



Technological Upgrading and its Labour Implications

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Outline

- 1-Content of technological upgrading
- 2-Labour implications of technological upgrading
- 3-Inequalities in technological adoption
- 4-Inequalities in technological impacts
- 5-Efforts to synchronize technological and social upgrading

1-Content of technological upgrading



- ◆ **Technological Upgrading:** technological content of economic upgrading
 - **Process upgrading:** the process in which goods and services are produced in a more efficient way.
 - **Product upgrading:** the process during which technologically more sophisticated products and equipment are developed.

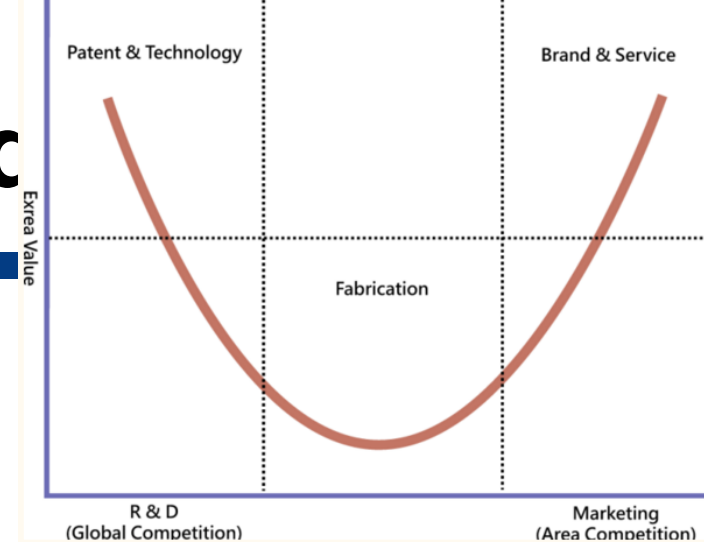


1-Content of technological upgrading

◆ Process upgrading: the evolution of process technology in developed economies

- The First Industrial Revolution in the late 18th century (**Industry 1.0**): machinery driven by **steam and water power**
- The Second Industrial Revolution in the late 19th century (**Industry 2.0**): **electrification of machines and mass production**
- **The Third Industrial Revolution in the 1970s (Industry 3.0): industrial robots, computer numerical control (CNC) machine tools, and information technology (IT)-based production management**
- **The Fourth Industrial Revolution (Industry 4.0): technological progress in the Internet of Things (IoT), cloud computing, AI and robotics**
- **China:** most enterprises are at the stage of **Industry 2.0**. While enterprises in advanced economies are pursuing Industry 4.0, enterprises in China are **pursuing Industry 3.0 and 4.0** at the same time.

