

# THE COMING DIGITAL TECHNOLOGY LANDSCAPE, BREAKTHROUGHS, AND A GLIMPSE INTO THE FUTURE

## 2018 PIDS ANNUAL PUBLIC POLICY CONFERENCE

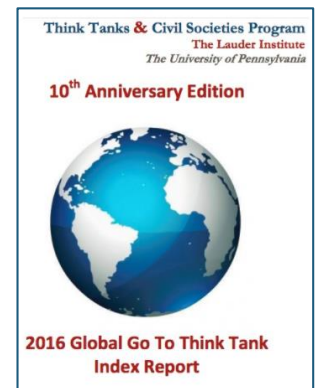
Stephen Ezell  
Vice President, Global Innovation Policy, ITIF

September 19, 2018

# ABOUT ITIF

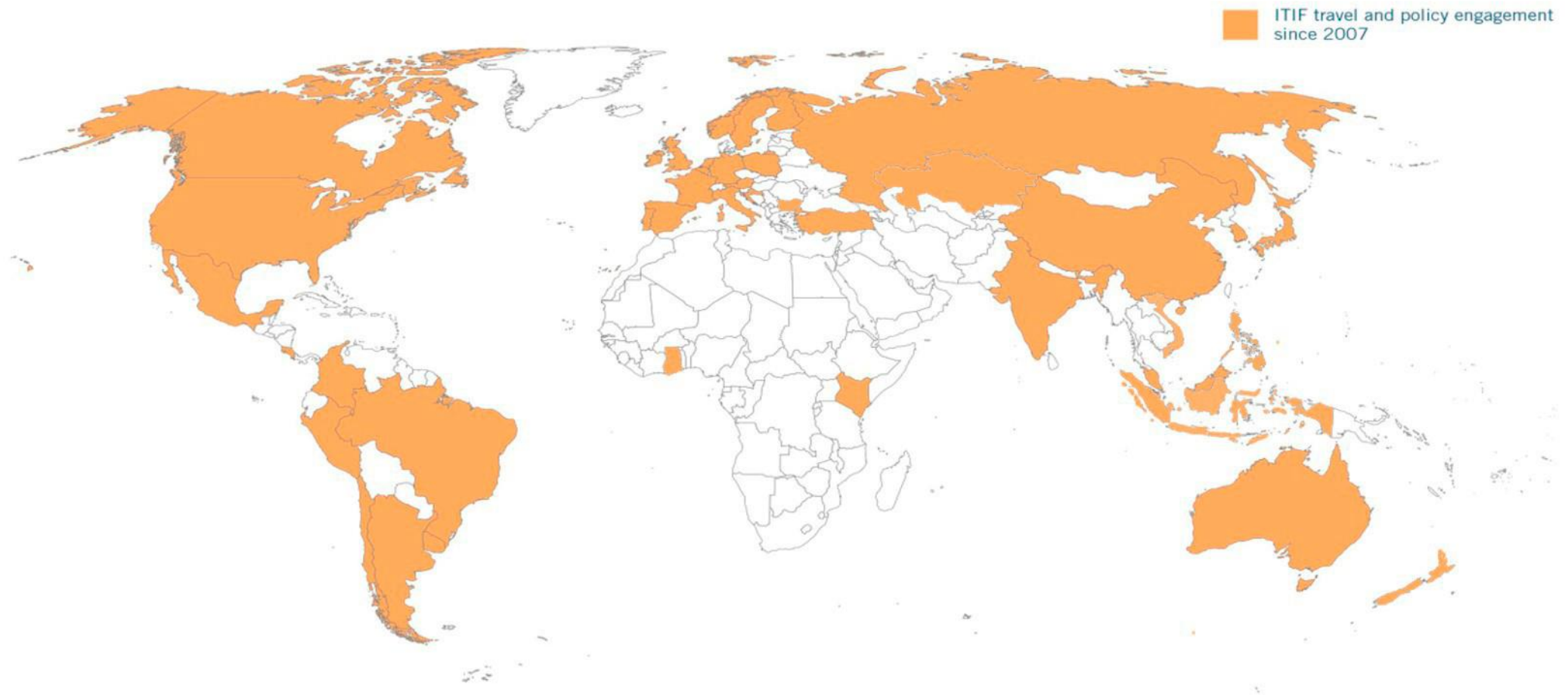
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- The world's leading science and technology policy think tank.
- Supports policies driving global, innovation-based economic growth.
- Focuses on a host of issues at the intersection of technology innovation and public policy across several sectors:
  - Innovation and competitiveness
  - IT and data
  - Telecommunications
  - Trade and globalization
  - Life sciences, agricultural biotech, and energy



# ITIF GLOBAL ENGAGEMENT

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# TODAY'S PRESENTATION

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- 1 ICTs Driving Global Economic Growth
- 2 Overview of Key Emerging Digital Technologies
- 3 How Digitalization is Transforming Industries
- 4 Policy Recommendations to Spur Digitalization





# ICT HAS BIG IMPACTS BECAUSE IT'S A GENERAL PURPOSE TECHNOLOGY

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Approximately every half century a new technology *system* emerges that changes everything.

- The Railroad and Iron: 1840s
- Electricity and Steel: 1890s
- Electromechanical Systems: 1950s

Today, ICT is enabling innovation and productivity in virtually all industries, from agriculture and manufacturing to services and government.



# ICT AND DIGITAL ARE DRIVING GLOBAL ECONOMIC GROWTH

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- ICTs responsible for 25% of economic growth in developing countries from 2000-2010.
- The “digital economy” now accounts for 25% of global GDP.
- Half of all value created in next 10 years will be created digitally.



