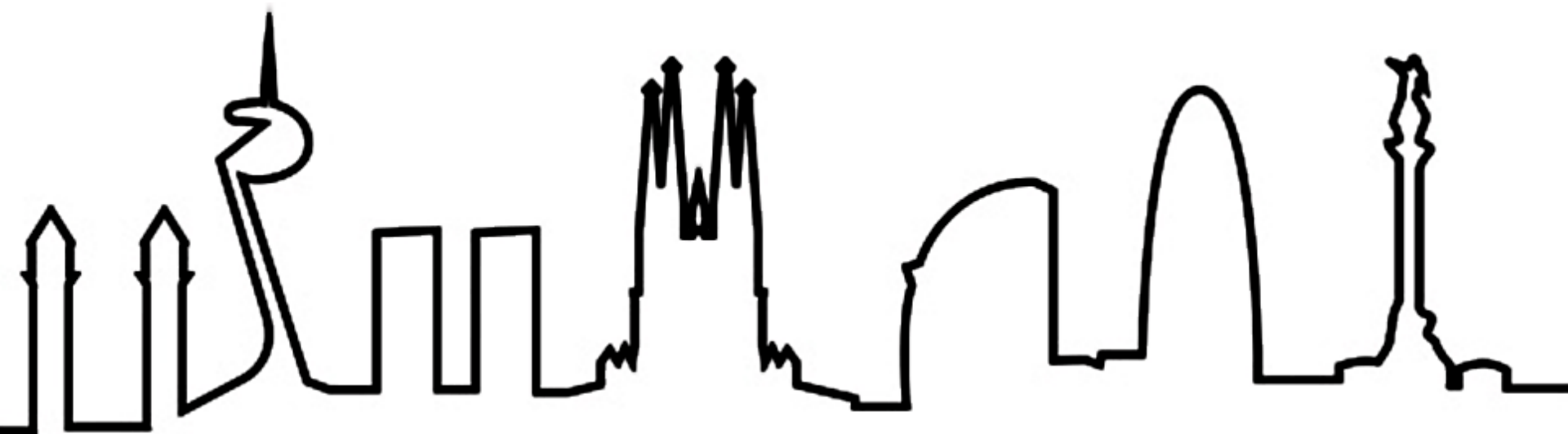


# ***Exponential Technologies: Impact in Business & Society***

*Prof. Xavier Ferràs, MBA, PhD.*

*March, 2019*



Modern Times?



## Time for a model change

“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”

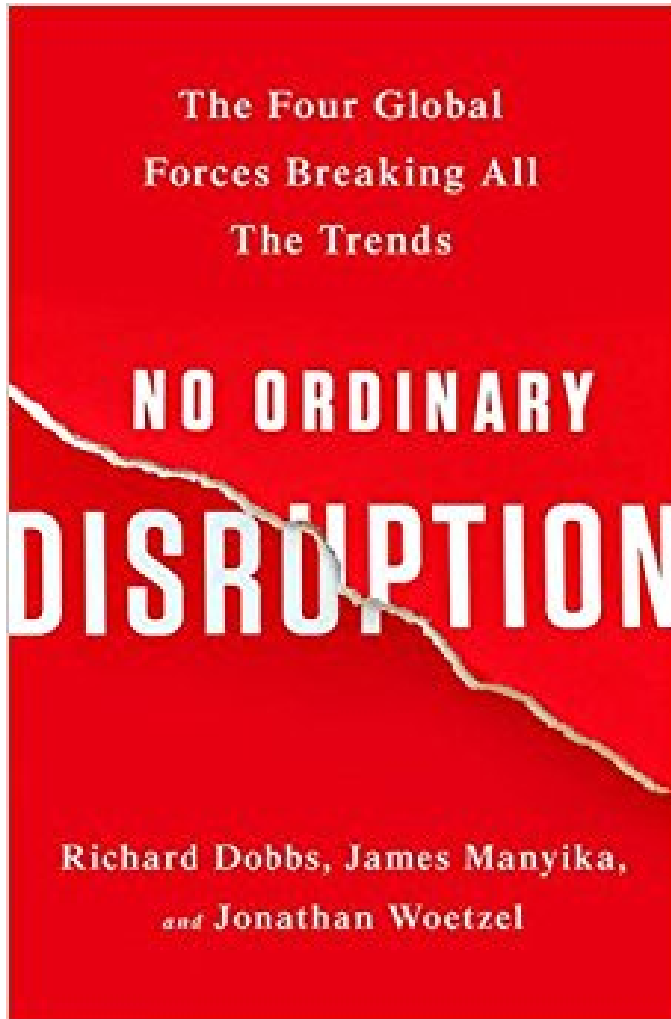
“In Germany, working population will fall from 54 million (2010) to 36 million (2050)”

“Capital flows expanded 25 times between 1980 and 2007”

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

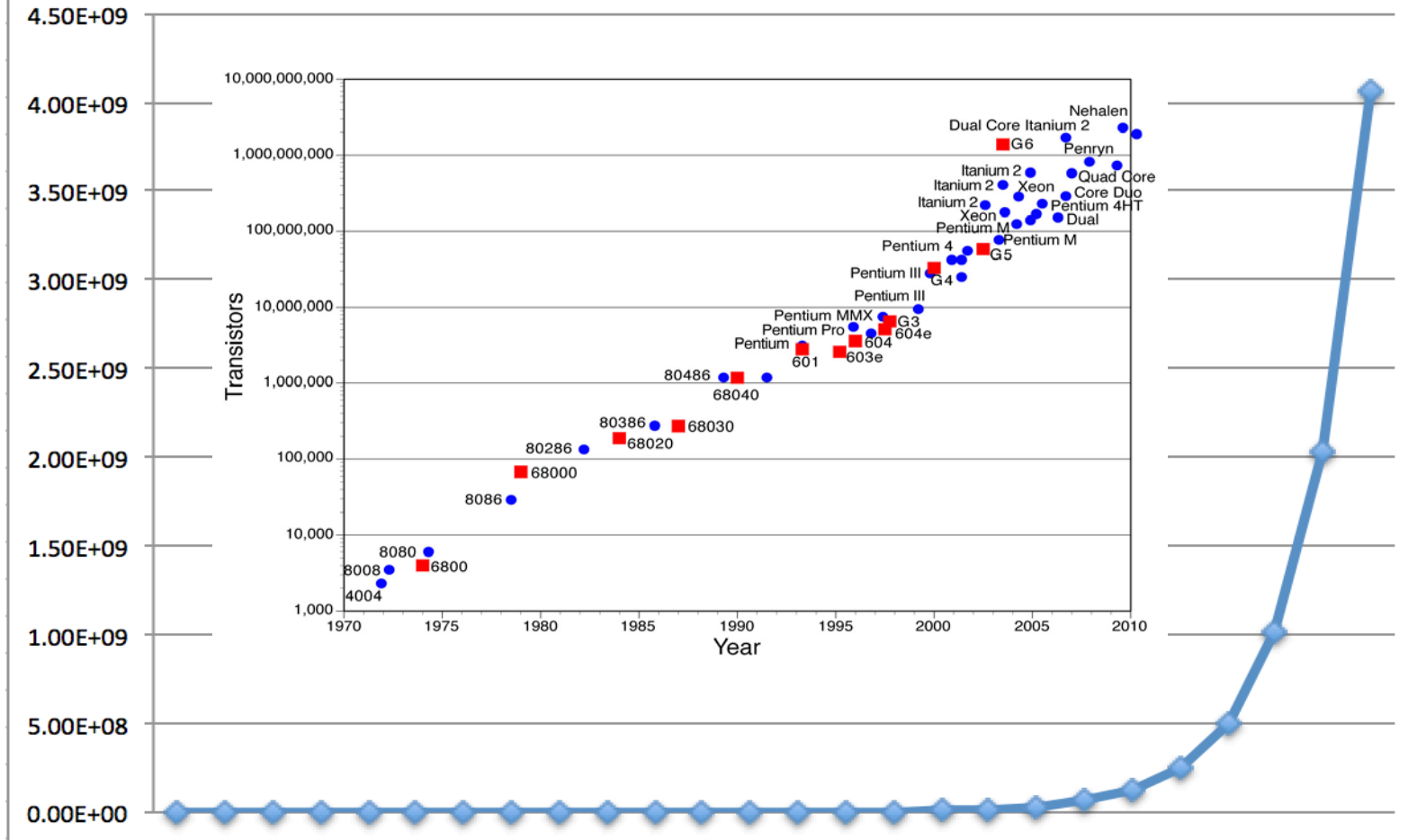
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McKinsey&Company

