In need of **Disruptive Future**

McKinsey Global Institute

Dr Jacques Bughin, Director, McKinsey

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Thank you for the invitation

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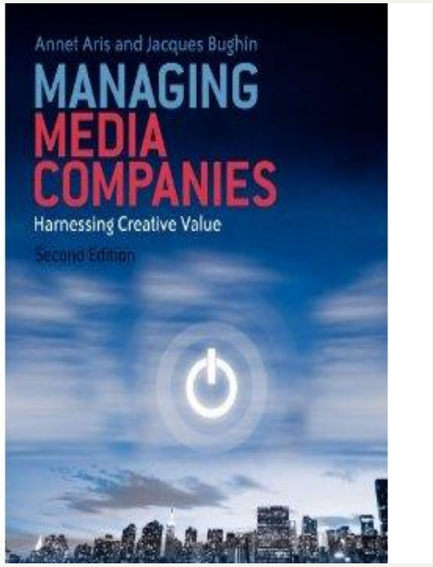
- Jacques Bughin is a Director with McKinsey & Company's Brussels office-
- Jacques is a core leader of the Media and Entertainment and Corporate Finance and Strategy practices. He has been a core member of MGI, MTI and co-ed Digital Economy Initiative, a major internal and external knowledge program launched by McKinsey
- Since joining the firm in 1992, he has been based in the Amsterdam, London, Montreal, New York, and Toronto offices, working mainly on projects related to telecom, media, and high-tech He has helped clients all around the world

Background

- Jacques received a master's summa cum laude in Economics from the University of Namur (Belgium) and University of Pennsylvania
- He holds doctoral degrees in Economics and in Operations Research
- He has lectured at many universities, including Toronto, London, and Brussels
- He is also a fellow of the ECARES, a think-tank on economic policy in Belgium, and a fellow of the Applied Economics of the KUL University.

Example of publication

1. McKinsey Global Institute – co-author of
   - Big Data
   - Social technologies
   - Disruptive technologies
   - Internet matters
2. 35 McKinsey Quarterlies
3. More than 50 academic research publications , e.g., in *Management Science, European Economic Review*
4. Business interviews, e.g., in *Le Monde*, *The Economist, Business Week, Fortune*
5. Multiple books of which *Managing media companies*, Wiley (ed)., coauthored with Annet Aris



