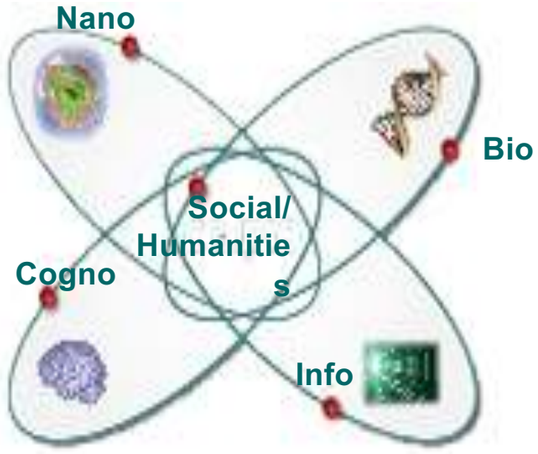
Private sector development in the age of digitalization and the great convergence

DCED, 2019 Annual Meeting Thematic Day

13 JUN 2019

Memedovic Olga



I. New industrial revolution: drivers and and characteristics

II. Opportunities and challenges

III. How are we prepared for the NIR?

Industrial revolutions: co-evolution of humans and technology

1.0 2.0 3.0 4.0 5.0 ?

18TH CENTURY
MECHANIZATION
Railroads
Steam and water

19TH CENTURY
MASS PRODUCTION
Assembly line
Conveyor
Electrification

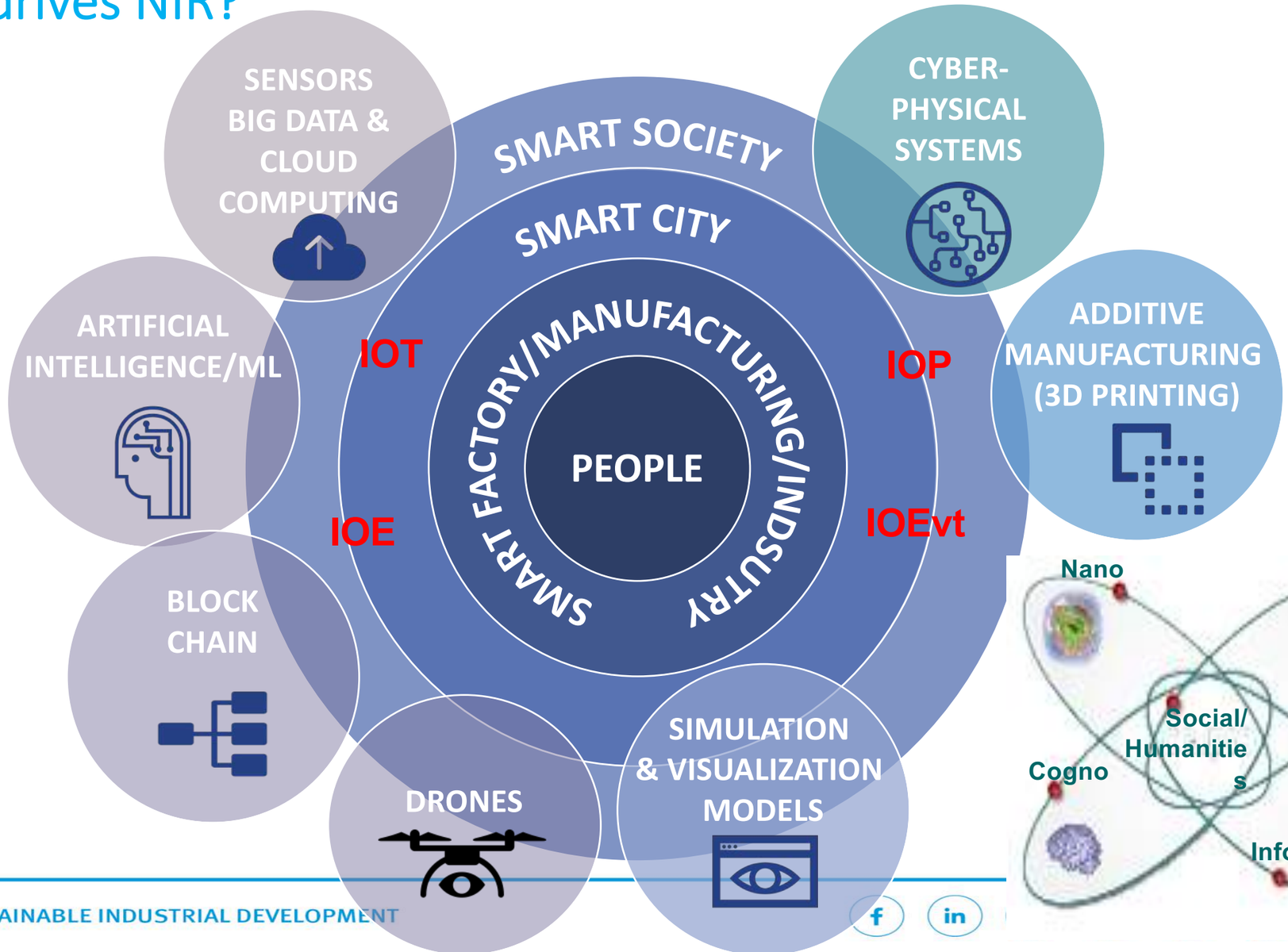
20TH CENTURY
AUTOMATION
MASS PRODUCTION
Computer
Electronics

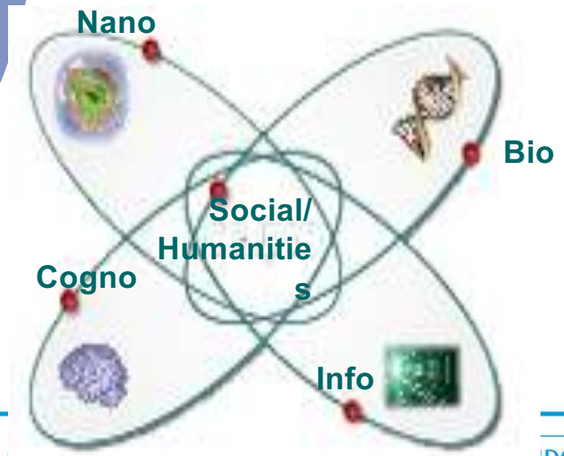
TODAY
CYBER PHYSICAL SYSTEM
MASS PRODUCTIONS/ CUSTOMIZATION
IoT; IoS; IoP; Robotics
Big Data, AI, 3D, NBCIS

Economies of scale → Economies of Scale and Scope → Customization at the unit price of mass production

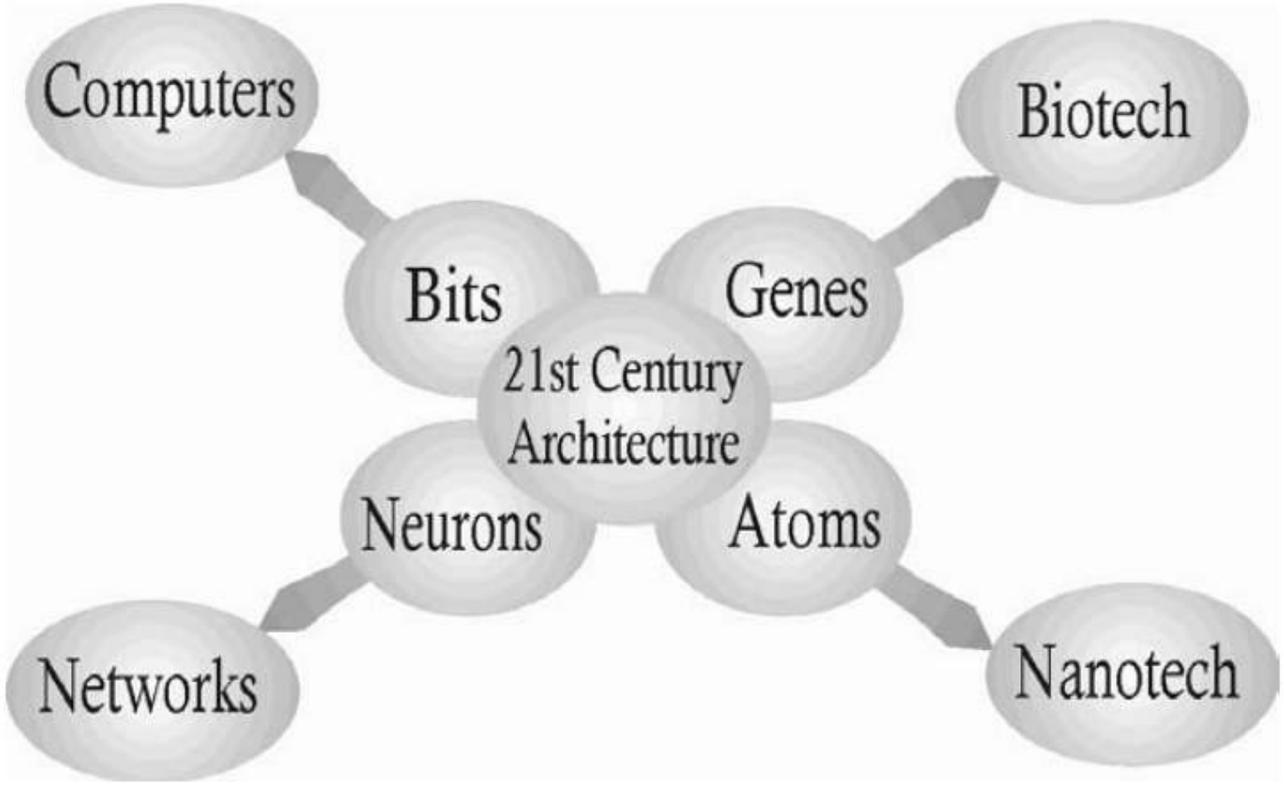
Material and energy intensity → Circular economy

What drives NIR?

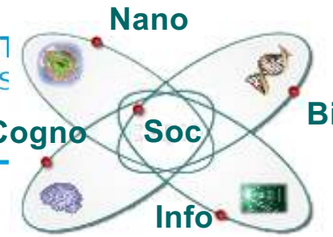




21st century technology convergence architecture driving NIR

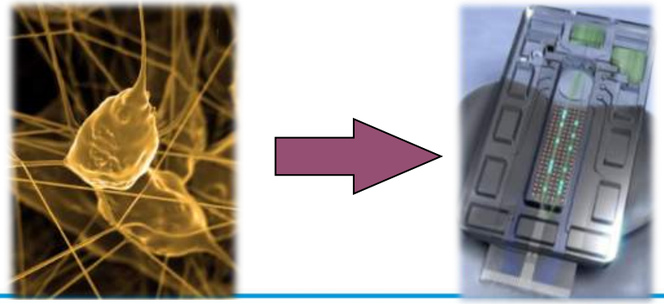


UNIDO Global Forum on Nature-like and Convergent Technologies for Inclusive and Sustainable Industrial Development, Russia, Sochi, 28-29 September 2018.



NANOBIOTECH + SOLID STATE MICROELECTRONICS (MEMS)

Hybrid materials and systems in manufacturing



UNIDO Global Forum on Nature-like and Convergent Technologies for Inclusive and Sustainable Industrial Development, Russia, Sochi, 28-29 September 2018.