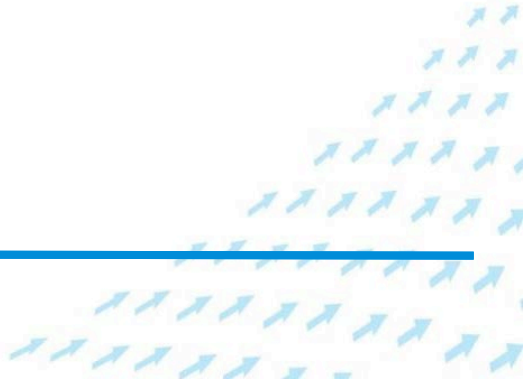




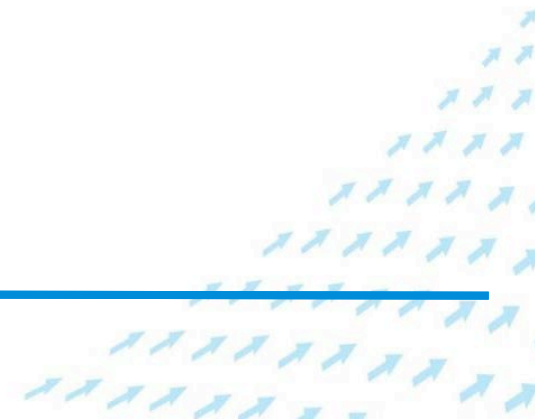
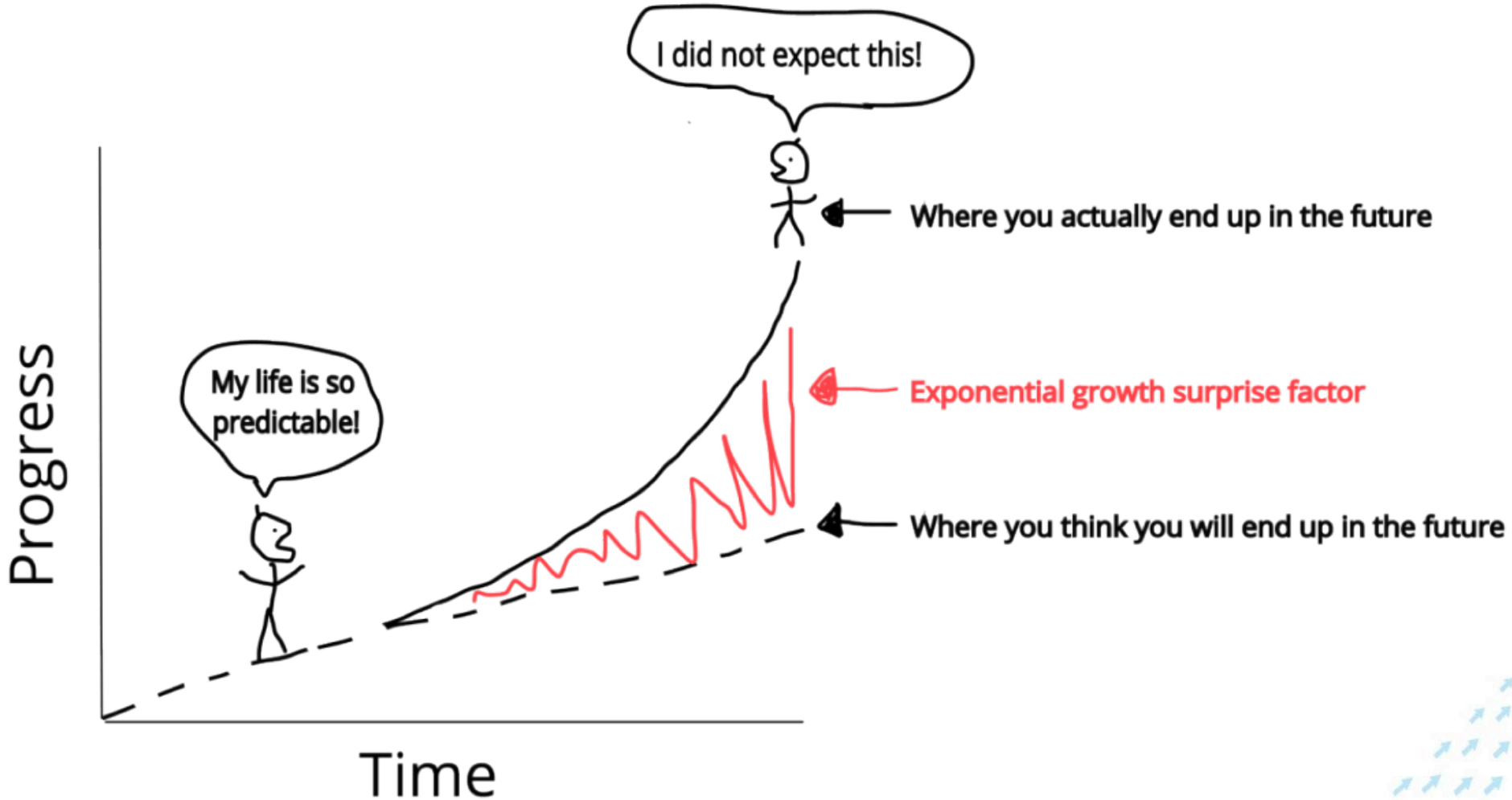
## Transistors per chip over 50 years



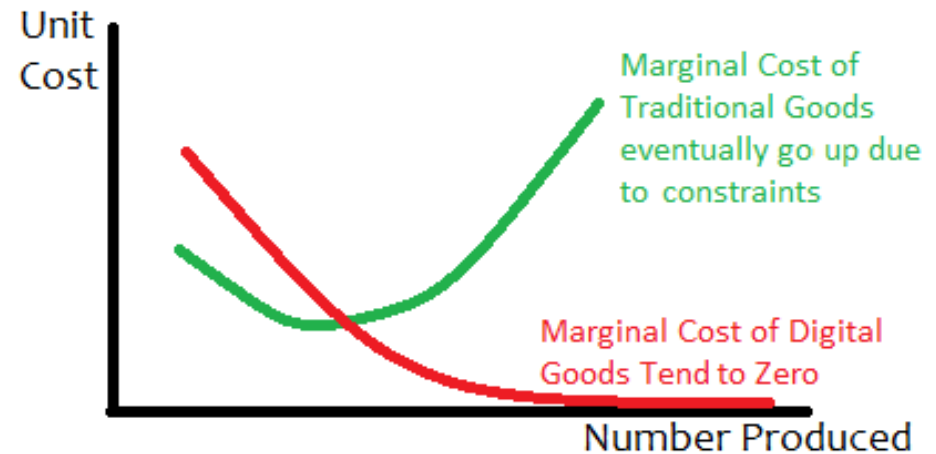
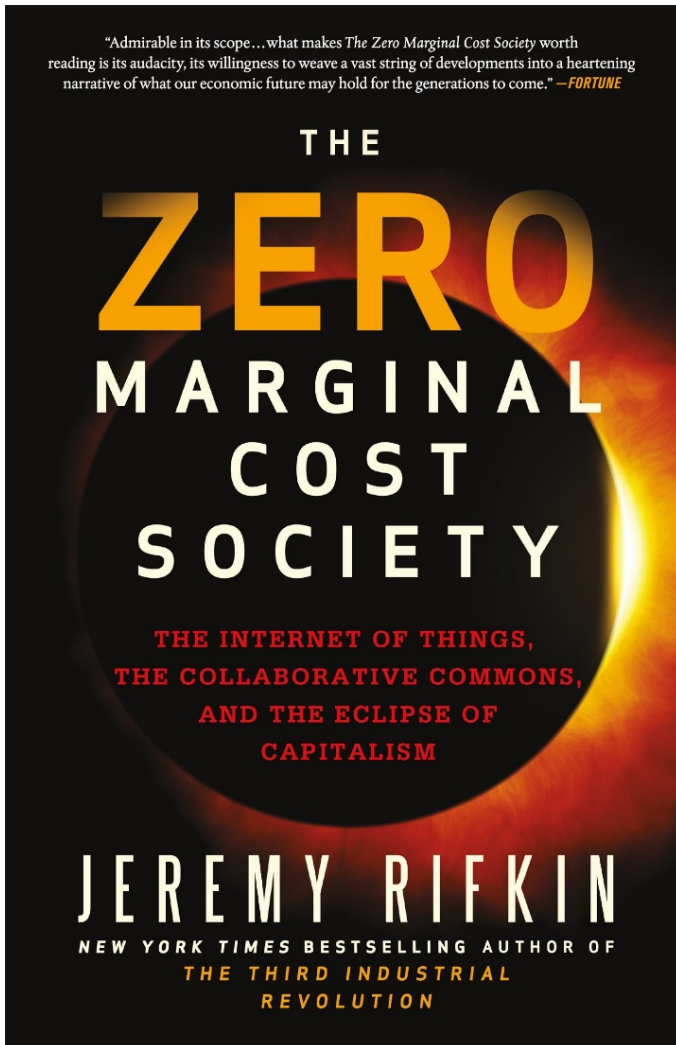
# Digital laws: Moore's law



# Digital laws: Moore's law



## Digital laws: Zero marginal cost

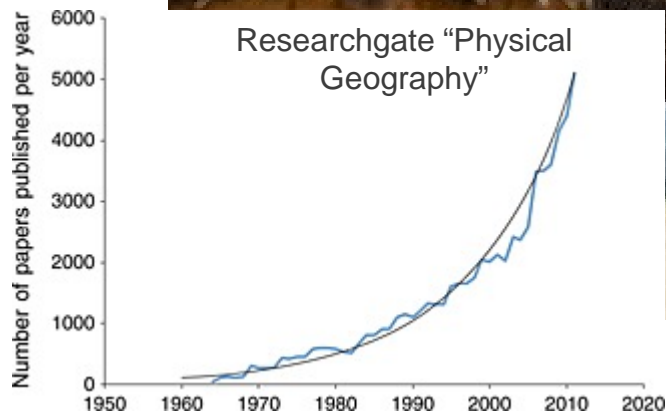


ZERO MARGINAL COST:  
Towards a “perfect  
competition” market  
structure  
CULMINATION OF  
CAPITALISM?