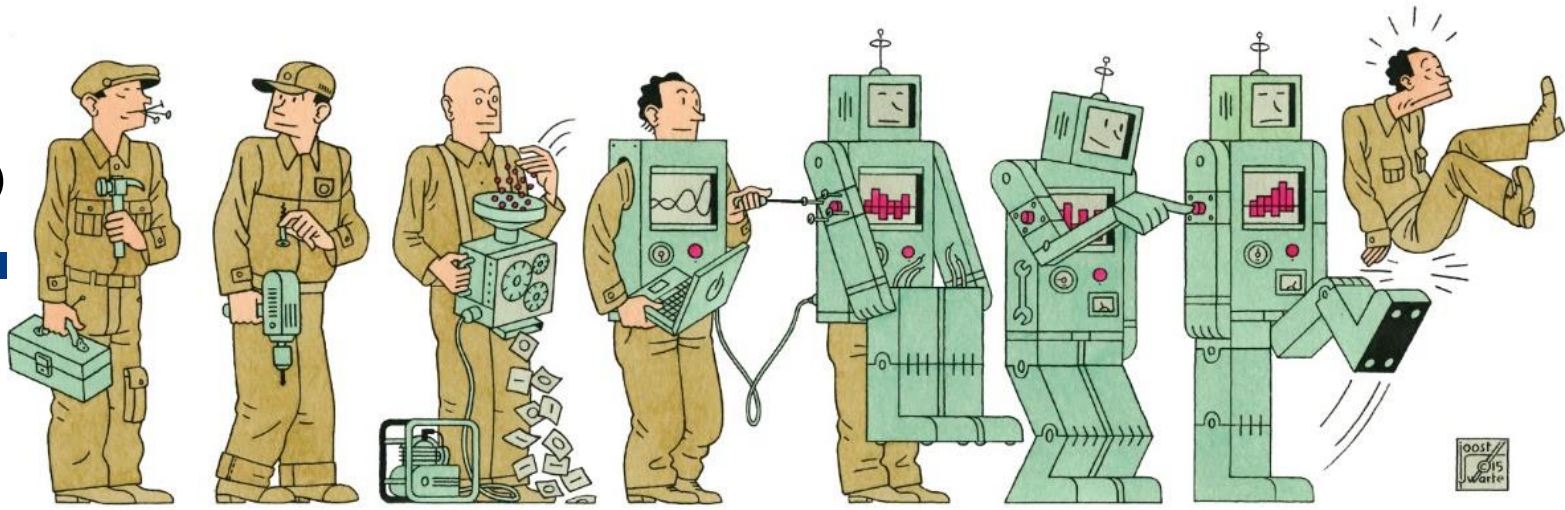
1-Content of technological upgrac



◆Trajectory of product upgrading:

- Raw materials & Assembly
 - Original Equipment Manufacturing (OEM): a business model that focuses on manufacturing activities, particularly **parts and components**
 - Original Design Manufacturing (ODM): adds **design** capabilities to production
 - Original Brand Manufacturing (OBM): **branding** and the sale of own-brand products
- **China:** While maintaining its **dominance as an assembly station** in the global commodity chains, China is **emerging as an OEM supplier of parts and components**. In major **mass consumption** industries, Chinese companies have increasingly engaged in **OBM**.

2-Labour implicatio



◆ Displacing jobs:

- Automation displaces routine, repetitive, and manual jobs.
- New products and services displace old ones and related jobs.

◆ Creating jobs:

- Jobs for developing, maintaining, and co-working with machines
- Tech upgrading → lower product costs and better quality → higher demand → more jobs
- Tech upgrading → more profits → more investment → more jobs
- Development of new products and services → New jobs

◆ **Deskilling workers:** reduce skill content of jobs

◆ **Reskilling workers:** new jobs → new skills

2-Labour implications of technological upgrading

- ◆ **Offshoring & Reshoring**: digitalization can **reshuffle the global distribution of jobs** by affecting variables that determine **the localization of manufacturing**, including
 - the substitution of work through automation
 - the deepening of the customer–producer relationship
 - the rationalization of distribution through digitalized logistics networks
 - the increased modularization of supply chains through standardization and “platformization”