Disruptive power of technological change

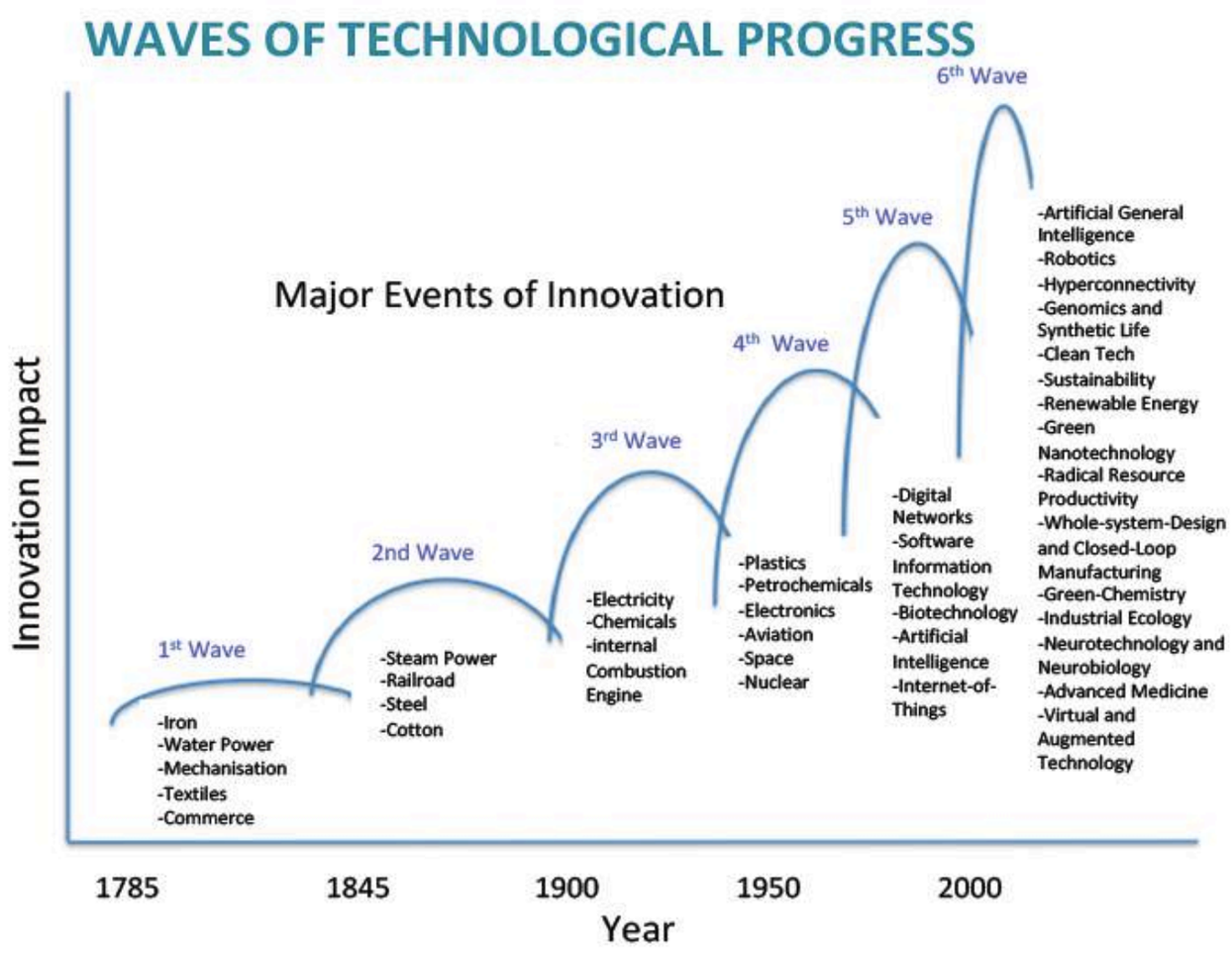
Speed of change

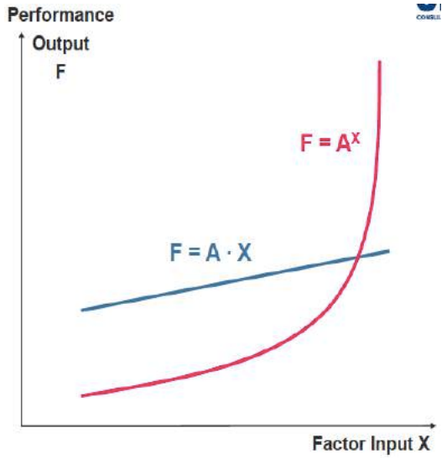
Widespread implications

Systemic impact

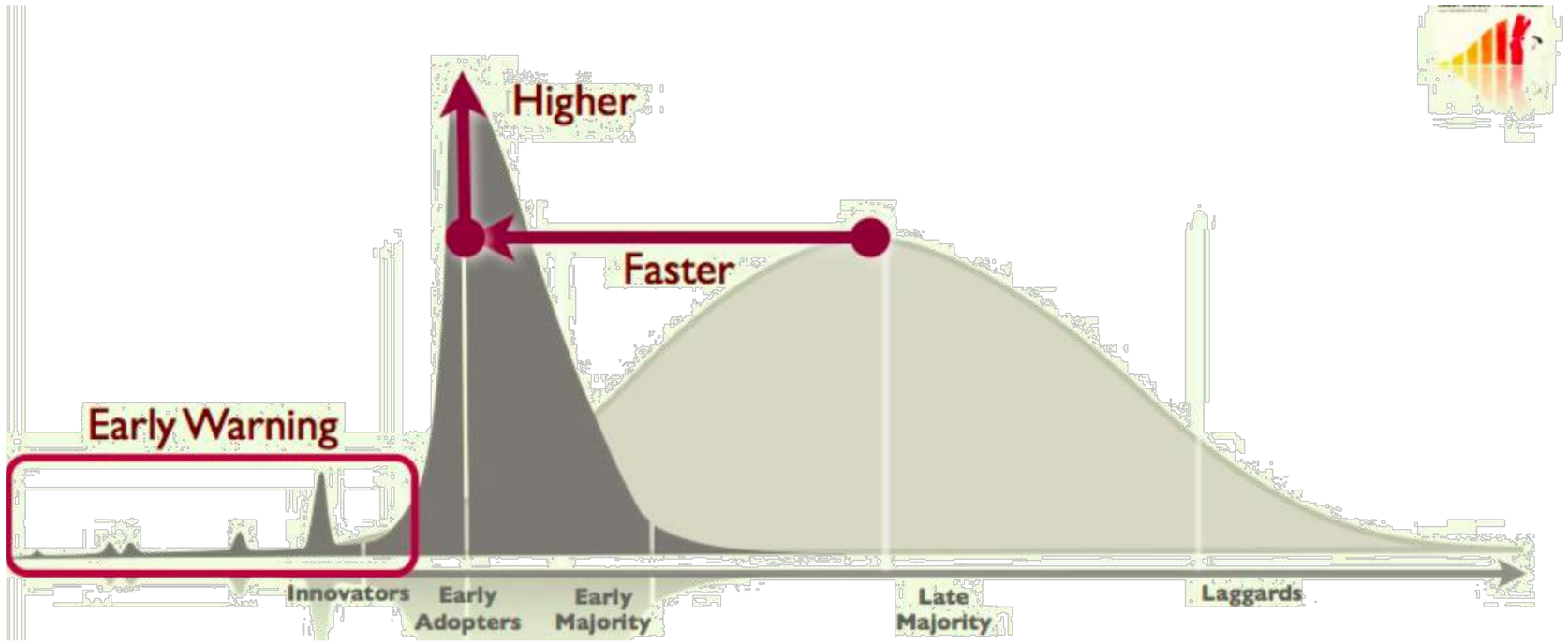
Who we are? How we work and leave?

Accelerating technological change: from incremental to exponential





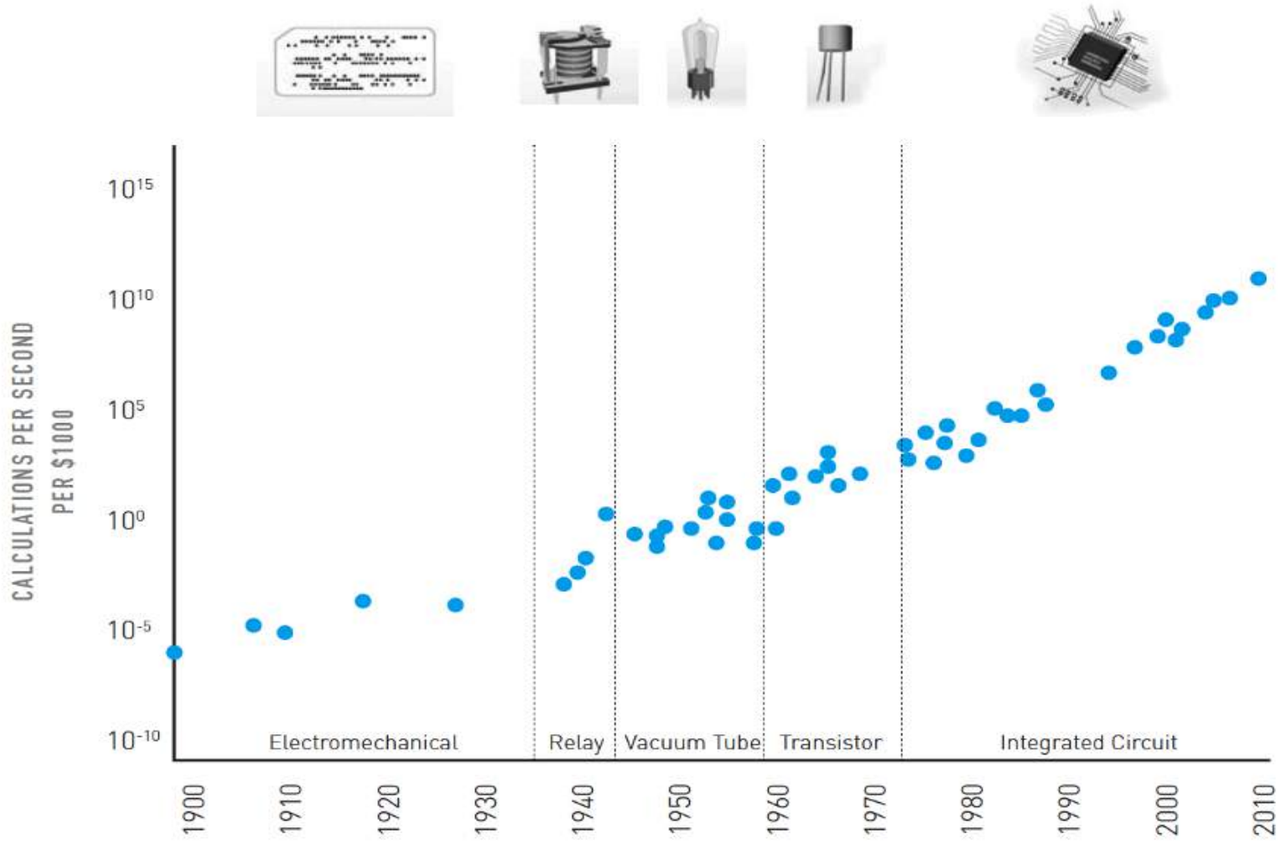
Accelerating (disruptive) innovation: shorten product life cycles; adoption time shorten from decades to a few years



Disruptive innovation collapses product life cycle; need to identify the early warning signals in order to participate

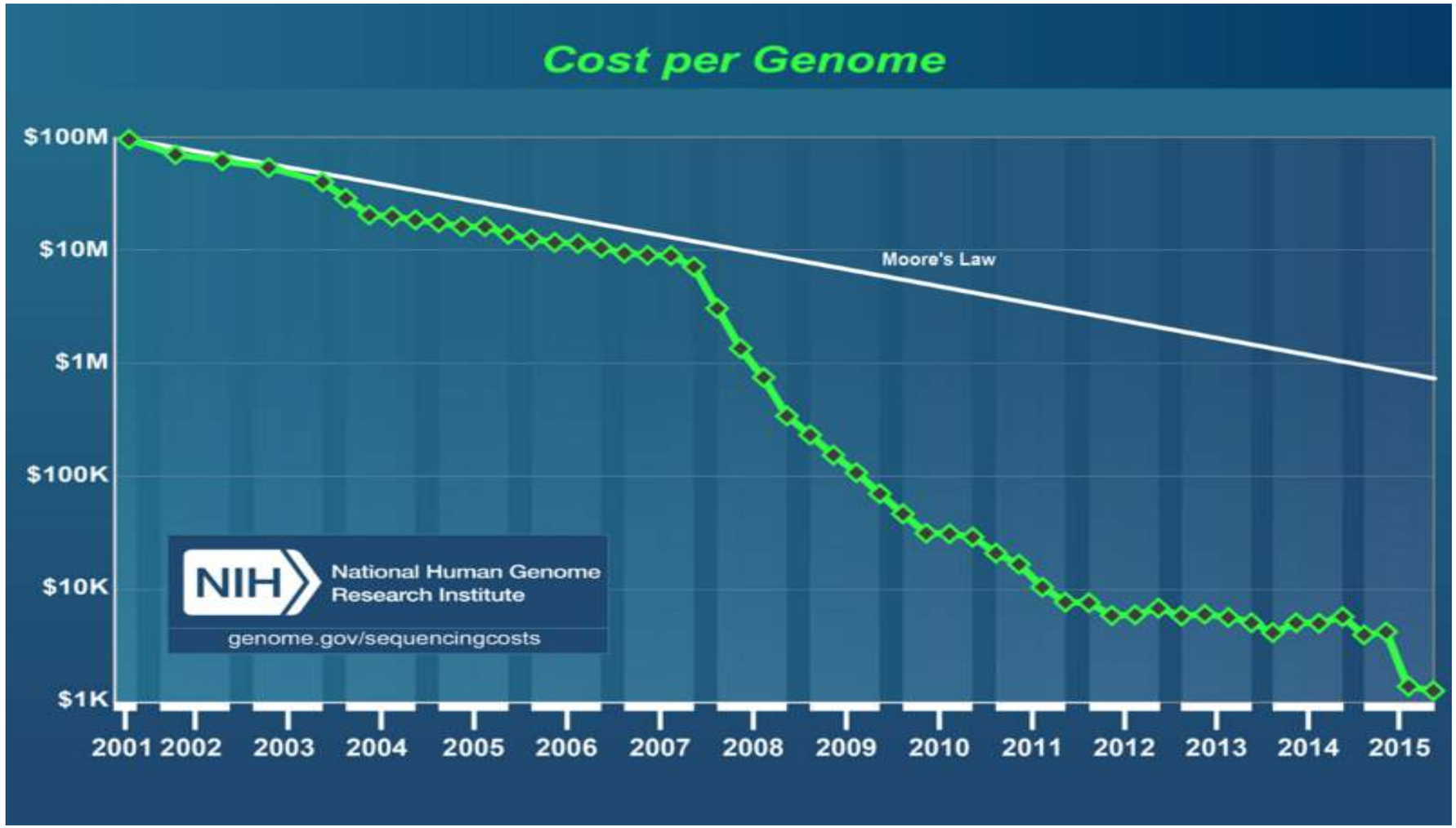
Source: Larry Downes and Paul F. Nune, Big Bang Disruption

