Generating, acquiring and imparting knowledge in era of the Fourth Industrial Revolution

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*Draws heavily from referred to papers

Outline

Characteristics of the Fourth Industrial Revolution

Implications for

- Production and distribution systems
- Labor market
- Generating and acquiring knowledge
- Imparting knowledge

References:

Dadios, et al. (2018) "Preparing for the Fourth Industrial Revolution: A Scoping Study" (http://serp-p.pids.gov.ph/publication/6152)

Albert, et al. (2018) "Harnessing Government's Role for the Fourth Industrial Revolution", (http://serp-p.pids.gov.ph/publication/6485)

Video: https://www.youtube.com/watch?v=LX8ucERD6RI

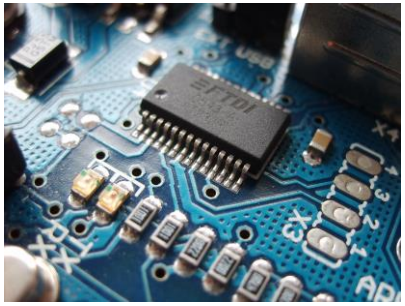
The Fourth Industrial Revolution(FIRe)

1. What is the Fourth Industrial Revolution (FIRe)?

First came steam and water power; then electricity and assembly lines; then computerization. Throughout history, we have improved industry by migrating from established production methods to utilizing cutting-edge technologies

1st Revolution
(1784)
Steam, water, mechanical production equipment

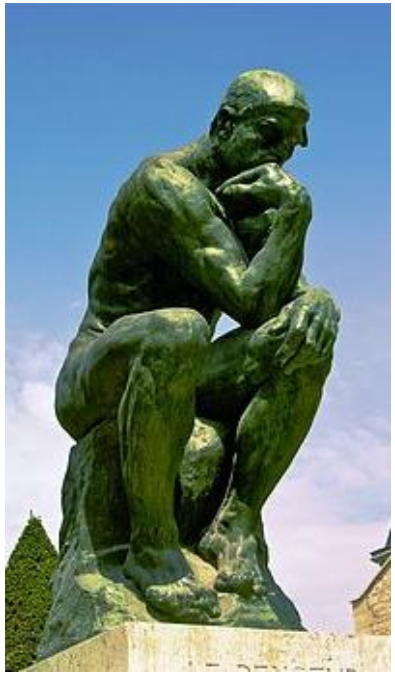
2nd Revolution
(1870)
Division of labor, electricity, mass production, assembly line



3th Revolution
(1969)
Electronics, computers, internet, automated production

4th Revolution
(???)
Cyber-physical systems

FIRe (cont'd)?



"*Characterized by a fusion of technologies that is blurring the lines between the physical, digital and biological spheres.*" – Schwab (2016)

1.1 Frontier Technologies in FIRe

Frontier technologies identified by select organizations

- No universally agreed definition of frontier technology

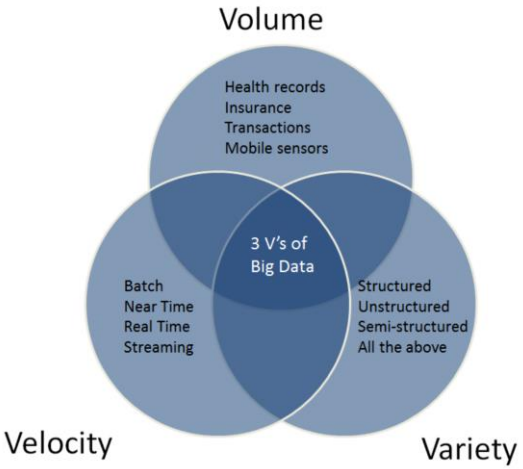
- It shows that the following technologies have been most commonly identified as frontier: 3D printing, the Internet of Things, AI, and robotics

(ESCAP, 2018)