# Tech 4 Good: Abundance of information/ knowledge



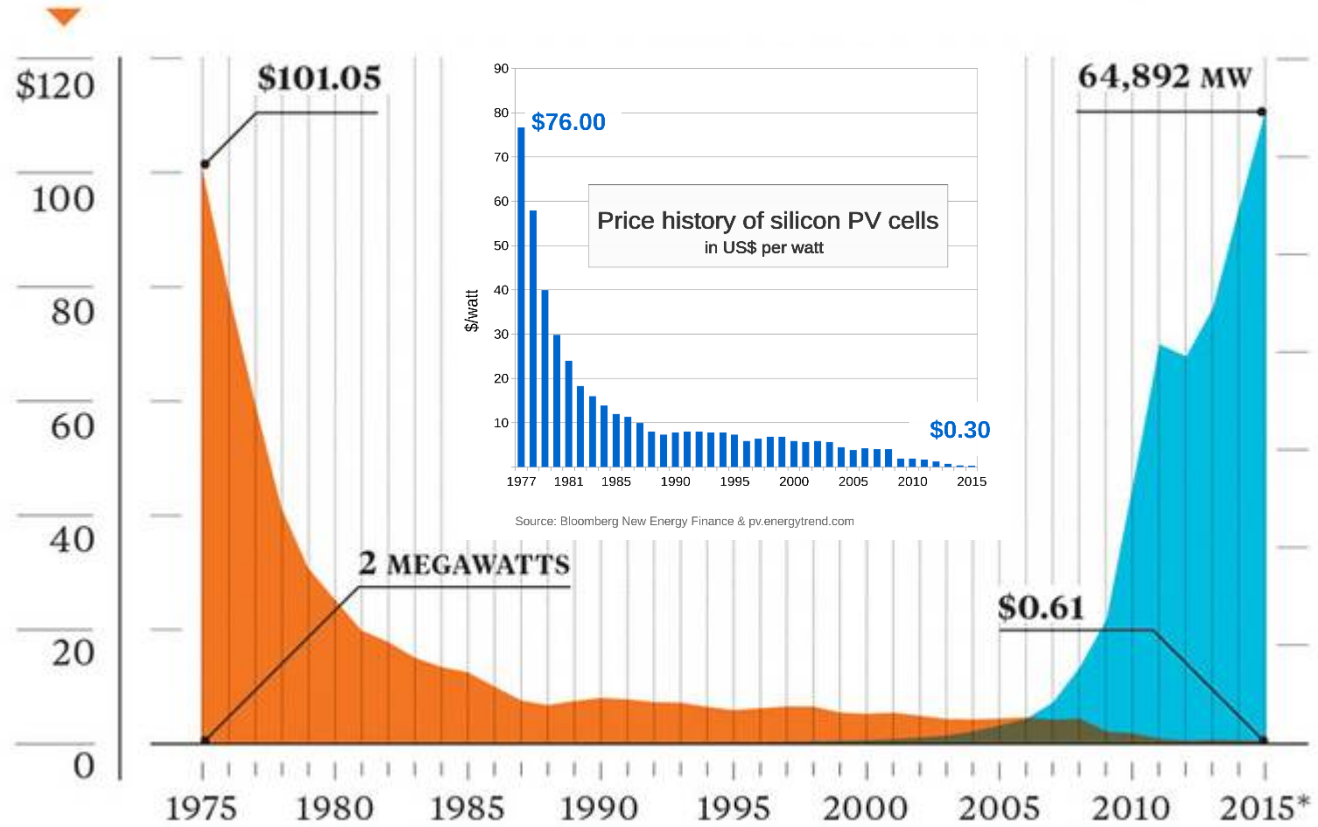
Researchgate "Physical Geography"



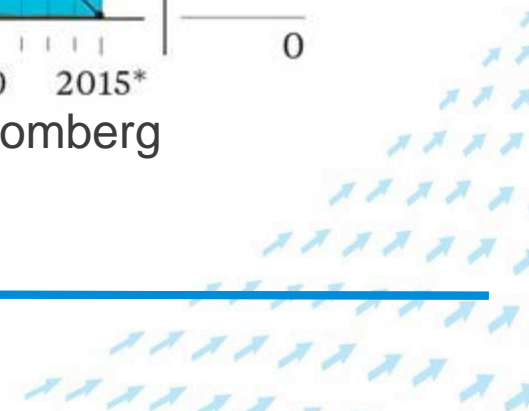


# Solar technology

Price of a solar panel per watt



Source: Bloomberg





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

Photograph: Kristian Bock/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



## Solar Could Beat Coal to Become the Cheapest Power on Earth

By **Jess Shankleman** and **Chris Martin**  
3 de enero de 2017 1:00 CET | [Actualizar en](#) 3 de enero de 2017 13:16 CET

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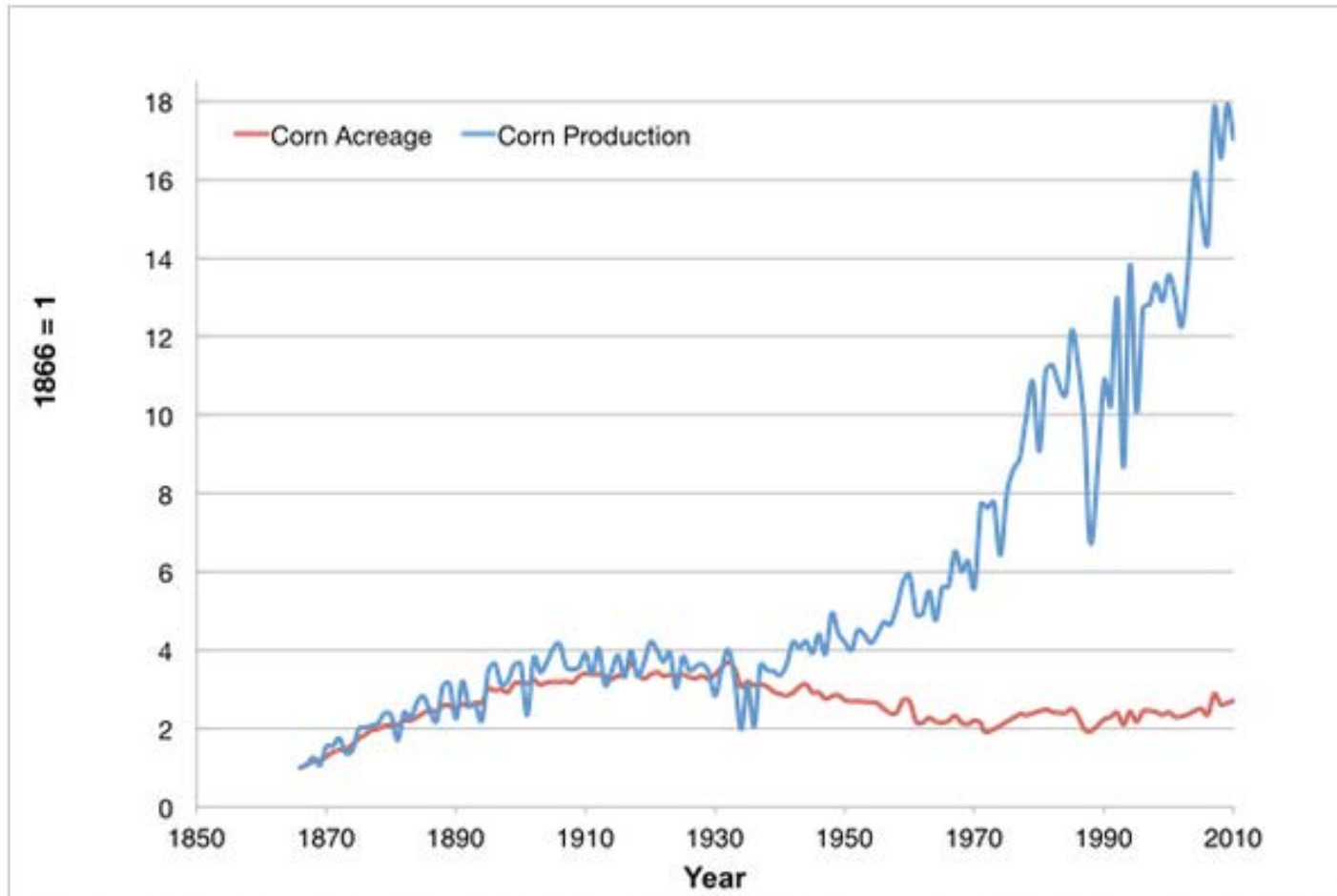
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SUSTAINABILITY

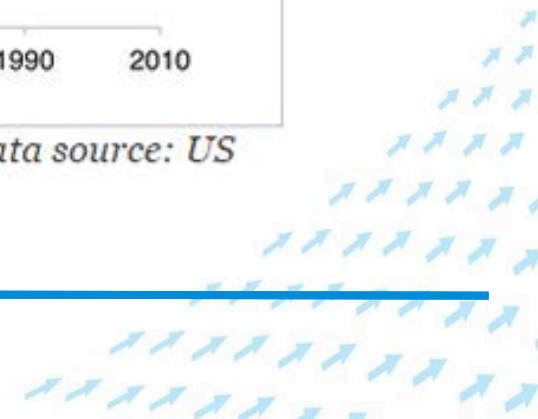
# A Way to the Most Abundant Energy

Viable solar energy has been a long-sought-after goal, but with new and affordable technologies, we might soon be able to make the switch





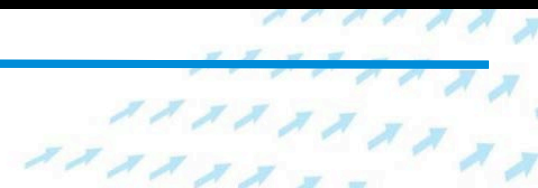
**Figure 1:** Decoupling of US corn production from area farmed. Data source: US Census Bureau (1975, 2012).