Accelerating price-performance of computing devices power (*consistently multiplying in power per unit of time/money*)

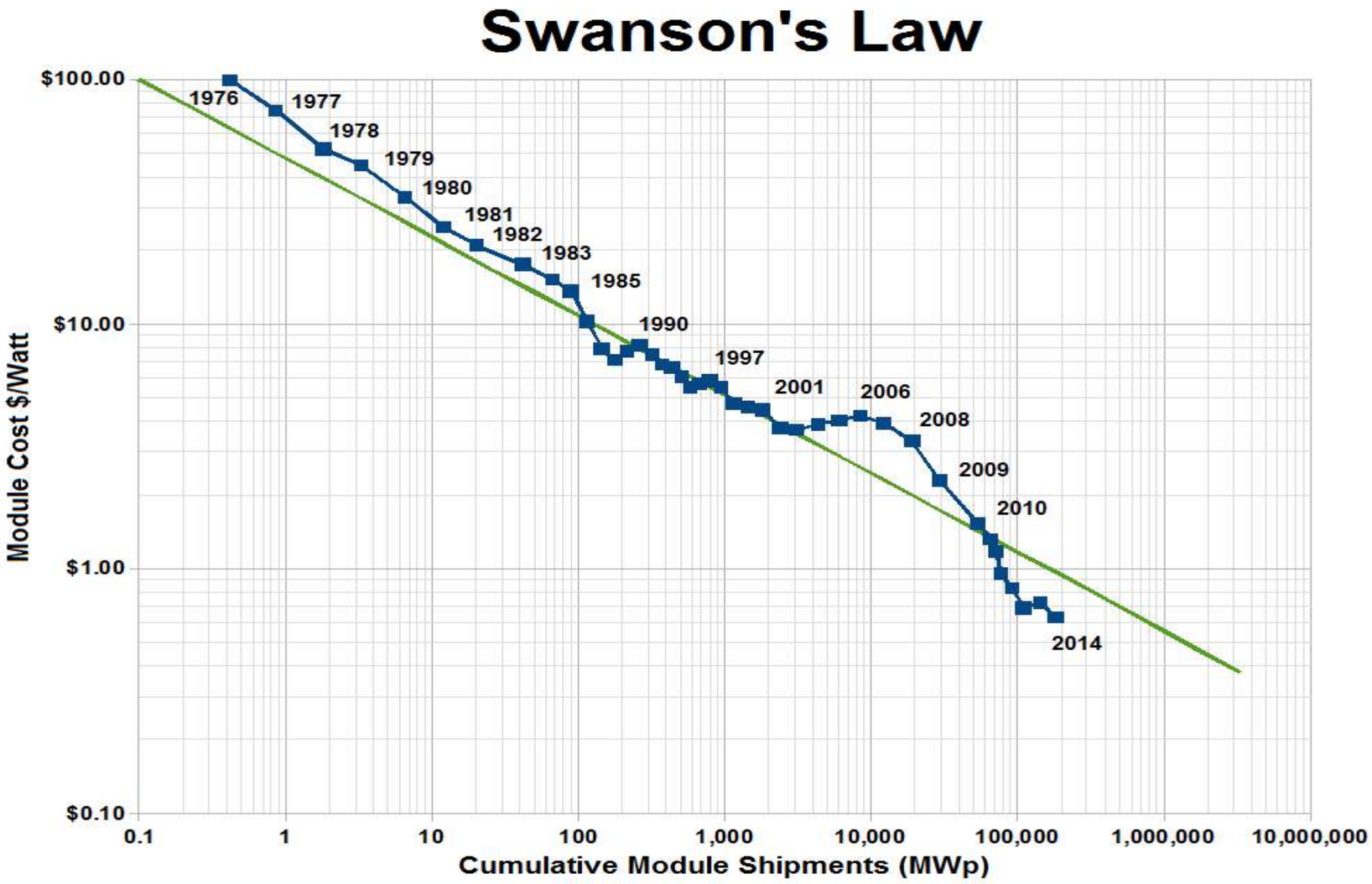


Ray Kurzweil extending Moore's law due to paradigm shift

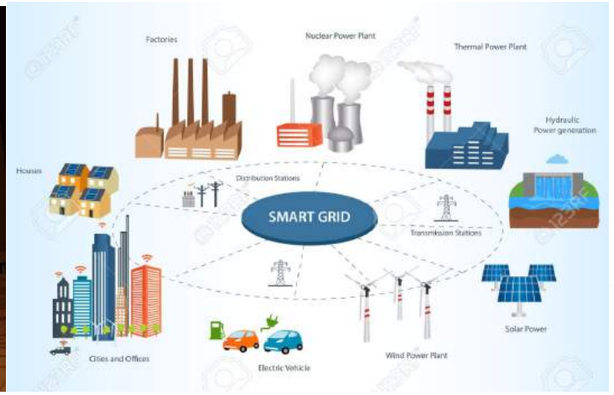
Accelerating price performance in genome sequencing



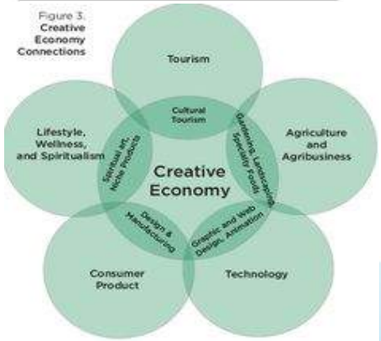
Accelerating price performance of Photovoltaic Panels



Widespread implications:
All economic sectors will be affected

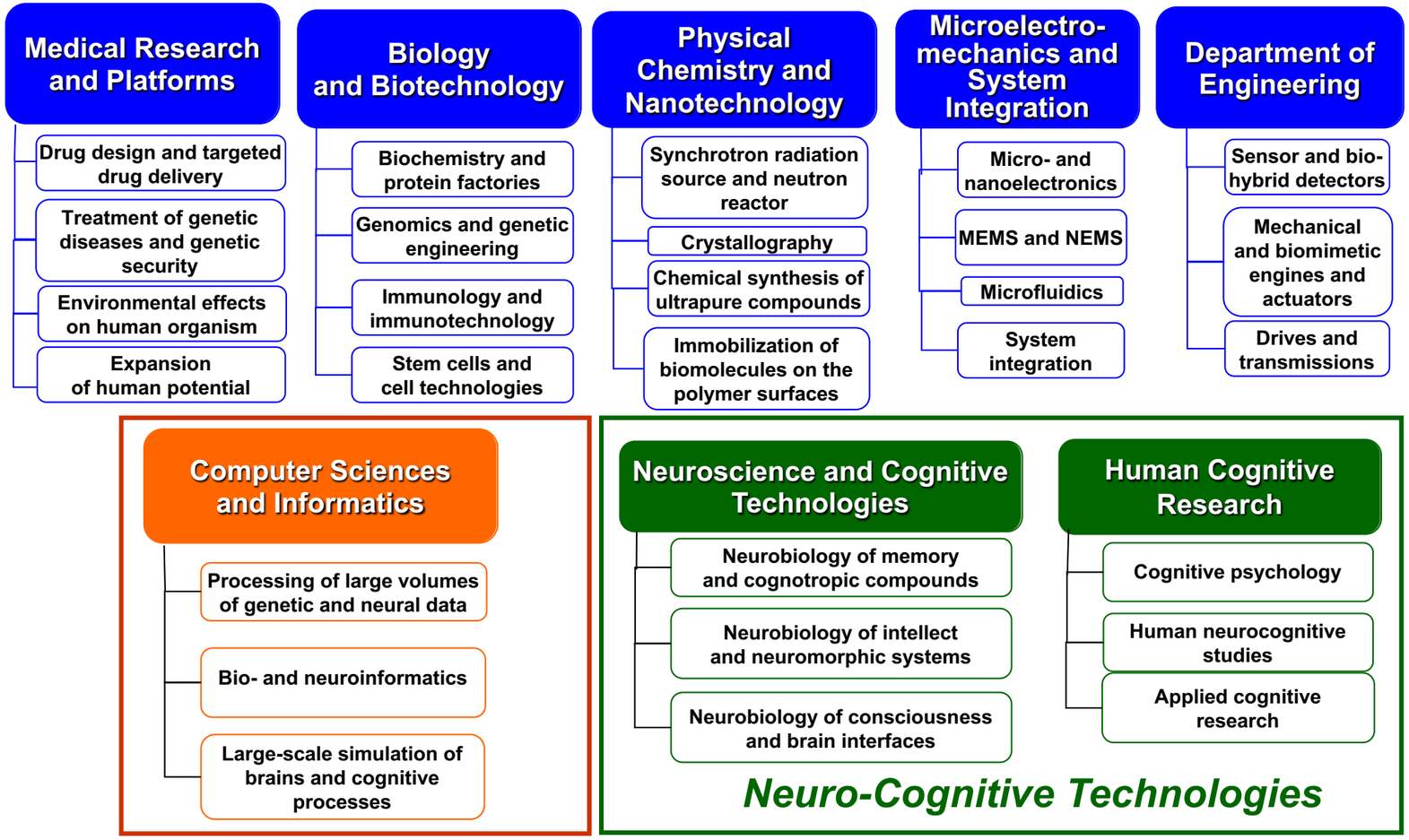


Human Hearts
From Stem Cells



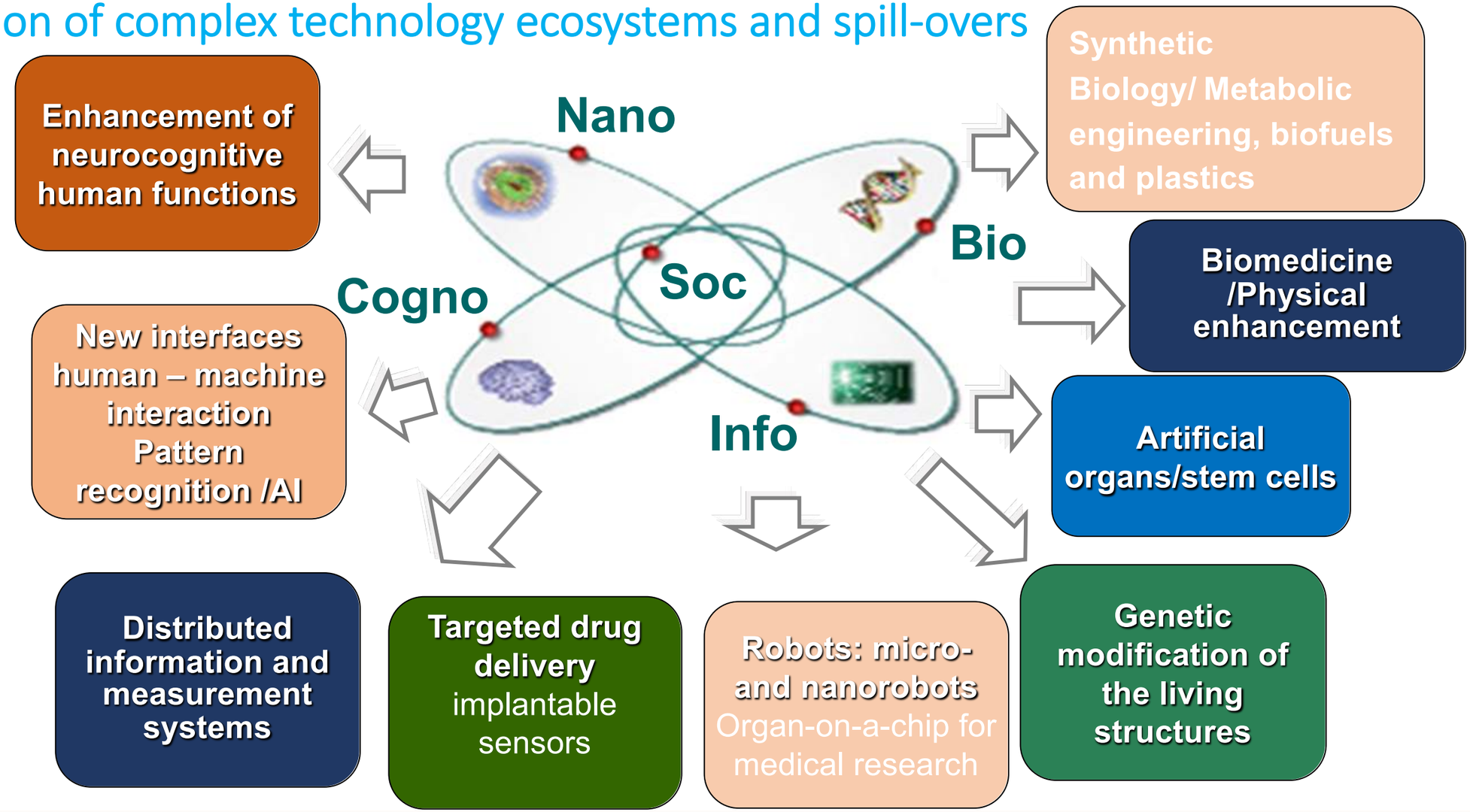
New business models:

New sciences and technologies



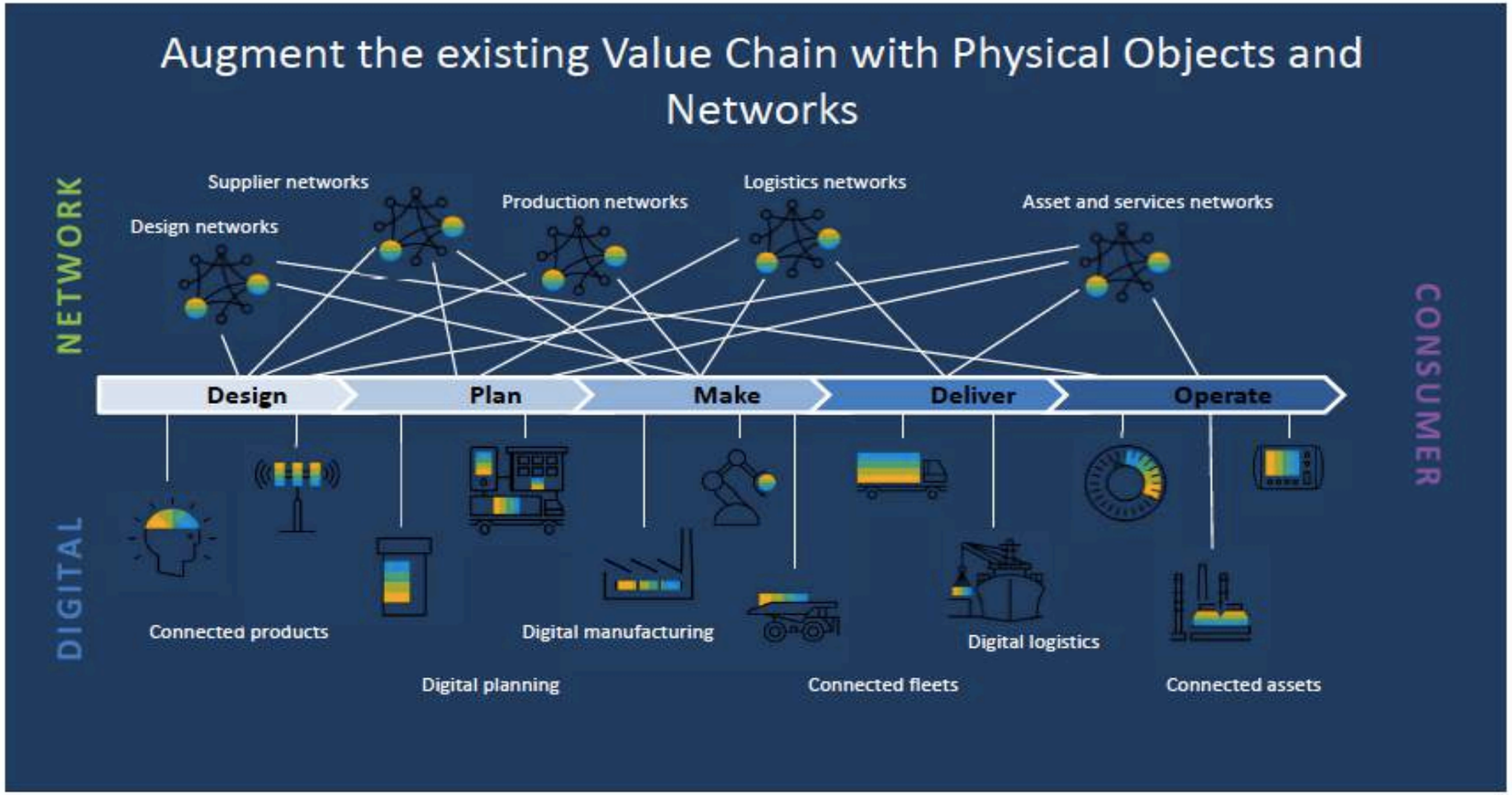
Kurchatov Institute presentation at the UNIDO Global Forum on Nature-like and Convergent Technologies for Inclusive and Sustainable Industrial Development, Russia, Sochi, 28-29 September 2018.

Convergence driving divergence: new value is created by a recombination of complex technology ecosystems and spill-overs



Kurchatov Institute presentation at the UNIDO Global Forum on Nature-like and Convergent Technologies for Inclusive and Sustainable Industrial Development, Russia, Sochi, 28-29 September 2018.

Intelligent GVCs: horizontal and vertical integration



Dr. Carsten Polenz – SAP SE, presentation at the Bonn workshop on
Industry 4.0: challenges for productivity, employment and inclusion, Bonn, 28- 29.05.2018

All countries will be affected by the disruption

Systemic impact

- Differences between economic sectors become blurred

- Prospects to radically change economic models: redefying the role of market and the government; the role of public and private sector; the role of the forth sector (the social and solidarity economy, social entrepreneurship); the role of SMEs

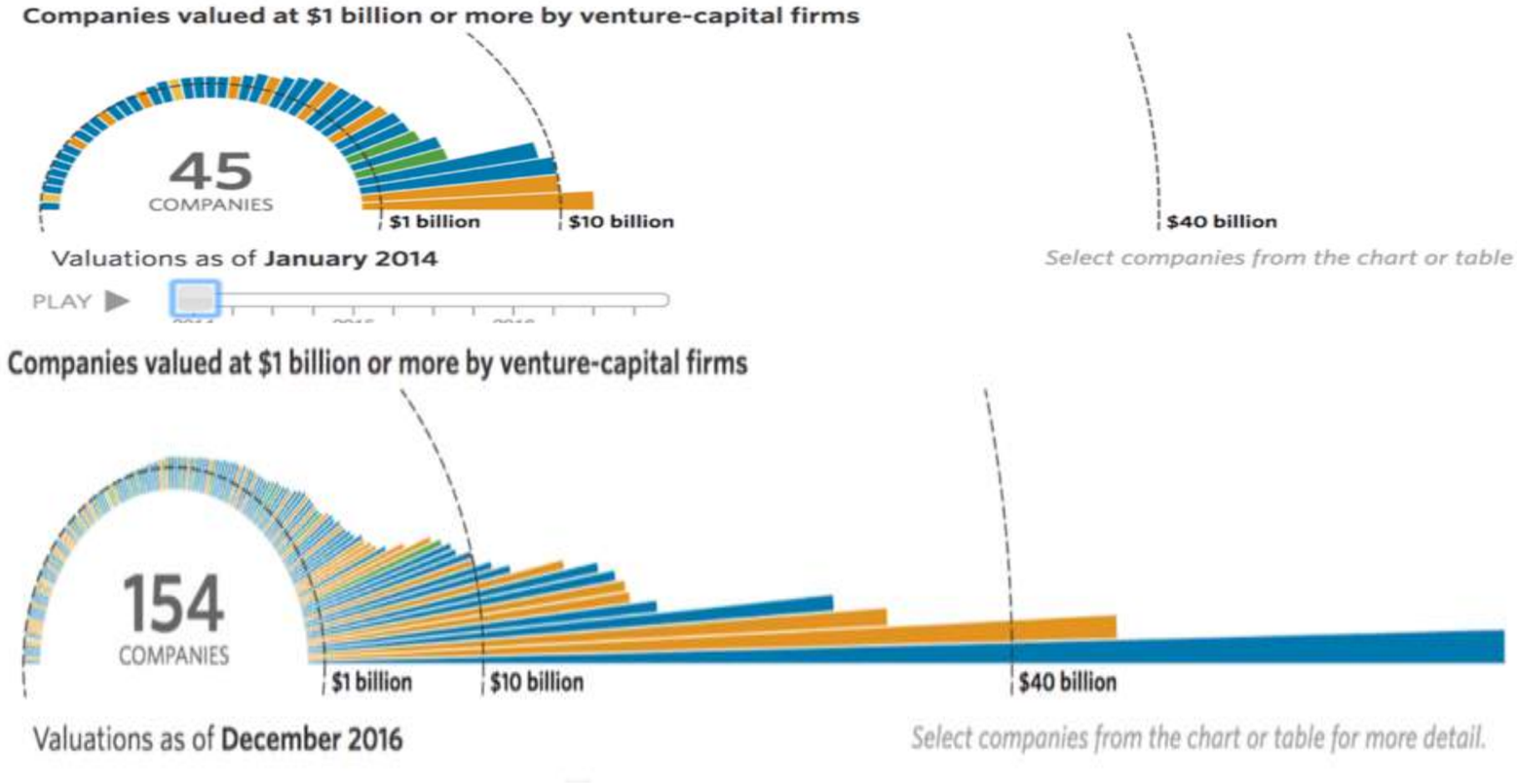
- Questioning traditional linear models of economic development
  - From linear to network, and compressed model of economic development
  - From closed to open and collaborative innovation model

- Educational systems reforms and STI mainstreaming

The rise of the Unicorns — startups with a Billion dollar valuation.

Exponential technological progress creates disruptive potential for startups.

Potential for startups creating new companies have never been greater



- *Startup Ecosystem building crucial: for job creation and as a hedge towards the social security of the future!*
- *Start ups are much better at new disruptive innovation than large companies.*
- *Large companies' role is in growing acquired products and applying their capacity for efficiency and scale. Developing a more symbiotic relationships with start ups (e.g. Apple; Microsoft; Amazon, providing infrastructure and platforms for start ups; general electrics)*
- *Convergence of non-ICT companies becoming ICT companies*

Moving to open innovation and ecosystem building requires connectivity and collaboration to strengthen resilience

Source: WEF, AT Kearney

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Extraordinary opportunities for realizing the SDGs

ENVIRONMENTAL RETURNS

25% decrease in pollution

- High resource efficiency and effectiveness, particularly energy efficiency
- Significant cuts in CO2 emissions
- Better access to electricity and water
- New materials and production processes: products and services, can be designed to save natural resources

ECONOMIC RETURNS

25% productivity gain

- Higher efficiency, productivity and opportunities
- Economic diversification
- Increased revenues from lower transaction costs, increased productivity, higher quality products, increased market share
- Customization at the unit price of ass production

SOCIAL RETURNS

Increased quality of life

- Enhanced human physical and cognitive capabilities
- Improvements in health and safety of workers
- SMEs inclusion: e-commerce
- inclusion of women, youth
- A push for changes in education, training systems, as well as for research and innovation
- Government capacity and transparency to increase; better government services

Huge challenges

- Skill mismatch

- Slow technological diffusion and technology gap widening

- Infrastructure gap

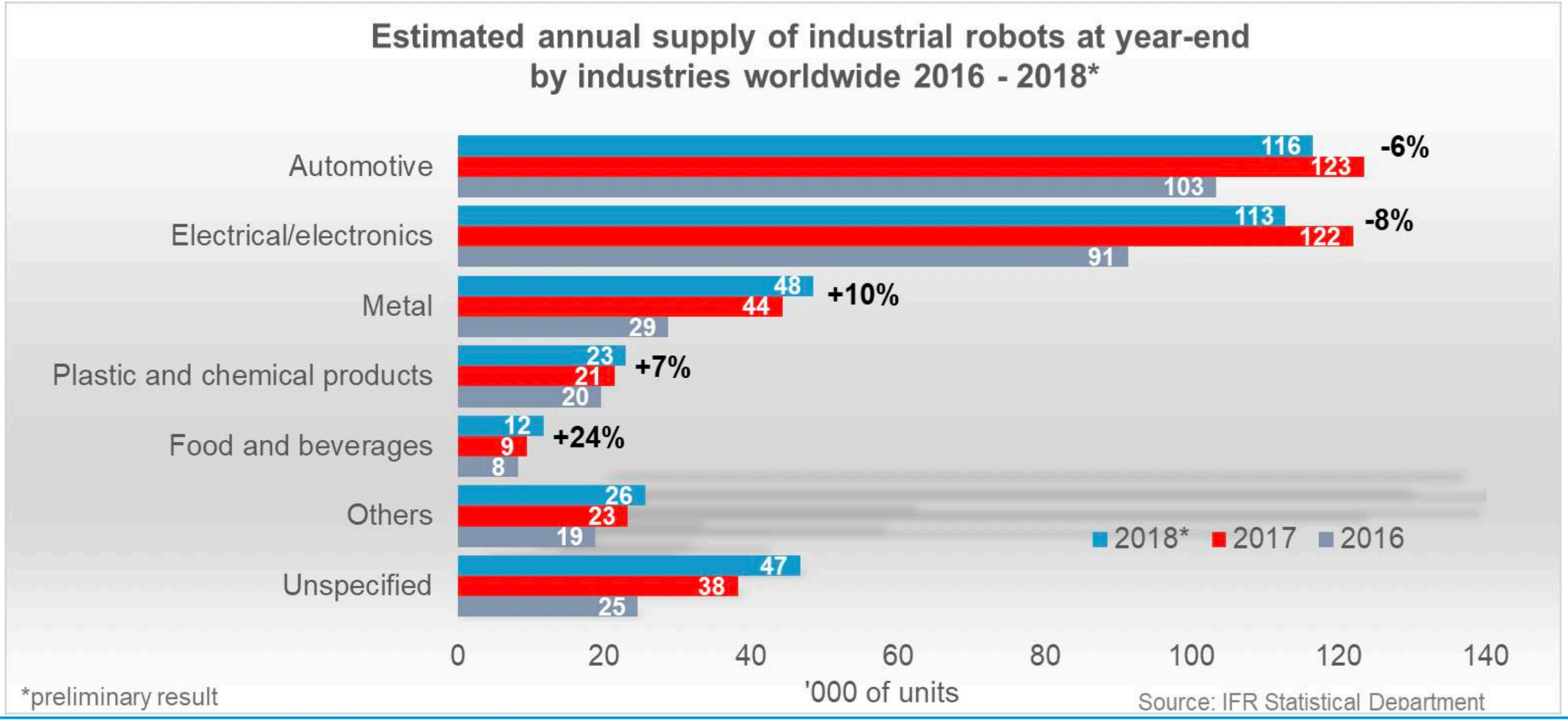
- Institutional mismatch; rules, regulations; norms standards