Sources: Accenture, “Digital Disruption: the Growth Multiplier”; McKinsey Global Institute, “Digital Globalization: The New Era of Global Flows”



# COMPETITION WAS ONCE CONFINED TO VERTICAL ICT INDUSTRY SECTORS

## Mainframe

IBM  
Sperry  
Burroughs  
Honeywell  
NCR  
CDC  
ICL  
Amdahl  
Siemens  
Fujitsu  
Hitachi  
Cray

## Mini

Digital  
IBM  
Data General  
Wang  
Prime  
HP  
Sun  
Tandem  
Oracle  
Honeywell  
Olivetti  
NEC

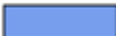
## PC

IBM  
Apple  
Intel  
Microsoft  
Dell  
HP  
Compaq  
Seagate  
Sony  
Toshiba  
Amstrad  
Lenovo

## Mobile

Apple  
Google  
RIM  
Arm  
Samsung  
HTC  
Motorola  
Nokia  
Ericsson  
Huawei  
Sony  
LG

Source: David Moschella, CSC Leading Edge Forum

 HQ in Silicon Valley



# NOW ICTS ENABLE DISRUPTION ACROSS VIRTUALLY ALL INDUSTRIES

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## Technology Disruptions



## Industry Disruptions

Artificial Intelligence (AI)

Data Analytics

Cloud Computing

Internet of Things (IoT)

Mobile Devices

Social Media

Supercomputing

■ Transportation (*Uber*, Driverless Cars)

■ Hospitality (*Airbnb*)

■ Education (*Coursera*, MOOCs)

■ Finance (Bitcoin, Algorithmic Trading)

■ Life-sciences (Bio/IT Convergence)

■ Manufacturing (3-D Printing)

■ Retail (*Amazon*, Same-day Delivery)

Source: David Moschella, CSC Leading Edge Forum

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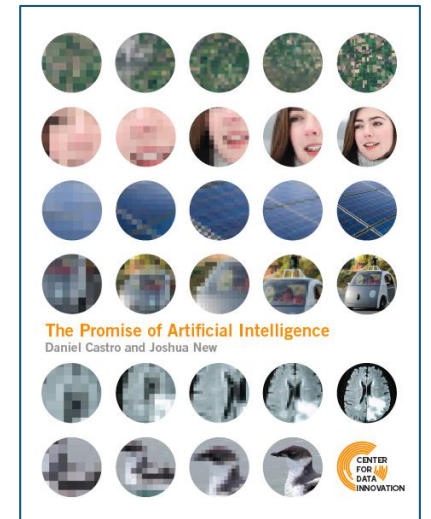
# KEY EMERGING DIGITAL TECHNOLOGIES

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1. Artificial Intelligence/Big Data
2. Autonomous Technologies/Robotics
3. Cloud Computing
4. The Internet of Things
5. Quantum Computing
6. Blockchain

# WHAT IS ARTIFICIAL INTELLIGENCE?

- “Artificial intelligence” is the use of software to imitate intelligent human behavior, such as learning, reasoning, and making decisions.
- “Machine learning” refers to systems that can learn and improve from experience without being explicitly programmed with specific solutions.
- AI may generate \$13 trillion in global economic impact by 2025.



Sources: Daniel Castro and Josh New, “The Promise of Artificial Intelligence”; Accenture, “Why Artificial Intelligence is The Future of Growth”

# HOW WILL AI/BIG DATA BE USED?



## Monitoring

Rapidly analyze large amounts of data and detect abnormalities and patterns.



## Discovering

Extract insights from large data sets and discover solutions through simulations.



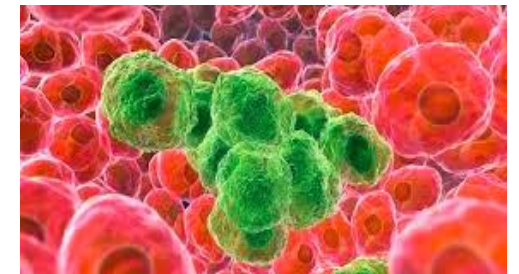
## Predicting

Forecast or model trends likely to develop in future (e.g., Netflix/weather).



## Interpreting

Interpret unstructured data, images, text (e.g., diagnostic software identifies cancer cells or analyzes X-rays to detect aneurysms).



Source: Daniel Castro and Josh New, "The Promise of Artificial Intelligence"



# AUTONOMOUS VEHICLES

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For many, *driving* is the distraction.

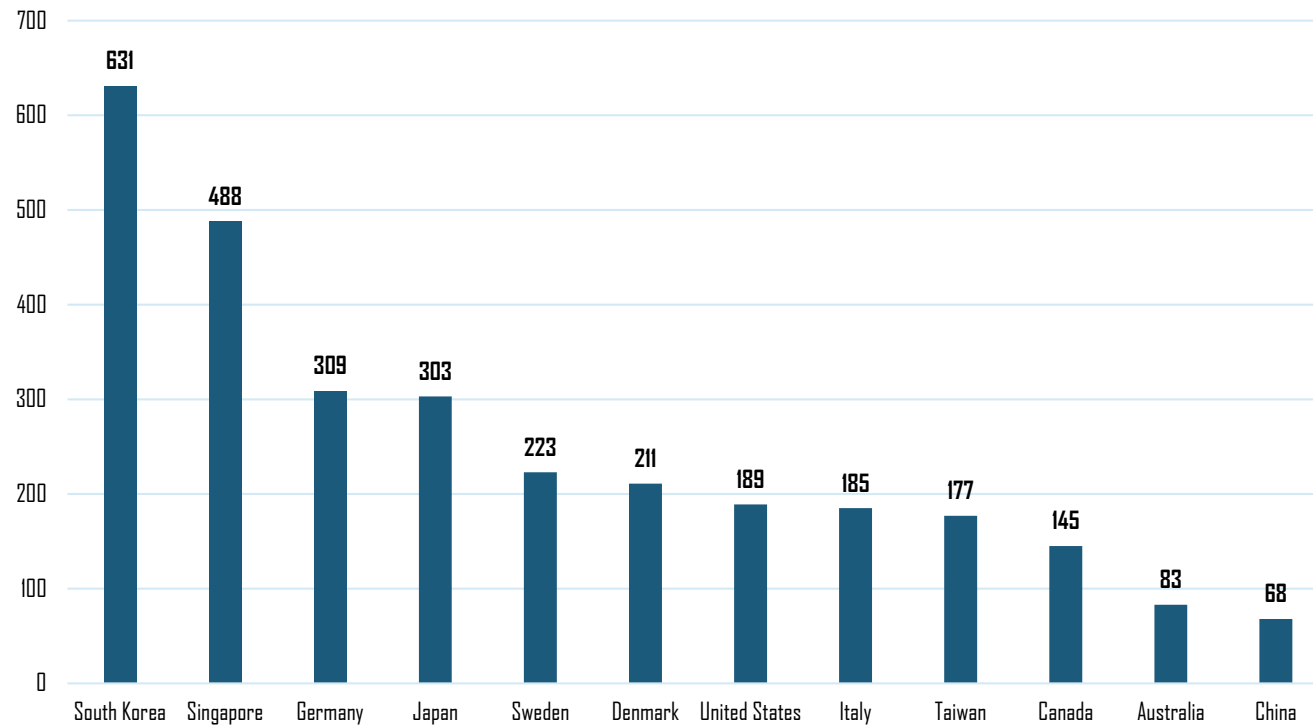
AVs promise tremendous safety, personal mobility, environmental, productivity, and economic benefits.



