Academic Day Session 2

Global Value Chains, the Digital Economy and the New Industrial Revolution
The digital economy and the new industrial revolution are fundamentally changing the way firms operate internationally.

The adoption of new technologies at all stages of production can bring transformative changes in the composition and governance of global value chains.

What are the implications for theories of international business?

What are key research questions for broader investment-for-development fields, such as development studies, tax and investment law?
Panel Members

Lorraine Eden, Texas A&M University (chair/moderator)

Niraja Srinivasan, Dell Technologies

Xiaolan Fu, Oxford University

Gabriel Benito, Norwegian Business School

Tony Addison, UN-WIDER
1. What is Industry 4.0?

• A new industrial revolution starting about 2000 that is characterized by a “fusion of technologies that is blurring the lines between the physical, digital, and biological spheres” (Schwab, World Economic Forum, 2016)

• Social and economic activities that are
  • Enabled by internet/mobile technology platforms and ubiquitous sensors,
  • Offer an information rich environment,
  • Built on global, instant/real-time information flows,
  • Provide access 24/7, anywhere,
  • Support multiple, virtual, connected networks.”

(Global Trends, 2013)
Characteristics of Industry 4.0

• Fueled by disruptive technologies that are transforming markets
  • the Internet
  • automation of knowledge-based work
  • Internet of Things (IOT)
  • cloud computing
  • advanced robotics
  • 3D printing
  • advanced materials

(McKinsey Global Institute, 2013)
Characteristics of Industry 4.0

- Distinct from the past in terms of:
  - **Velocity** (evolving at an exponential not linear rate)
  - **Scope** (disrupting almost all industries in all countries)
  - **Systems impact** (transforming production systems, management, and governance).

(Schwab, 2016)
Characteristics of Industry 4.0

- **Key features:**

  - **Mobility** (marginal cost of digital products much lower than fixed cost)

  - **Network effects** (platforms generate economies of scale & scope)

  - **Data usage** (volume rising and cost falling exponentially)

  (European Commission, 2014)
Industry 4.0 Firms Classified by Digital Content

• **Born Digital** - digital from inception, operate digitally & have products delivered digitally – Internet based:
  • Search engines (Google, Yahoo, Bing)
  • Social networks (NextDoor, Instagram, LinkedIn)
  • Sharing platforms (AirBnB, UBER, Dropbox)

• **Going Digital** - brick & mortar firms that are:
  • Consumers/Users: Adopting digital technologies into their production processes
  • Producers: Adding digital products as new products or lines of business
Industry 4.0 Impacts on Going Digitals

- **Open Innovation Platforms** - firms involve other firms and customers in their innovation and development processes. Encourages crowdsourcing of ideas, designs and problem-solving solutions.

- **Distributed Manufacturing** - advanced mfg technologies (3D printing) enable firms to move production closer to customers, engage in small-lot customized production, and integrate customers, designers and other firms into the value creation process.

- **New Forms of Collaboration** - cloud computing enables open-source horizontal platform-based collaboration (e.g. joint procurement and information gathering services, shared use of transportation and storage facilities)
Industry 4.0 Firms Classified by Function

- ICT Firms (Tech & Telecom) – 19 of Top 100 MNEs (WIR 2017)
  - **Tech**
    - IT Device Mfgrs (Apple, Dell Technologies, IBM, Sony, HP)
    - IT Component Mfgrs (Hon Hai Precision Industry, Toshiba, Flextronics, Nvidia, ZTE)
    - IT Software & Services (Microsoft, Oracle, Accenture, SAP, Tata Consultancy Services, Infosys, Wipro)
  - **Telecom** (AT&T, Nippon T&Y, Deutsche Telekom, BT Group)

- Digital Firms
  - Internet platforms (Alphabet, Facebook, eBay, Twitter)
  - Digital solutions (PayPal, Salesforce, Vmware, GoDaddy)
  - E-Commerce (Amazon, Priceline, Expedia, Sabre)
  - Digital content producers (Comcast, Time Warner, Netflix)
Industry 3.0 and Seven Lessons from the Past

Third Industrial Revolution (Industry 3.0)

- Electronics & Information Technologies
  - Semiconductors & integrated circuits → Mainframe computers → Personal computers → Internet - email

- Shift from Mass to Lean Production (auto industry)

- New International Division of Labor - global commodity chains (textiles, semiconductors, electronics)

- Rise of Emerging Market Economies
Seven Lessons from the Past – Industry 3.0

1. Shocks and Responses
2. Multinationals as Agents of Change
3. Hub and Spoke Economies
4. Who Is Us? Insiders and Outsiders
5. Technological Competition
6. Political Bargaining Model
7. Distance, Borders and Liability of Foreignness
Industry 3.0: Lesson 1 – Shocks & Responses

Industrial revolutions are generated by new technologies and novel ways of seeing that cause systemic shocks.

