

جامعة المدينة العالمية
Al-Madinah International University

4.0 INDUSTRIAL REVOLUTION

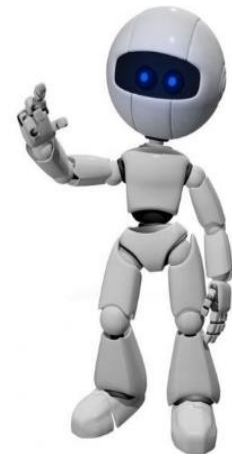
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PRINCIPLE OF 4.0 INDUSTRIAL REVOLUTION

Presented by: Assoc. Prof. Dr. Shadi M. S. Hilles

AGENDA

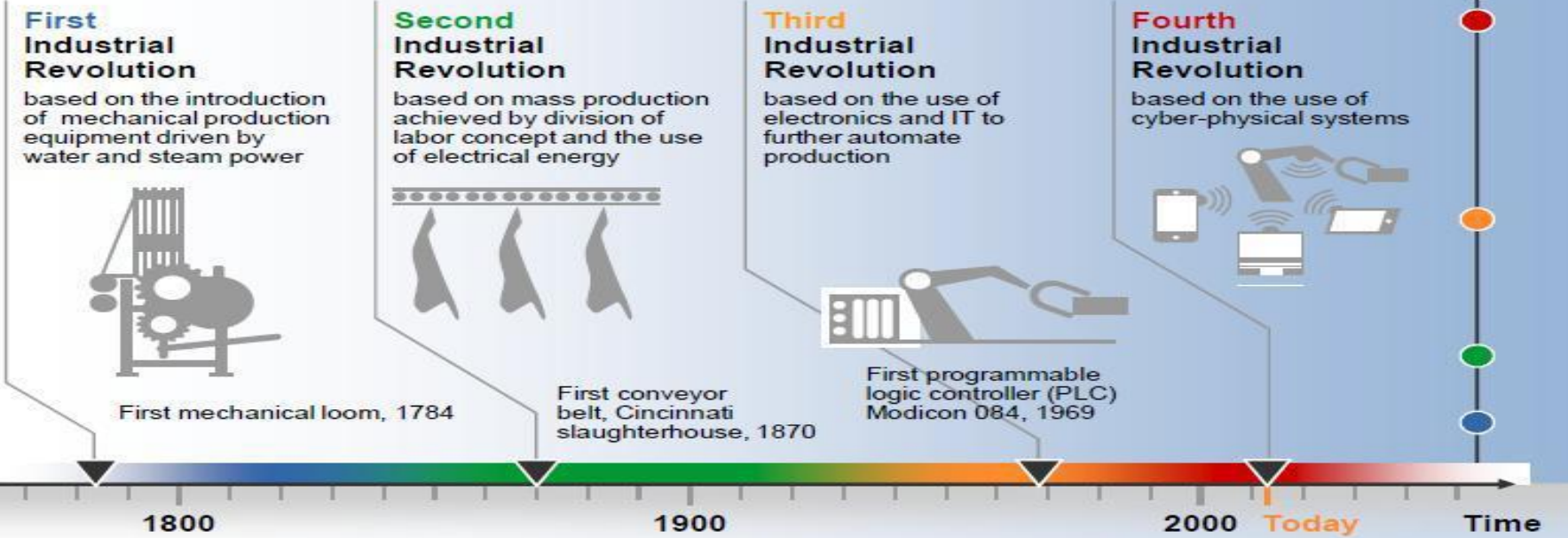
- ❑ **The Advent of the 4th Industrial Revolution**
- ❑ **Main Pillars of Industry 4.0**
- ❑ **Cyber Physical Systems 4th IR Era**
- ❑ **Three Clusters Merging In 4.0 IR**
- ❑ **Benefits of Moving on to 4.0 IR?**
- ❑ **Internet Of Things IoT**
- ❑ **Cyber Security and Cyber Attack**