- Industrial safety &security

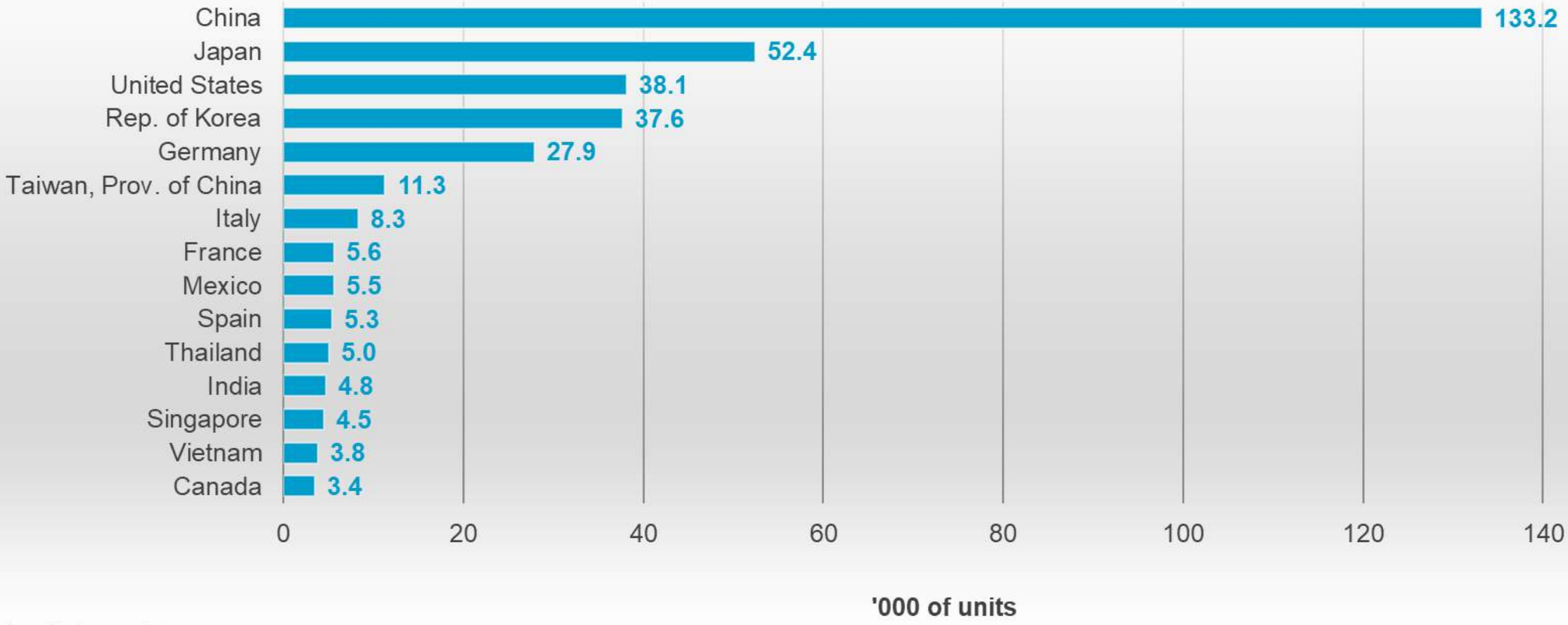
- Inclusiveness

Unequal distribution of and access to digital technologies, widening technology gap

- Concentrated in few sectors
- Concentrated in few countries
- Infrastructure gap driving the digital divide and technology gap

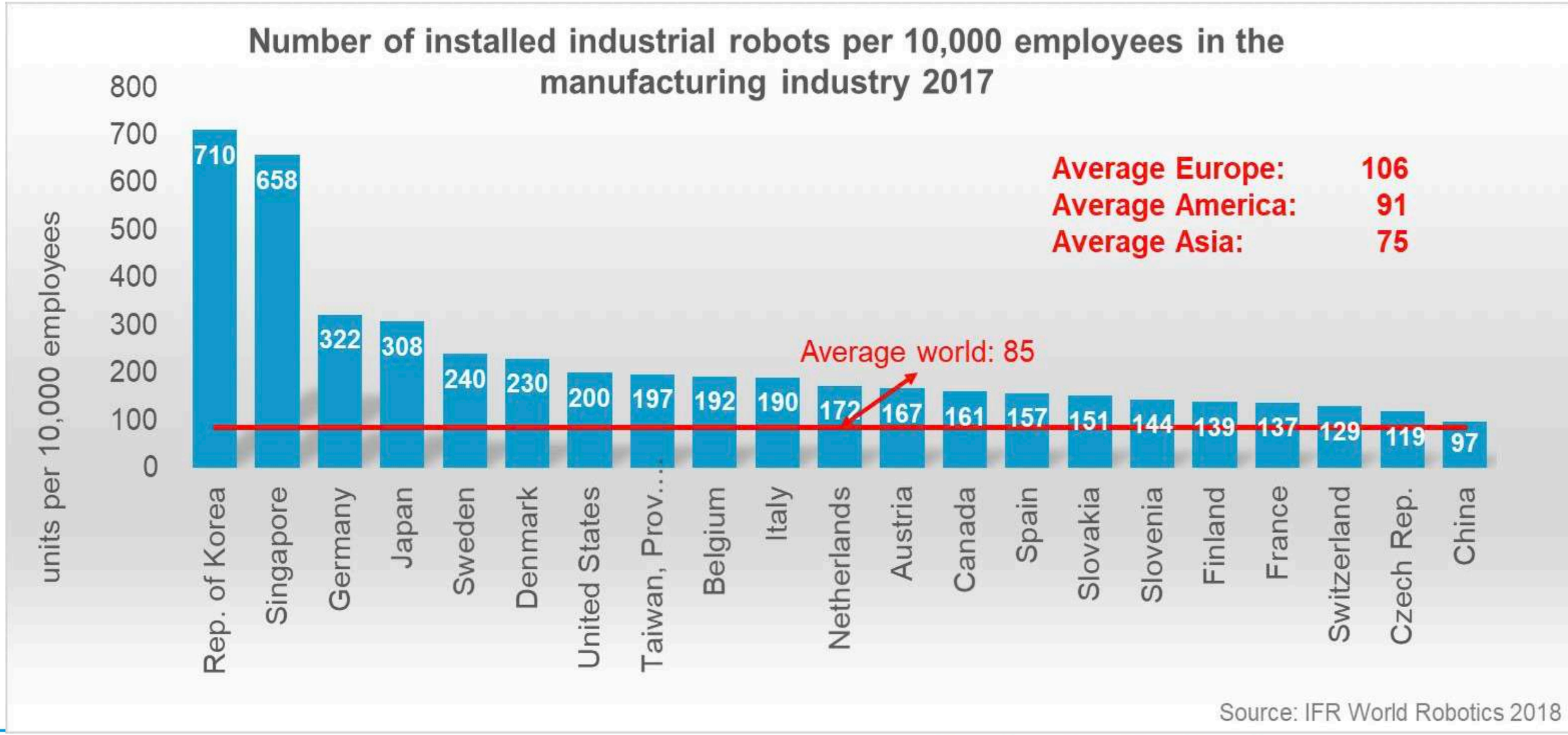

Estimated annual supply of industrial robots at year-end by industries worldwide 2016 - 2018*
Automotive
116
123
103
-6%
Electrical/electronics
113
122
91
-8%
Metal
48
44
29
+10%
Plastic and chemical products
23
21
20
+7%
Food and beverages
12
9
8
+24%
Others
26
23
19
Unspecified
47
38
25
2018*
2017
2016
0
20
40
60
80
100
120
140
'000 of units
*preliminary result
Source: IFR Statistical Department

Estimated worldwide annual supply of industrial robots at year-end 15 main markets 2018*



*preliminary data

Source: IFR Statistical Department

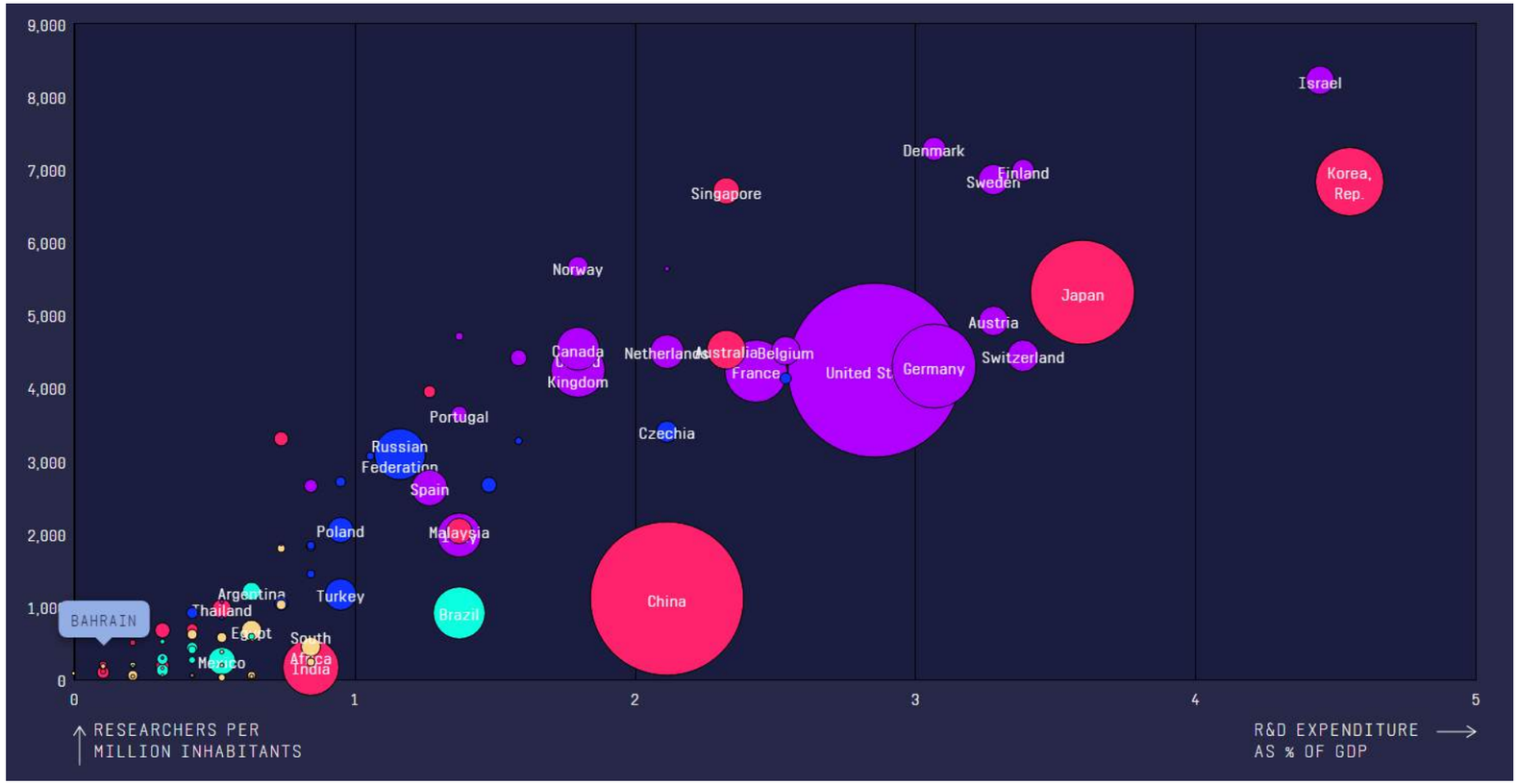

Number of installed industrial robots per 10,000 employees in the manufacturing industry 2017
units per 10,000 employees
800
700
600
500
400
300
200
100
0
710
658
322
308
240
230
200
197
192
190
172
167
161
157
151
144
139
137
129
119
97
Rep. of Korea
Singapore
Germany
Japan
Sweden
Denmark
United States
Taiwan, Prov...
Belgium
Italy
Netherlands
Austria
Canada
Spain
Slovakia
Slovenia
Finland
France
Switzerland
Czech Rep.
China
Average world: 85
Average Europe: 106
Average America: 91
Average Asia: 75
Source: IFR World Robotics 2018

Digital divide (4b people not in digital economy)

	40% of countries[1]	37% of countries	24% of countries
Cutoff >70% 3G coverage >60% internet usage	CONNECTED (3G+) USING THE INTERNET	CONNECTED (3G+) NOT USING THE INTERNET	NOT CONNECTED NOT USING THE INTERNET
Opportunities	The digital economy is developed and key enablers are in place; there are opportunities for WBG to invest in disruptive use cases (e.g. e-health, online education, etc.)	Although connected, the country is gradually moving toward a digital economy; WBG can develop key foundational elements (e.g. e-payments, etc.)	The country is disconnected; WBG can develop digital infrastructure and enable the private investment environment

