Big data is one of many disruptive technologies

Renewable energy
- 21,000 TWh annual global electricity consumption
- 85% lower price for solar photovoltaic cell per watt since 2000
- 13 billion tons in annual carbon dioxide emission from electricity generation
- $3.5 trillion value of global electricity consumption

Advanced oil & gas exploration & recovery
- 3x increase in efficiency of US gas wells between 2007 & 2011; 2x increase for oil wells over the same period
- 30 billion barrels of crude oil produced globally
- $3.4 trillion revenue from global sales of crude oil

Advanced materials
- $1000 vs $50: Price difference of 1 gram of nanotube over a decade
- 115x strength-to-weight ratio of carbon nanotubes vs steel
- $4 billion revenue from global carbon fibre sales

3D printing
- 90% decrease in price of home 3D printers compared to 2009
- $11 trillion worth in global manufacturing GDP
- 8 billion pieces of toys manufactured globally a year

Energy storage
- 40% price decline in Lithium-ion battery pack in an electric vehicle since 2009
- 1.2 billion people without access to electricity
- $100 billion estimated value of electricity for households currently without access

Next-generation genomics
- 10 months to double sequencing speed per dollar
- 100x increase in acreage of genetically modified crops between 1996 to 2012; 2.5 billion people employed in agriculture
- $6.5 trillion global health-care costs

McKinsey&Company
McKinsey Global Institute

12 Disruptive Technologies

Mobile Internet
- Fastest supercomputer in 1975 costs $5m, with equal performance as an iPhone 4, which costs $400
- 4.3 billion people yet to be connect to the Internet today
- $1.7 trillion worth of GDP related to the Internet
- 1.1 billion smartphone users, with potential to use automated digital assistance apps

Automation of knowledge work
- 100x increase in computing power from IBM's Deep Blue (1997) to Watson (2011)
- $9+ trillion global costs of employing knowledge workers, which is 27% of global employment costs

Internet of Things
- 300% increase in connected machine-to-machine devices since 2008
- 1 trillion things that could be connected to the Internet across different industries
- $36 trillion operating costs of key affected industries
- mining
- health-care
- manufacturing

Cloud technology
- 18 months to double server performance per dollar
- 2.7 billion Internet users served by 50 million servers worldwide
- $3 trillion spending by enterprises on information technology

Advanced robotics
- 170% growth in sales of industrial robots between 2009 and 2011
- 320 million manufacturing workers may be potentially affected
- $6 trillion in global manufacturing employment costs, which is 19% of global workforce

Autonomous and near-autonomous vehicles
- 300,000+ miles driven by Google's autonomous cars with only 1 accident (which was human-caused)
- 1 billion cars & trucks; 450,000 civilian, military & general aviation aircrafts globally
- $4 trillion automobile industry revenues