Every major global automaker developing autonomous vehicles; deployments coming next 3-5 years.

# ROBOTS

Industrial Robots per 10,000 Workers, 2017



Source: International Federation of Robotics, "Executive Summary World Robotics 2018 Industrial Robots"

Asia leading roboticization.

By 2020, 1.7 million new industrial robots deployed.

Payback period for industrial robot 1 year in the U.S., but over 30 in the Philippines.



# CLOUD COMPUTING

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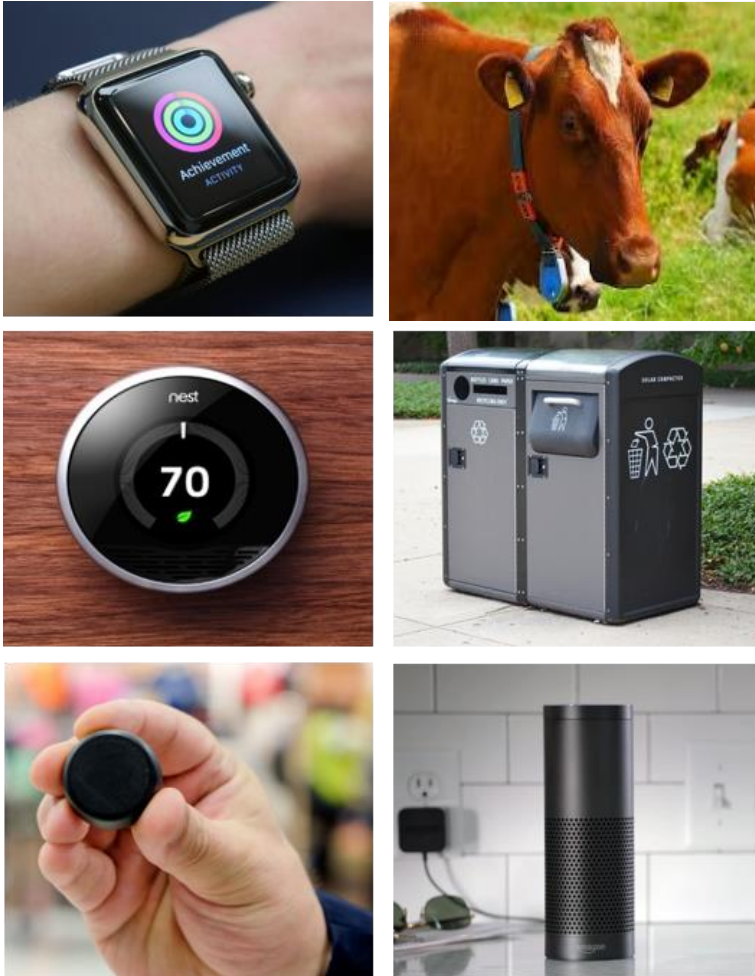
Delivery of scalable computing resources as an on-demand service.

- Computer storage or processing capacity; applications hosting.
- 96% of U.S. businesses use cloud computing.
- Expected to account for 60-70% of enterprise IT spend.



# THE INTERNET OF THINGS (IOT)

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- The Internet of Things is the universe of physical objects embedded with sensors or actuators that are enhanced with network connectivity.
- Analysts expect 55 billion connected devices by 2025 will generate as much as \$11 trillion in annual economic value.

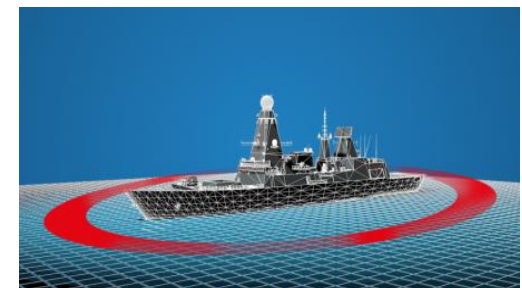
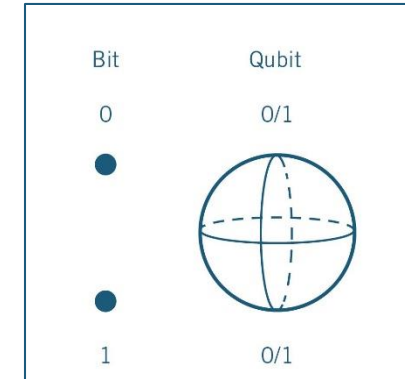


# QUANTUM COMPUTING

Quantum computers use qubits that leverage quantum principles to make computers thousands of times more powerful than today's supercomputers.

IBM offers free, cloud-based quantum computing services; Google has a 128-QB quantum computer.

Some countries claim they can already detect stealth aircraft and submarines based on their unique "quantum signatures."