In need of a disruptive future

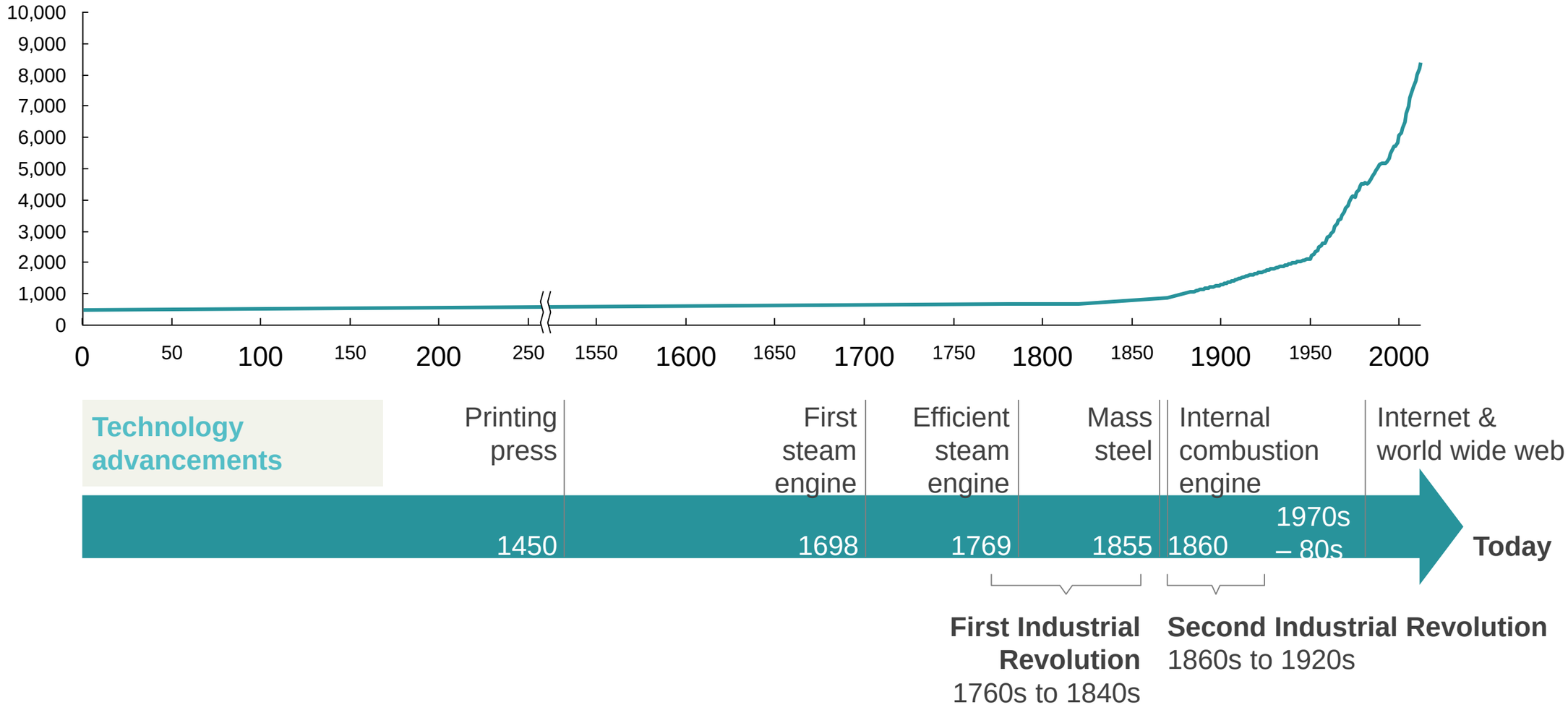
1. Why and how

2. The next 12

3. What to make out of it

Growth take-off

GDP per world capita
In real USD

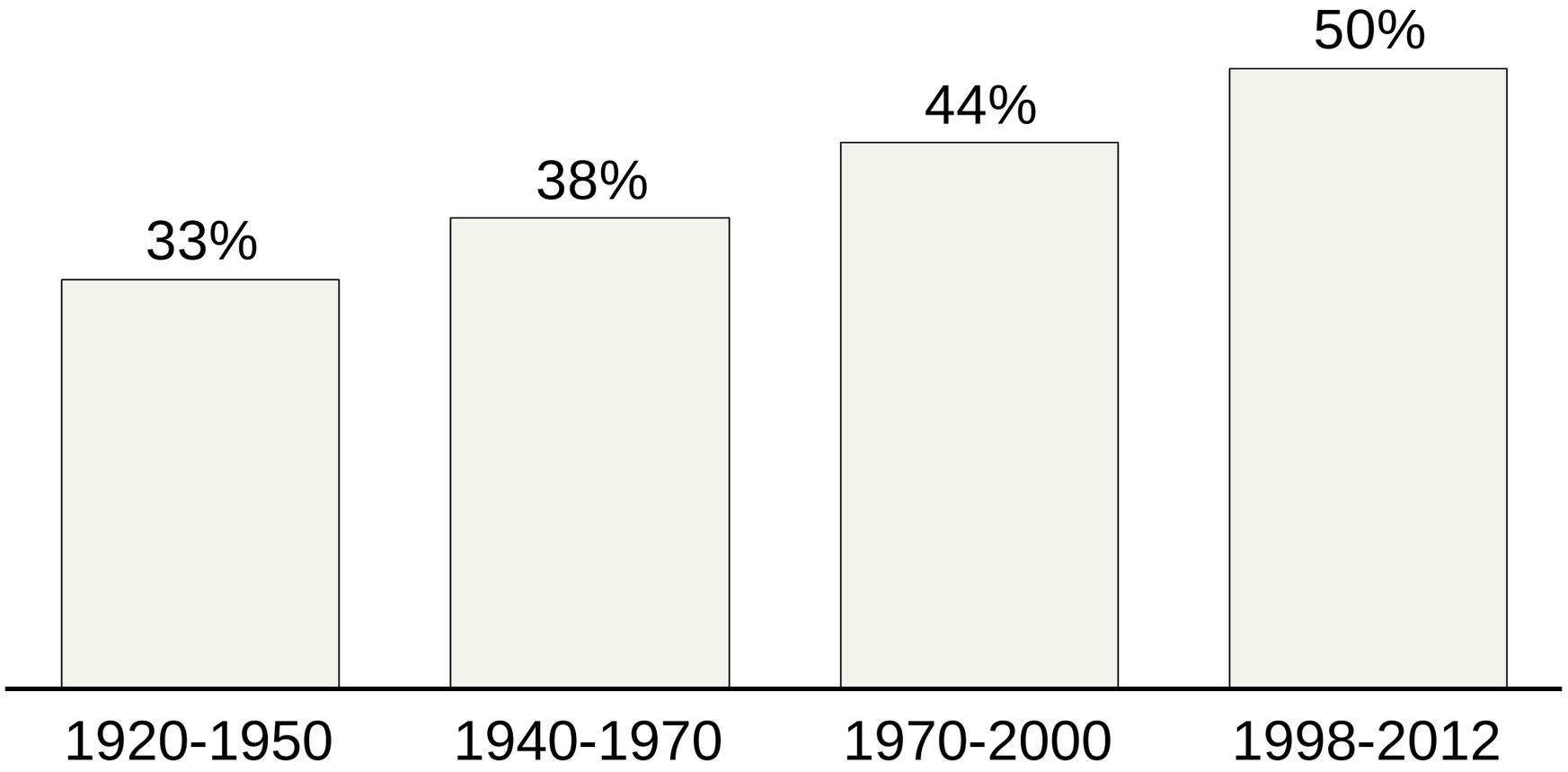


SOURCE: Angus Maddison's "World Population, GDP and Per Capita GDP, 1-2003 AD"; Projection based on Global Insight economic data; WIPO IP Statistics

Disruptive technology as engine of growth

% contribution of technology change to world output growth

ESTIMATES



SOURCE: R. Solow; Hall; Wikipedia; Annals of Statistics; McKinsey estimates

How? Predicting is hard especially the future

"We do not like their sound, and guitar music is on the way out"

– Decca, 1962

"640 k ought to be enough for everybody",

– Bill Gates, 1981

"There is absolute no reason why people would want a PC in their home"

– DEC, 1977

"Louis Pasteur's theory of germs is ridiculous fiction"

– Pierre Pachet, Professor at University of Toulouse, 1872

"I suppose we shall soon travel by air-vessels, and at length find our way to the moon in spite of he want of atmosphere"

– Lord Byron, 1882

Predicting the future is hard, especially the future (continued)

More than half of local online populations engage in social networking.

North America		North America		Europe		Middle East & Africa		Asia Pacific	
Canada	94%	Argentina	96%	Austria	86%	Israel	94%	Australia	96%
United States	98%	Brazil	97%	Belgium	93%	South Africa	88%	China	53%
		Chile	94%	Denmark	94%			Hong Kong	93%
		Colombia	96%	Finland	91%			India	95%
		Mexico	96%	France	91%			Indonesia	94%
		Peru	96%	Germany	90%			Japan	58%
		Puerto Rico	90%	Ireland	95%			Malaysia	94%
		Venezuela	96%	Italy	93%			New Zealand	95%
				Netherlands	94%			Philippines	96%
				Norway	89%			Singapore	94%
				Poland	95%			South Korea	87%
				Portugal	96%			Taiwan	94%
				Russia	88%			Vietnam	85%
				Spain	98%				
				Sweden	93%				
				Switzerland	90%				
				Turkey	96%				
				United Kingdom	98%				

Percentage of Online Population Using Social Networking around the World*
% Reach of Online Population