THE ADVENT OF THE 4TH INDUSTRIAL REVOLUTION



From Industry 1.0 to Industry 4.0

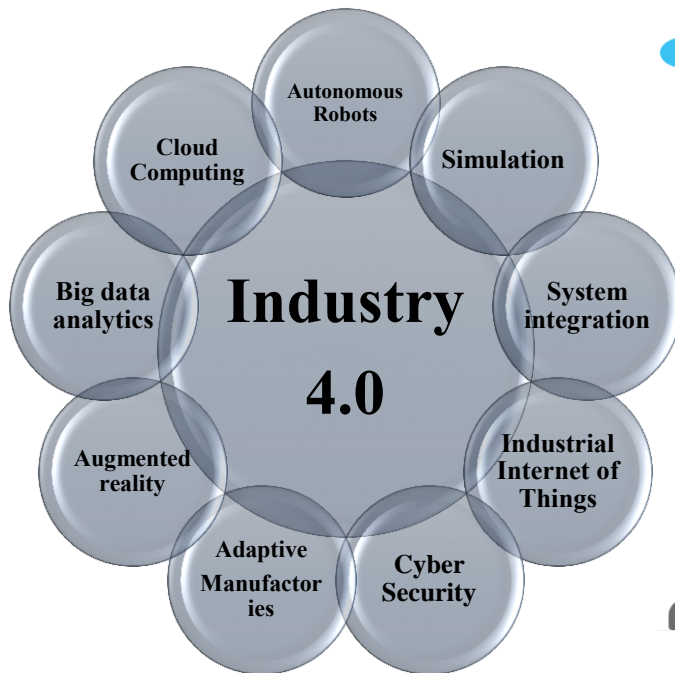


The 4th Industrial Revolution is leading the Intelligent Information Society the Digital Transformation, its advance Technologies.

By using 5G wireless network which is 70 times faster than 4G wireless.

- I**nternet of Things
- C**loud Computing
- B**ig data
- A**rtificial Intelligence
- M**obile

WHAT ARE THE MAIN PILLARS OF INDUSTRY 4.0?



Technology

- Robotics deals with the design, construction, operation and its Replacing humans on assembly line.
- 3D Printing is any of various processes in which material is joined or solidified under computer control to create a three-dimensional object, the manufacturing customized components
- Big Data – Collecting performance parameters, used to refer to data sets that are too large or complex for traditional data-processing application, analytics – Understanding collected data



People

- Increased efficiency – Reduction in labor per unit
- Skill Development – Up-skilling, Re-skilling, Continuous learning & Mindset change
- Only to handle disruptions – Monitoring and corrective actions



Process

- Constant communication – Data exchange between components
- Decentralized decision making any process where the decision-making authority is distributed throughout a larger group
- Standardization – Ease of customization
- Smart Transport System - Automated transportation of raw material for final products

SOCIAL CHANGES DUE TO THE 4TH INDUSTRIAL REVOLUTION

- **Intellectualization (Human-machine) : Transformation into Intelligent Society**
 - Technology including machine learning, deep learning and big data makes machine think like human.
 - Changes in recognition of human identity and job topography are commonplace.
- **Virtualization (Reality-virtual) : Acceleration of the Fusion of Virtual and Reality**
 - New products , VR/AR, smart car, telemedicine, virtual labs virtualize general daily lives and social and economic activities.
 - Human experience and cognitive domain become blurred
 - New service in various fields of industry can be created
- **Hyper-connection (Human-things) : Transformation into Hyper-connection Society**
 - Proliferation of digital network and mobile devices expand a range of human-human, human-thing and thing-thing interaction (IoE: Internet of Everything)
 - Hyper-connection causes new group behavior pattern

CONVENTIONAL INDUSTRIAL PRODUCTION AND THE INDUSTRY 4.0

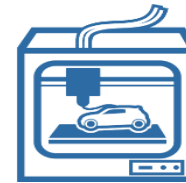


Advanced Manufacturing Systems



Sensors

- Traceability
- Predictability



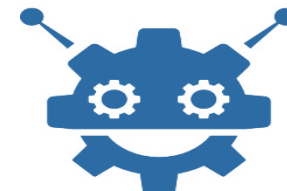
3D Printing

- Scrap Elimination
- Customization



Cloud Computing

- Big Data
- Cyber Security



Robotics

- Autonomy
- Productivity

Source: ECPE European Center for Power Electronics e.V., Nuremberg, Germany

THREE CLUSTERS MERGING IN CYBER- PHYSICAL SYSTEMS DRIVEN BY AI AND ROBOTS:

- Physical, Digital (techno sphere),
- Biological (natural world)

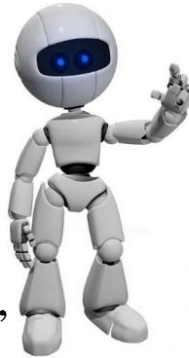
Physical:

- Autonomous technology from DARPA, Google, Tesla, Toyota, 3D printing, Advanced Robotics, New Materials such as polymers, nanomaterials like quantum, new batteries and dot tech



Biological:

- Genetic analysis.
- Synthetic human genome cell line.
- CRISPR for designer plants, animals, humans, embryo experimentation
- DARPA example: brain implants, Brain interfaces, Mind control of objects, EU Brain project, US Brain initiative



Digital:

Mobile, Smart sensors, Smart devices: heterogeneous computing network, Stochastic network, Arduino, Augmented reality and virtual reality.

WHAT ARE THE BENEFITS OF MOVING ON TO INDUSTRY 4.0?

Moving to Industry 4.0 include improved productivity and efficiency, better flexibility and agility, and increased profitability. **Industry 4.0** also improves the customer experience.

This includes technologies that improve automation, machine-to-machine communication, manufacturing oversight, and decision making.