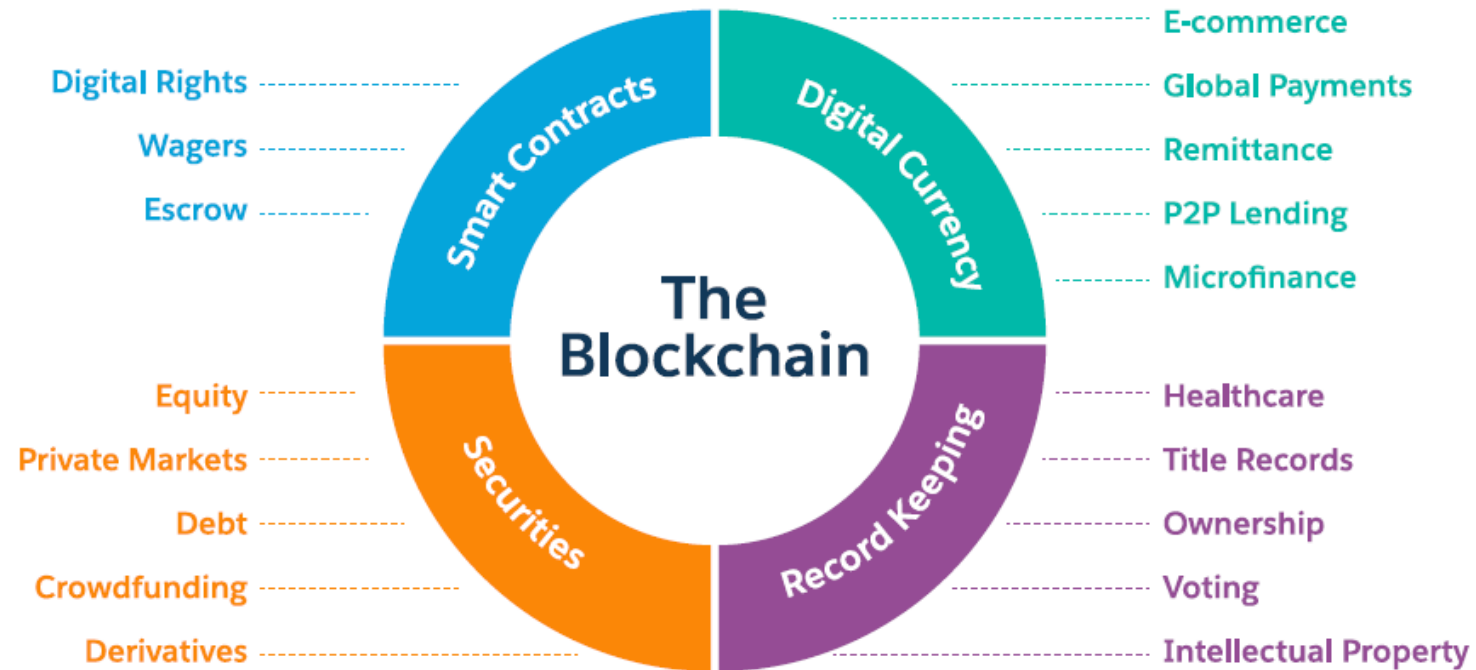




# BLOCKCHAIN

- Shared, digital ledgers cataloging transactions as they occur in chronological order, using cryptography and public recording to validate transactions.

A new method for simultaneous, secure updates



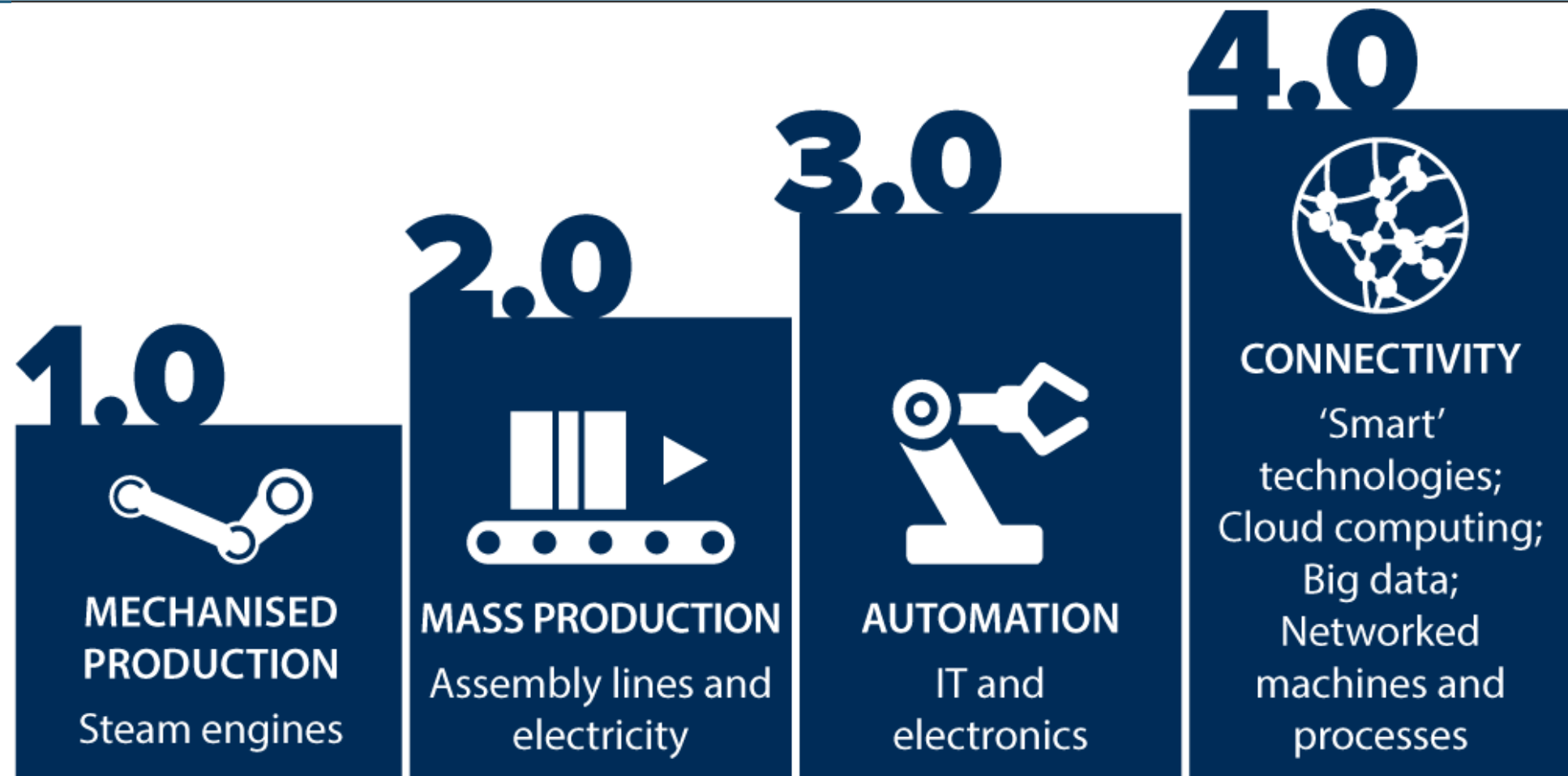
Source: BTCS, Inc.