** Data is based on the 43 countries on which comScore reports individually.*

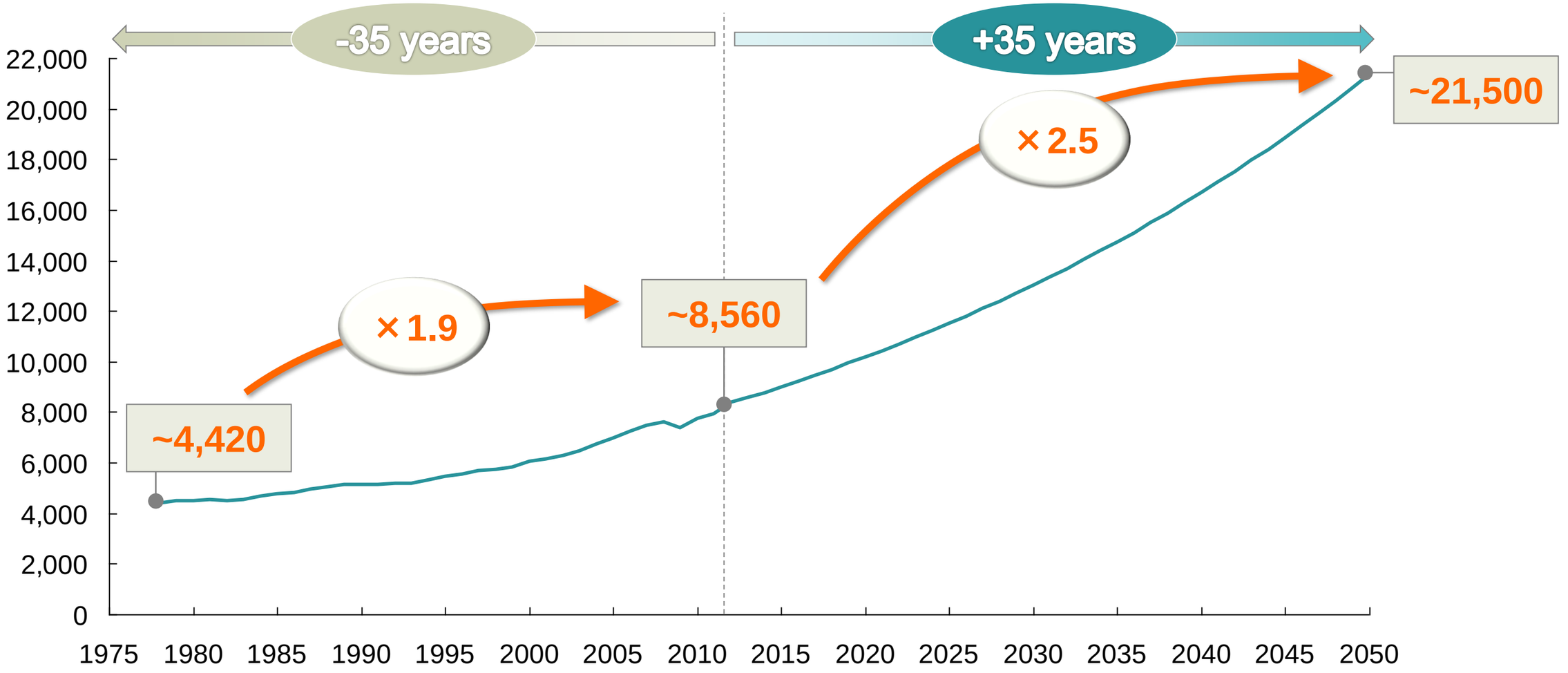
comScore

Source: comScore Media Metrix, October 2011

The future is exponential

GDP per world capita

In real USD



SOURCE: Angus Maddison's "World Population, GDP and Per Capita GDP, 1-2003 AD"; Projection based on Global Insight economic data; WIPO IP Statistics

Back to future in 1978: The First Portable Music Player by Nobutoshi Kihara (Sony)

The 1978 quote: *"The invention of the Walkman revolutionized the way that **people** can enjoy music: on the go!"*

Survey 2013: « *What do you think of the walkman? Response: 97% think it is dumb*

SOURCE: Managing product families: The case of the Sony Walkman

Back to future in 1978: The First Handheld Cell Phone by Martin Cooper (Motorola)