- Increase flexibility
- Productivity
- Efficiency
- Quality
- Reduced time to market
- More R&D and activities
- Development of new skills



Benefits

Parallel



Shorter
Time
Frames



Work with
existing
infrastructure



Fail Fast
& Learn



Low
cost



INTERNET OF THINGS IoT

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Internet of Things, integrated into the manufacturing, processing and logistics
The IoT is a term coined by Kevin Ashton back in 1999 and the term quickly gained popularity as a way to refer to physical devices that are able to connect and exchange data.

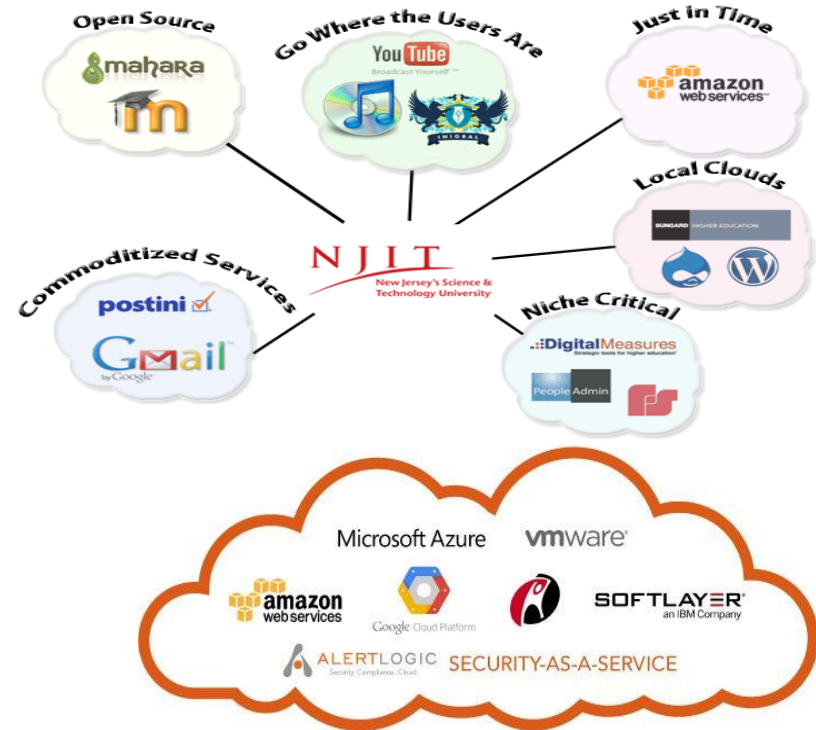
IoT will consist of about 30 billion objects by 2020” and that “the global market value of IoT will reach \$7.1 trillion” by the same year.



INTERNET OF EVERYTHING IoE

IoE is the network of devices, vehicles, and home appliances that contain electronics, software, actuators, and connectivity which allows these things to connect, interact and exchange data. IoE is considered a superset of IoT. Cisco, first coined the term the Internet of Everything, process , people, data, and things together to make networked connections more relevant and valuable.

The Industry 4.0 Environment

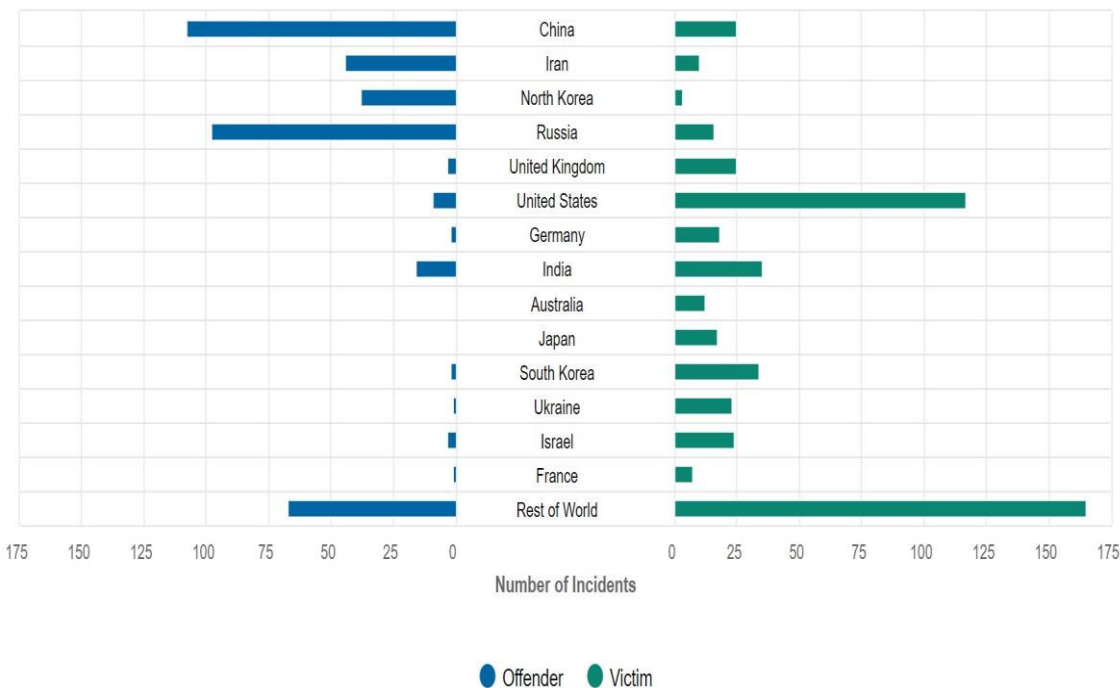


CYBER SECURITY AND CYBER ATTACKS

Cyber attacks can exploit the vulnerabilities of critical infrastructures such as the energy, transportation and communications sectors and seriously undermine military mission success,