- Responses vary: status quo, defensive, aggressive

- Winners & Losers: Analogy to chessboard with immovable blocks – what happens blocks removed?
  - Incumbents vs new players
  - Rationalization – what determines who survives?
Industry 3.0 – Lesson 2 – MNEs as agents of change

• Role of the individual plant within the MNE group (FDI motivation, technological sophistication, location, nature of plant activity, relative importance in the MNE network)

• How plant roles changed in response to:
  • Technological Change: shift from mass to lean production and introduction of ITC technologies
  • Regional Integration (NAFTA)
Industry 3.0 – Lesson 3 – Hub & Spokes

- Small open economies vs Large open economies
  - Price makers vs price takers

- Canada and Mexico as “spokes” to US hub
  - Trade & FDI mediated through US hub
  - Relative dependence of spokes on hub
  - Spokes bear the burden of both hub and spoke tariffs
  - Adjustment takes place through the spokes

- Hub & spokes affected differently by shocks
Insiders and Outsiders treated differently - benefits go to firms viewed as insiders

- What determines who is us? nationality vs organizational legitimacy

- How firms create org legitimacy
  - Economic strategies – exports vs FDI, input purchases, contributing to local economy
  - Political strategies – join industry associations, advertising, CSR, nationals on corp boards
Industry 3.0 – Lesson 5: Tech Competition

- Case study - Japanese autos penetrate US market (1950s-1990s)
- Lean production – Japanese entry ignored by Big 3
- Japanese move onshore – threat recognized
- Possible US responses:
  - Change production: intensification (short run), rationalization (medium term), tech upgrading (long term)
  - Political: insider/outsider, lobby for pro/anti-market policies
- Incumbents fail to change – too little, too late. Too defensive.
Industry 3.0 – Lesson 6 – Political Bargaining

- Old model - obsolescing bargain model of host government & foreign MNE over entry. What have you done for me lately?

- New model- richer, more complex
  - Multiple players – who is us? Old vs new entrants
  - Multiple governments – home and host – three-way bargains
  - Multiple rounds of bargaining – bargain over policies
Industry 3.0 – Lesson 7– Distance, Borders & LOF

- Liability of foreignness – unfamiliarity, relational and discriminatory hazards
- LOF depends on institutions and institutional distance
- Borders - impede trade & FDI flows
- Coping mechanisms for LOF
Seven Lessons for Industry 4.0

1. Shocks and Responses
2. Multinationals as Agents of Change
3. Hub and Spoke Economies
4. Who Is Us? Insiders and Outsiders
5. Technological Competition
6. Political Bargaining Model
7. Distance, Borders and Liability of Foreignness
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Dell Technologies Portfolio

Dell Technologies: A FORCE MULTIPLIER FOR DIGITAL TRANSFORMATION

Workforce Transformation

Digital Transformation

IT Transformation

Applications

Internet of Things

Users/Edge

Security

Pivotal

virtustream

vmware

RSA

Secureworks

Security Transformation

DELL Technologies Services

Dell Financial Services™

Services

Consumption

DELL Technologies Portfolio
“Internet of Things” Ecosystem
Industry 4.0: From Chains to Shops & Networks?

Global Value Chains

- Infrastructure
- Human resource management
- Technology management

Support activities:
- Procurement
- Inbound logistics
- Operations
- Services
- Outbound logistics
- Marketing & Sales

Primary activities:
- Added value

Global Value Shops

- Firm Infrastructure
- Human Resource Management
- Technology
- Procurement

Global Value Networks

Diagram showing network connections.
Global Value Chains

• **Value Chain** - converts inputs into outputs through discrete but related, sequential tasks (functions). Stages can be done inside firm, acquired or contracted out. Final goods typically standardized.