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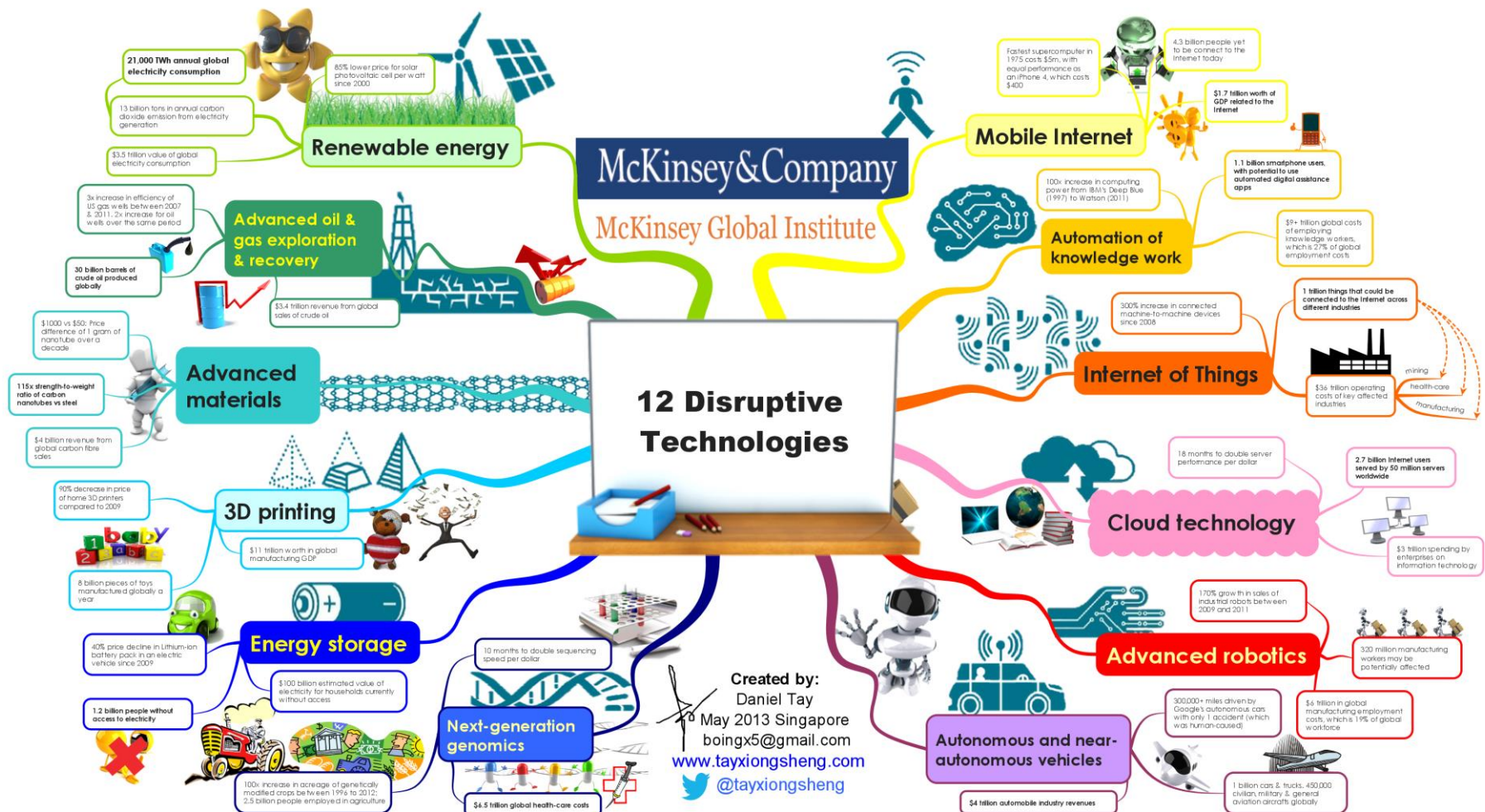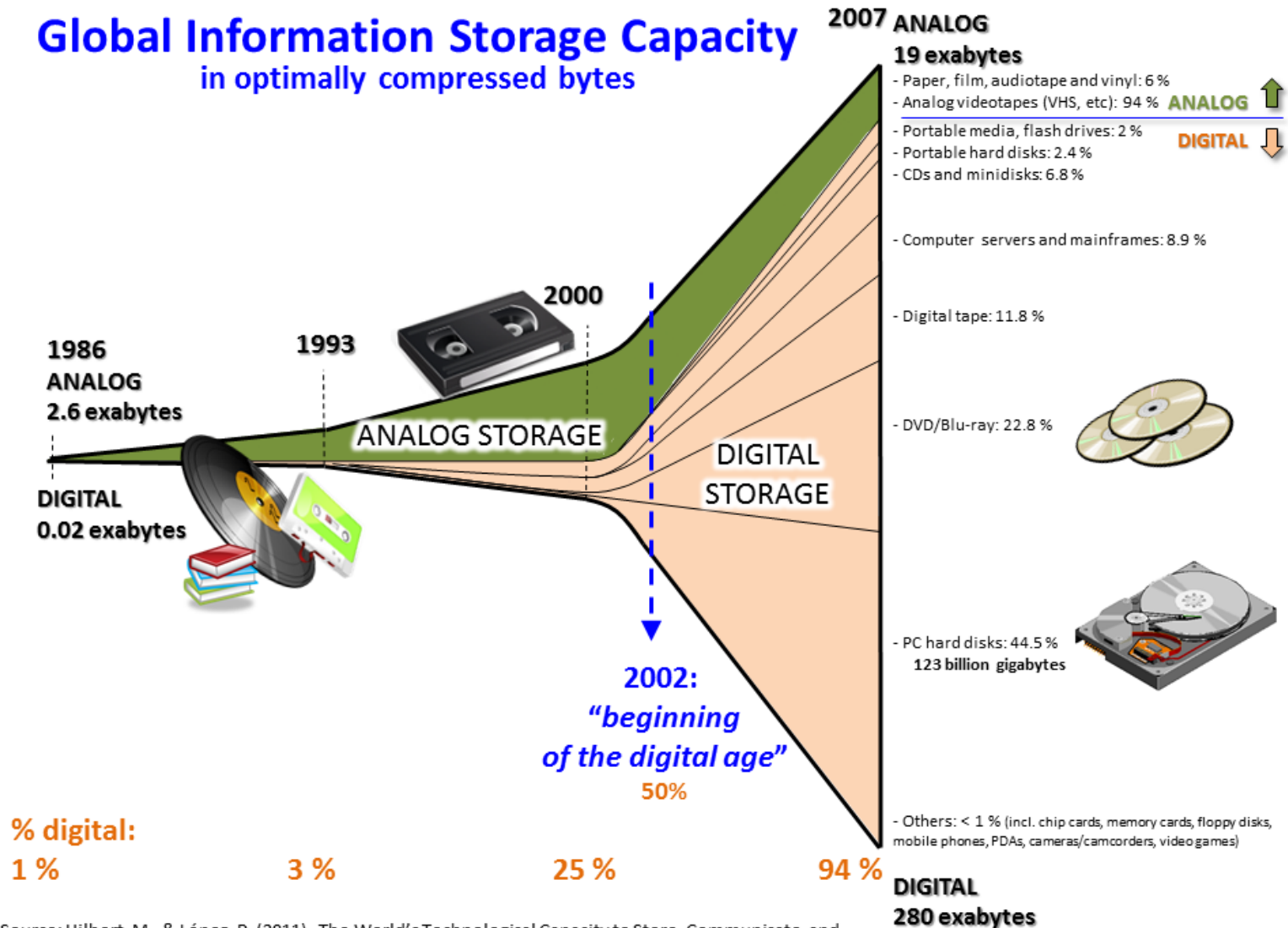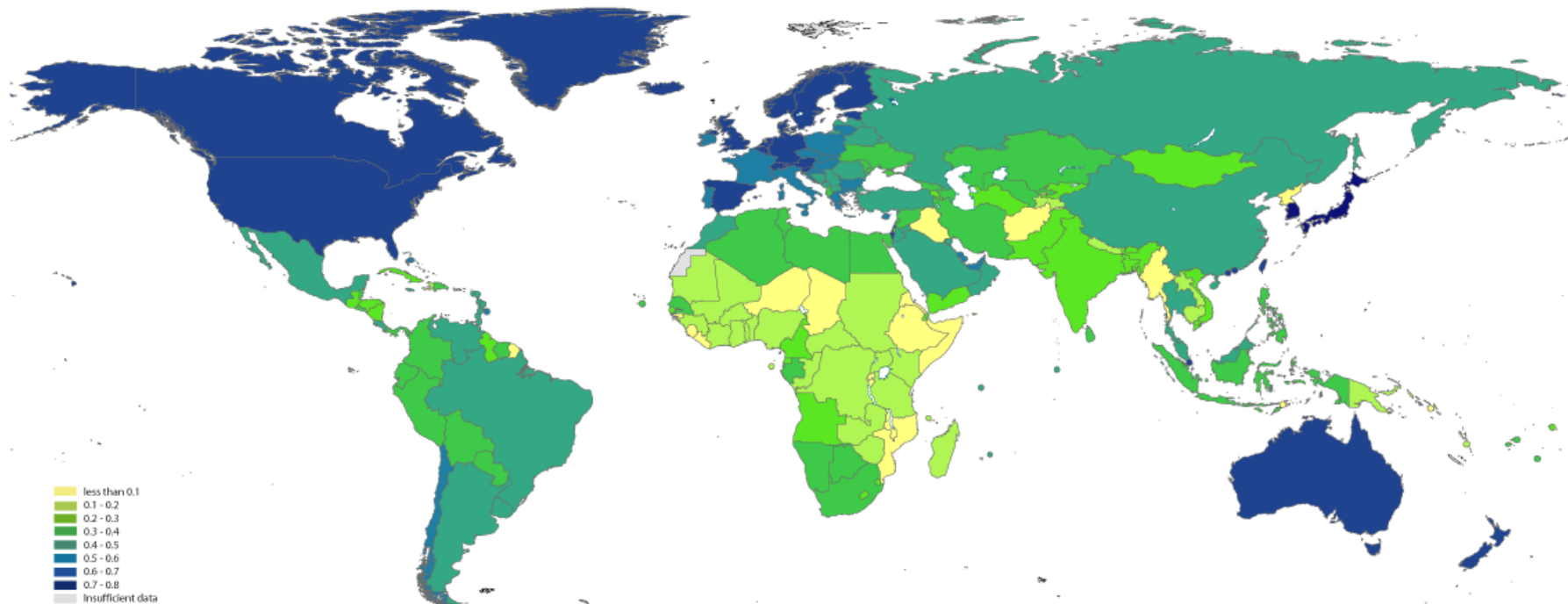The source of information in this Mind Map comes from *http://www.mckinsey.com/insights/business_technology/disruptive_technologies*