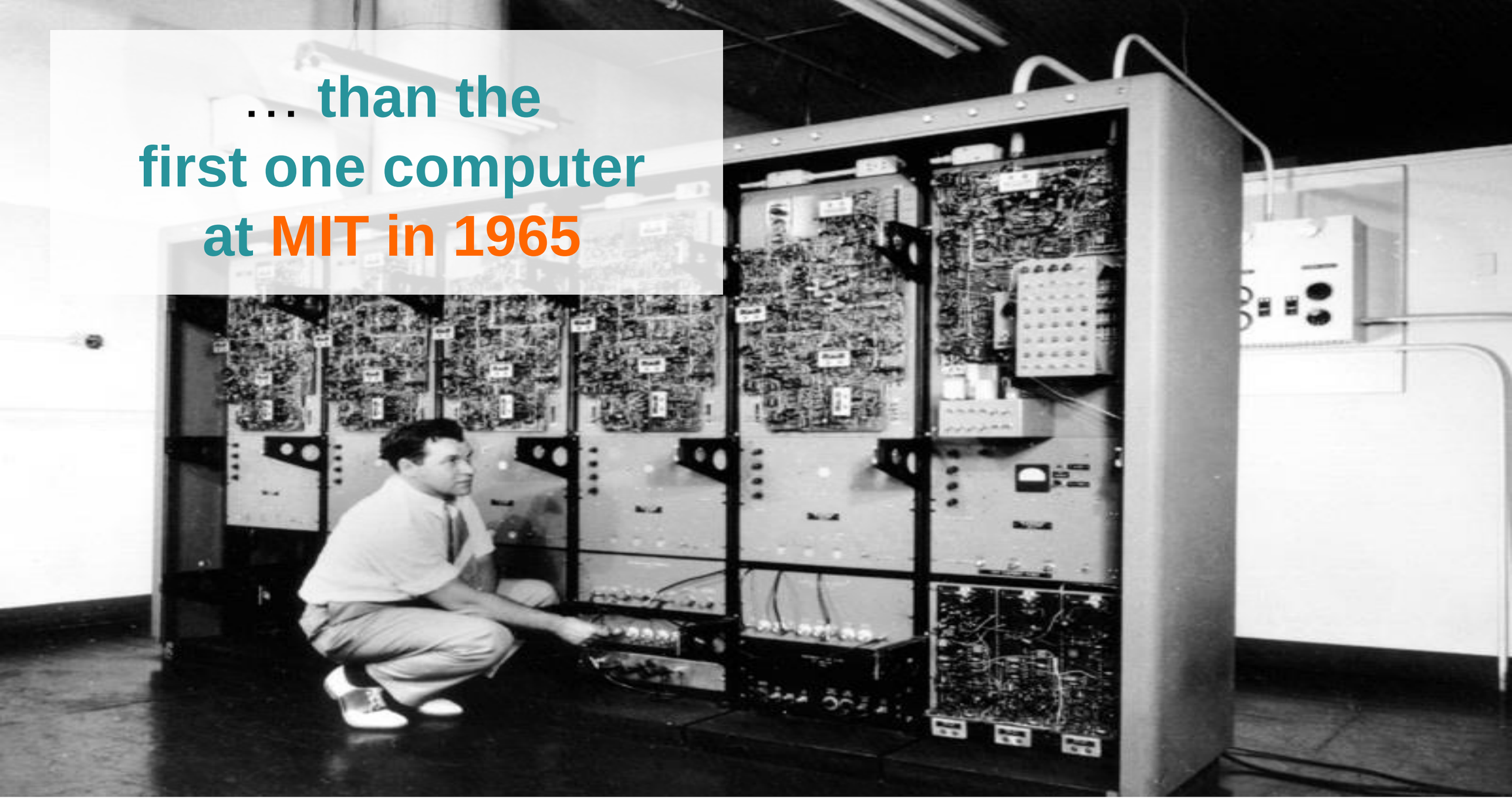
The 1978 quote: *"The invention of the cell phone revolutionized the way that **people and companies** communicate: quickly, anywhere, anytime!*
"

Survey 2013: « *What do you think of this handheld cell phone?*
Response: 97% think it is uncool; 98% would not think this is portable; 82% are horrified by the size and look

SOURCE: Mobile telephone history

And more …

The computer in your smart phone today is …



… than the first one computer at MIT in 1965

Disruptive technology defined

- High rate of technology change (in terms of cost or performance)

OR

- Significant increase in the rate of technology change

Rapid technology change

- Potential to touch the lives of billions of people or millions of workers

AND

- Potential to impact multiple sectors

Extensive reach of technology impact

Economically disruptive technology

Large economic value at stake

- Potential to impact large pools of economic value by 2025

Measurable in economic terms by 2025

Transformative potential impact

- Potential to significantly change people's jobs and lives (day-to-day, health, and environment)

OR

- Large portion of impact and disruption in the next 10 years

Not only economic, but societal

SOURCE: McKinsey Global Institute analysis

Not a prediction, but a careful selection

1 **Collect existing list**

- *Hype* list built up, through various sources:
  - Media
  - Academic intelligence
  - Business intelligence
- Reviewed by external experts+ McKinsey expertise

2 **Screen list based on our 4 definition criteria**

- Speed of technology diffusion
- Impact (breadth & size)
- Measurable in GDP activity and more
- Disruptive nature (value chain, consumer)

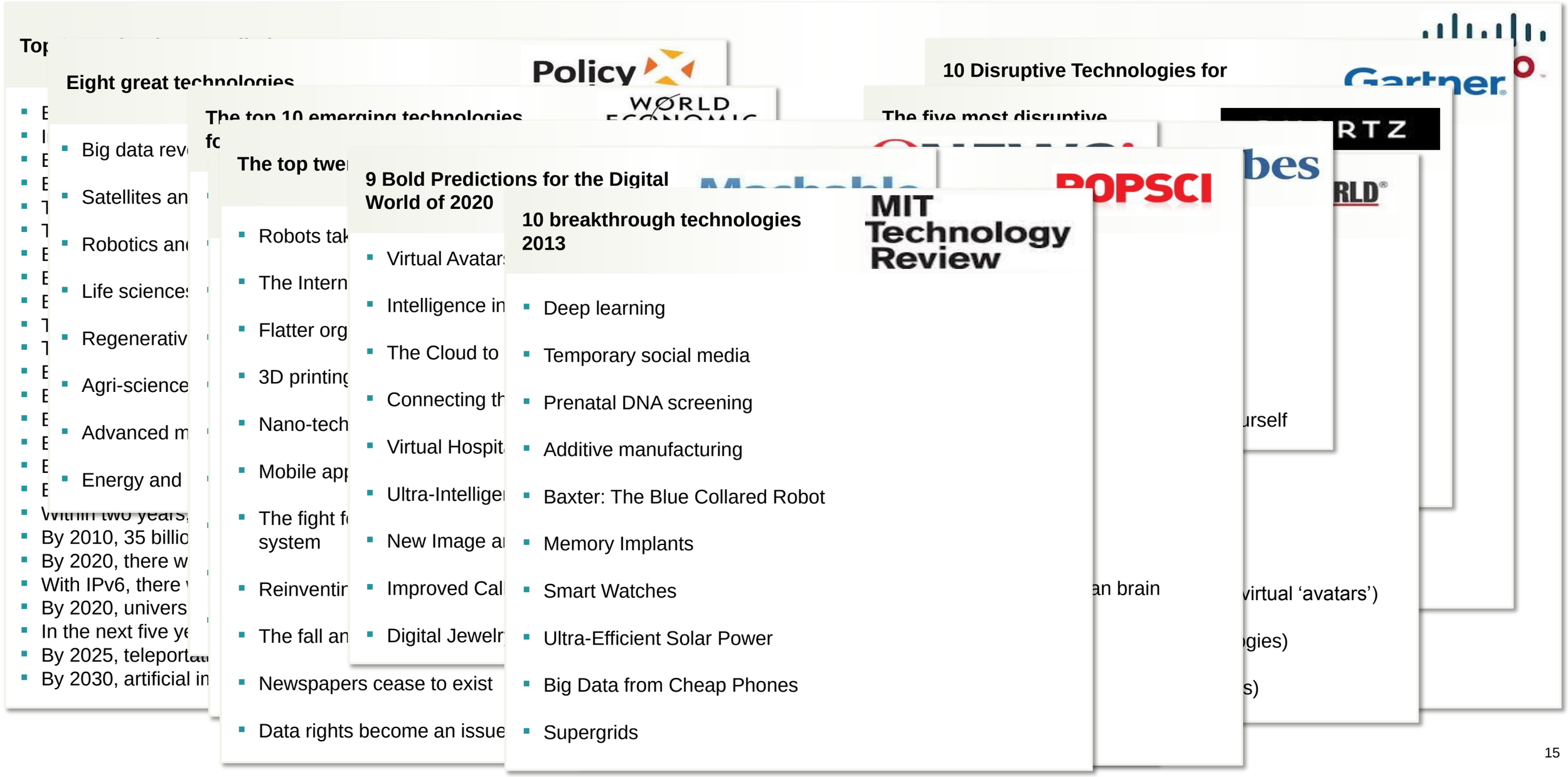
3 **Further detailed impact on list of technologies**