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# DIGITAL DRIVING THE FOURTH INDUSTRIAL REVOLUTION



Source: Oxford Analytica

# “DIGITALLY ENABLED” AT EACH STEP OF MANUFACTURING

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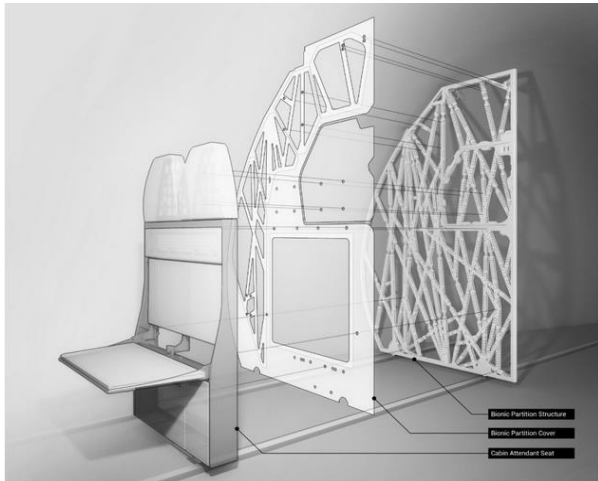
1. Product Design
2. Fabrication and Assembly
3. Factory Integration
4. Supply Chain Integration
5. Product Use and Consumption



# GENERATIVE DESIGN & 3 D PRINTING

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- Software designs products based by specified input constraints.
- Synthesizing successive layers of material into a three-dimensional solid object composed from a digital file.





# FACTORY INTEGRATION

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- Sensor-enabling equipment generates a comprehensive, real-time view of the status of machines, work cells, and systems.



# SUPPLY CHAIN MANAGEMENT

- Real-time visibility into every machine making every component across entire industrial supply chains.

## Suppliers to the new BMW i8

ONE-WAY CLUTCH - 6 SPEED AUTOMATIC TRANSMISSION  
BORGWARNER

COOLING FAN MODULE (TIER 2)  
JOHNSON ELECTRIC

ENGINE & GEARBOX BRACKETS  
FEMALK

FRONT BRAKE CALIPER  
BREMBO

SOUND DEADENERS  
FAIST CHEMTEC

PEDAL SENSORS  
HELLA

ELECTRO-COAT  
PPG INDUSTRIES

LASER LIGHT  
OSRAM

FRONT GRILLE  
SOLE SPA

STEERING WHEEL  
TAKATA

SHOCK ABSORBERS  
THYSENKRUPP

TIMING DRIVE SYSTEM  
IWIS

GRILL SHUTTER ACTUATORS  
BROSE

GEAR SHIFT ACTUATOR (TIER 2)  
NIDEC MOTORS & ACTUATORS

HEATING/COOLING/TURBOCHARGER LINES  
CONTITECH



## Automotive News Europe

ELECTRONIC CONTROL UNITS FOR BATTERY MANAGEMENT  
PREH

PORTABLE ELECTRIC VEHICLE CHARGER  
DELPHI

RGB LED PUDDLE & ENTRY LAMP  
GRUPO ANTOLIN CML

DECOUPLING ELEMENT  
TRELLEBORG VIBRAACOUSTIC

BODY CASTING STAMPINGS  
MAGNA

FPC-ECU BRUSHLESS  
OMRON

LOCKSETS  
U-SHIN

TWO SPEED E-AXLE  
GKN DRIVE LINE

COLD & HOT GASKETS  
FEDERAL-MOGUL

GULLWING DOOR STRUTS  
STABILUS

CV-JOINTS (HALFSHAFTS)  
HIRSCHVOGEL

ELECTRIC MOTOR HOUSING  
NEMAK

HYBRID STEEL PRESSURE TANK  
MAGNA

TRANSMISSION OIL COOLING MODULE  
MAHLE

SPECIALITY GASKETS - EXHAUST SYSTEM  
ELRINGKLINGER

# DIGITALLY ENABLED PRODUCT USE AND CONSUMPTION

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- “Product servitization”: Products consumed as services.

E.g., Rolls Royce’s “Power by the Hour” model.  
Generates \$1 billion new revenues annually.

- “Digital twins” concept a key enabler.



# ECONOMIC IMPACTS OF MANUFACTURING DIGITALIZATION

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- Generate \$10 trillion in value for the global economy by 2025.
- Will boost productivity of the world's factories 10 to 25%.
- Could add 1-1.5% to a nation's annual productivity growth.

Sources: McKinsey Global Institute, "The Internet of Things: Mapping the Value Beyond the Hype"  
GE, "Industrial Internet: Pushing the Boundaries of Minds and Machines"





# DIGITAL DRIVING LIFE SCIENCES INNOVATION

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ICT powering precision medicine, gene editing, and earlier disease detection.

Over 7,000 new-to-the-world drugs in development.