Significant Cyber Incidents

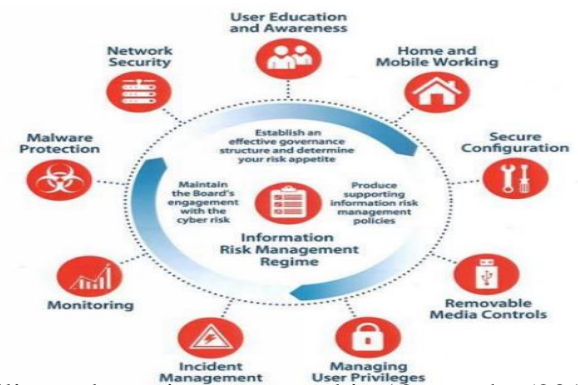
Based on publicly available information on cyber espionage and cyber warfare, excluding cybercrime. Long-running espionage campaigns were treated as single events for the purposes of incident totals. Tallies are partial as some states conceal incidents while others fail to detect them.



Cyberwar Defense team of the US Air Force monitoring cyber threats at a workstation.

Cyber attacks on government agencies, defense and high tech companies, or economic crimes with losses of more than a million dollars.

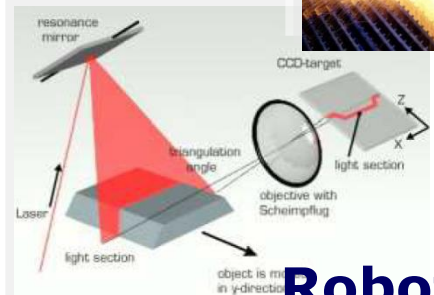
Cyber security is a discipline that requires national effort, and it is not something that the citizens and private companies can expect to outsource to the military.



CYBERCRIME IN NUMBERS: 3.9 Million cyber crimes reported in 12 months (2016)