## “Clean” Meat



believe that in 30 years or so we will no longer need to kill any animals and that all meat will either be clean or plantbased, taste the same and also be much healthier for







# “Clean” Meat or “Fake” Meat?

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## The battle between the beef industry and Silicon Valley’s lab-grown meat startups is heating up

Leanna Garfield  

© Feb. 21, 2018, 4:35 PM  1,230

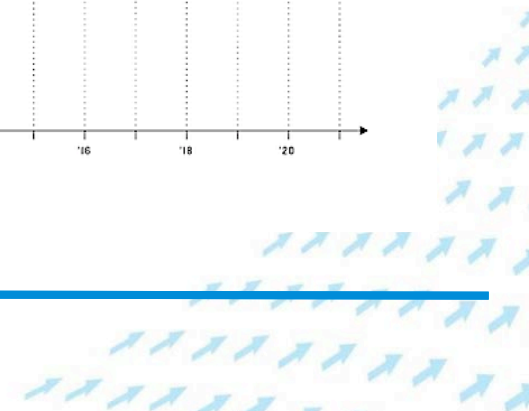
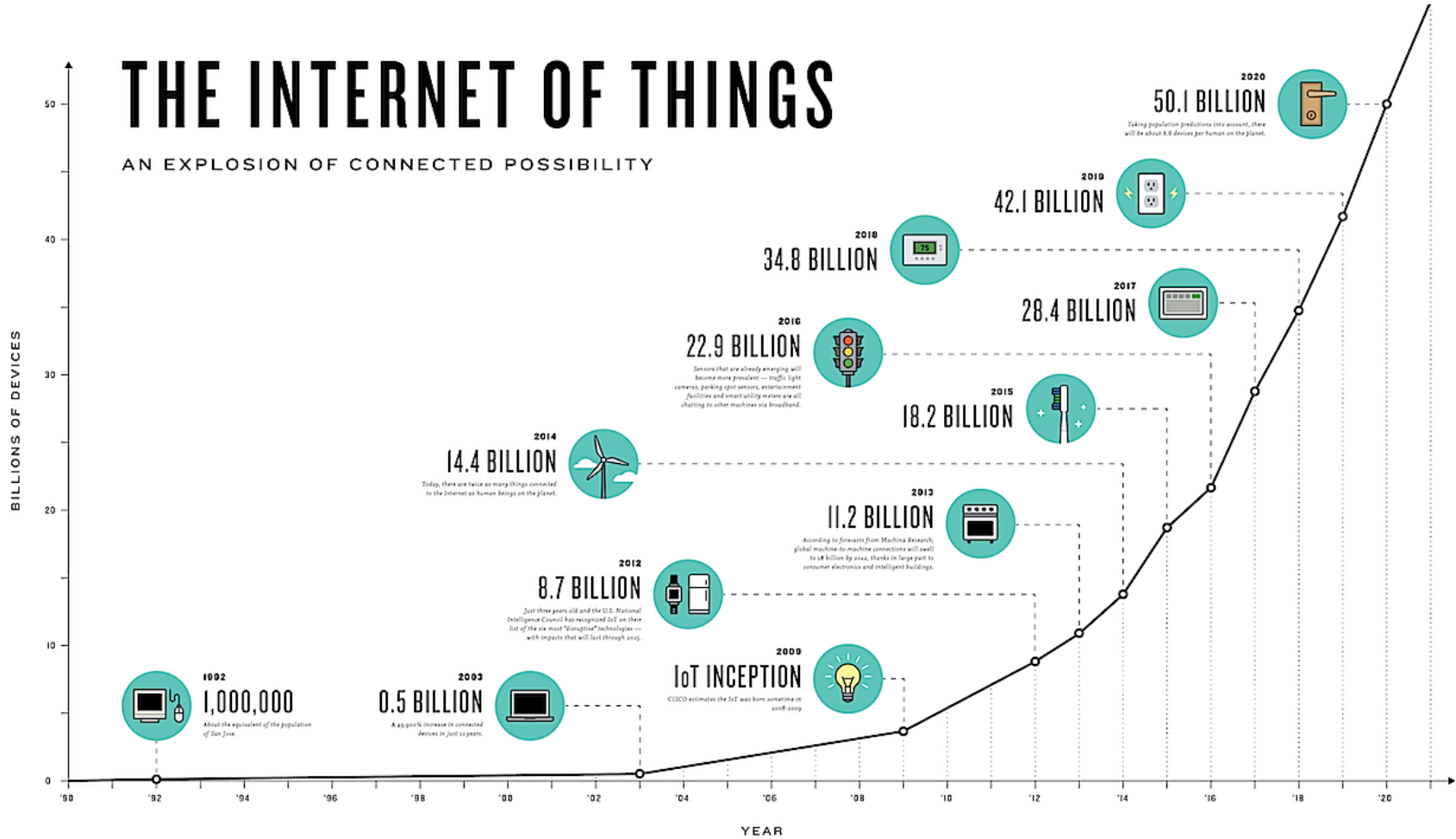
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# The Internet of Things

## THE INTERNET OF THINGS

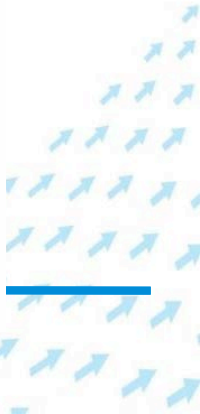
AN EXPLOSION OF CONNECTED POSSIBILITY



# Industry 4.0 and Advanced Factories (3DP)

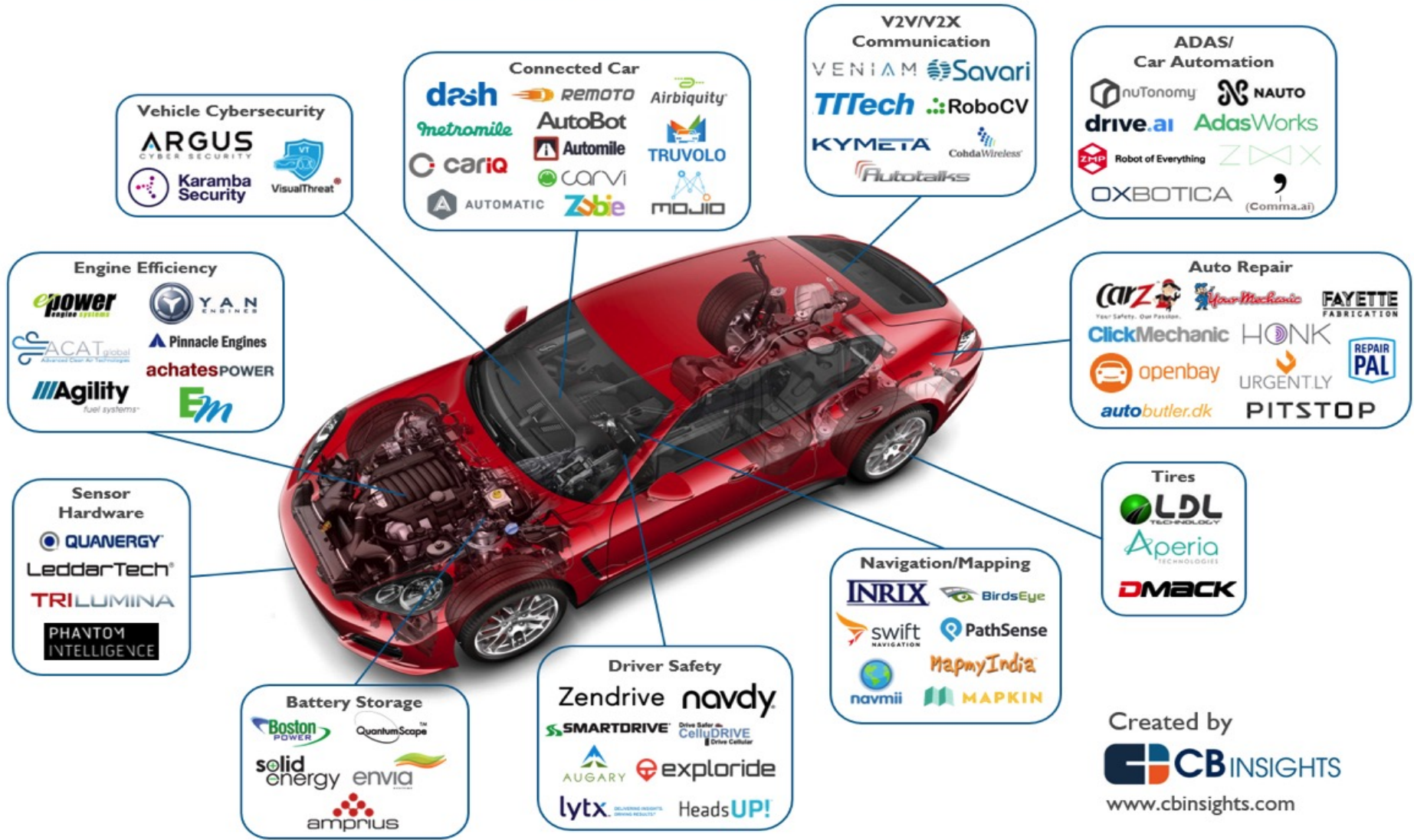


- Clean technology
- Almost zero marginal cost
- Sophisticated shapes & geometries
- Possibility to compete in cost & flexibility
- Independence of scale
- Independence of location





# Unbundling The Automobile



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

# Artificial Intelligence: The Next Big Thing



# Feature: MIT Technology Review

soul  
machines

*In the news today on MIT Technology Review:*

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

By: Tom Simonite // March 22, 2017





CIO JOURNAL

## The Morning Download: Daimler Financial CIO Explores Ever-More Lifelike Chatbots

By *Steve Rosenbush*  
Mar 2, 2018 8:26 am ET

0 COMMENTS



...at West says it is in advance

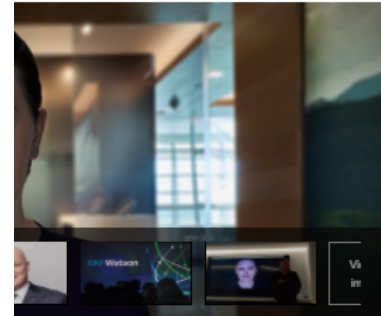
## ...s customer service team at Air New

...pearance at US launch of Air NZ's global marketing campaign.