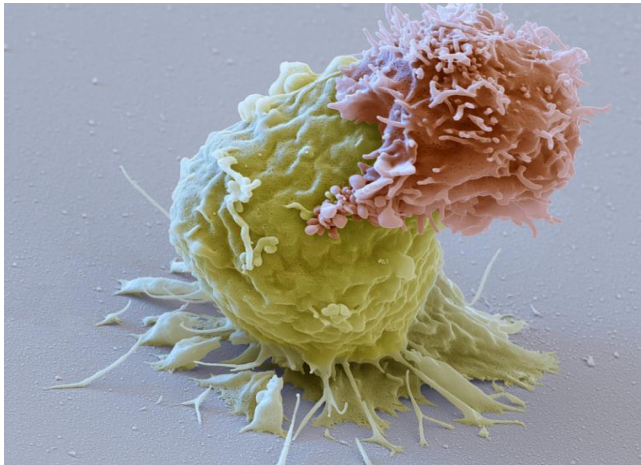
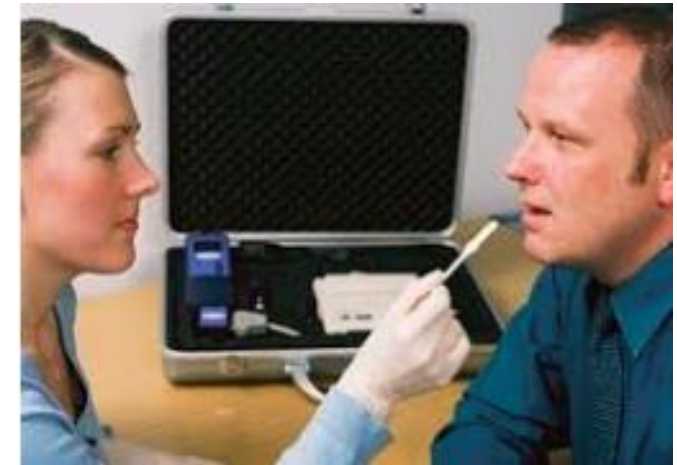


Image of a CAR-T cell (reddish) attacking a leukemia cell (green).



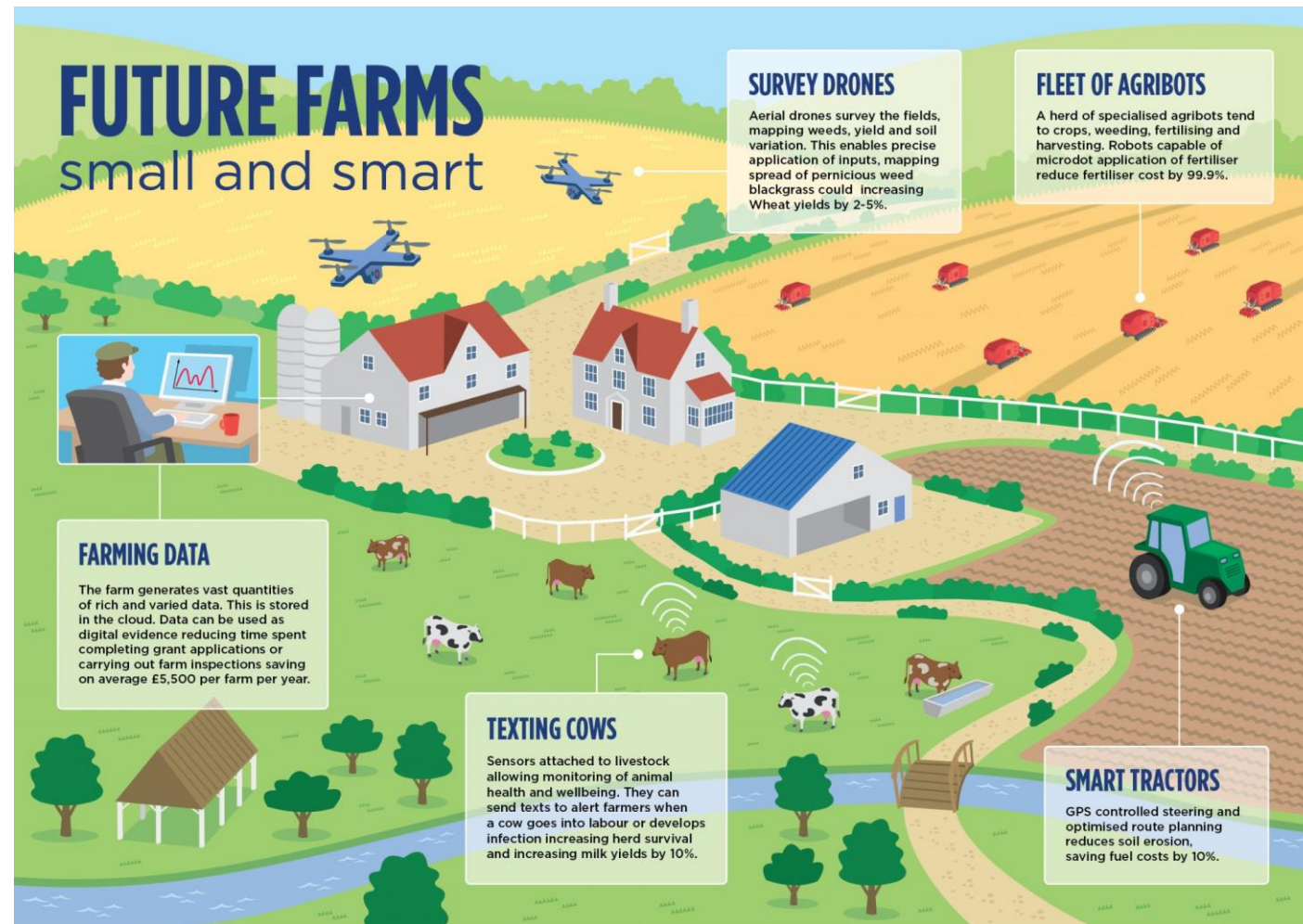
Gene editing can repair or replace corrupted or missing genes.



New tests claim to be able to detect cancer in 10 minutes from mouth swabs.