• **Technology** – Long-linked. Linear process from upstream inputs to downstream finished products sold to final customers

• **Value Creation** - by making and transferring a product from the firm to its customers
Global Value Shops

• **Value Shop** - designed to solve problems characterized by information asymmetry (the shop has more information than its customers). Problem solving may use high skilled professionals and specialists, and either standardized or highly customized

• **Technology** – Intensive – forms of hardware and knowledge are used to change a specific object

• **Value Creation**– by solving or resolving customer problems or demands
Global Value Networks

- **Value Network** - intermediary facilitating bilateral interactions between itself and its customers, and multilateral interactions among its customers (e.g., buyers/sellers; passengers/drivers). Value creation may involve direct links between customers (e.g., telephone call, friend request) or indirect links (e.g., a commercial bank can make a loan using deposits that customers supply in aggregate).

- **Technology** – Mediating – used by firms to link users or customers interested in engaging in a transaction

- **Value Creation** – by organizing and facilitating exchanges between (linked) customers
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The New Industrial Revolution
and Implications for Investment-for-Development:
A Global Value Chains-based Perspective

Academic Day Session 2

Global Value Chains, the Digital Economy and the New Industrial Revolution

Xiaolan Fu
Oxford University
4th Industrial revolution

Breakthroughs & Convergence

Wide Applications in manufacturing & beyond

Greater impact than that of the previous IRs.

Source: Gartner, 2016; Weigel, 2016
Impact: Two-sided story

- Connectivity & empowerment
- Efficiency & welfare gains
- Transformation of value creation model, production process, and global business organisation
- Changes of comparative advantage, global division of labour, and trade & investment pattern
- Human job replacement
- Income distribution: increase inequality, deepening smile curve
- The new globalization paradox
Transformation of value creation model, production process, and global business organisation

- Major platforms
- Large numbers of new firms
- Intelligentized & connected firms
- New models of value creation based on platforms or contents

Source: Christopher Roser on wiki
The transformative power of 3D printing:

From mass manufacturing
to
distributed production
Changes of comparative advantage, global division of labour, and trade & investment pattern

- Labour intensive industries may become Robotics/AI/capital intensive industries (R&AI-intensity)
- Developed countries:
  - regain comparative advantage in labour intensive industries
  - sharpen comparative advantage in skills- and capital-intensive industries
- Resource rich countries maintain CA, but resource-processing may be shifted away from developing countries
- All Depends on the cost efficiency of the tech. and speed of tech progress
Impact of 4th IR on jobs

- Research from Oxford University Martin School, 47% of US jobs is likely to be replaced by AI.

- World Bank: More than 60% of the jobs in the developing countries may be replaced by robotics and AI.

Source: Frey and Osborne (2013)
Income distribution:
Increased inequality, deepened smile curve
The smile curve of GVC & trade in intangibles

Source: Shih, 1992 with author’s modification
The ‘global factory’ & network model of FDI-cum-trade

- Tier 1 developed country
- Tier 2 developed country or Some LDCs
- LDCs
- Tier 1 developed country

- Trade measurement shall Integrate Trade in Goods & Trade in Intangibles

Modified from Baldwin and Venables (2013)
<table>
<thead>
<tr>
<th>TYPES OF TRADE OF INTANGIBLES</th>
<th>DESCRIPTION</th>
<th>FORMS OF VALUE CAPTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LICENSING (patented technology &amp; business model, or know-how or brand)</td>
<td>License the right to use the IP and transfer relevant knowledge</td>
<td>Royalty fee, guaranteed and flat rate, or a fixed lump sum payment upfront.</td>
</tr>
<tr>
<td>FOREIGN DIRECT INVESTMENT</td>
<td>Invest and hold equity shares (IP counts as part of investment or tools to control)</td>
<td>Dividends, hidden profits obtained through transfer pricing.</td>
</tr>
<tr>
<td>OUTSOURCING</td>
<td>Sign vender contract</td>
<td>Profit of final products net of outsourcing costs. Captures value of branding, marketing channel, or ideas/concept, or key components that the vendor owns. Controller.</td>
</tr>
<tr>
<td>COLLABORATION/ALLIANCE</td>
<td>Form alliance between different firms and parties (Intangibles count as part or all of the contribution)</td>
<td>Share proportional part of the value-added of final product. Captures value of intangibles according to agreed contract.</td>
</tr>
<tr>
<td>CONSULTING SERVICES (include training, consultancy)</td>
<td>Provide knowledge to individuals and organisations</td>
<td>Consultancy fee for the training or consultancy or other forms of services provided, e.g. after-sales services for installation, maintenance and repair.</td>
</tr>
</tbody>
</table>
R&D & financial services imports & exports in China & the U.S.