The digital age has made information widely available

Global Information Storage Capacity
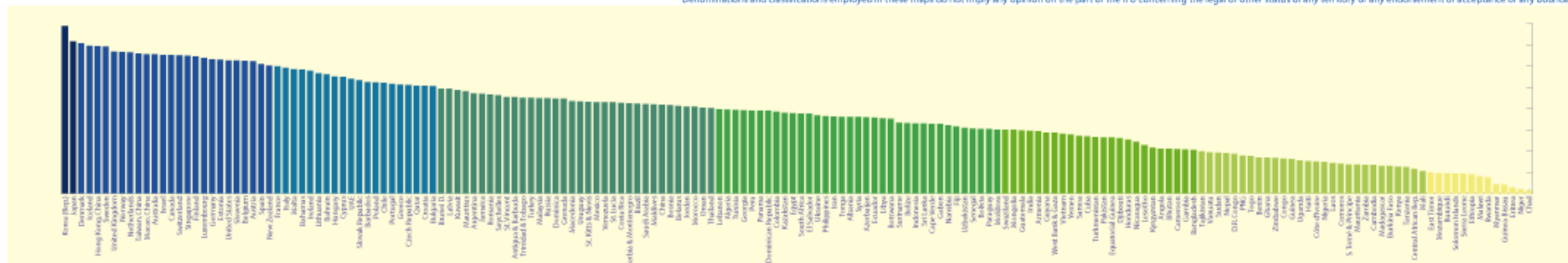### in optimally compressed bytes

2007 ANALOG

19 exabytes
- Paper, film, audiotape and vinyl: 6 %
- Analog videotapes (VHS, etc): 94 %   ANALOG
- Portable media, flash drives: 2 %   DIGITAL
- Portable hard disks: 2.4 %
- CDs and minidisks: 6.8 %

- Computer servers and mainframes: 8.9 %

- Digital tape: 11.8 %

2000

1993

**1986
ANALOG
2.6 exabytes**

ANALOG STORAGE

- DVD/Blu-ray: 22.8 %

DIGITAL
STORAGE

**DIGITAL
0.02 exabytes**

- PC hard disks: 44.5 %
    123 billion gigabytes

**2002:
"beginning
of the digital age"**

50%

- Others: < 1 % (incl. chip cards, memory cards, floppy disks, mobile phones, PDAs, cameras/camcorders, video games)

% digital:

| 1 % | 3 % | 25 % | 94 % |

**DIGITAL
280 exabytes**

Source: Hilbert, M., & López, P. (2011). The World's Technological Capacity to Store, Communicate, and Compute Information. *Science*, 332(6025), 60 –65. http://www.martinhilbert.net/WorldInfoCapacity.html

Can space help to bridge the "Digital Divide"?