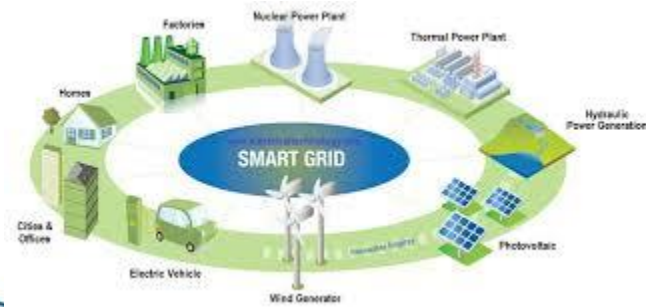


# DIGITAL DRIVING AGRICULTURAL INNOVATION



Source: NESTA

# DRIVING THE TRANSFORMATION OF CITIES



## SMART CITY USE CASES



# TODAY'S PRESENTATION

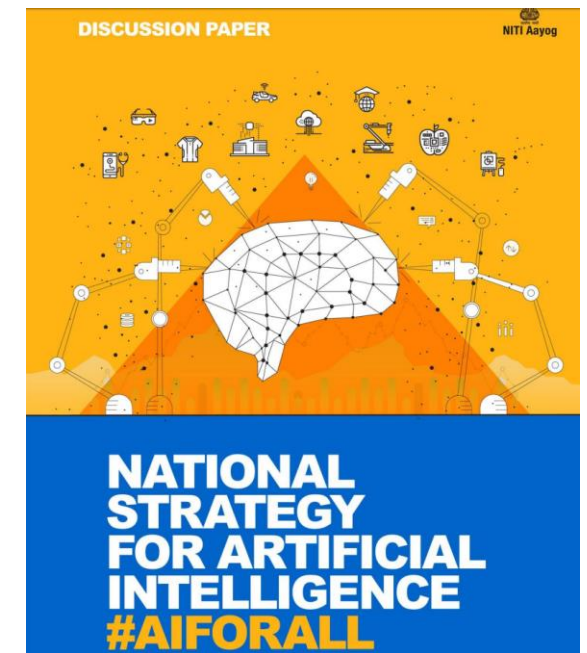
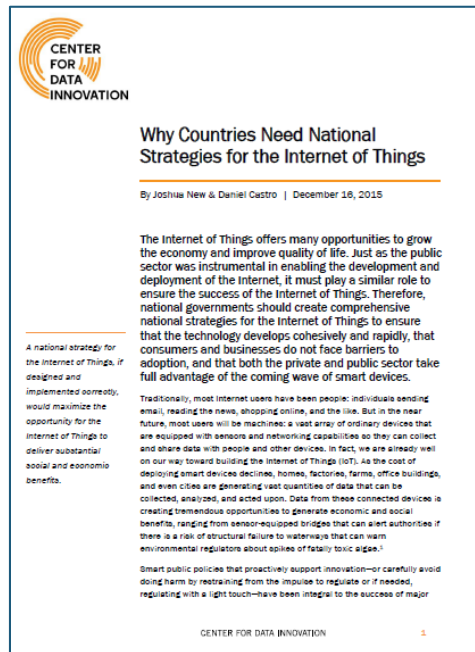
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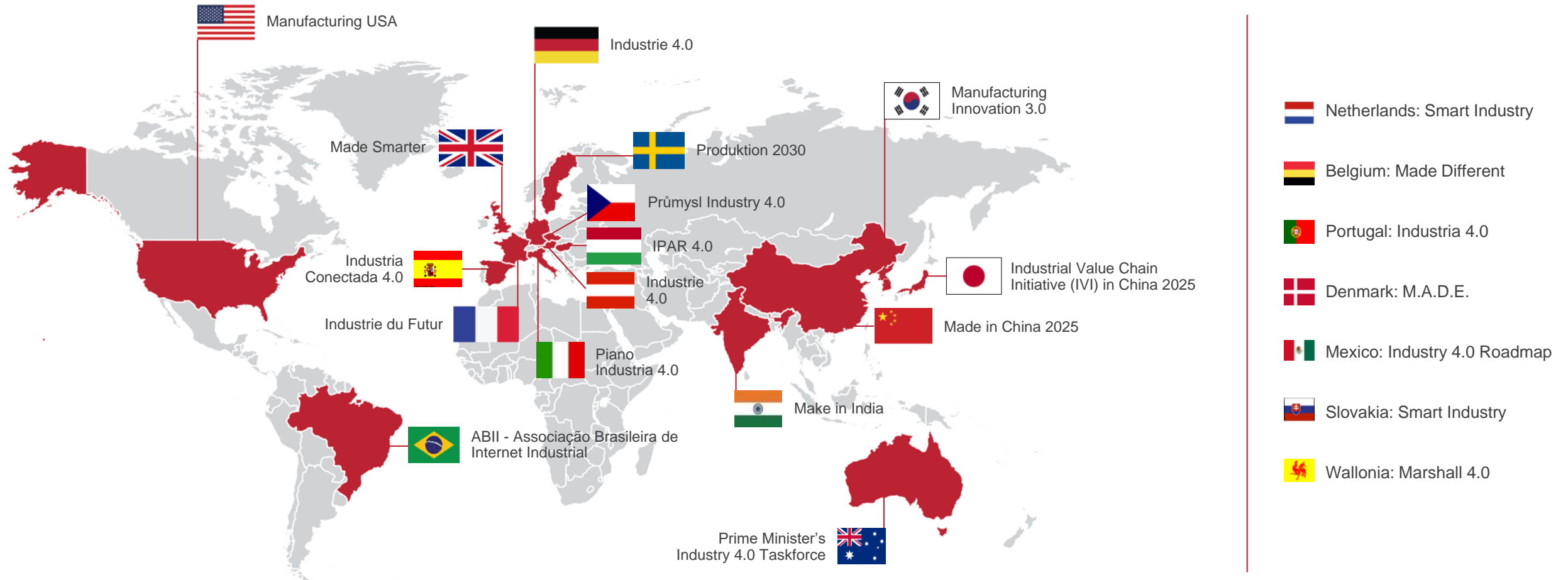


# HOW POLICYMAKERS CAN SPUR GREATER DIGITALIZATION

- Develop both formal, national digitalization strategies...
- And particular strategies for the deployment of AI, IoT, Industry 4.0, etc.