INNOVATIVE ICT MAKES THE DIFFERENCE

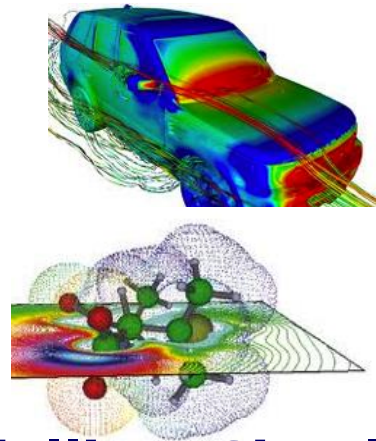
Laser-based manufacturing



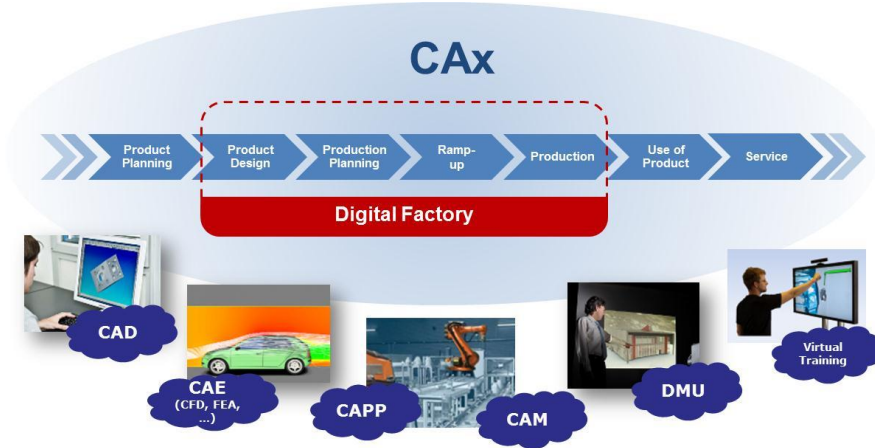
Robotics



Cyber-physical systems for process (chain) optimisation



Modelling, Simulation, Analytics



BEING DEVELOPED OR NEW ON THE MARKET

Robotics



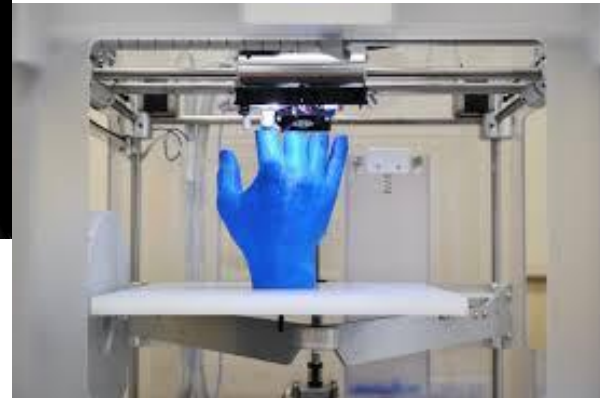
Artificial intelligence



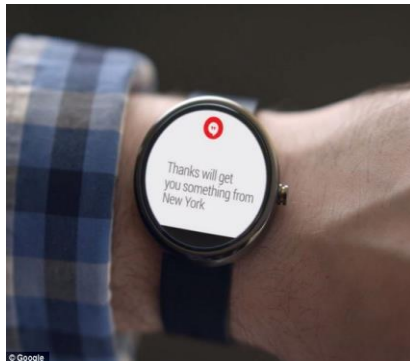
Virtual reality



3D printing



Self driving cars



Google Smart hand watch



VIRTUAL REALITY AND AUGMENTED REALITY (VR, AR) IN CLASS ROOM

AR will soon affect the conventional learning process, and could grant students extra digital information about any subject, and make complex information easier to understand.



AR animated content in classroom lessons could catch students' attention in dynamic day and age



The use of VR is already practiced and highly appreciated in the field of medicine



Samsung Providing AR in Classroom

AR motivate them to study. Adding extra data, short bio of a person, fun facts, historical data about sites or events, visual 3D models, would give students a wider understanding of topics.

VR in manufactory

Structure and optimise the location.

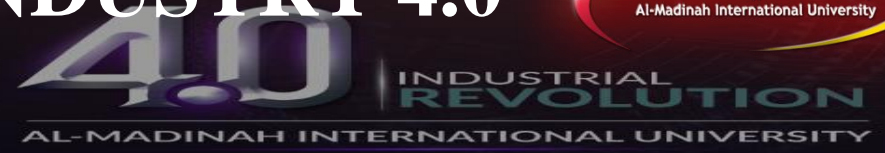
Flow of production lines.

Position automation lines, robots, production cells

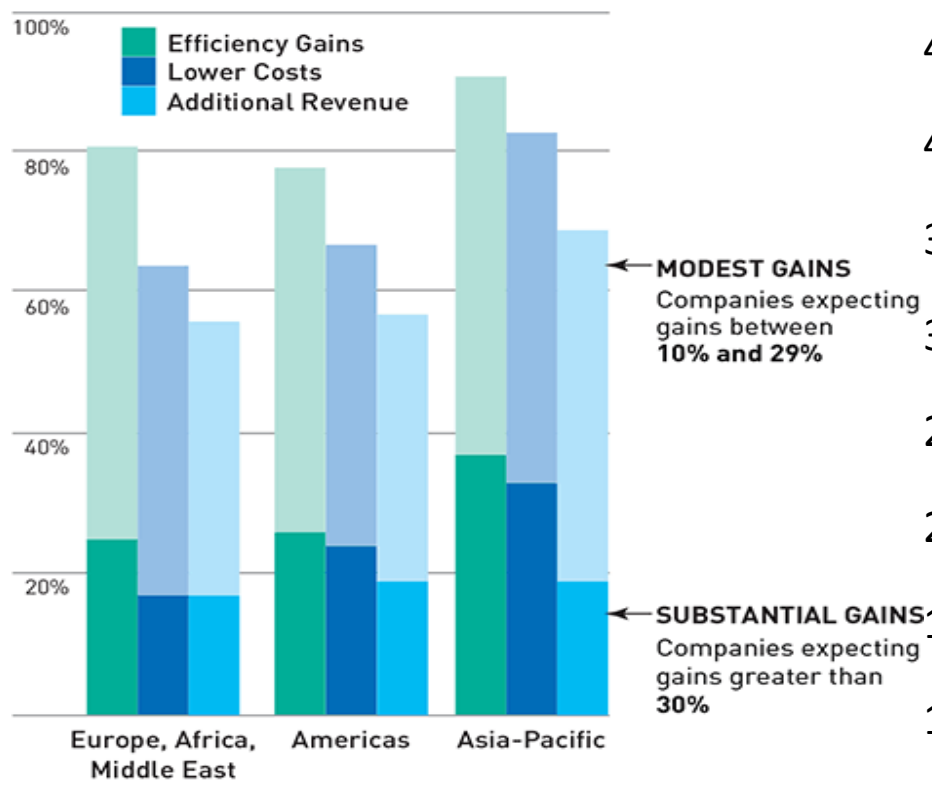
Operate and handle virtual tools and equipment.