GLIS 2016
GLOBAL CONFERENCE ON SPACE AND THE INFORMATION SOCIETY

The Digital Opportunity Index Worldwide, 2005

Legend:
- less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
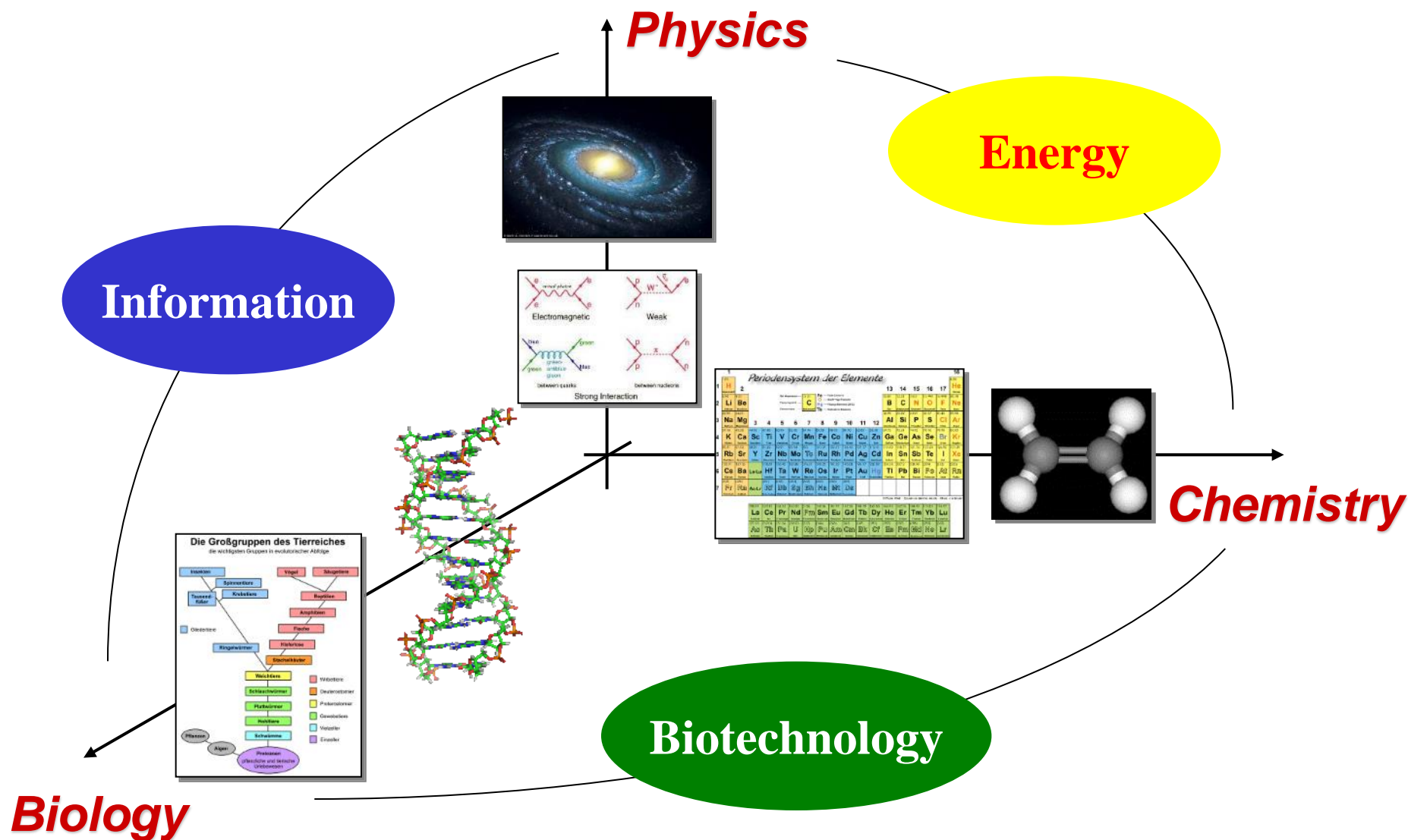- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- Insufficient data

Denominations and classifications employed in these maps do not imply any opinion on the part of the ITU concerning the legal or other status of any territory or any endorsement or acceptance of any boundary.

For more information about the Digital Opportunity Index, please see www.itu.int/doi.

This map is a part of the *World Information Society Report 2006*, available at www.itu.int/wisr.