OECD	World Bank	World Economic Forum	McKinsey Global Institute	Institute of Development Studies	MIT Technology Review 2018
Internet of Things	Fifth-generation (5G) mobile phones	Artificial intelligence	Mobile internet	3D printing	3D Metal Printing
Big data analytics	Artificial intelligence	Robotics	Automation of knowledge work	Collaborative economy tools	Artificial Embryos
Artificial intelligence	Robotics	Internet of Things	Internet of Things	Alternative internet delivery	Sensing City
Neuro technologies	Autonomous vehicles	Autonomous vehicles	Cloud technology	Internet of Things	Artificial intelligence for Everybody
Nano/micro satellites	Internet of Things	3D printing	Advanced robotics	Unmanned aerial vehicles/drones	Dueling Neural Networks
Nanomaterials	3D printing	Nanotechnology	Autonomous and near-autonomous vehicles	Airships	Babel-Fish Earbuds
3D printing (additive manufacturing)		Biotechnology	Next-generation genomics	Solar desalination	Zero-Carbon Natural Gas
Advanced energy storage technologies		Materials science	Energy storage	Atmospheric water condensers	Perfect Online Privacy
Synthetic biology		Energy storage	3D printing	Household-scale batteries	Genetic fortune-telling
Blockchain		Quantum computing	Advanced materials	Smog-reducing technologies	Materials' Quantum Leap
			Advanced oil and gas exploration		
			Renewable energy		

1.2 Example: Big Data

- While big data has no definition, it has **3Vs** (Gartner, 2001) **:**



Information is power !

- Awash in a flood of data !!! : *"drowning in numbers"*
  - 25 years ago, the first SMS was sent. We now send 23 billion text messages worldwide every day — or 16 million every minute. We type 156 million emails, 452,000 tweets and 3.5 million queries into Google every 60 seconds.
  - **From** the **beginning of** recorded **time until 2003, we created 5 billion gigabytes** (exabytes) of data. **By 2012**, about 2.5 exabytes of data were created per day, or 5 exabytes created **every 2 days**.
  - **In 2016,** around 16.1 zettabytes of data has been produced — 1 zettabyte = 1021 bytes, enough to fill 320 billion 16GB iPhones (which would circle the earth more than 400 times). **5 exabytes** were then being created **every 10 minutes**. By 2025, 163 zettabytes would be produced.

DATA: "the new oil"
a driver of growth and change

Implications of FIRe on Production and Distribution Systems

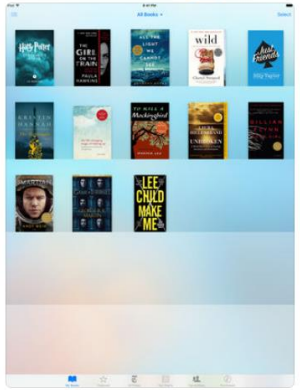
2.1. Impact: Opportunities and Risks

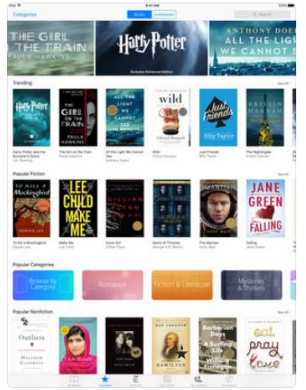
- From E-commerce to Digital Trade

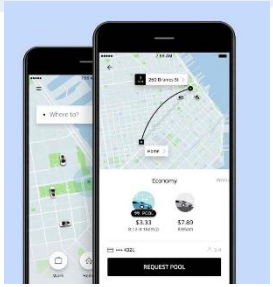
Figure 1. Dimensions of digital trade[1]

Nature ('how')	Product ('what')	Actors ('who')
Digitally ordered	Goods	Business
Platform enabled	Services	Consumer
Digitally delivered	Information	Government

Source: López González and Jouanjean (2017); OECD (2017)