1 % of countries affected does not reflect population represented within each archetype

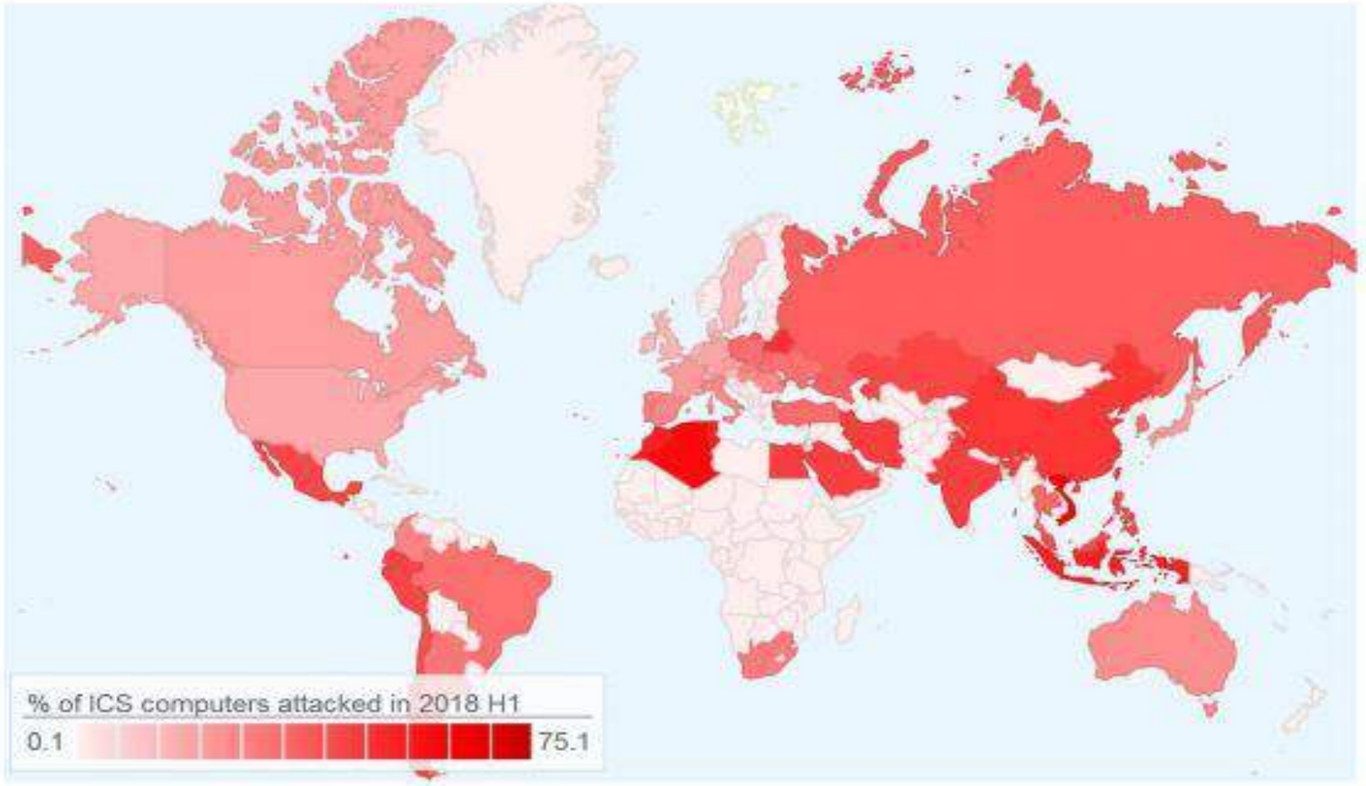
http://uis.unesco.org/apps/visualisations/research-and-development-spending/



Cloud Computing & Cybersecurity

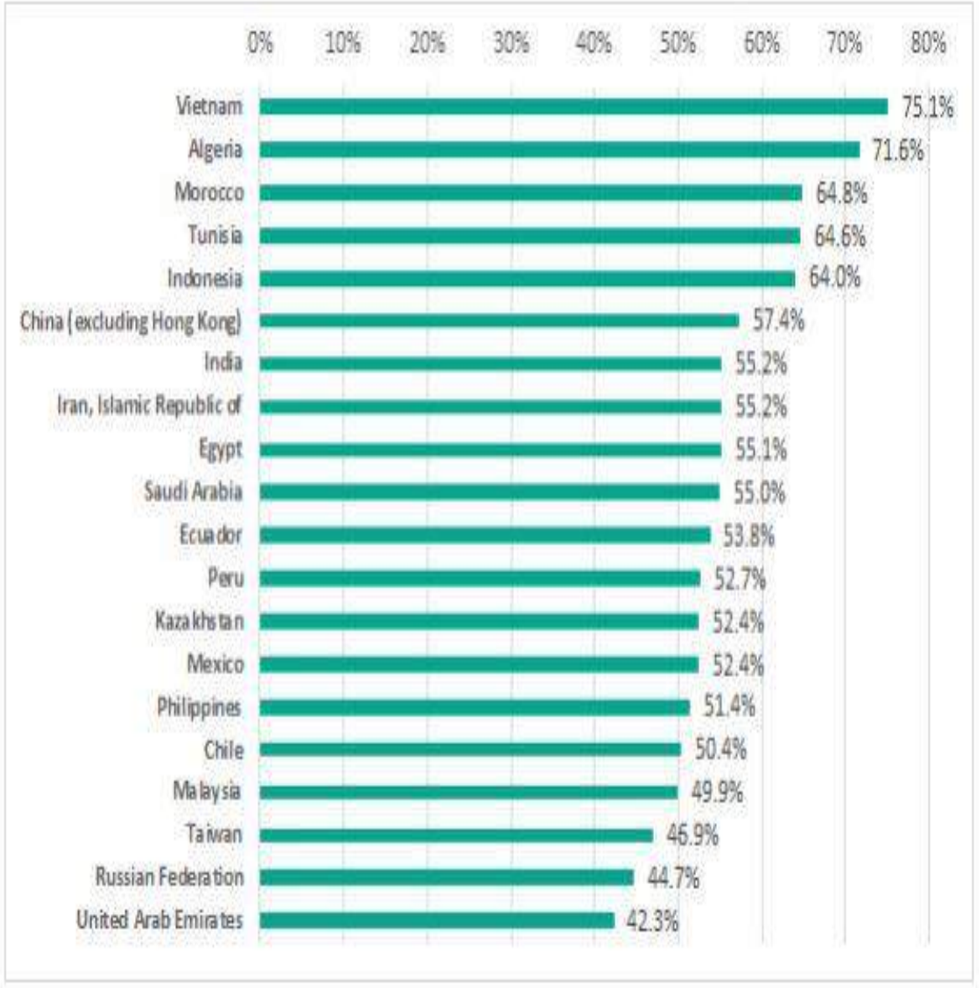
Geographical distribution

Geographical distribution of attacks on industrial automation systems, H1 2018, percentage of ICS computers attacked in each country

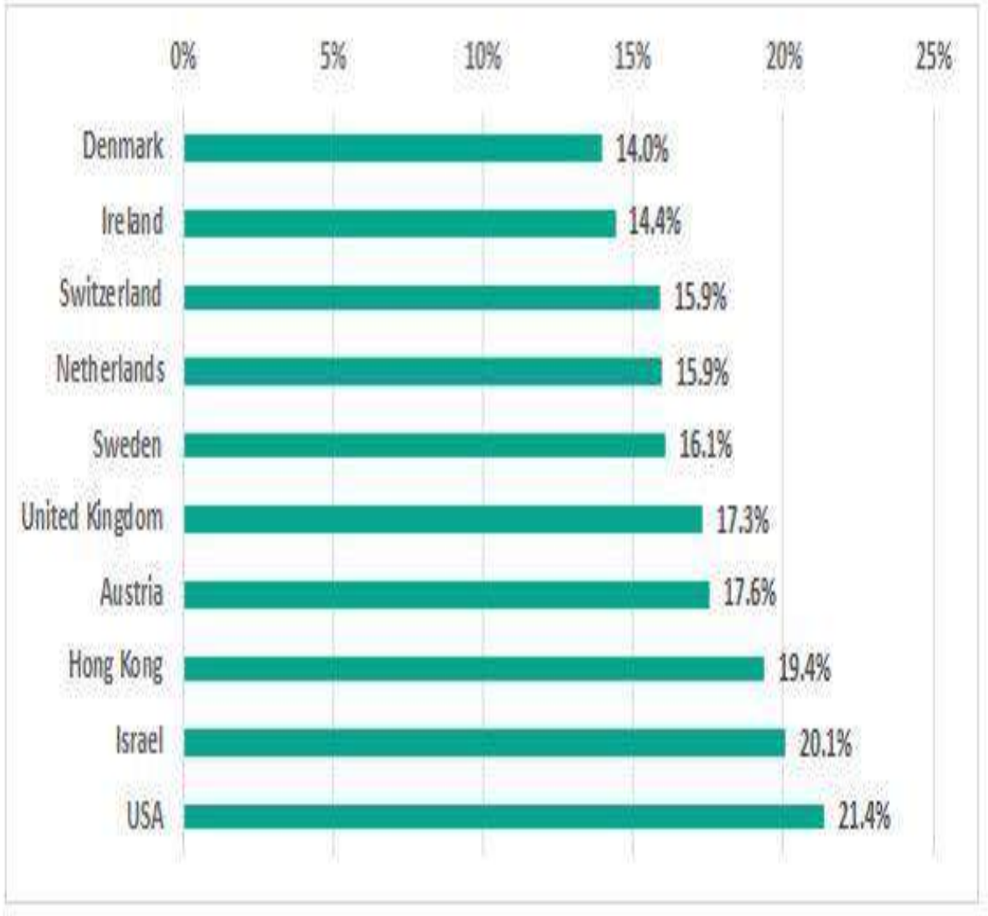


ICS-Industrial control system

TOP 20 countries by percentage of ICS computers attacked, H1 2018



10 countries with the lowest percentages of ICS computers attacked, H1 2018



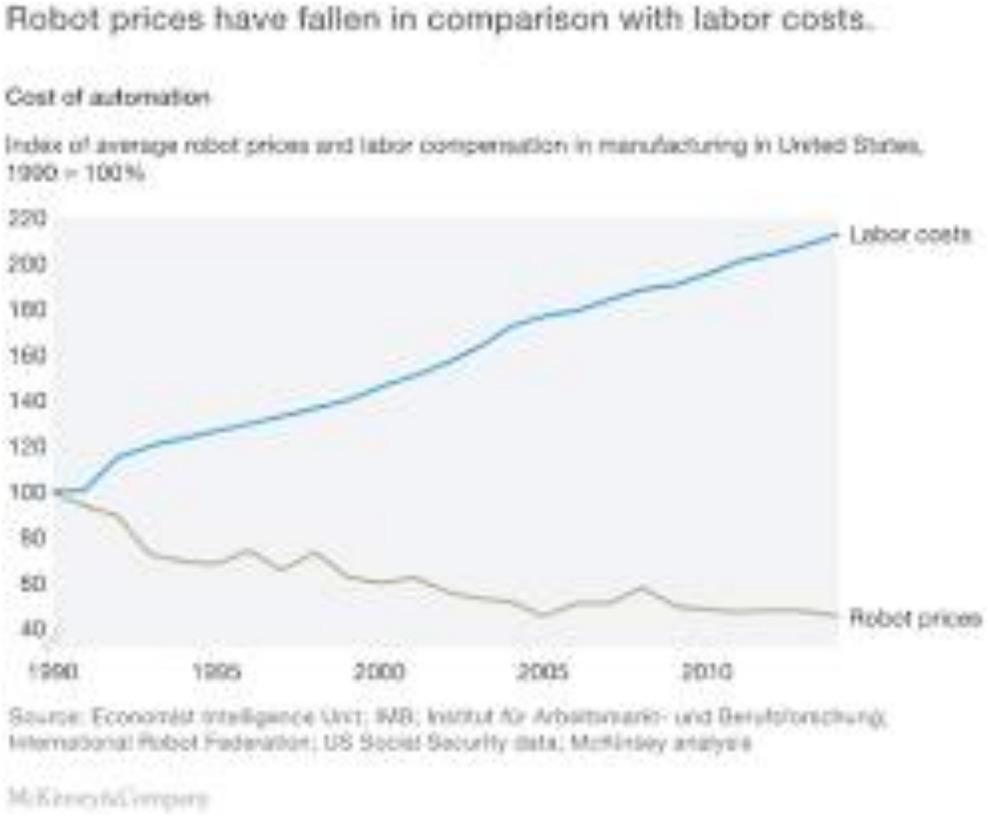
Labor market/Inclusiveness

Job displacement faster then job replacements + demographic trends = rise in global **unemployment, inequalities and migration**

Affect nearly entire spectrum of professional groups, but mostly low skilled, routine tasks and even white collar jobs; appearance of new occupations