Global IoT, M2M and the Industry 4.0 Vision – Blessing or Curse?
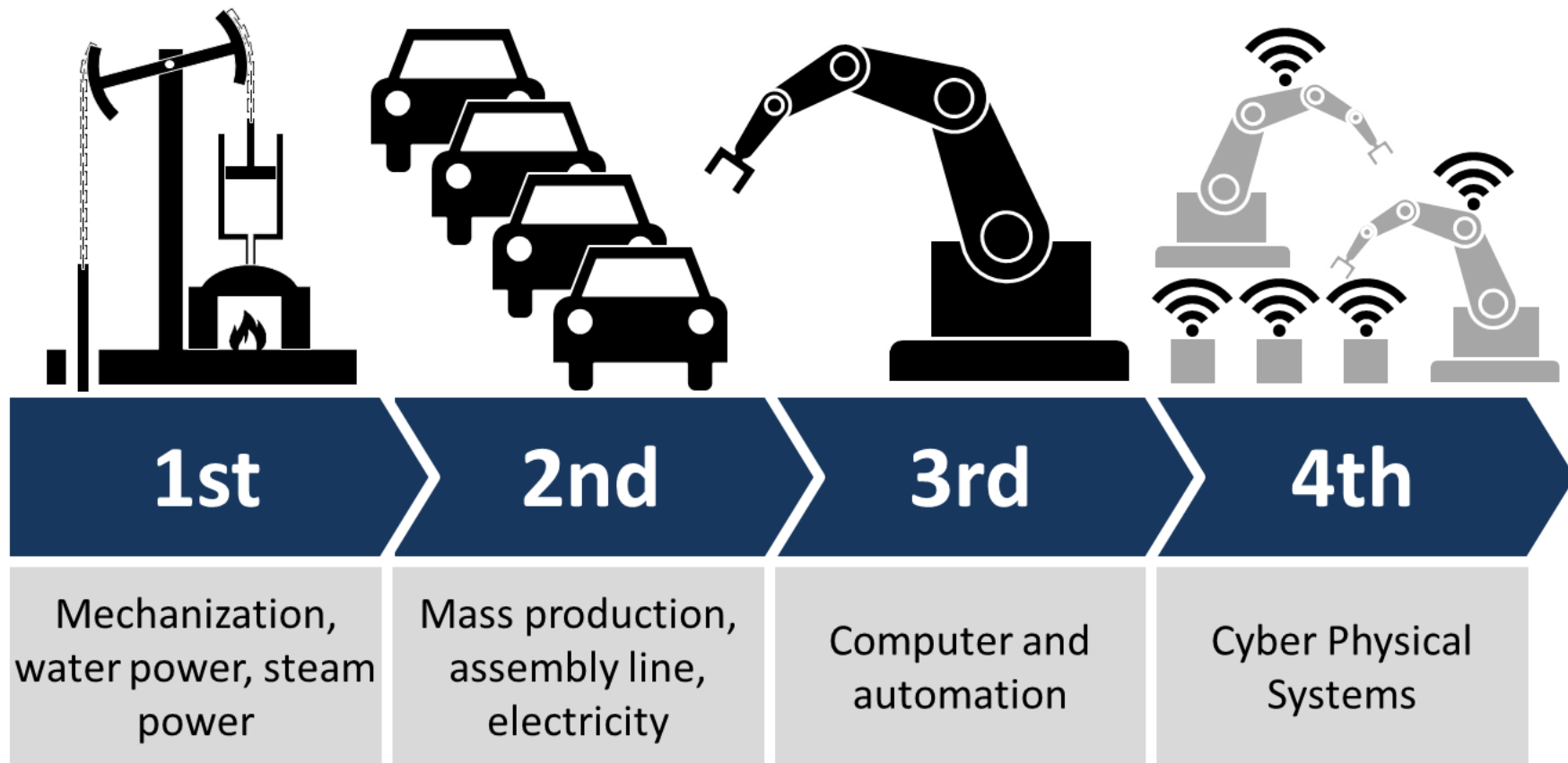
In a global-interlinked industry scenario, Cybersecurity becomes a GLOBAL threat!

The 3 classical natural sciences form the basis for progress…

Physics

Energy

Information

Chemistry

Biotechnology

Biology

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… and for a landscape of emerging risks