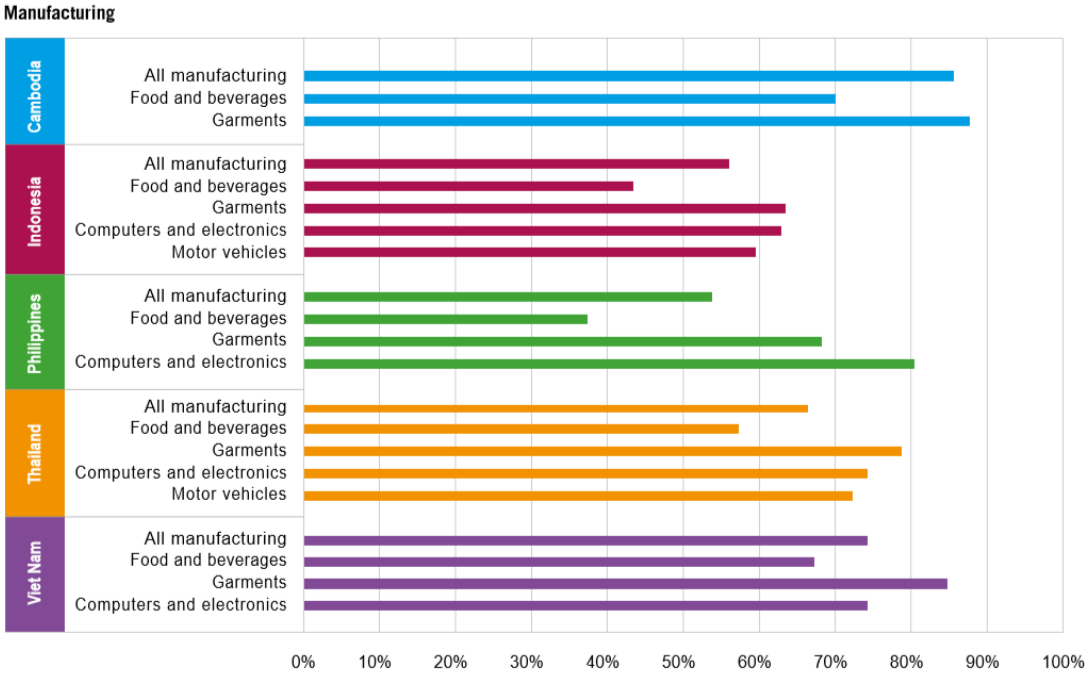






2.1. Impact: Opportunities and Risks (cont'd)

Figure 3. Share of wage and salaried employment in key **manufacturing** subsectors at high risk of automation (per cent).

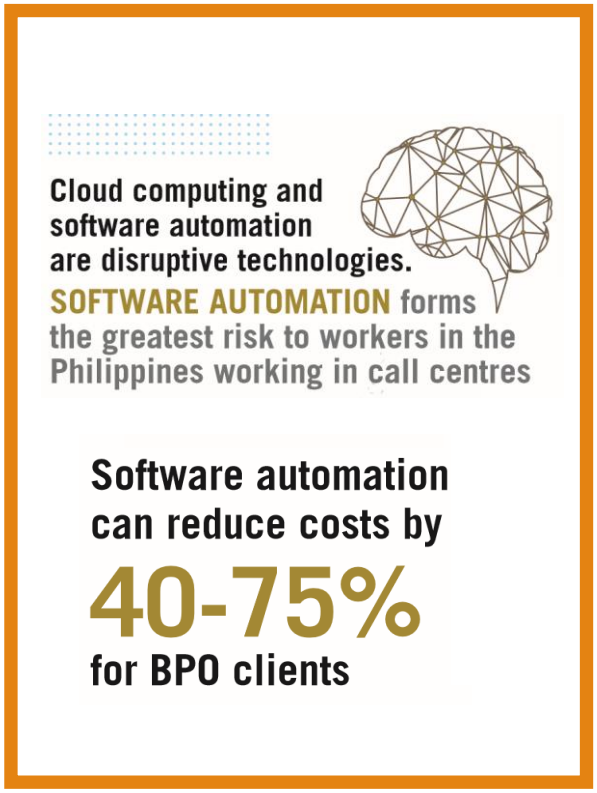


ILO (2016)

Acc to ILO, in the Philippines:

- nearly half (49%) of wage workers (males: 44%, females : 52%) face a high probability of getting affected by automation
- those working as fishery laborers (580,000), waiters (574,000), carpenters (525,000) and office cleaners (463,000) face a high potential of automation
- around 89 per cent of salaried workers in BPO sector fall into the high risk category of automation