2-Labour implications of technology

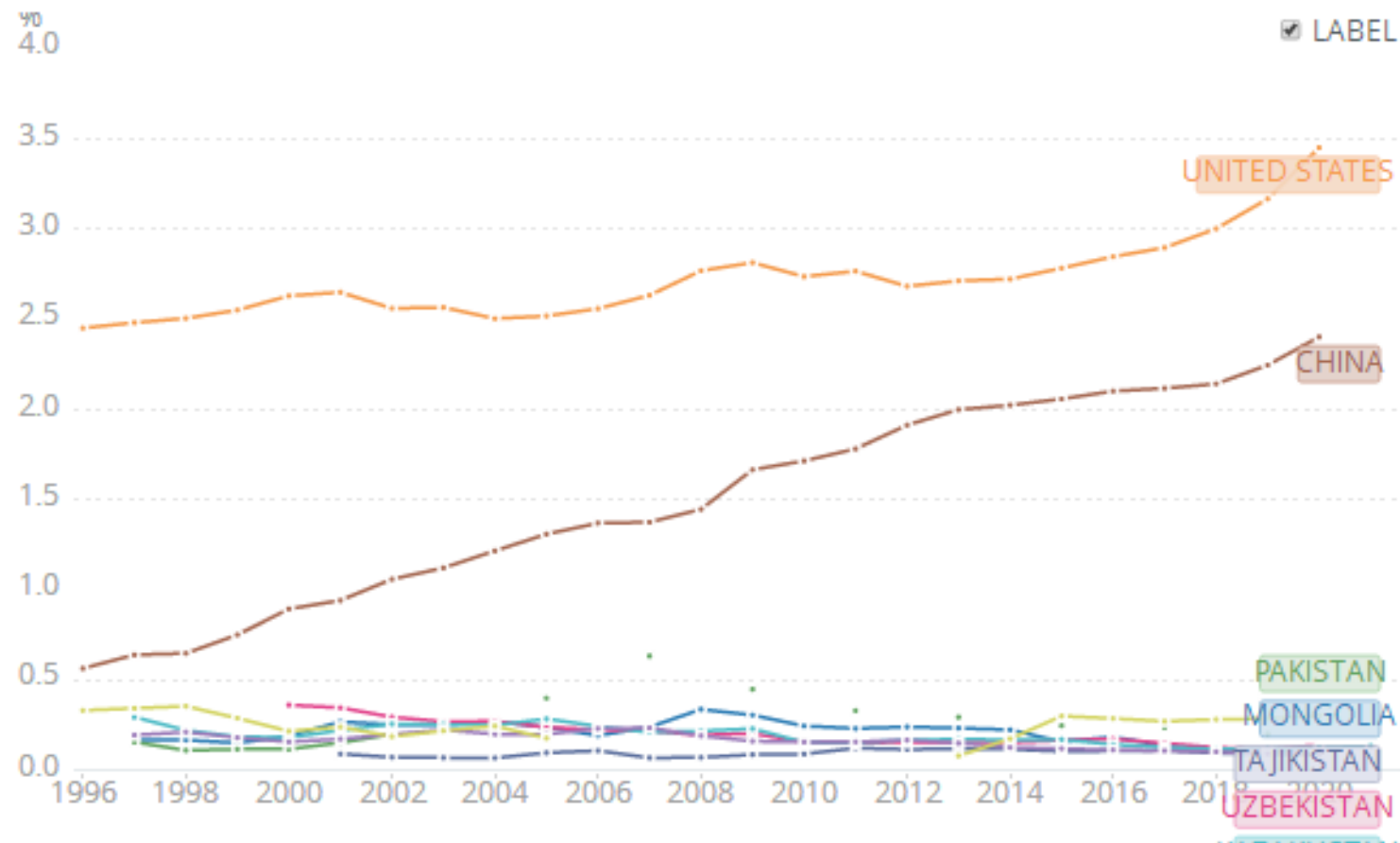
- ◆ Altering the organization of production: platformization → **Increasing labour precarity**
- ◆ Increasing labour productivity → **Increasing wages? + Shortening working hours?** ONLY if workers can share technological dividend
- ◆ Enhancing **labour control**
- ◆ Enhancing **workplace safety**