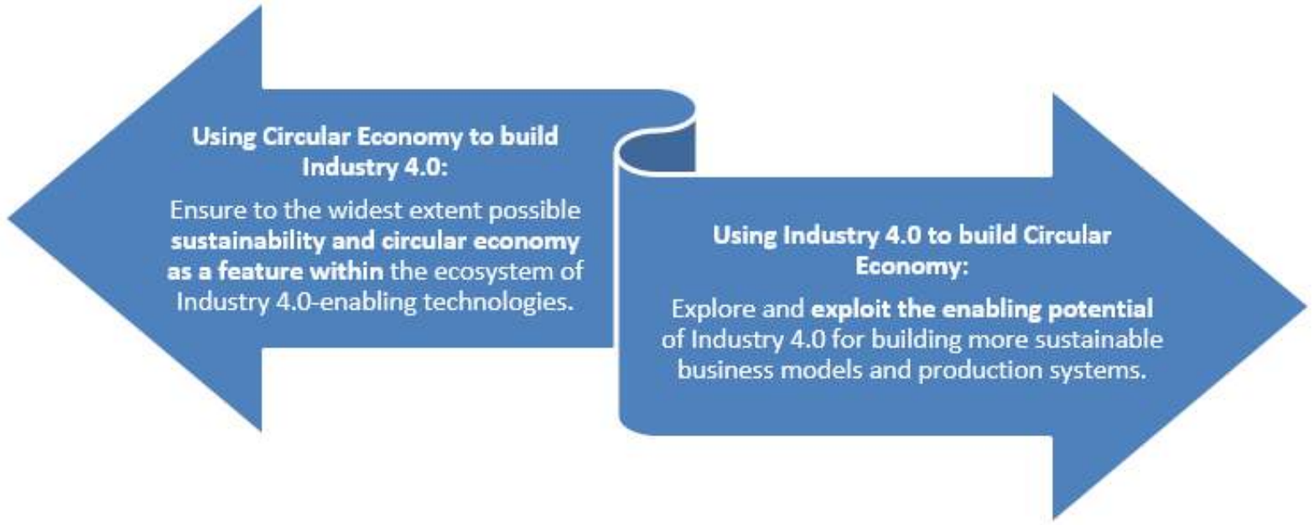
Impact of developing countries: technologies diffuse slowly and labour remains cheaper: can competition between I2.0 and I3.0 countries/locations and I4.0 countries/locations sustain?

Educational systems weak in developing countries/LDC especially , lacking basic skills; need for digital skills; STEAM; cognitive and social skills



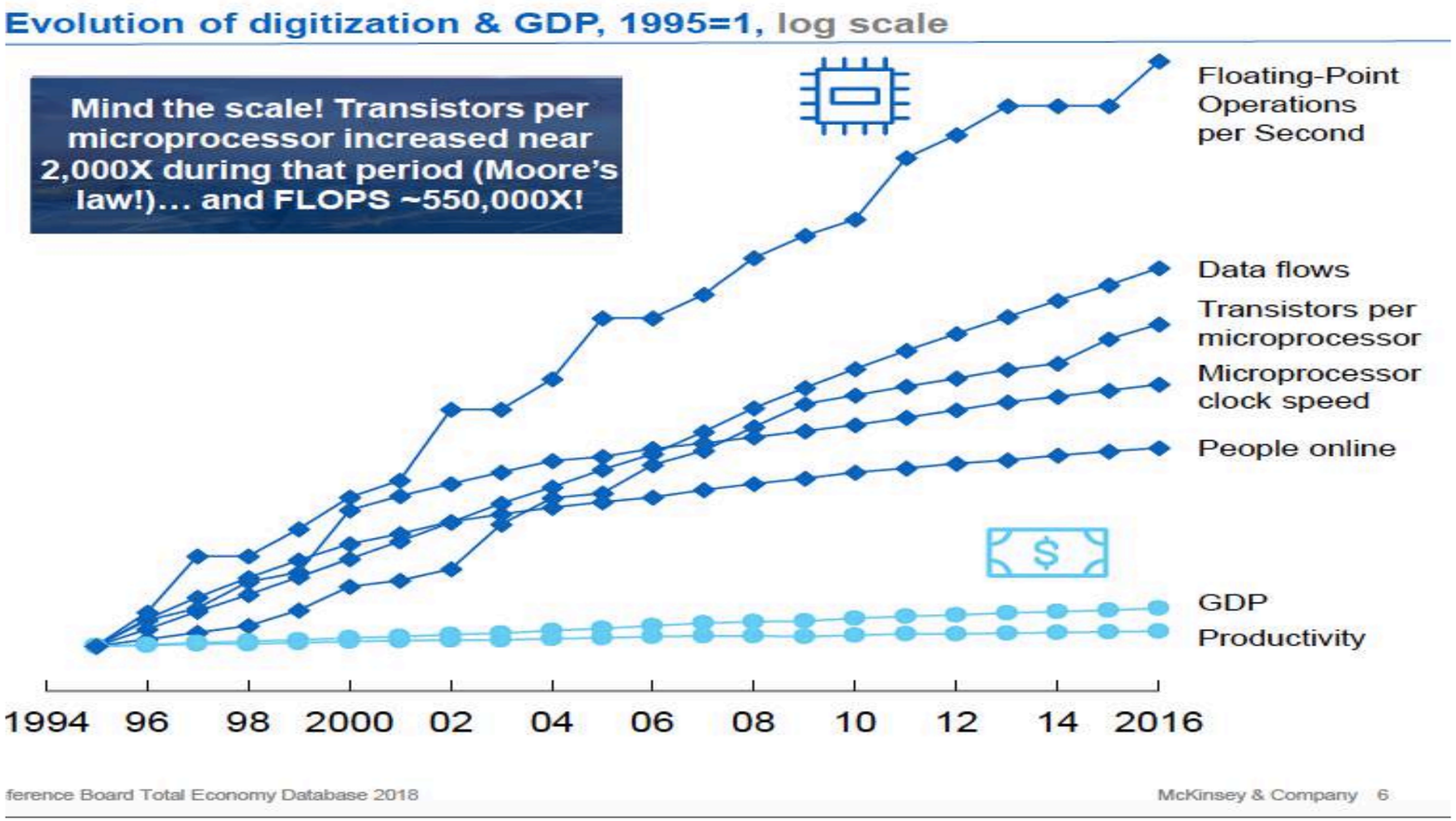
Rebound effect

- *Industry 4.0 related technologies may facilitate more sustainable production, but* can also be accompanied by **rising demands for scarce resources** such as (certain) metals
- Increasing **consumption of energy**
- Additive manufacturing: increasing efficiency and reducing waste but can result in shortening of product lifecycles and **increase in consumption in some industries; health issues**
- **Waste issues (*electronic waste*)**



Revolutionary but no revolutionary effects so far:

IT boosting productivity but not yet reflected in global GDP and productivity



- No revolutionary effects so far, *but we are likely at the very beginning of a*

Tsunami of changes

- Preparedness is crucial for all countries!

Negligent applications of new technologies could lead to social tragedies and even global catastrophes, more devastating, than predictions of climate change.

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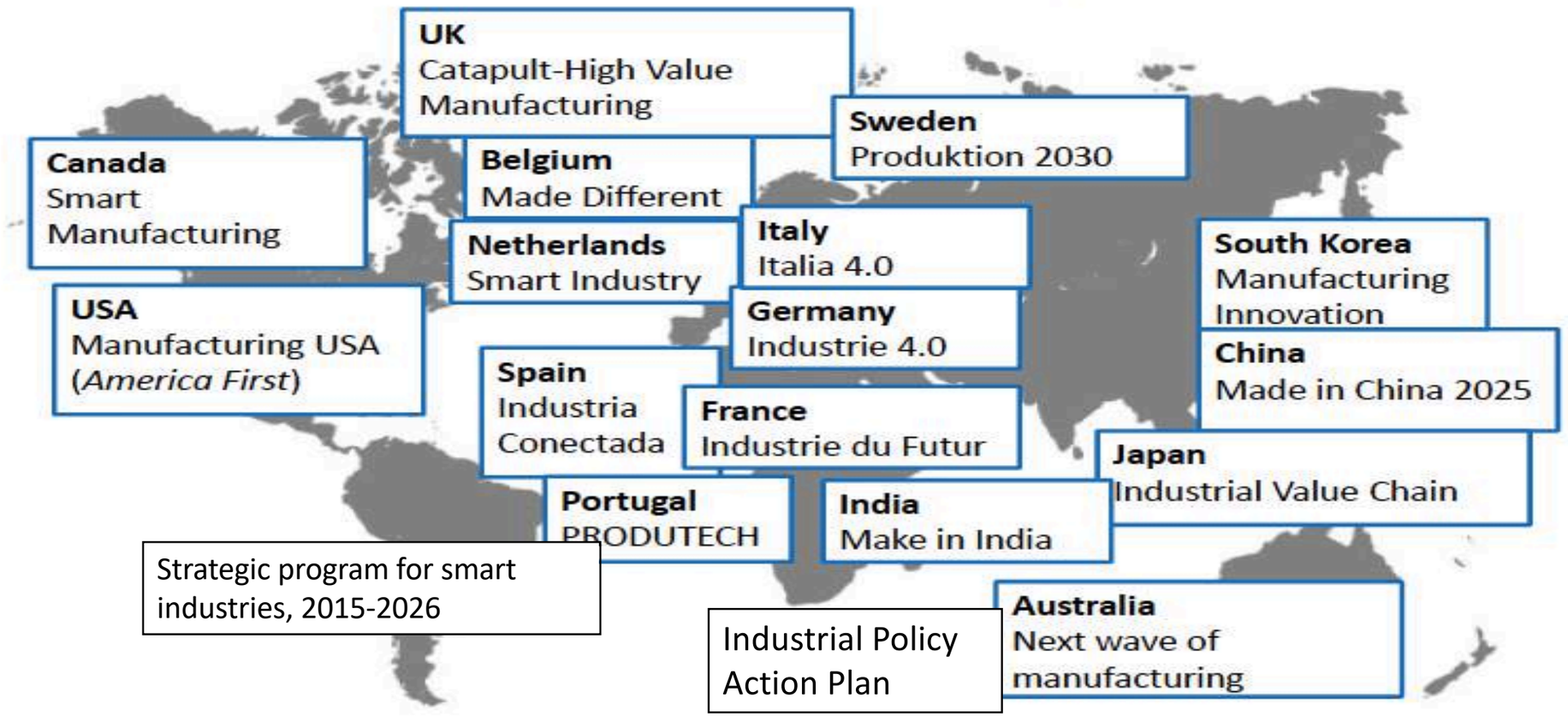
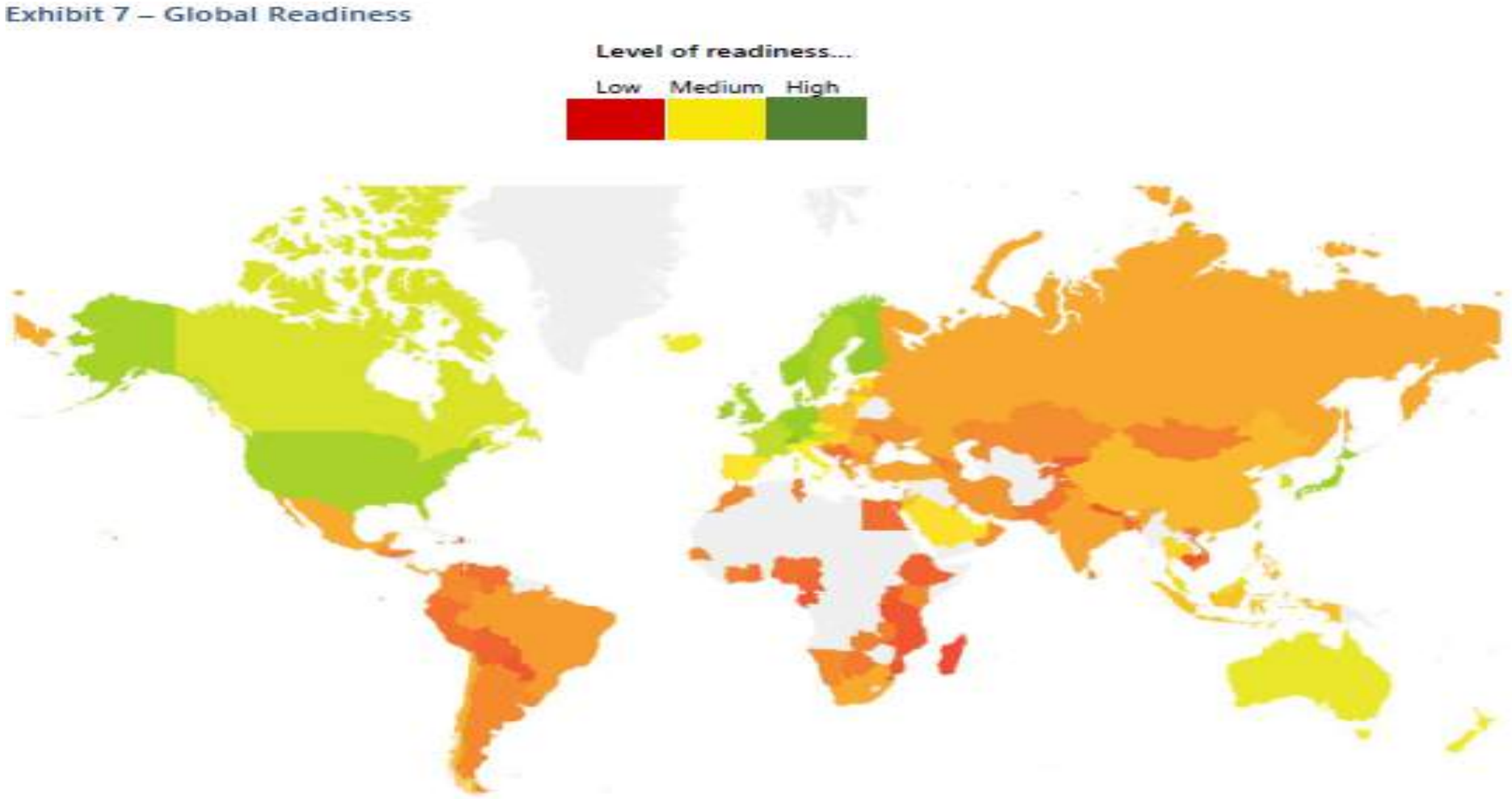
New Industrial Policy