The Fourth Industrial Revolution will trigger selective reshoring, nearshoring and other structural changes to global value chains (WEF 2018, ILO 2016)



Implications of FIRe on the Labor Market

Nature of work is changing

WB 2019 World Development Report

Through digital transformation firms can grow rapidly (challenges traditional production patterns)

The digital platform enable firms to reach more people faster

Technology is changing the skills employers seek (complex problem-solving, teamwork, and adaptability)

How people work and the terms on which they work is changing (short-term work, online platforms)

Implications on the Labor Market

Conceptually technology:

1. Substitute for labor
2. Complement labor
3. Create jobs

Net effect depends on which effect is strongest

Implications on the Labor Market

Empirical trends:

- Substitute routine or codifiable jobs
- Complement non-routine jobs
  - Dynamic classification: because of machine learning, what is not codifiable today maybe codifiable tomorrow
- Create entirely new jobs; redefine existing ones

10 Jobs AI will replace

https://blog.hubspot.com/marketing/jobs-artificial-intelligence-will-replace

1) Telemarketers (99%)

2) Bookkeeping clerks (98%)

3) Compensation and Benefits Managers (96%)

4) Receptionists (96%)

5) Couriers (94%)

6)Retail Salespeople (92%)

7) Proofreaders (84%)

8) Computer Support Specialists (65%)

9) Market Research Analysts (61%)

10) Advertising Salespeople (54%)

4 Top Career Fields Technology has Changed

https://workplacediversity.com/articles/How-Technology-Has-Changed-4-Top-Career-Fields-Within-the-Last-Two-Decades

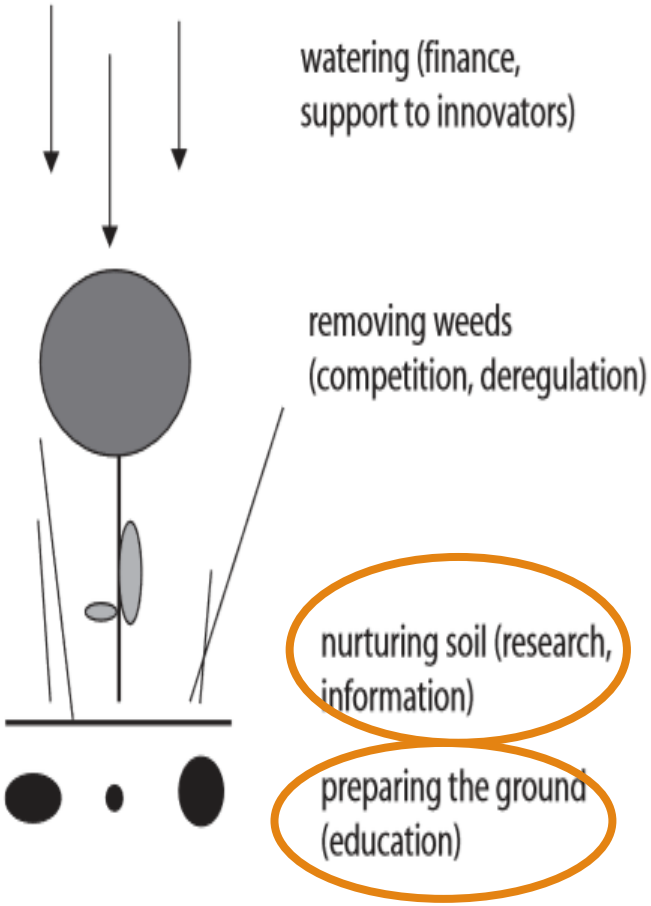
- Supply Chain Management
- Medicine and Health Care
- Law and Court
- Marketing

10 Jobs Created by Tech That Didn't Exist 10 Years Ago (2017)

https://blog.nasstar.com/10-jobs-created-by-tech-that-didnt-exist-10-years-ago/

1. Uber Driver
2. Social Media Managers
3. Airbnb Host
4. Cloud Service Specialist
5. YouTube Content Creators
6. App Developers
7. Driverless Car Engineer
8. Drone Operator
9. Millennial Generational Expert
10. Use Experience Designer

Implications on Knowledge Generation



Two items directly affected by technology

Source: World Bank (2010)

Gardening innovation framework

Preparing the soil (Education)

What are the desired characteristics of the education system?