3-Inequalities in technological adoption

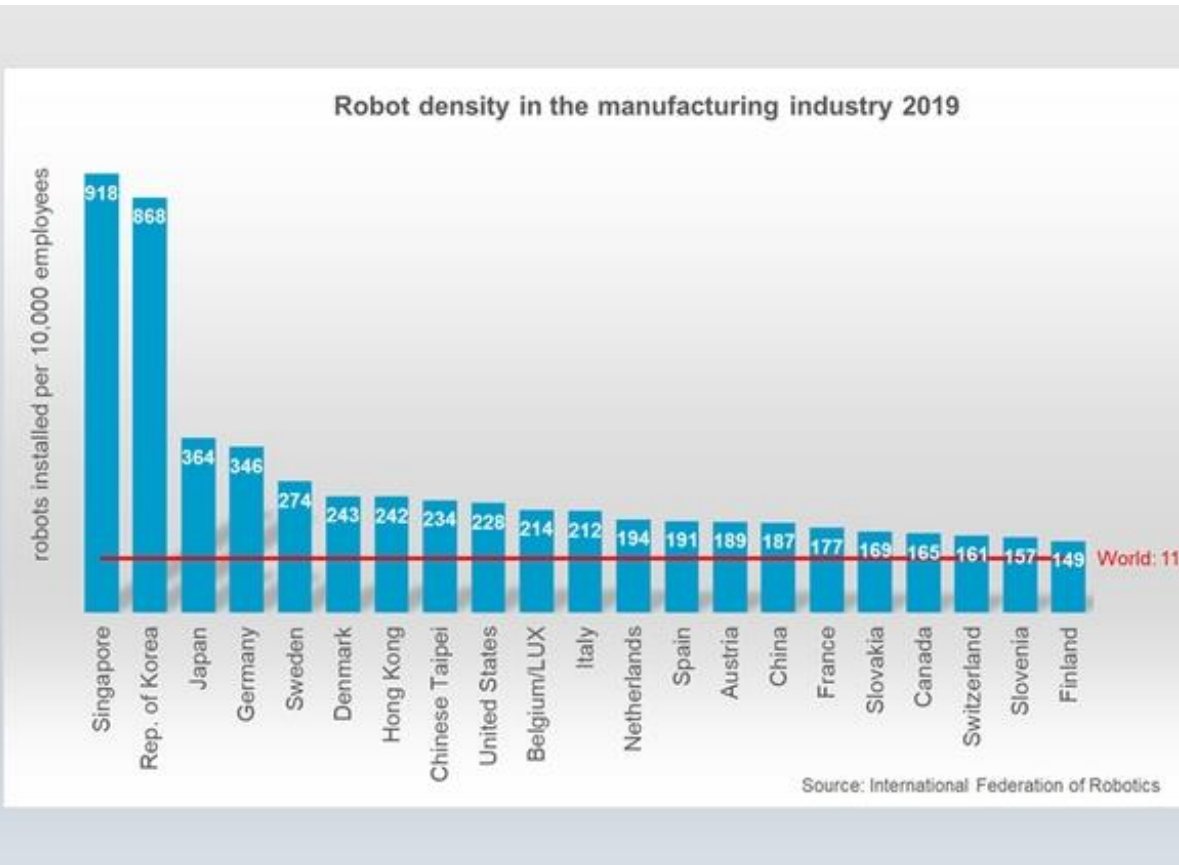
◆ Regions, firms, and individuals

◆ **Capital in R&D:** R&D expenditure as % of GDP, 1996-2020



3-Inequalities in technological adoption

- **Capital in tech adoption:** robot density in manufacturing



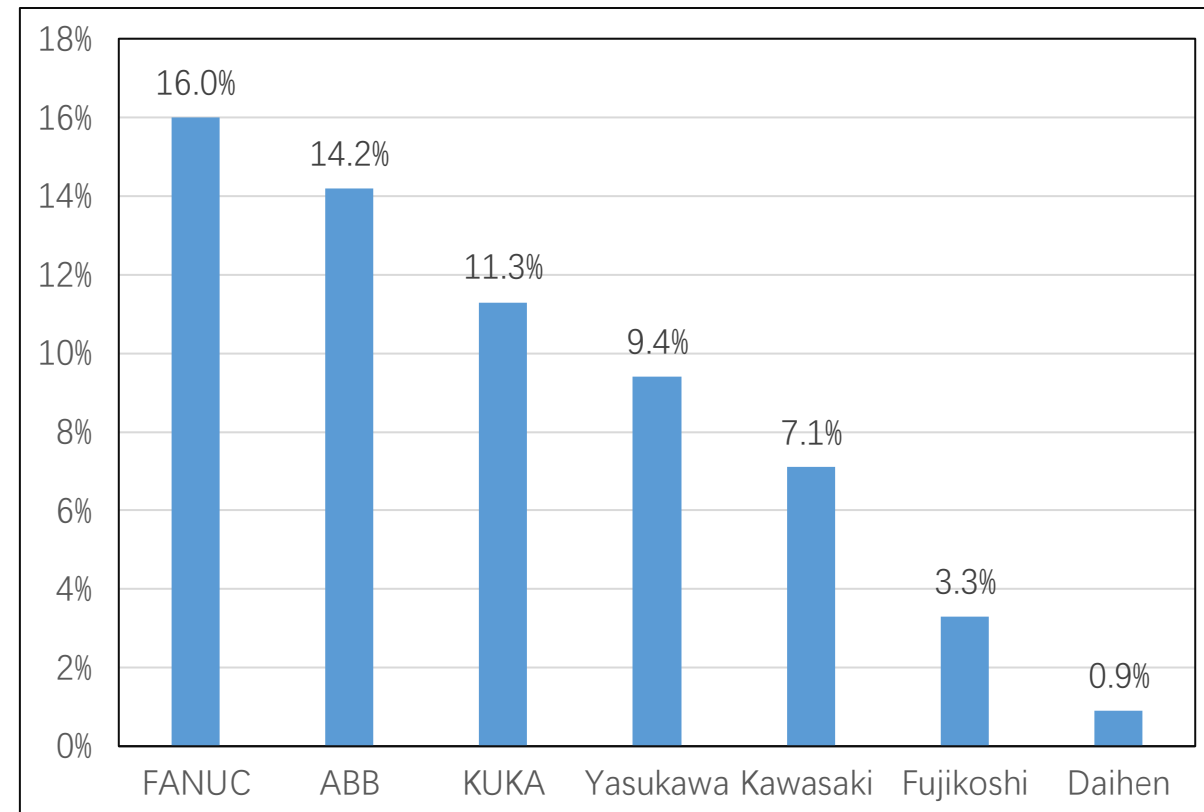
	Overall sample (n=1,882)	Guangdong (n=439)	Jiangsu (n=335)
% of firms using industrial robots before 2008	2%	3%	5%
% of firms using industrial robots before 2013	7%	9%	11%
% of firms using industrial robots in 2017	13%	18%	19%
% of firms planning to use industrial robots in the next few years	10%	9%	17%
Average number of industrial robots used by per 100 firms, 2017	112	177	165
Industrial robot density, 2017	39	53	33