...sland)



0 Comments



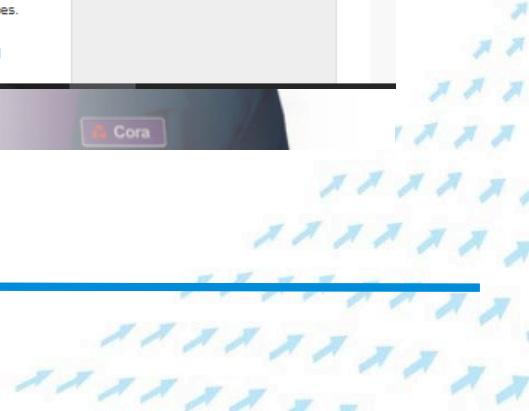
...ed guests at the recent US launch of Air New Zealand's global  
...y to Fly.

...otional intelligence and responsiveness as she answered  
...questions about New Zealand as a tourist destination and the airline's products and services.

...ked with Soul Machines to create 'Sophie' as it explores how artificial  
...disruptive technologies can be used to help travelers.

Cora

?



# Artificial Intelligence: The Next Big Thing

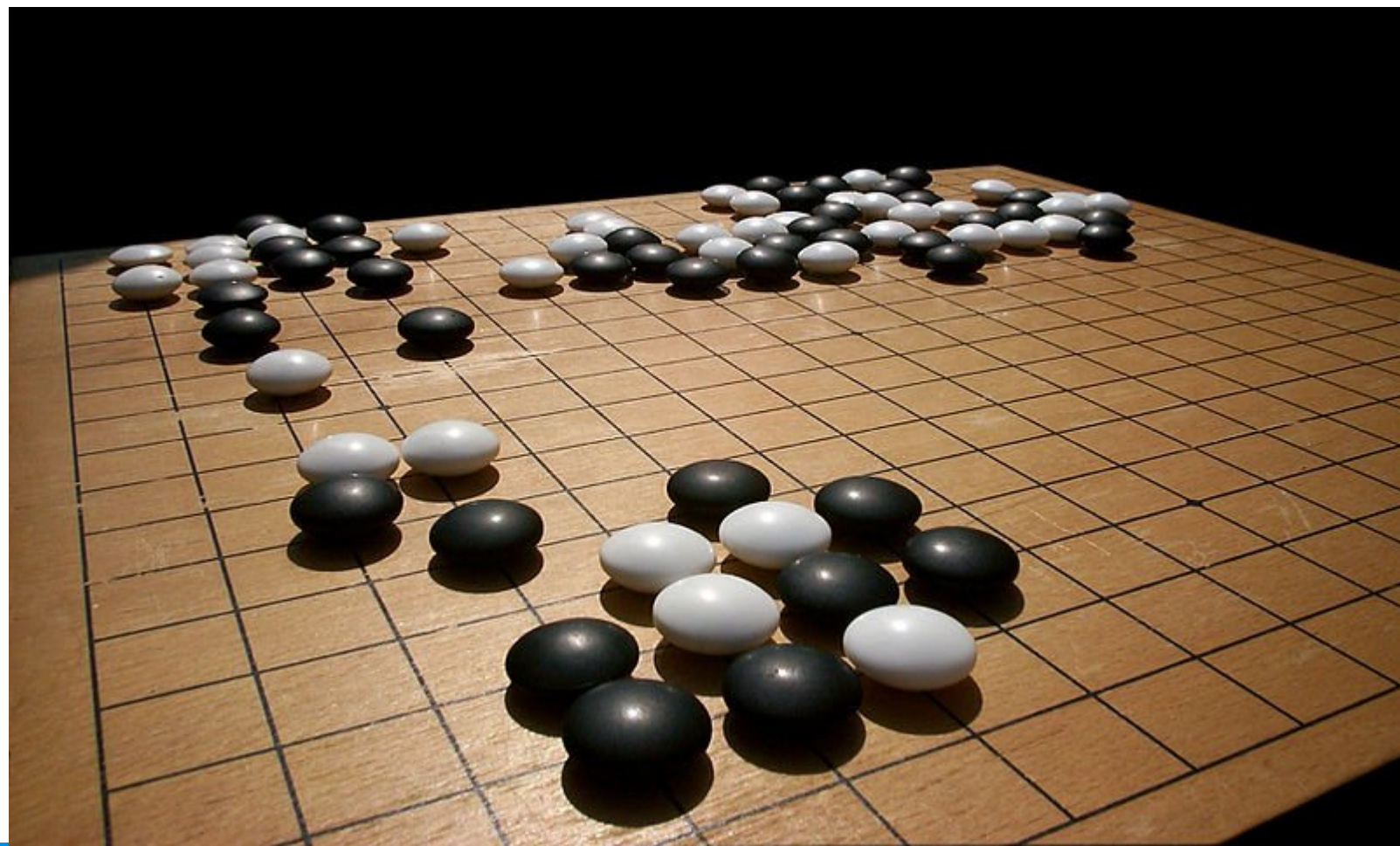


# Google



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

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



CADE.METZ BUSINESS 03.16.16 07:00 AM

## IN TWO MOVES, ALPHAGO AND LEE SEDOL REDEFINED THE FUTURE

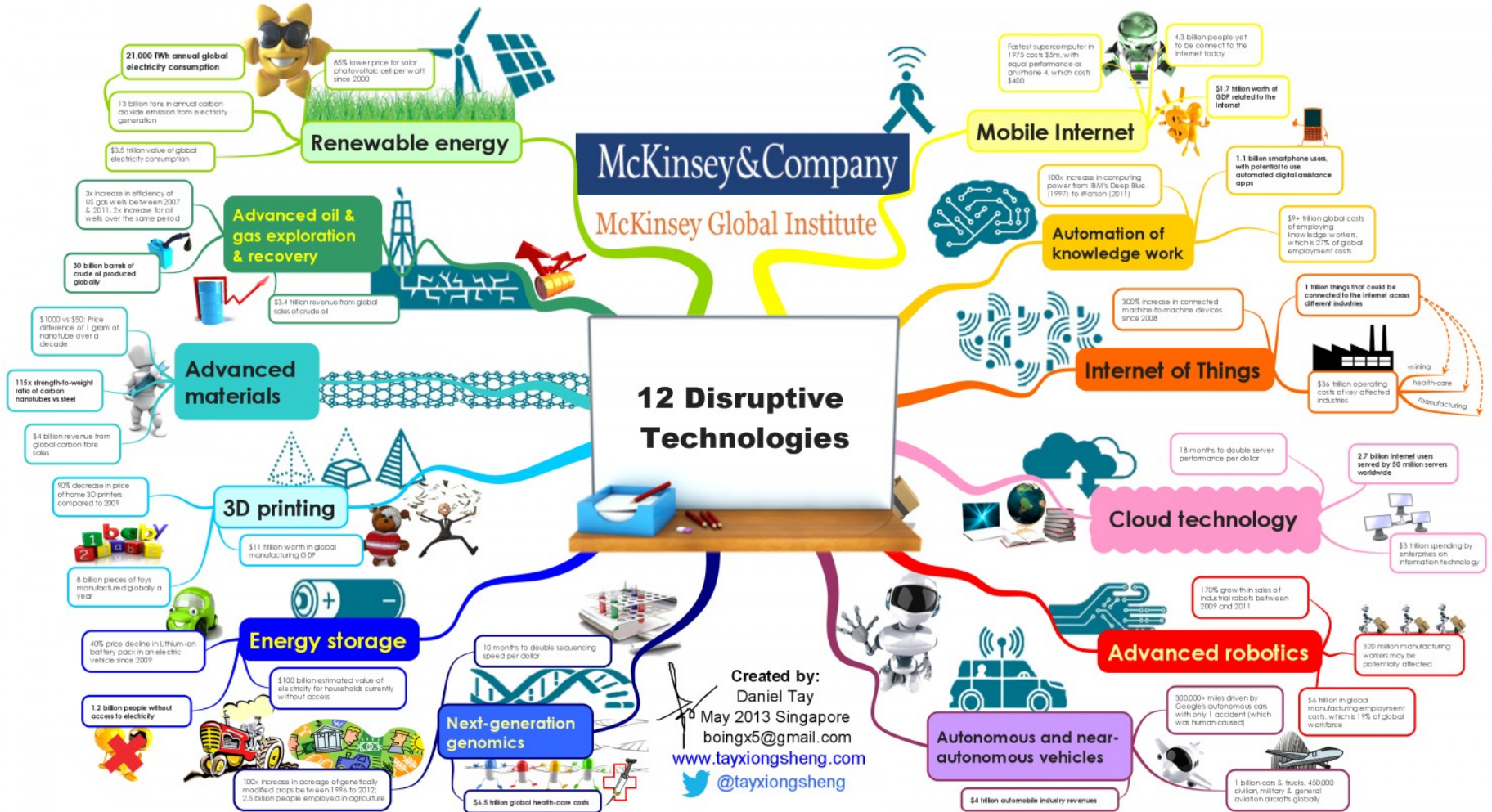


CADE.METZ BUSINESS 03.11.16 07:00 AM

## THE SADNESS AND BEAUTY OF WATCHING GOOGLE'S AI PLAY GO

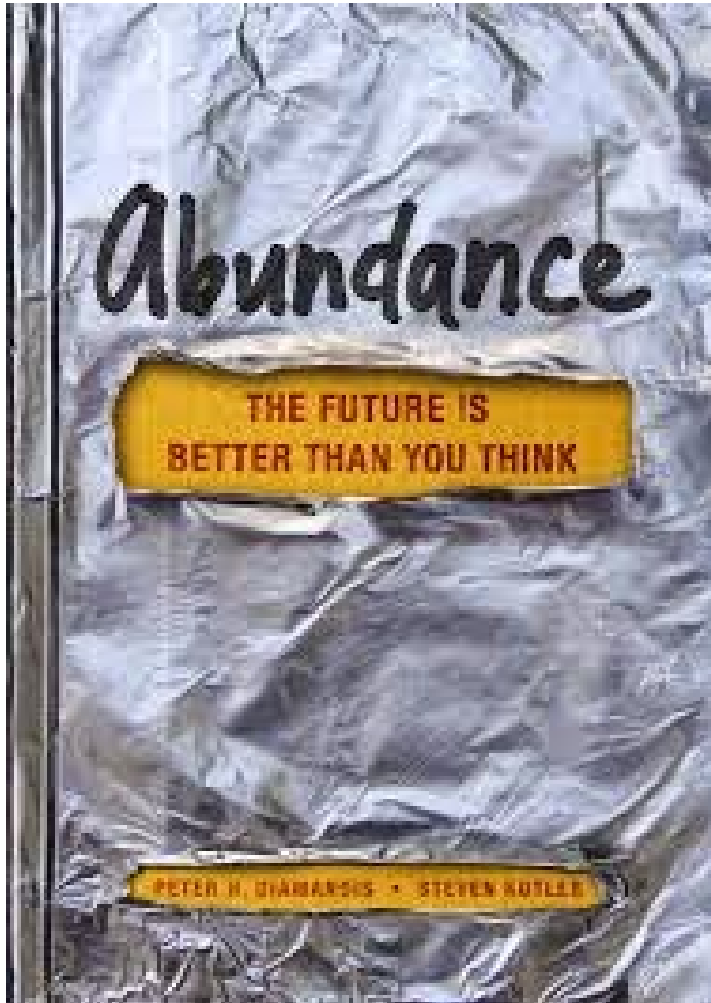






Created by:  
Daniel Tay  
May 2013 Singapore  
boingx5@gmail.com  
www.tayxiangsheng.com  
@tayxiangsheng

## A World of Abundance?



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

Abundance of information/  
education/ energy/  
food/social relationships/  
health/ transport...

# The World as 100 People over the last two centuries

Our World in Data

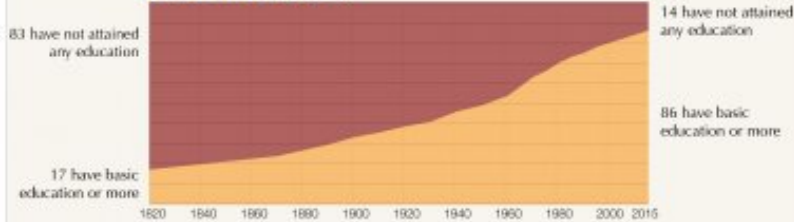
## Extreme Poverty



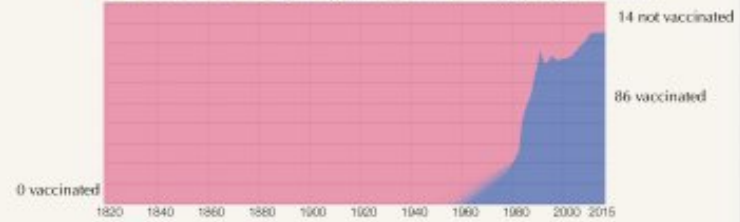
## Democracy



## Basic Education



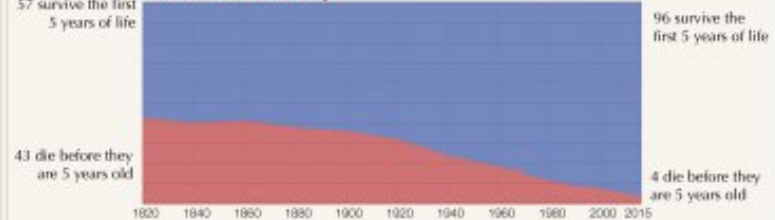