Figure 6. Trade in Commercial Services in China, U.S. and the U.K.

Source: WTO
Foreign Direct Investment

Profit shifting

Source: Bureau of Economic Analysis

Source: Gusvenen et al (2018), NBER WP
Outsourcing

Smartphone lead firms take a large chunk of value

- **42%** Apple
- **22%** Cost of materials
- **15%** Distribution and retail
- **5%** IP licenses
- **5%** Unidentified material
- **3%** Other U.S.
- **3%** Taiwan (Province of China)
- **2%** Unidentified labor
- **1%** Labor (China)
- **1%** Rep. of Korea
- **1%** Japan

Source: WIPO, 2017; Apple, annual report

Apple non-America profits:
- 2016: $31.95
- 2017: $27.34
Impact of 4IR on the ‘global factory’

1. Re-shoring
2. Increased trade in intangibles through networks, and income concentrated large platforms & firms in Tier1 countries

- Trade measurement shall Integrate Trade in Goods & Trade in Intangibles
The deepened smile curve: outcome of 4IR

Source: Shih, 1992 with author’s modification
The new globalisation paradox

- Three objectives of production activities
  1. Income growth
  2. Full employment
  3. Environment protection

- Objective 3 can meet together with 1 and 2 with tech. progress.
- But 1 and 2 cannot be met at the same time due to MNEs’ strategy to maximise profits in the global factory.

- Impact of 4IR: Re-shoring of manufacturing in industrialised countries
- But limited increase in human jobs – The paradox persists
- Increased income inequalities: more between countries, also within countries depend on domestic policy
Conclusions

- Both opportunities and challenges for I4D, but challenges for LDCs more significant.
- Not only depend on 4IR in LDCs, but more on 4IR in all countries.
- Also depend on LDCs ability to benefit from 4IR
- Continued new of global division of labour
- Deepened Smile Curve and increased income inequalities within and between countries will increase
- A new paradox of globalisation persist.
- Increased importance to view & measure global trade by integrating trade-in-intangibles and trade-in-goods and services.
Policy and managerial implications

- Policy measures and international cooperation to help the developing countries to develop skills & capacity for 4th IR
- Policies incentives & regulations to direct MNEs & private sector to invest in technologies that improve human welfare and equality
- Re-distribution of the hidden income from the entities who gained from the trade & investment in intangibles to the rest of the society.
- Tax avoidance by shifting these benefits abroad should be curbed.
- MNEs face re-shuffle, policies to facilitate digitisation & intelligentisation.
- Prepare for technological disruption by collaboration and innovation.
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IB theories and the digital economy: What should be on our research agenda?

Gabriel R.G. Benito

World Investment Forum 2018, Geneva
Academic Day, October 26
Session 2: Global value chains, the digital economy and the new industrial revolution
Industry 4.0 means....

• The transformation and increasing importance of ICT industries
• Extensive use of digital technologies, robotization and AI, but retaining Industry 2.0 & 3.0 primary business models
• Moving to digital platforms
IB theories (internalization, internationalization process) aim to explain

- Location choices
- Governance choices
- Organizational processes
Industry 4.0 effects on

- **Location patterns**
  - To a great extent endogenous; who invests and takes initiatives?
  - Both concentration ("network" and cluster effects) and dispersion (i.e. scale effects sometimes less pronounced, e.g. 3D printing)
Industry 4.0 effects on

Organization and governance

- **Which** value activities are conducted? Some activities become obsolete, other activities become more prevalent and significant, most activities undergo changes
- **What** are the relations between activities? Increasingly interdependent, often reciprocal rather than sequential
- **How** are activities governed? Control through equity ownership less needed. Trust increasingly important, both relational and institutional
Internalization theory (IT) and GVCs