EXPECTATIONS FOR INDUSTRY 4.0 BY REGION

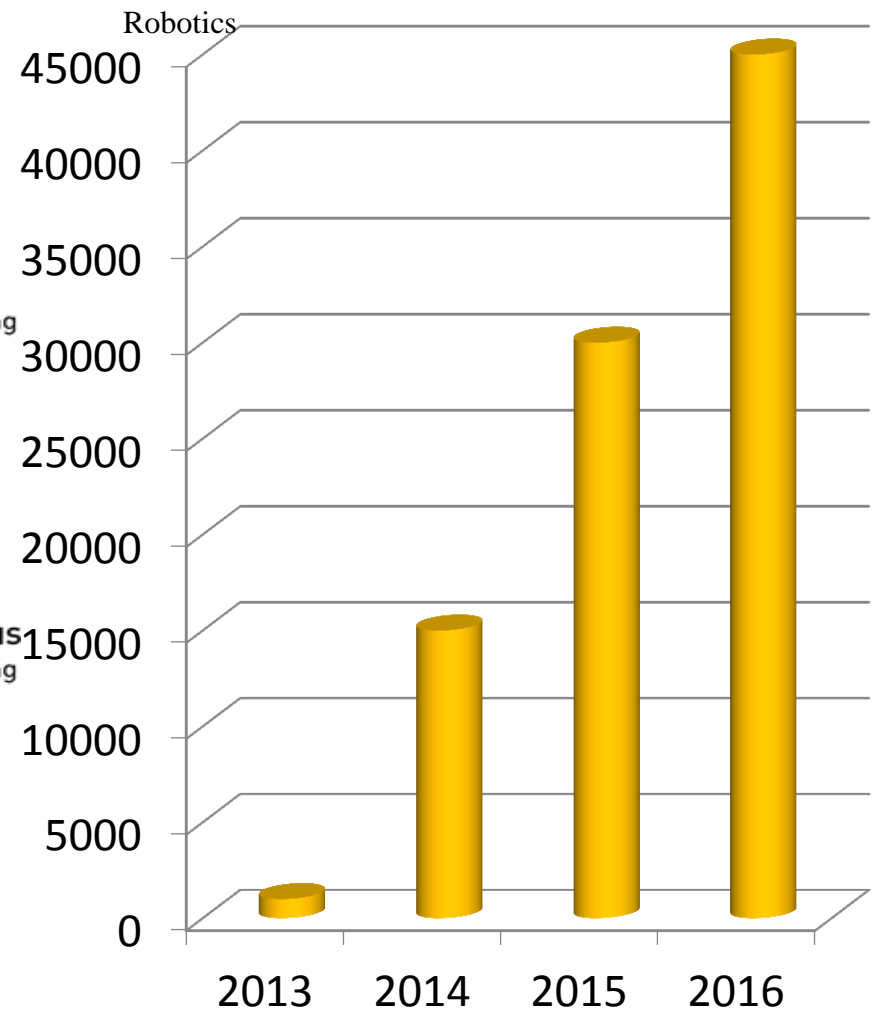


Respondents from three major regions were asked: "What cumulative benefits from digitization [in the context of an Industry 4.0-related survey] do you expect in the next five years?" Asia-Pacific had the largest percentage of companies with high expectations.