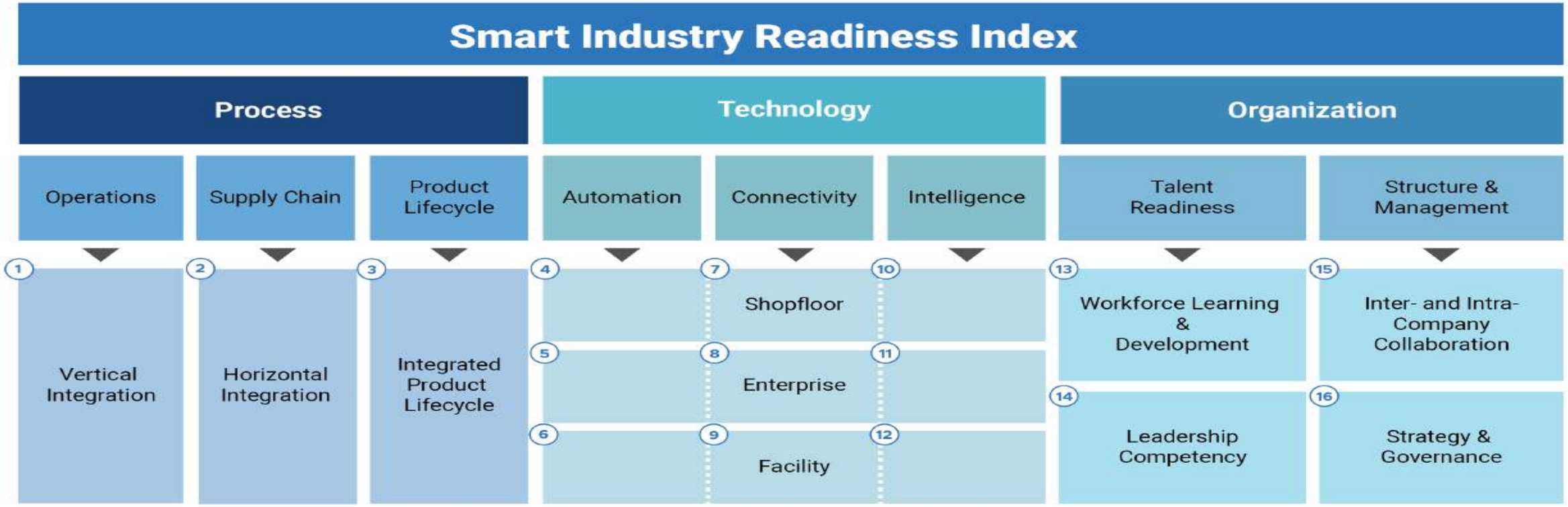
Strategic program for smart industries, 2015-2026

Industrial Policy Action Plan

WEF: Readiness for the future of production



Company readiness
Singapore: Companies to use index to learn, evaluate, design and implement transformation initiatives



Source: The Singapore Smart Industry Readiness Index Whitepaper (2017), Singapore Economic Development Board, Ministry of Trade & Industry

Private sector challenges:

HUMAN RSOURCES

- Develop talent: through Companies/Unions/Government cooperation
- Identify new skilled needed
- Support continuous education, learning and capability building

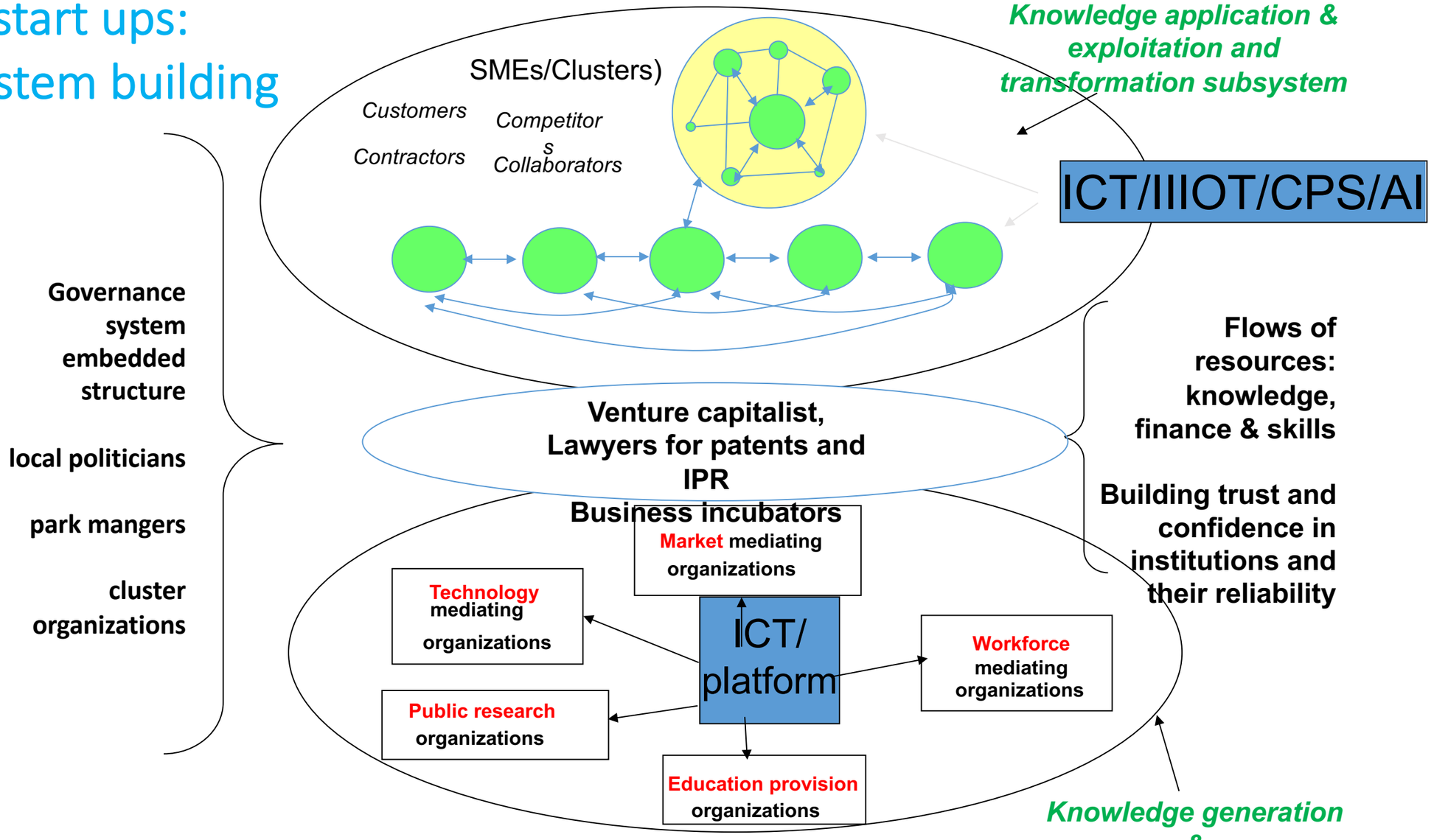
INNOVATION & ECOSYSTEM BUILDING

- Model factories to foster technological learning and innovation
- Promote open innovation
- Start up programs

BUSINESS ENVIRONMENT REFORMS

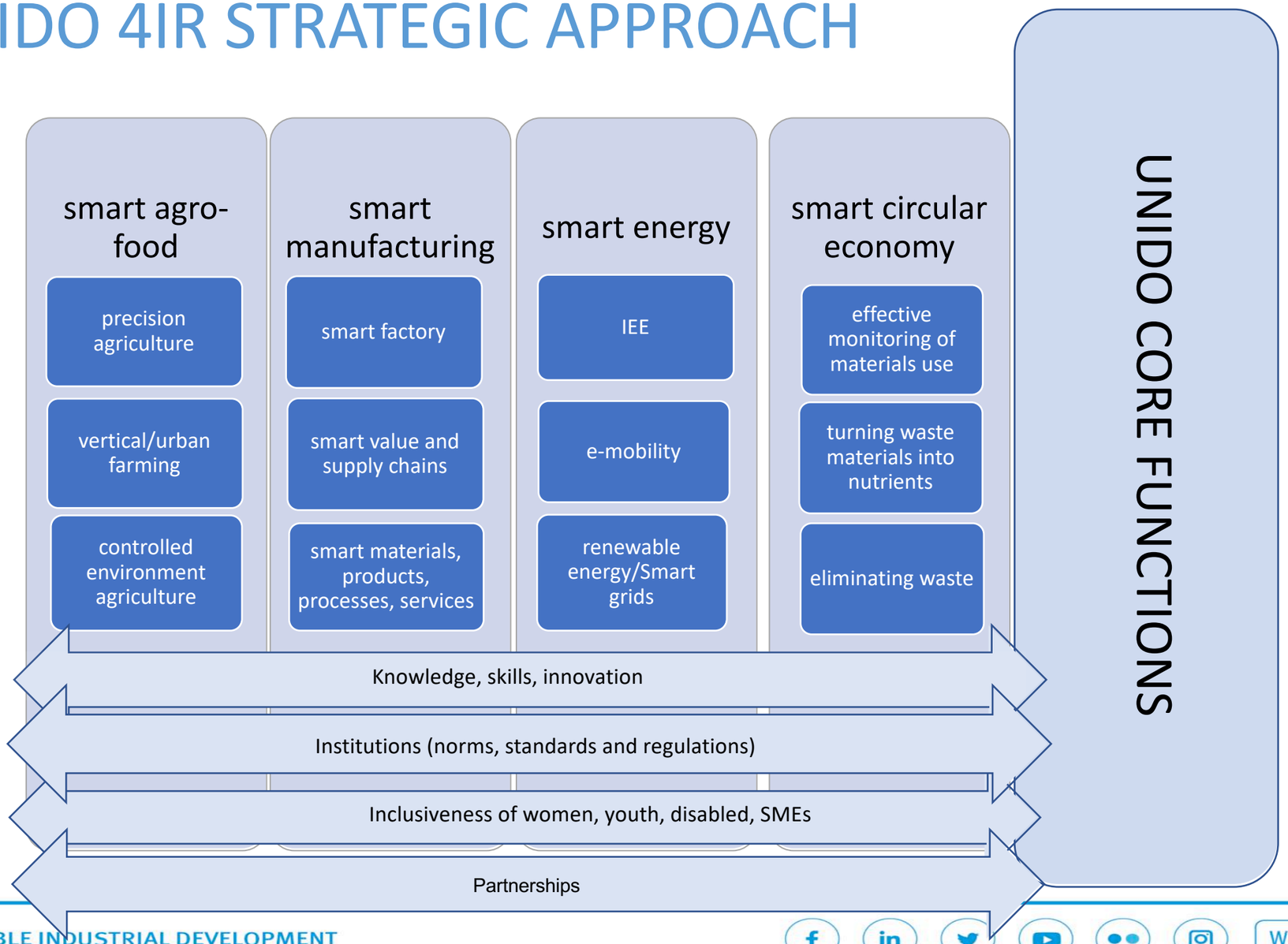
- Norms, standards, regulatory

Empowering start ups: Innovation system building



Memedovic after Cooke 2006, UNIDO

UNIDO 4IR STRATEGIC APPROACH



4IR TECHNICAL COOPERATION

CONVENING/AWARENESS RAISING	Establishing multi-stakeholder knowledge sharing platforms to create awareness on Industry 4.0 opportunities and challenges for pursuing ISID in developing countries
ROADMAPPING & POLICY ADVICE	Support governments in the development of industry roadmaps and innovation-friendly policies, business environment regulations and standards
READINESS ANALYSIS & INDUSTRY 4.0 OBSERVATORY	Maturity and readiness analysis at the macro, meso, micro and SME level, Development and application of indicators and measurement tools for an assessment of 4IR readiness. The capacity building to independently undertake readiness analysis for roadmapping and monitoring implementation
DEMONSTRATION, LEARNING &INNOVATION CENTERS	Technological learning and innovation
I4.0 ABSORPTIVE CAPACITY BUILDING	Vocational education and training to meet demand of Industry 4.0 Innovation management
INTERNATIONAL TWINNING	Creating international networks between local and renowned international institutions to strengthen local capacities

THANK YOU