## Vaccination against diphtheria, pertussis (whooping cough), and tetanus



## Literacy



## Child Mortality



Data sources: Extreme Poverty: Bourguignon & Morrison (2002) up to 1973 - World Bank 1981 and later (2015 is a projection). Vaccination: WHO (Global data are available for 1968 to 2015 - the DPT3 vaccination was licensed in 1949). Education: OECD for the period 1920 to 1960. IASO for the time thereafter. Literacy: OECD for the period 1820 to 1996. UNESCO for 2004 and later.

Democracy: Polity IV index (own calculation of global population share). Colonisation: Winmar and Ma (own calculation of global population share). GDP: HYDE database. Child mortality: up to 1950 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 Rose.

# Towards a non-distributive model

## The second economy

W. Brian Arthur

Digitization is creating a second economy that's vast, automatic, and invisible—thereby bringing the biggest change since the Industrial Revolution.

**W. Brian Arthur** is a visiting researcher with the Intelligent Systems Lab at the Palo Alto Research Center (PARC) and an external professor at the Santa Fe Institute. He is an economist and technology thinker and a pioneer in the science of complexity. His 1994 book, *Increasing Returns and Path Dependence in the Economy* (University of Michigan Press, December 1994), contains several of his seminal papers. More recently, Arthur was the author of *The Nature of Technology: What It Is and How It Evolves* (Free Press, August 2009).

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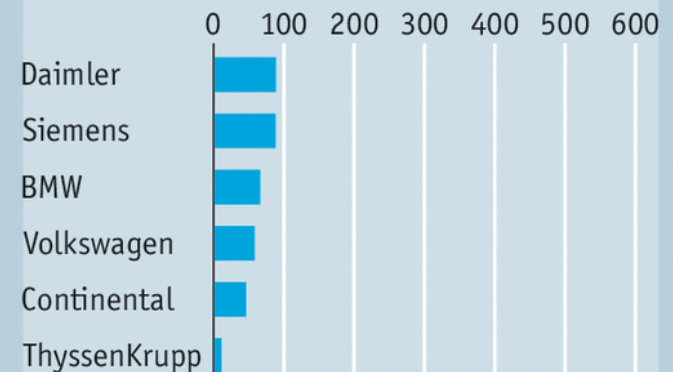
## Tech titans, manufacturing midgets 2