- Detail by industry
- Taxonomy of impact
  - Employees
  - Consumers
  - Entrepreneurs
  - Governments, etc.

Agenda

1. Why and how
2. **The next 12**
3. What to make out of it

Technology trend “lists” everywhere



We focused our work on an original list of 100 contenders

- Fission
- Fusion panel
- Carbon sequestration
- Advanced water purification
- Quantum computing

12 winners

5 close contenders

All 83 others reviewed

And the winners are? A few tips

"We see computers everywhere, not in statistics"

- Technology disruptions can be visible (e.g. cost decrease by 50% in one year, etc), yet it usually takes time to percolate and penetrate all sectors of life/economy

"The internet economy is barely 3% of GDP but we can't live without it"

- Major technology disruption affects as much user surplus as economic activity

"Technology without science and funding will not be called technology"

- Nanotechnology driven by Human Genome Project
- Internet ancestor, the Arpanet was a publicly funded project

And the winners are? A few tips

	Rate of technology change	Scope of groups, products, and resources that could be impacted	Scale of economic value that could be impacted	Potential for economic impact and disruption by 2025
12 final technologies				
Some close runners-up				
Carbon sequestration				
Next-generation nuclear				
Fusion				
Quantum computing				
Water purification				

High
Medium
Low

Why not a winner – examples

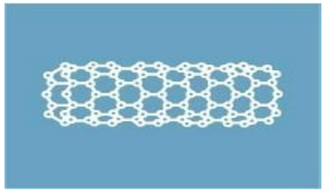
1 **Quantum computing**		Transformative alternative to digital computers but breadth of its applicability remains uncertain and time frame of commercialization not solid to have likely meaningful and broad impact by 2025
2 **Space flight**		Limited to a few applications in next 10 years like space tourism and private satellite launch- even much larger impact afterwards, e.g., asteroid mining, etc.

Why a winner – Example

Changing the basic building blocks of everything

Next-generation genomics

Fast, low-cost gene sequencing, advanced big data analytics, and synthetic biology (“writing” DNA)



Advanced materials

Materials designed to have superior characteristics (e.g., strength, weight, conductivity) or functionality

So … The Disruptive Dozen: Speed, Scope, and Economics at stake

IT and how we use it

Mobile Internet
Increasingly inexpensive and capable mobile computing devices and Internet connectivity

Cloud technology
Use of computer hardware and software resources delivered over a network or the Internet, often as a service

Internet of Things
Networks of low-cost sensors and actuators for data collection, monitoring, decision making, and process optimization

Automation of knowledge work
Intelligent software systems that can perform knowledge work tasks involving unstructured commands and subtle judgments

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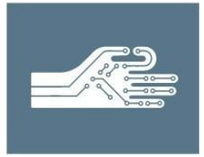
Machines working for us



Advanced robotics
Increasingly capable robots with enhanced senses, dexterity, and intelligence used to automate tasks or augment humans

Autonomous and near-autonomous vehicles
Vehicles that can navigate and operate with reduced or no human intervention

3D printing
Additive manufacturing techniques to create objects by printing layers of material based on digital models

The Disruptive Dozen: Speed, Scope, and Economics at stake

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Rethinking energy comes of age

Energy storage
Devices or systems that store energy for later use, including batteries

Advanced oil and gas exploration and recovery
Exploration and recovery techniques that make extraction of unconventional oil and gas economical

Renewable energy
Generation of electricity from renewable sources with reduced harmful climate impact

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Changing the building blocks of everything

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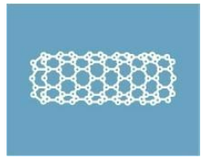
Fast, low-cost gene sequencing, advanced big data analytics, and synthetic biology (“writing” DNA)



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Disruption in number (1/2)