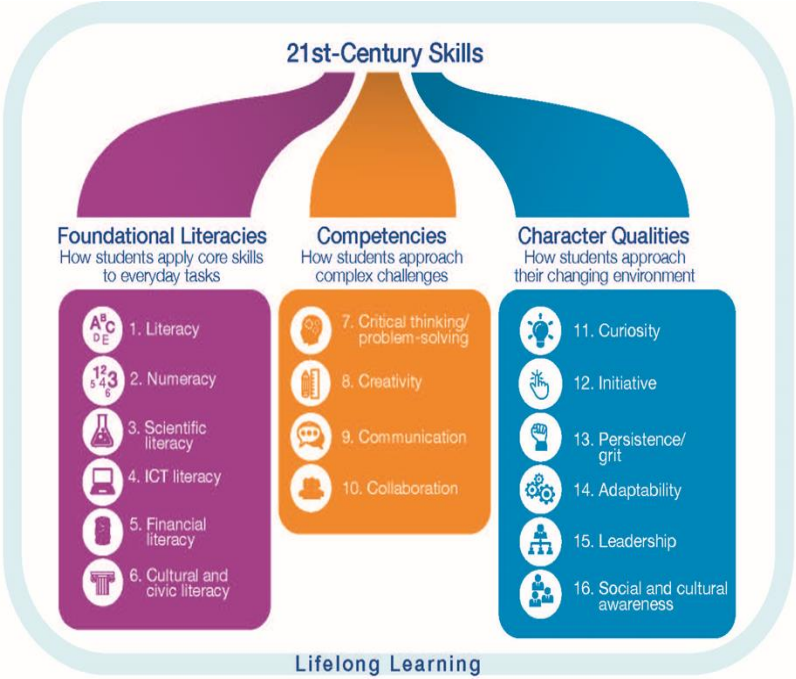
1. Flexible and modular (LEGO-like) competency generation
   - Strong basic foundations to enable flexibility and trainability
2. Pedagogy should go beyond transmitting knowledge into encouraging reconstruction of knowledge
3. Produces ability to work with (not against) “learning” machines
4. Continuous and life-long learning
   - A key skill that needs to be developed among learners is “learning how to learn”.
   - New illiteracy: “those who cannot learn, unlearn, relearn” (Toffler, 1970)
5. Enabling learning from various sources: formal, non-formal, informal
   - Importance of assessment and certifications systems

Preparing the soil (education)

Rise in importance of non-cognitive skills

21st century skills says complex challenges and changing environment require non-cognitive skills

Empirically validated the importance of non-cognitive skills in labor market outcomes (World Bank, 2016)



Source: WEF (2015)

Nurturing the Soil (Research, Information)

Research: Data generation methodologies changing

Computer Aided Personal Interviews (CAPI)

Online surveys

Web scraping

- Events such as stock prices
- Online conversation using tweets
- Newspaper articles

Sensor-based data generation

- Health information using phones: How many steps you did today?
- Traffic speed of using vehicle mounted sensors, e.g. Uber taxis
- Monitoring doctor washing of hands using cameras; teacher attendance in India
- Geo-tagged pictures of progress of road construction
- Where people actually passes?

Nurturing the Soil (Research, Information)

Research: Analysis is changing

Complex analysis facilitated by better computing power and better algorithms

Machine learning to detect patterns

Implications for Extension and Advisory Services

Key changes:

- More rapid generation of knowledge
- More intensive use of technology in knowledge acquisition and delivery

Continuous training and re-training

- Keeping updated with new knowledge
- More intensive use of technology in knowledge delivery
  - Different media: technical papers, policy briefs, social media

More customization and interactive engagements with clients

- Better customization targeted at varied clients
- Better interactive engagements with clients mediated by technology

Philippine Institute for Development Studies

Surian sa mga Pag-aaral Pangkaunlaran ng Pilipinas

Service through policy research

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