3-Inequalities in technological adoption

◆ Technological readiness:

- Short of homemade tools, rely on expensive imports
- Short of skills:
 - Skills to tailor automatic equipment to their needs
 - Skills to operate automatic equipment, etc.

Share of leading foreign brands in the Chinese industrial robot market, 2017



3-Inequalities in technological adoption

◆ Bias in the provision of digital infrastructure:

- 2007.6-2020.12, the Internet penetration rate in China rose
 - from 5.1% to 55.9% in **rural** areas
 - from 21.6% to 79.8% in **urban** areas

◆ **Digital literacy**: one's ability to use IT and digital technology to find, evaluate, create and communicate information

- The less educated, the elderly, etc.



4-Inequalities in technological impacts

- ◆ **Skill:** skilled vs. low-skilled workers
- ◆ **Gender:** male vs. female workers
- ◆ **Age:** junior vs. senior workers
- ◆ **Employment status:** formal vs. informal workers
- **Automation in China:** Low-skilled, female, senior, and informal workers are more likely to be displaced by robots and less likely to be reskilled.



4-Inequalities in technological impacts

◆ Aggravating power imbalance between workers/farmers and capital:

- vs. local capitals in the pre-digital age
- vs. quasi-monopolies in the digital age
- E. g., Chinese farmers usually have **dozens** of brokers to negotiate terms with when selling their produce offline, but only **four** major shopping platforms to choose from when selling online. In 2021, **Alibaba, JD, Pinduoduo,** and **TikTok** contributed **51%, 20%, 15%,** and **5%** of China's online retail revenue respectively.



5-Efforts to synchronize tech and social upgrac



2021年强基计划招生简章

- ◆ **Social upgrading:** improvement in the rights and entitlements of workers as social actors and in the quality of their employment
- **Education and training: China as an example**
 - The government has maintained its focus on academic education but has **diverted more attention to vocational education and training.**
 - Many universities have **set up new programs and expanded related programs** in the ten key fields listed in the MIC 2025.
 - With regard to vocational education, the government has planned to **expand vocational education** at both the secondary and tertiary level, and has encouraged **enterprises to play a bigger role in the supply of training.**
 - The government has also introduced policies to **promote training for groups with low employability** and the working population in general.

5-Efforts to synchronize tech and social upgra

- **Better governance to harness the technological shock:**
 - **Inclusive digital strategy** to **narrow digital divide** across regions of different development levels, firms of different sizes, and individuals of different digital literacy and to **fight against discrimination** enhanced by digitalization
 - **Active employment policies** to buffer unemployment pressure
 - **Active industrial relations policy** to redress power imbalance aggravated by digitalization
 - **Skilled workers policy** (e. g., **increase their compensation**) to reduce skill shortage
 - **Inclusive social security policy** to counter labour precarity in the platform economy
 - **Anti-monopoly policy** to foster a competitive market



Thank you!