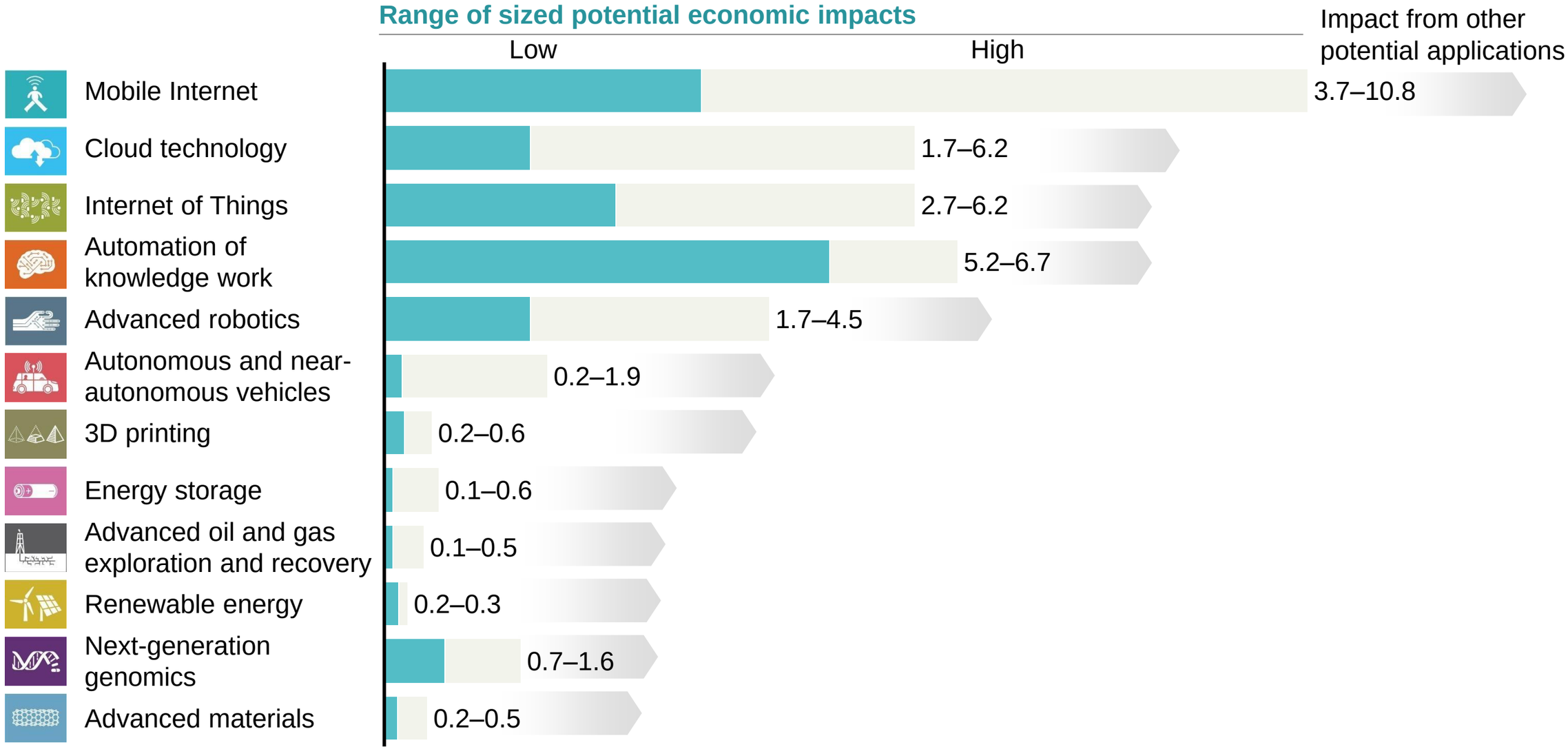
	Technology improvement/difference example	Disrupted pools
 **Mobile internet**	▪ **6x** growth in sales of smart wireless devices since 2007	▪ **4.3 billion** people connected to the web
 **Automation of work**	▪ **100%** increase in computing power from IBM's Deep Blue to Watson	▪ **230 million knowledge** workers
 **Internet of Things**	▪ **80-90%** reduction in sensor cost per year	▪ **100 million** M2M B2B industrial devices
 **Cloud**	▪ **300%-** the ratio of cost of owning versus renting a server	▪ **80%** large companies adopting Cloud tech
 **Advanced robotics**	▪ **85%** lower price for a Baxter versus average industrial robot	▪ **250 million** annual major surgeries
 **Near autonomous driving machines**	▪ **300,000 miles** driven by Google autonomous car without accident	▪ **1 billion** trucks globally

Disruption in number (2/2)

