‘The Fourth Industrial Revolution: Introduction and Overview’

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Topics for today

• What is the Fourth Industrial Revolution / Industry 4.0 [4IR]?

• How is it different?

• Developing countries

• Impact on employment

• State of the literature

• Thinking about policy implications
What is 4IR?

• Term apparently first used in 2016 by World Economic Forum (Klaus Schwab)

• Dramatic change in pace and scope of automation of tasks previously done by humans

• Blurring of boundaries between the physical, biological and digital spheres

• Robotics; Artificial Intelligence (AI); Internet of Things (IoT) and Industrial Internet of Things (IIoT); cyber-physical systems; augmented reality (AR); virtual reality (VR); biotechnology; nanotechnology; autonomous vehicles; cloud computing; 3D printing…
Historical background

• **First Industrial Revolution**
  - Late 18C and early 19C
  - Industrialisation
  - Use of water and steam to mechanise production
  - Steam engine

• **Second Industrial Revolution**
  - + 1970 – 1914
  - Use of electricity for mass production
  - Electricity, combustion engine, steel, chemical synthesis, large factories, assembly lines
Historical background

• Third Industrial Revolution
  • 1980s onwards
  • ‘Digital revolution’
  • Use of electronics and ICT to automate production
  • ICT, internet and computers
1st: Mechanization, water power, steam power
2nd: Mass production, assembly line, electricity
3rd: Computer and automation
4th: Cyber Physical Systems
How is 4IR different?

• Is it really a “revolution” or just a lot of hype?

• Not linear stages

• But it is qualitatively different and new, and irreversible

• Distinguished by
  • Exponential *velocity*
  • Wide-ranging *scope*
  • *Systemic impact*
4IR in SA and developing countries

- We are still undergoing elements of earlier industrial revolutions

- 4IR still nascent

- International diffusion of 4IR is exponentially faster than earlier industrial revolutions

- “Estimates of how many jobs are vulnerable to being replaced by machine vary but it is clear that developing countries are more susceptible to automation compared to high-income countries.” (Millington, 2017)
How is employment likely to be affected?

- Multiple channels affecting
  - Overall number of jobs
  - Composition of employment (by skills level, sector etc.)
  - Nature of work, work processes and the workplace
Overview of literature

• Academic studies; policy reports; business press and media

• Deal with various aspects of 4IR from various disciplines (engineering, economics, politics etc.)

• Theoretical analyses; empirical analyses of what has happened so far; projections of likely short- to medium-term impact; futuristic projections
Overview of literature – employment impact

• Recent burgeoning of studies analysing impact on employment

• Empirical studies mostly focus on advanced economies (especially USA and Germany)

• Little on practical policy options
Important contributions on the impact of 4IR on jobs include:

- Frey & Osborne (2017) ‘The future of employment: how susceptible are jobs to computerisation?’


- Autor (2015) ‘Why are there still so many jobs? The history and future of workplace automation’


Emerging findings from the literature

- Impact on total employment
  - Lack of consensus
  - ‘Mass technological unemployment’?
  - Some argue that ‘dystopic’ future of job destruction is overestimated/alarmist
  - There will be job displacement/destruction and job creation (generally for different people)
  - Automation can potentially raise productivity and earnings for some people
  - But very strong evidence of large net negative impact
Emerging findings from the literature

• Impact on composition of employment
  • Clear that there will be uneven impact, by occupation, sector, skills level etc.
  • Certain types of jobs are most vulnerable
  • Growing number of empirical studies internationally, identifying jobs most likely to be affected

• Impact on distribution
  • Effect on incomes and quality of life depends on what happens to ‘surplus’
  • Likely rise in inequality
Which jobs most likely to be affected

- Depends on degree of *automatability* – how routine and codifiable are tasks

- Overall, lower-skilled jobs more vulnerable than high-skilled, but not straight correlation

- This is one difference from previous types of automation – some white-collar jobs now more vulnerable than some blue-collar jobs

- Less vulnerable jobs are those involving creativity, social interaction, high levels of dexterity, lot of variation amongst tasks
Policy implications

• Employment outcomes not cast in stone – policy can influence to some extent

• The less prepared and proactive a country is, the higher job losses likely to be
  • Direct due to changing nature of domestic production
  • Indirect due to loss of international market shares

• Should policy focus on
  • Minimising job losses, and/or
  • Reskilling workers in vulnerable jobs, and/or
  • How to distribute costs and benefits of 4IR?
Further work on this paper

- Literature review
- Organising, synthesising, summarising, critiquing the existing literature and drawing out particular implications for SA