Company valuations\*, \$bn

### US technology firms



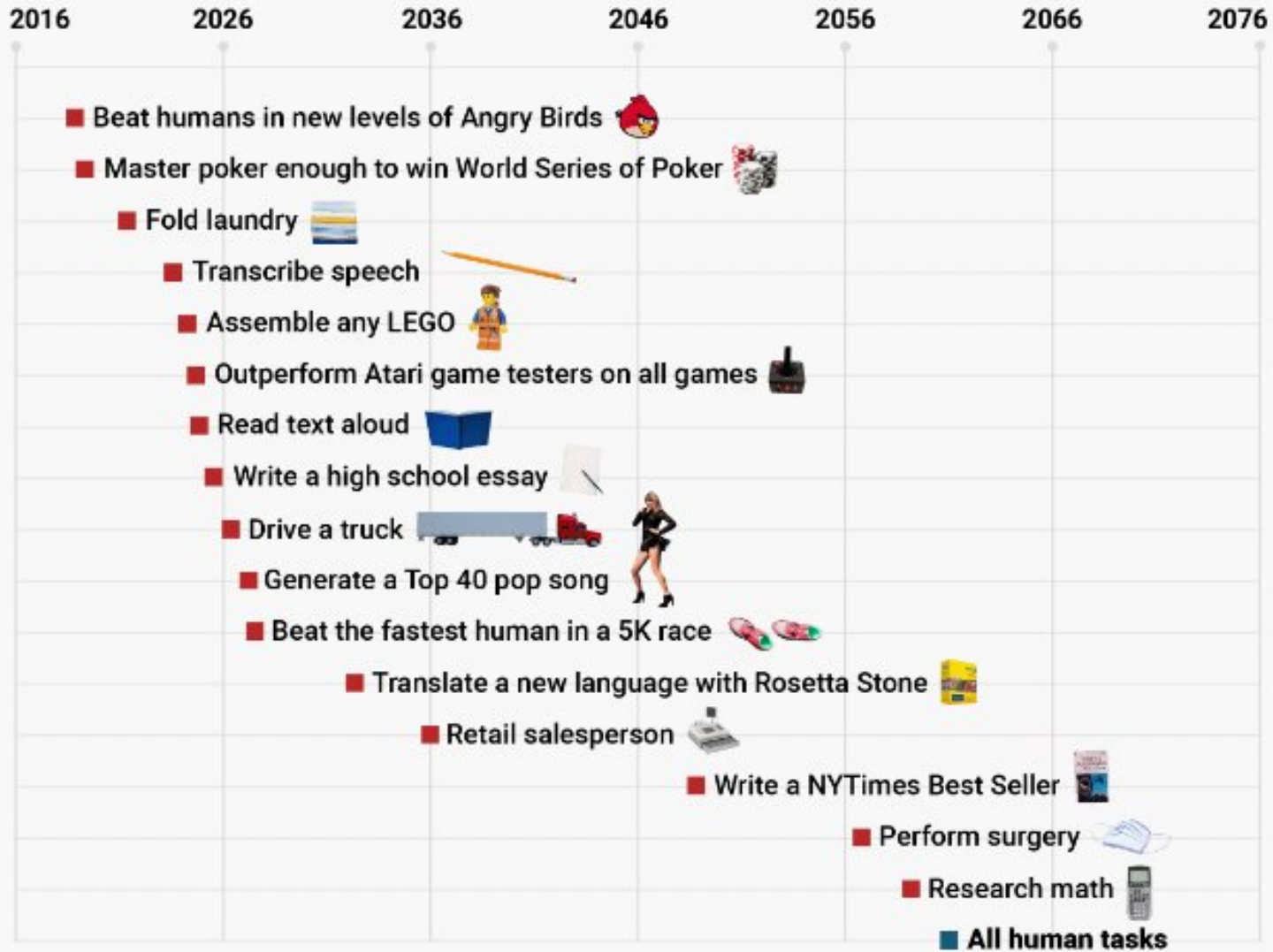
### German manufacturing firms



Source: Thomson Reuters

\*At November 17th 2015

# WHEN JOBS/TASKS WILL BE TAKEN OVER BY MACHINES



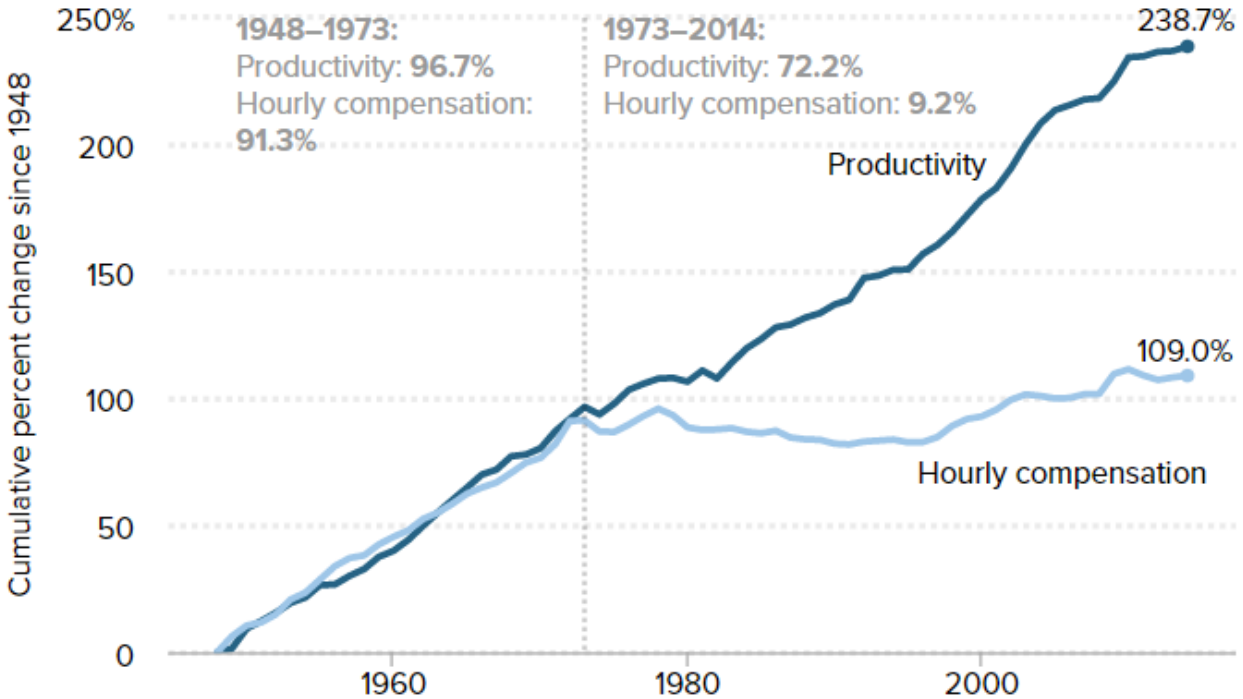
SOURCES: Grace, Salvatier, et al

BUSINESS INSIDER



FIGURE A

## Disconnect between productivity and a typical worker's compensation, 1948–2014



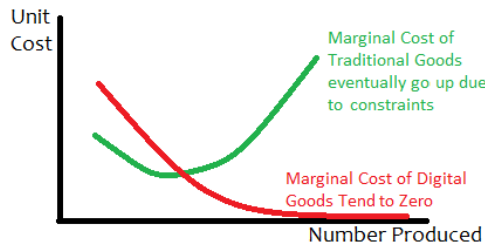
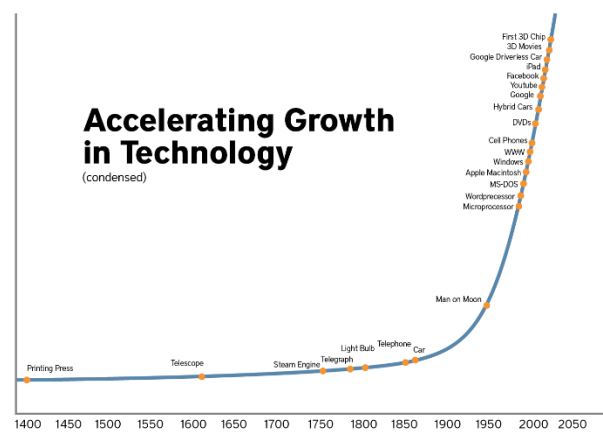
Source: Economic Policy Institute



# AT THE CROSSROADS...

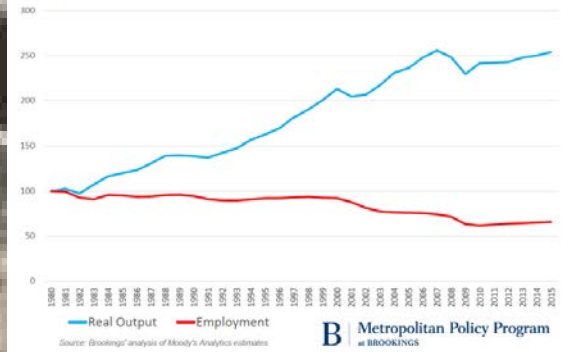
## Accelerating Growth in Technology

(condensed)



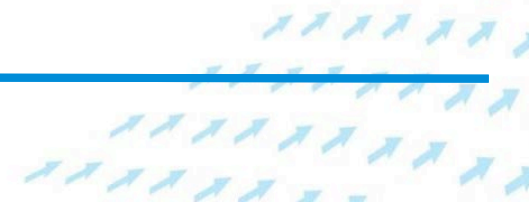
## More Output, Less Employment

The manufacturing sector has gotten more productive, while giving fewer people jobs (normalized as a percent of levels in 1980).



# ABUNDANCE

# INEQUALITY



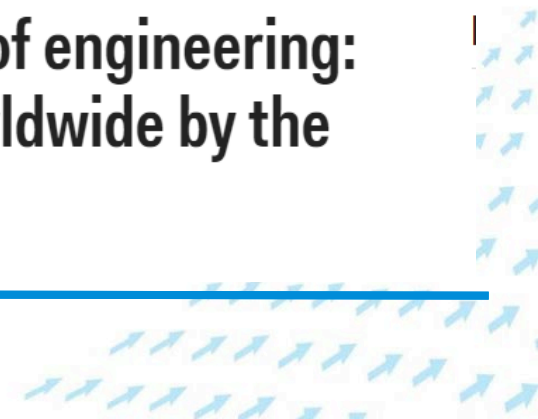


## Universal basic income has support from some big names



A look at some of the entrepreneurs who have supported univer

**Google futurist and director of engineering:  
Basic income will spread worldwide by the  
2030s**



FUTURE OF WORK

# Bill Gates Says Robots Should Be Taxed Like Workers

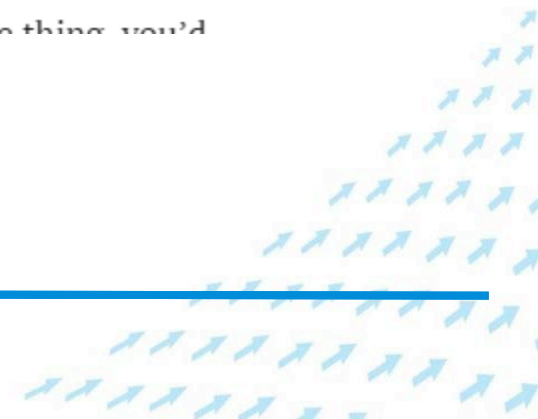
David Z. Morris

Feb 18, 2017



In a new [interview with Quartz](#), [Microsoft](#) founder Bill Gates makes a rather stunning argument—that robots who replace human workers should incur taxes equivalent to that worker’s income taxes.