Source: "Industry 4.0: Building the Digital Enterprise," PwC

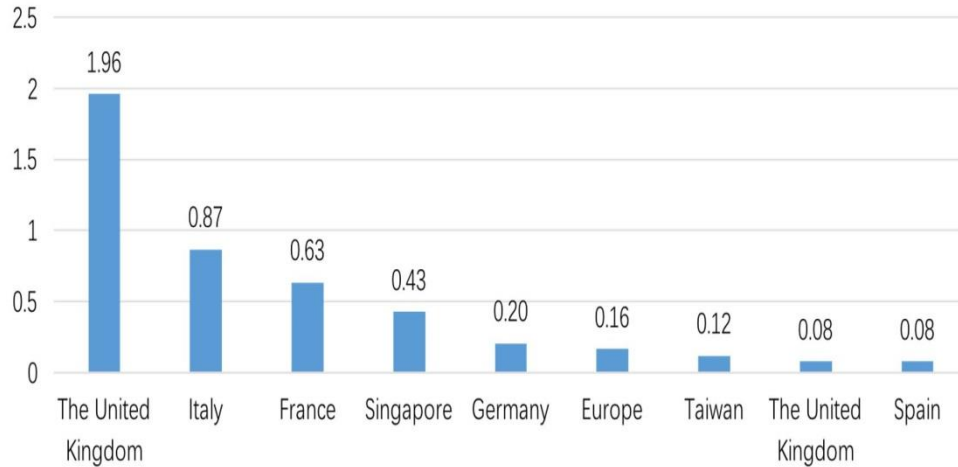
ROBOTS WORKING IN AMAZON



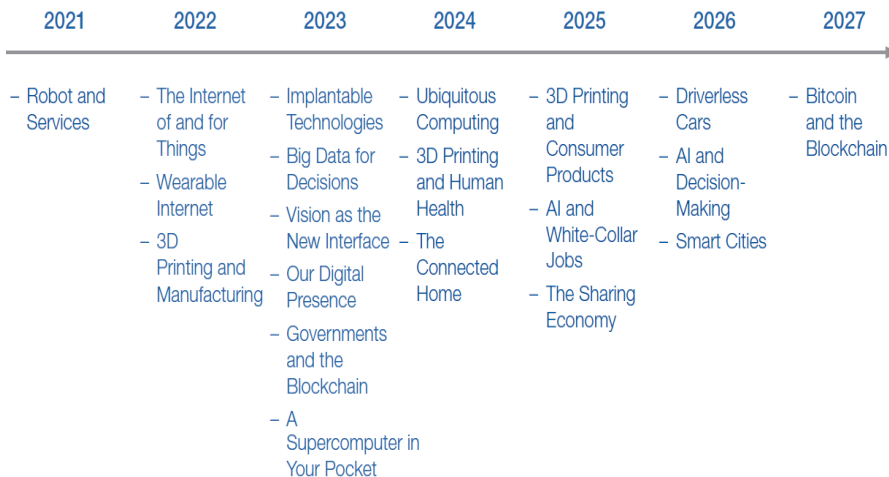
THE IMPACT OF THE FOURTH INDUSTRIAL REVOLUTION CROSS-COUNTRY

Country/Region	Continent	Start Year	End Year	Duration
United States (US)	North America	2011	N/A	N/A
Germany	Europe	2012	2020	9
France	Europe	2013	2020	8
United Kingdom (UK)	Europe	2013	2050	38
Europe	Europe	2014	2020	7
South Korea	Asia	2014	2020	7
India	Asia	2014	N/A	N/A
Netherlands	Europe	2014	N/A	N/A
Sweden	Europe	2015	2020	6
China	Asia	2016	2025	10
Spain	Europe	2015	N/A	N/A
Malaysia	Asia	2016	2020	5
Taiwan	Asia	2016	2024	9
Japan	Asia	2016	2020	5
Mexico	North America	2016	2030	15
Canada	North America	2016	2030	15
Singapore	Asia	2016	2020	5
Italy	Europe	2017	2020	4

ANNUAL INVESTMENT IN INITIATIVES RELATED TO THE FOURTH INDUSTRIAL REVOLUTION



Pontifícia Universidade Católica do Paraná, Curitiba, PR, Brazil, 2018



technology based critical points for the future society: deep shift technology tipping points and societal impact(wef)

Digitization index

Accenture and Oxford Economics' Digital Opportunity Index measures the present and future digitalization status in 14 of the world's economies.



Source: Accenture/Oxford Economics

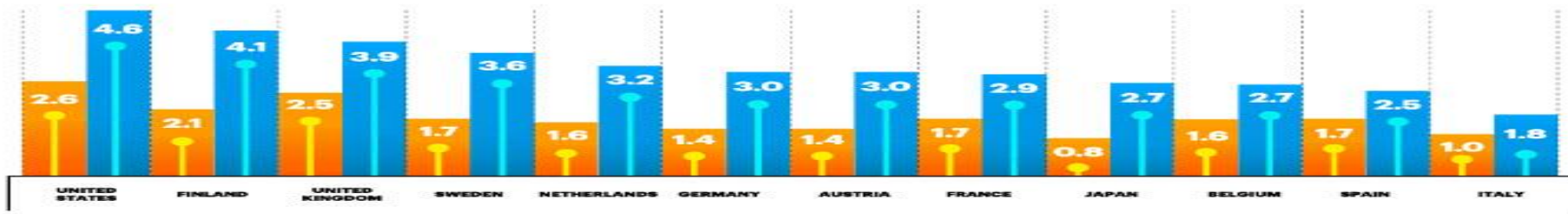
The countries leading the fourth industrial revolution in 2016



Focused manufacturing sectors in the public policies

ARTIFICIAL INTELLIGENCE AS THE FUTURE OF ECONOMIC GROWTH

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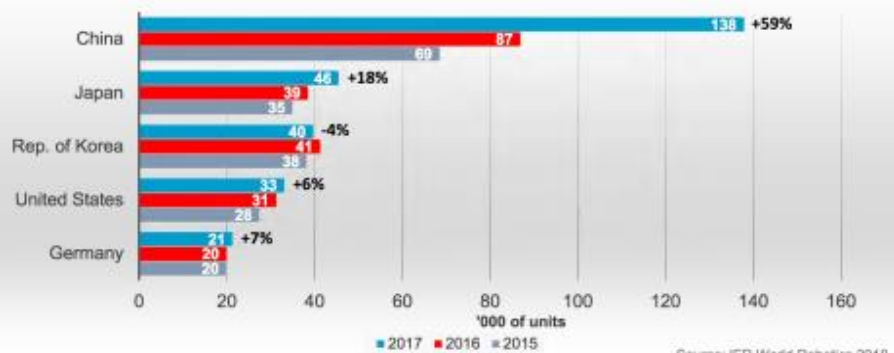