- IT deals with discrete, long-term efficiency-driven governance choices of distinct value activities
  - IT explains what given companies do and what they do not do

- GVCs are systems composed of multiple linked, but spatially dispersed value activities
  - The GVC approach describes the locational and governance properties of the whole set of activities

- Discrete governance choices aggregate into GVCs, assuming choices are durable and interdependencies are negligible
What we particularly need to discuss regarding IT and GVCs in Industry 4.0 contexts

- Dynamics
- Multiplicity of modes and their combinations
- Efficiency
Explaining dynamics

Drivers
- Changes in resource base
- Learning, adaptation, correction
- Exogenous changes

Barriers
- Switching costs
- Inertia
Explaining mode combinations

Benefits

• Efficient micro-organization (fine-slicing all the way down to the individual transaction), incl. better incentive alignment and benchmarking information
• Realizing economies of scale
• Adaptation to local conditions

Costs

• Coordination
• Complexity
• Depend on the type of interdependency across activities (pooled, sequential, reciprocal)
Problematizing efficiency

- Activity-level versus system-level
- Efficiency for whom?
- Appropriability of gains and the role of power
In sum

- IB theories need some serious re-thinking to remain relevant in Industry 4.0 contexts

- We need to consider our conceptualizations, our levels of analysis, and our terminology, e.g. “internalization” (no longer simply 1=make or 0=buy) and “GVCs” (the hallmark of Industry 4.0 is platforms, not chains)
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Extractive Industries

UNCTAD World Investment Forum 2018

Tony Addison, UN-WIDER
Materials
+
Energy

**ELECTRONICS**

**MICRO-ELECTRICAL**
Copper, gold, silver, and tungsten are used for electrical connections within the phone. Which metal is chosen depends on the need. For example, while silver is the most conductive metal, gold never tarnishes.

- **GOLD**
- **SILVER**
- **COPPER**
- **TUNGSTEN**

**MICRO-CAPACITORS**
Micro-capacitors regulate the electricity flow. Apple managed to guarantee the use of conflict-free tantalum in February 2014.

- **TANTALUM**

**PROCESSOR CHIP**

**SILICON**
The phone's processor is mainly made from silicon, but it is bombarded by various elements to give it superior electrical properties.

- **Phosphorus**
- **Antimony**
- **Arsenic**
- **Boron**
- **Indium**
- **Gallium**

**SOLDERING**

- **COPPER**
- **TIN**
- **SILVER**
Metals

- Metals – transition to low-carbon economies (renewables etc) adds to demand
- Recycling (circular economy) highly desirable – but only takes us so far
- Tech: ‘green mining’ – cut (large) emissions of mining & environmental footprint
- Large amounts of FDI required (key to new mining technologies)
- Supply constraints: mining investment cycle (new mines). Government-Company relations (inc. tax agreements). Community-Company relations. Local content requirements. Downstream processing in the GVA etc.
- Automation (& digital technology). Highly capital-intensive already. Further K for L substitution. But potential to reduce costs => expansion mining & more (very high skill) jobs?. E.g Deep-sea mining. + Indirect jobs via mining expansion
Fossil Fuels (Oil, Gas, Coal)

- Expected decline in fossil fuels as % power generation (but by how much? How fast?): gas for coal substitution in power => LNG (integrated global gas market)
- Petrochemicals: becoming biggest source of demand growth (about 25% to 2023)
- MENA oil producers looking to petrochemicals as GVA strategy. More plastics!
- ‘Stranding’ : (unburnable carbon) companies exiting the sector (becoming renewables MNCs? Maybe, or could just shrink)
- FDI (MNCs + SOEs) v National Oil Companies as providers of tech & finance
Free to Download!

- Open Access
- https://www.wider.unu.edu/publication/extractive-industries
- https://global.oup.com
Panel Discussion

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DISCUSSION QUESTIONS

- The digital economy and the new industrial revolution are fundamentally changing the way firms operate internationally.

- The adoption of new technologies at all stages of production can bring transformative changes in the composition and governance of global value chains.

- What are the implications for theories of international business?

- What are key research questions for broader investment-for-development fields, such as development studies, tax and investment law?
Thank you!