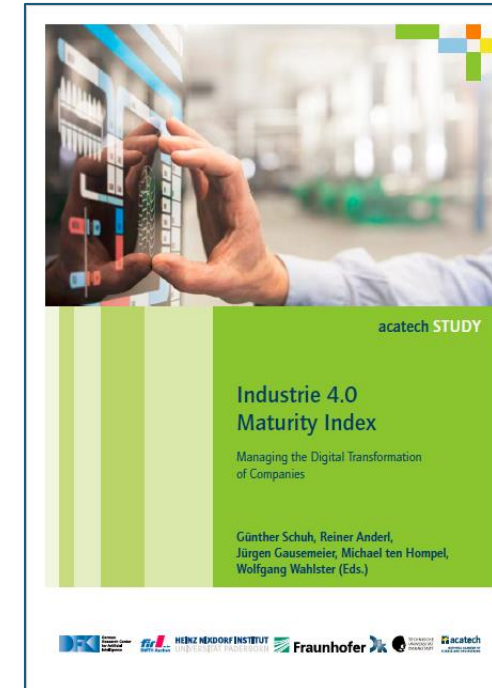
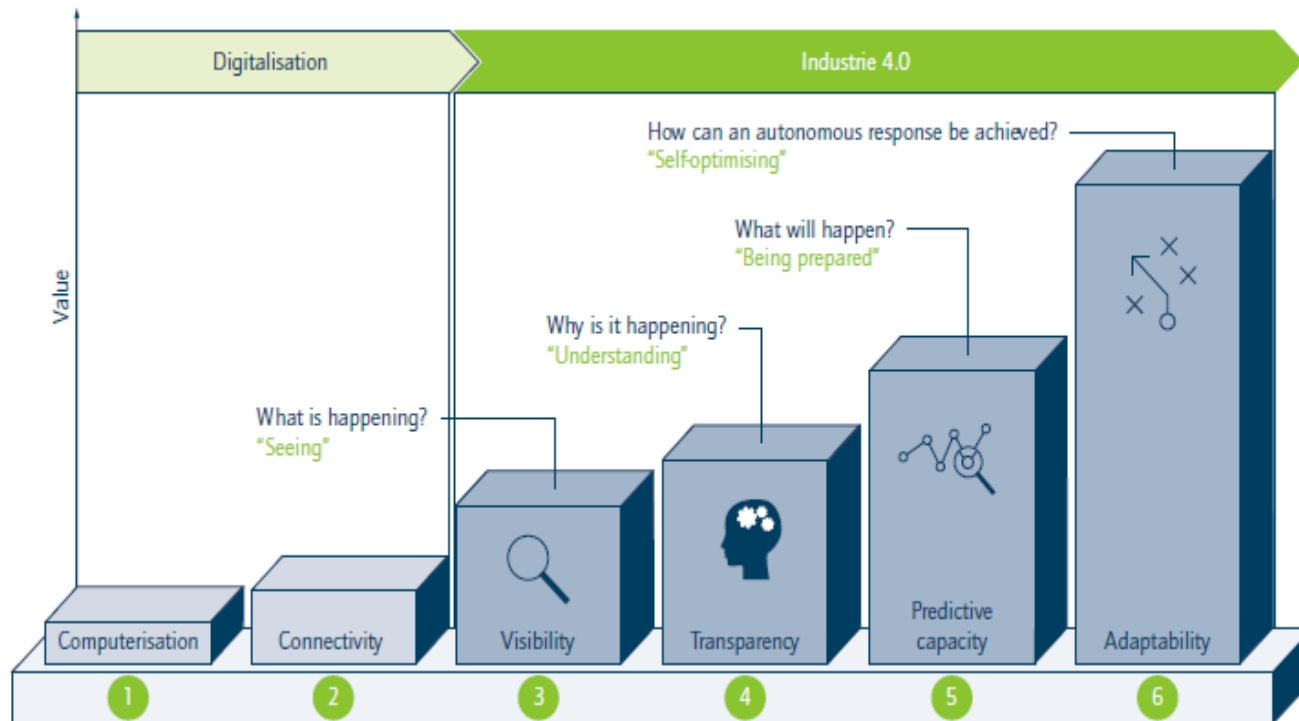
# MAKE MANUFACTURING DIGITALIZATION A NATIONAL PRIORITY



Courtesy: Dave Vasko, Rockwell Automation

# WHAT COUNTRIES' INDUSTRY 4.0 POLICIES ARE DOING

1. Building "Maturity Indices" and "Model Use Cases" to facilitate manufacturers' digital transformation journeys. (Germany/USA)





# WHAT COUNTRIES' INDUSTRY 4.0 POLICIES ARE DOING

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2. Launching “pilot fabs” that demonstrate smart-manufacturing techniques on active production lines. (Germany/Austria/Manufacturing USA)
3. Providing SMEs tax credits to facilitate equipment upgrades. (Austria/Italy)
4. Providing SMEs access to cloud-based, HPC-powered design, modeling, and simulation software. (Korea)
5. Developing smart manufacturing workforce training/credentialing programs and supporting enterprises' investments therein. (Germany)

# HOW POLICYMAKERS CAN SPUR GREATER DIGITALIZATION

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- Deploy next-generation digital infrastructure (e.g., 5G).
- Make digital literacy a central objective of public education and adult workforce retraining systems.
  - E.g., UK: National Mandatory Computer Science Curriculum
  - E.g., Singapore: “Future Skills Initiative” Online Skills Assessment
- Don’t introduce barriers to cross-border data flows/digital trade.
- Adopt an “innovation principle” not “precautionary principle.”

# STRATEGIC OPPORTUNITY FOR THE PHILIPPINES

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- Global manufacturers are in the midst of reimagining their global supply chain structures.
- Leverage current global trade dynamics to make the Philippines even more-attractive location for international tech-sector FDI.

# MARAMING SALAMAT!

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