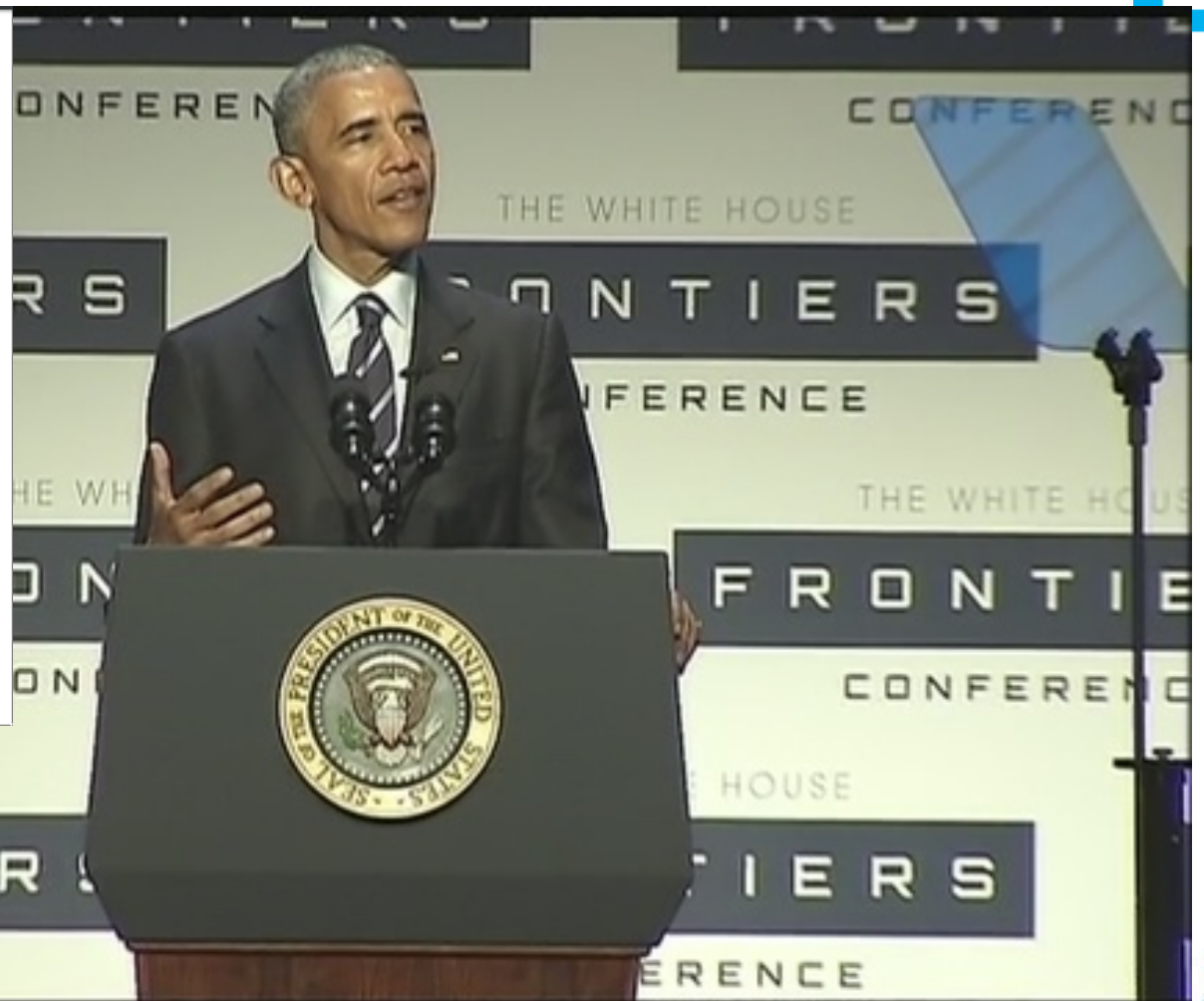
“Right now, the human worker who does, say, \$50,000 worth of work in a factory, that income is taxed. If a robot comes in to do the same thing, you’d



Artificial Intelligence,  
Automation, and the Economy

Executive Office of the President

December 2016



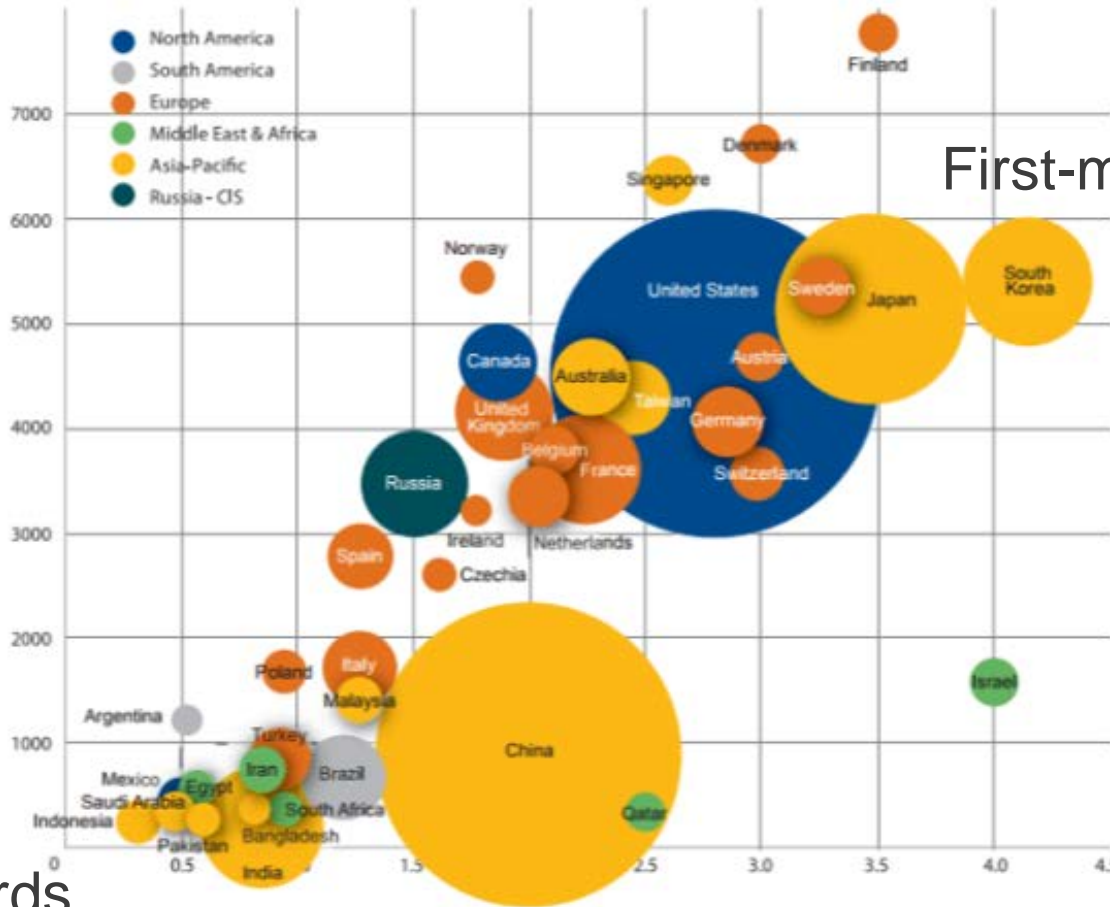
**“I can convince  
my country about  
change precisely  
because I embrace  
it.”**

INTERVIEW WITH WIRED  
THURSDAY, MARCH 29TH, 2018



**WIRED**

# The value-creation problem

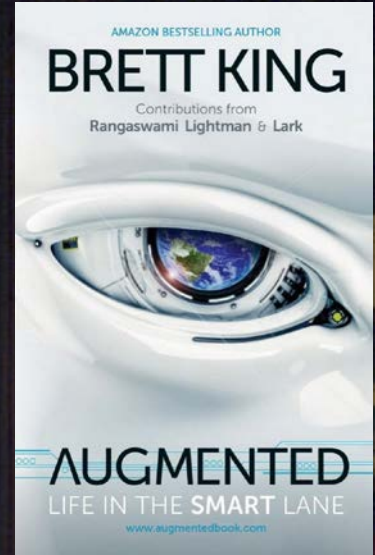
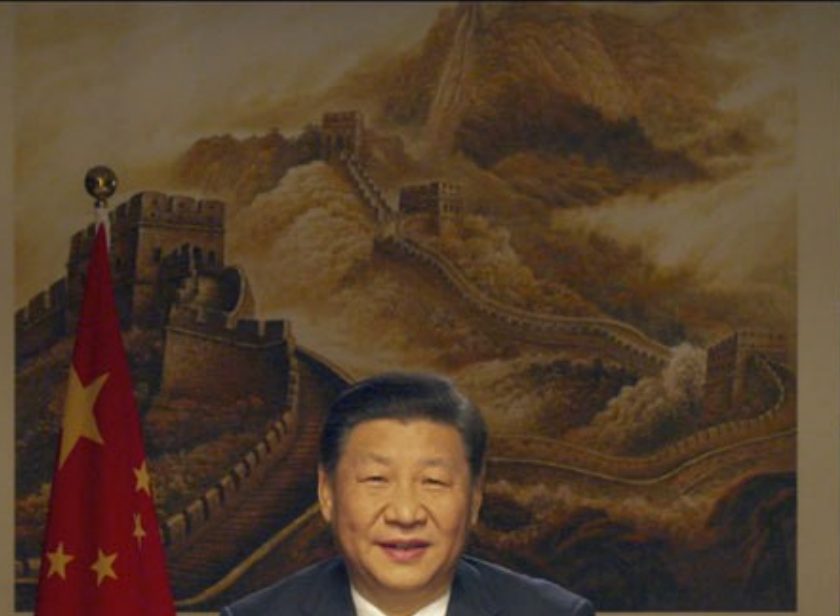
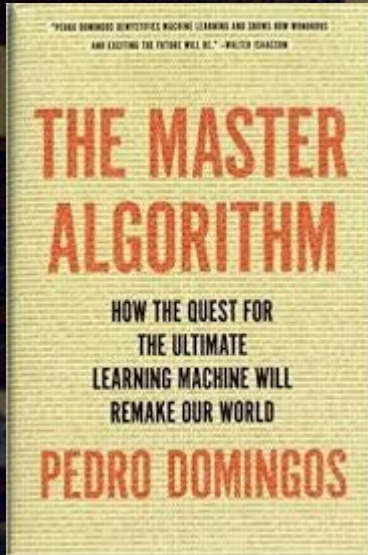


First-mover nations

Laggards

The size of the circles in this Chart reflects the relative amount of annual R&D spending by the indicated country. Note the regional grouping of countries by the colors of the balls. The horizontal axis reflects R&D spending as a percent share of the countries' GDP (gross domestic product). The vertical axis reflects the number of researchers (including scientists and engineers) per million population for the respective countries.

R&D Magazine, 2018



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**Thanks for your attention!**

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