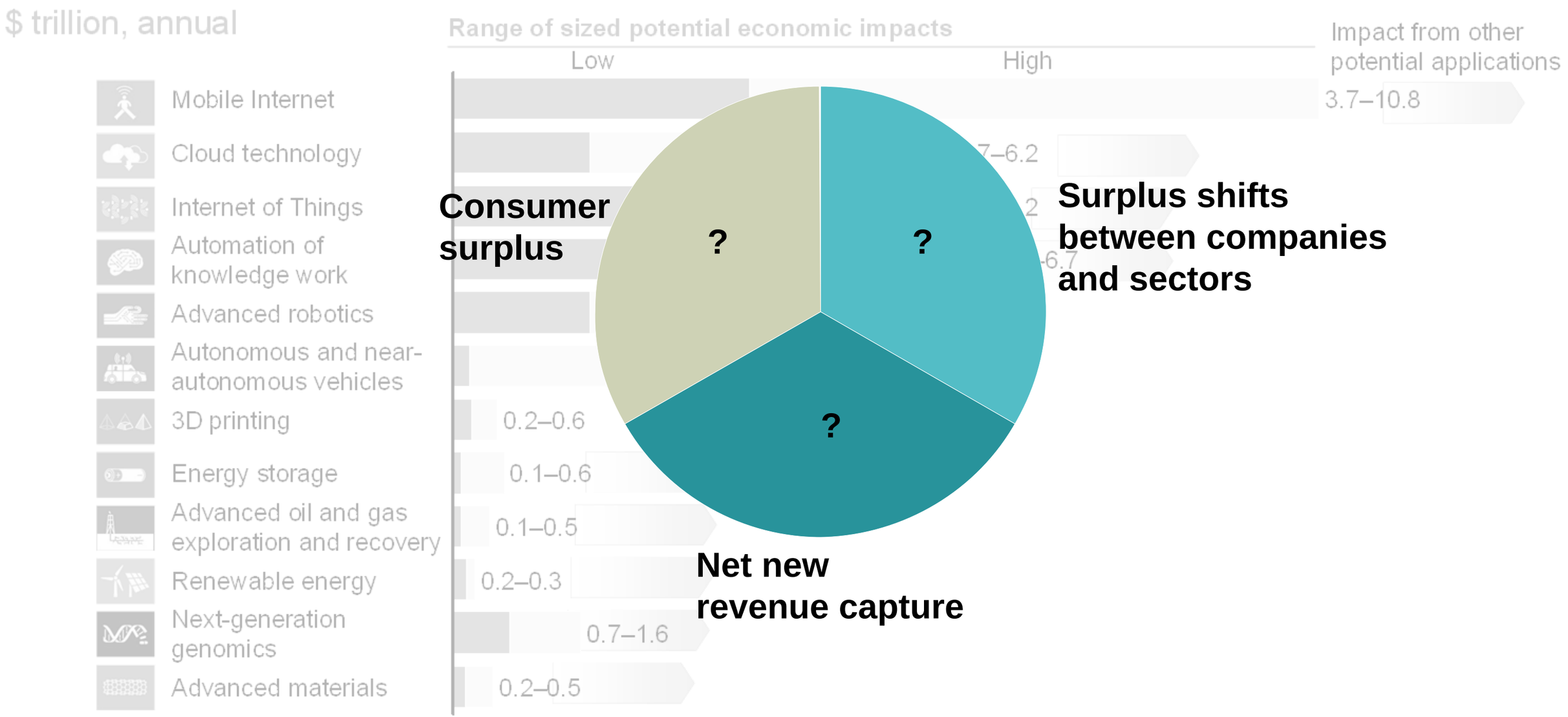
	Technology improvement/difference example	Disrupted pools
Energy storage	▪ **40%** price decline ion-lithium battery cost	▪ **1.2 billion** people without electricity
Advanced oil & gas	▪ **3x** increase in efficiency	▪ **30 billion** barrels of crude oil produced globally
3D printing	▪ **90%** price decline in 4 years	▪ **11 tiillion** global manufacturing industry
Renewable energy	▪ **19x** growth in solar photovoltaic capacity	▪ **13 billion** tons of CO_2 emissions
Next-generation genomics	▪ **10 months** – time to double sequencing speed per US dollar	▪ **30 million** people dying from diabetes, cancer, cardiovascular disease
Advanced materials	▪ **115x -** strength to weight ratio of carbon nanotubes versus steel	▪ **8 million** tons –annual global silicon consumption

Economic Potential – Sized applications in each category by 2025

$ trillion, annual



Economic Potential – The Competing Claims



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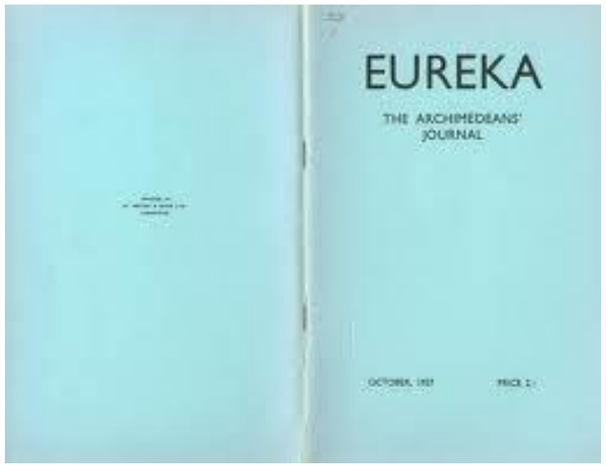


Five interesting insights

1 If all disruptions fully materialize, they will produce close of half of expected tech-enabled productivity increase by 2025

- About an average potential of USD 15 trillion of nominal productivity gain by 2025, or roughly USD 6 trillion of *volume* productivity increase
- USD 6 trillion versus USD 14 trillion of technical change contribution to world GDP

2 Significant power law in tech impact

- Top 2 disruptions = 20%, top 5 = 35%, top 10 = 43%, etc.

3 Social Hype does not necessarily anticipate impact

- Poor correlation in media coverage of technologies and their impact

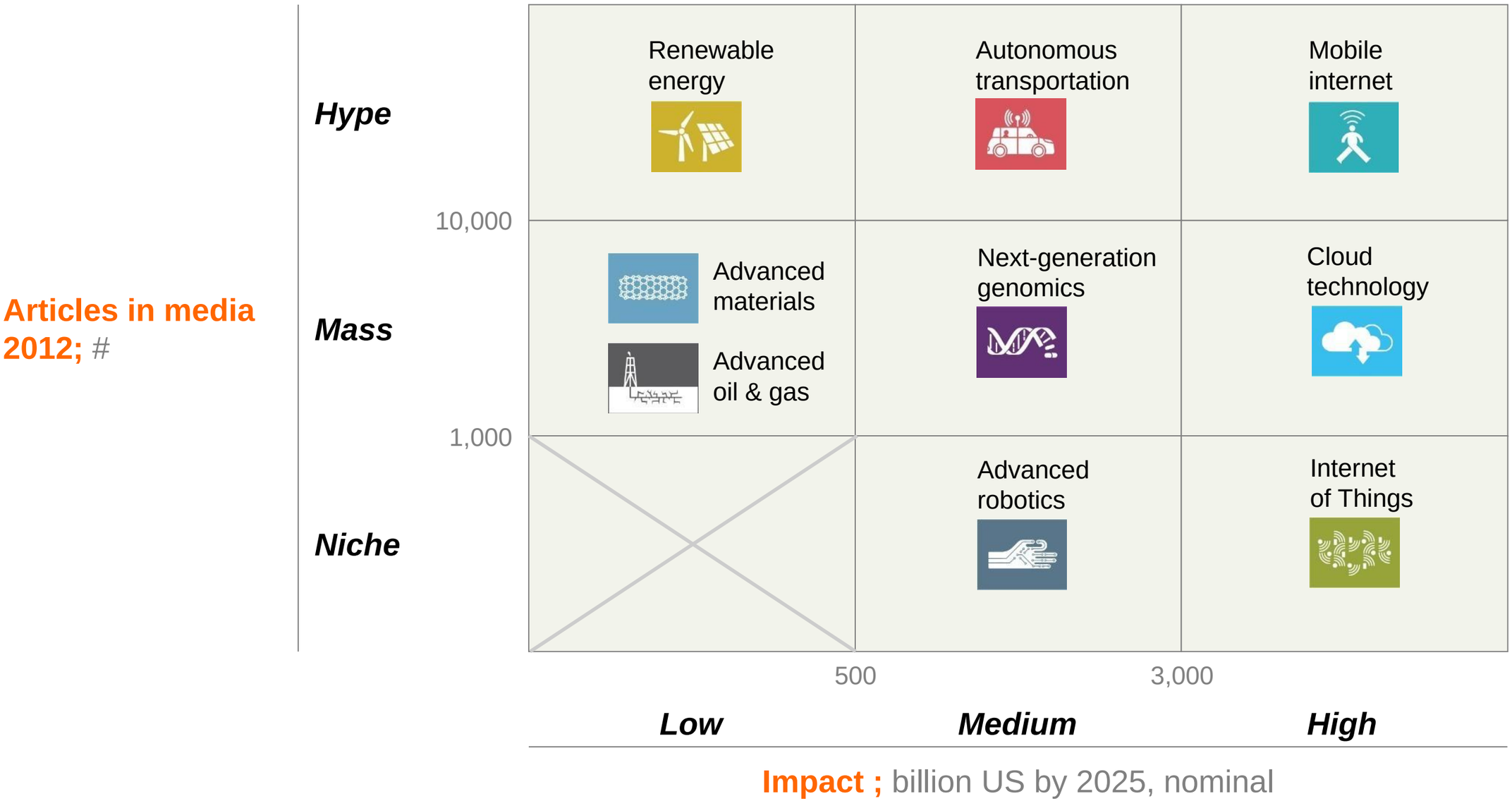
4 Benefits still to be in favor of developed countries