Annual growth rates in 2035 of gross value added (a close approximation of GDP), comparing baseline growth in 2035 to an artificial intelligence scenario where AI has been absorbed into the economy. Source: Accenture and Frontier Economics



Percentage increase in labor productivity with AI, compared to expected baseline productivity levels in 2035. Source: Accenture and Frontier Economics

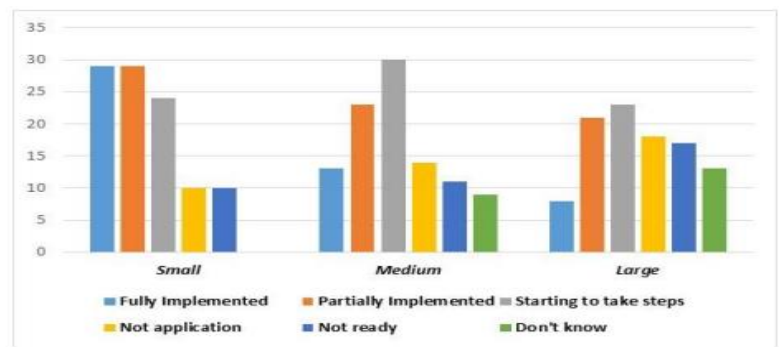
Estimated worldwide annual supply of industrial robots at year-end main markets 2015 - 2017



Source: IFR World Robotics 2018

The top five countries for industrial robotics by sales and density

State of Implementation of Industry 4.0 in Malaysia



Source: Monash Malaysia-CPA (Australia) 2018 Business Sentiment Study undertaken by the Monash Team

INDUSTRIAL 4.0 IN CHINA

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Technology and Competition

Made in China (by robots): A global perspective on the hottest story in automation

Textile Industry
USD 800 billion Industry

With government encouragement and bottomless capital, China's automation sector is outpacing the U.S. Here's why.

By Greg Nichols for RObOtics | July 23, 2018 -- 09:12 GMT (last 45:11) | Topic: RObOtics

Figure 3: Global apparel & non-apparel manufacturing market geography segmentation, % share, by value, 2017

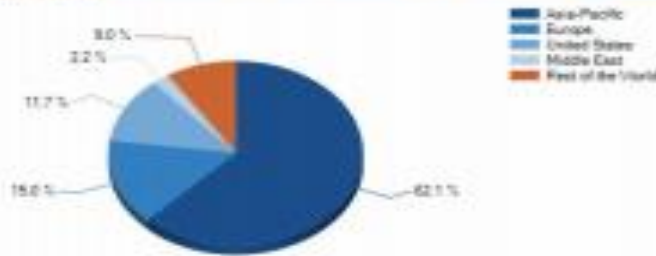


Figure 3: Asia-Pacific apparel & non-apparel manufacturing market geography segmentation, % share, by value, 2017



China has a major drive on Industry 4.0 – Automate all their industries – Leading to better Economies Scale and Scope

THE UNIVERSITY OF THE FUTURE

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Change Of Organizational Structures

- Change of business model
- Cooperative structures enhancing interdisciplinary
- New concept for faculties or departments

Change Of Accreditation Procedures

- New role of examination offices
- No fixed degree programs
- Acceleration in education according to fast innovation cycles

Change Of Teaching Methods

- New teaching concepts flipped classroom
- New method of teaching and their infrastructures in example using equipment's for virtual worlds
- Digital rights management

Change Of Learning

- Massive and personalized learning
- New learning infrastructure example increased computing capacities
- Shift from presence learning to distance learning

RESOURCES

- <http://www.techrepublic.com/article/microsoft-envision-prepare-yourself-for-the-fourth-industrial-revolution/>
- <https://www.weforum.org/pages/the-fourth-industrial-revolution-by-klaus-schwab/>
- https://www.ubs.com/global/en/about_ubs/follow_ubs/highlights/davos-2016.htm
- <http://techcrunch.com/2016/04/15/artificial-intelligence-and-racist/?ncid=rss>
- <http://www.techrepublic.com/article/microsoft-envision-prepare-yourself-for-the-fourth-industrial-revolution/>
- <https://www.weforum.org/pages/the-fourth-industrial-revolution-by-klaus-schwab/>
- <http://www.mckinsey.com/mgi/overview/in-the-news/by-2025-internet-of-things-applications-could-have-11-trillion-impact>
- [KPCB
http://motherboard.vice.com/blog/inexpensive-small-computers-are-changing-the-maker-movement](http://motherboard.vice.com/blog/inexpensive-small-computers-are-changing-the-maker-movement)
- <http://www.cnet.com/news/samsung-artik-teases-smart-robots-light-switches-of-the-future/#ftag=CADf328eec>
- <http://www.cybersecurity.my/en/index.html>