- 60% of impact accruing to developed economies

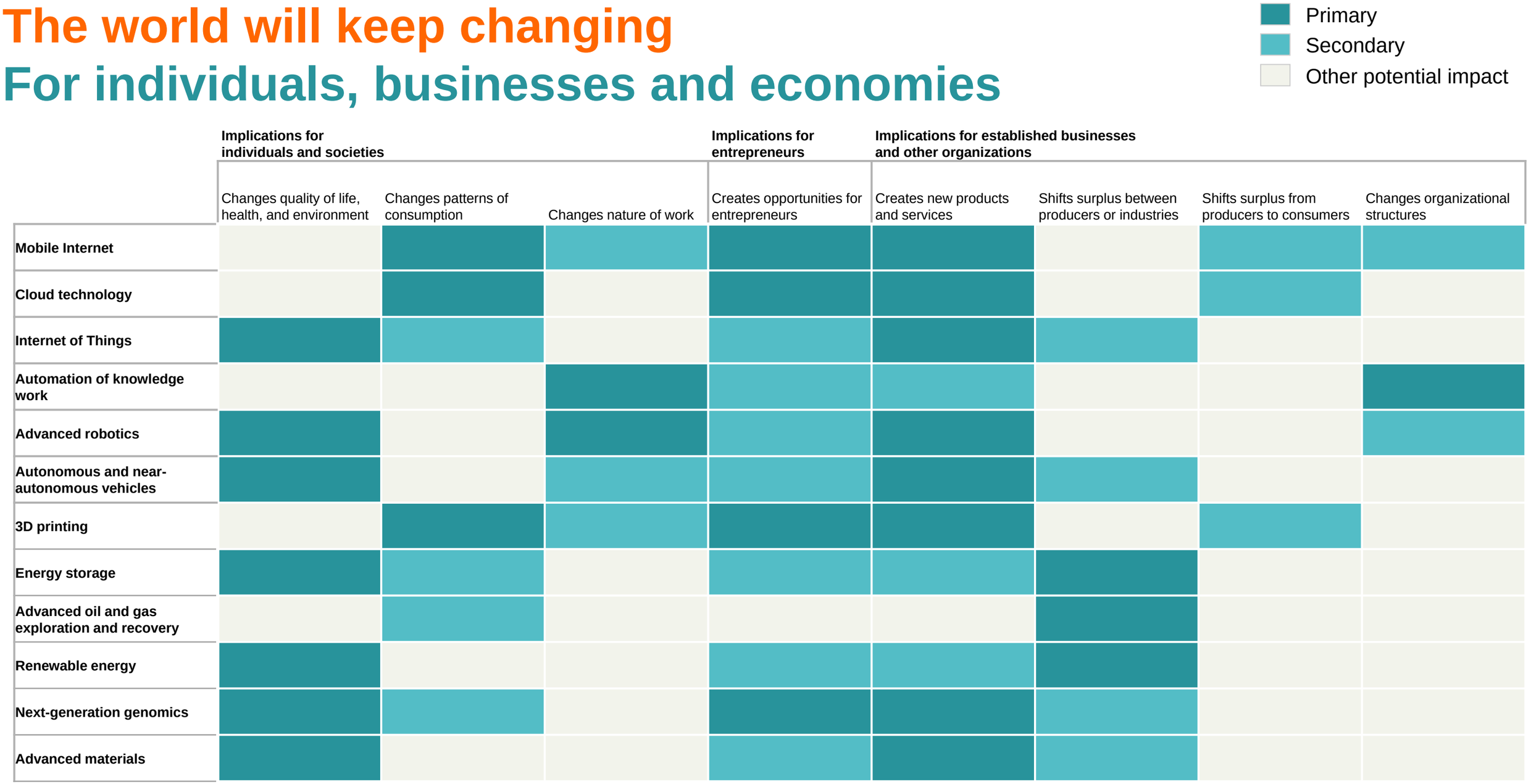
5 People matter

- Largest impact arises when tech impacts a broad set of consumers and employees

Hype versus impact



The world will keep changing
For individuals, businesses and economies



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