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Digital Technology and Global Integration: Opportunities for Innovative Growth

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Advancing Free Trade for Asia-Pacific Prosperity

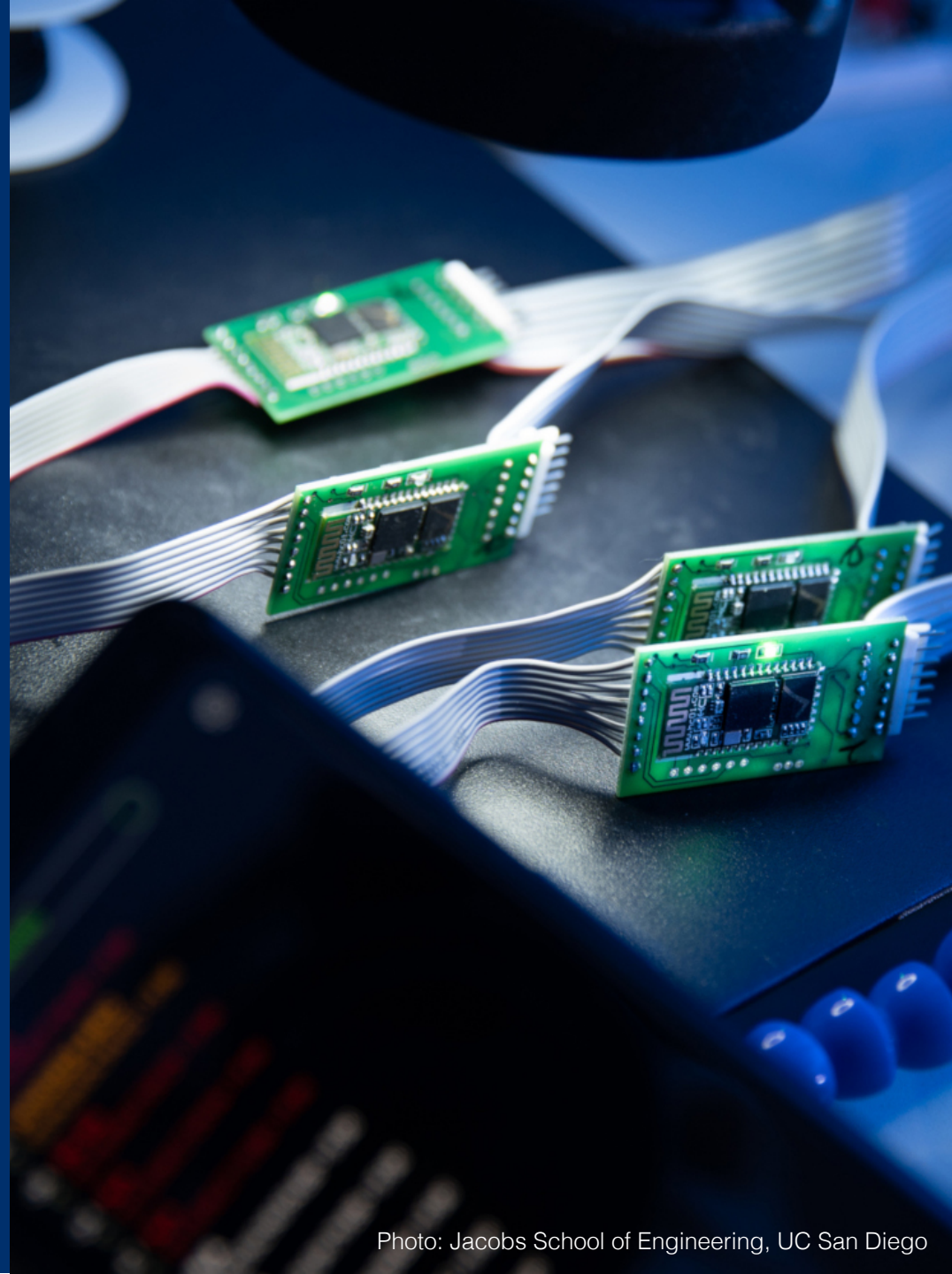


Photo: Jacobs School of Engineering, UC San Diego

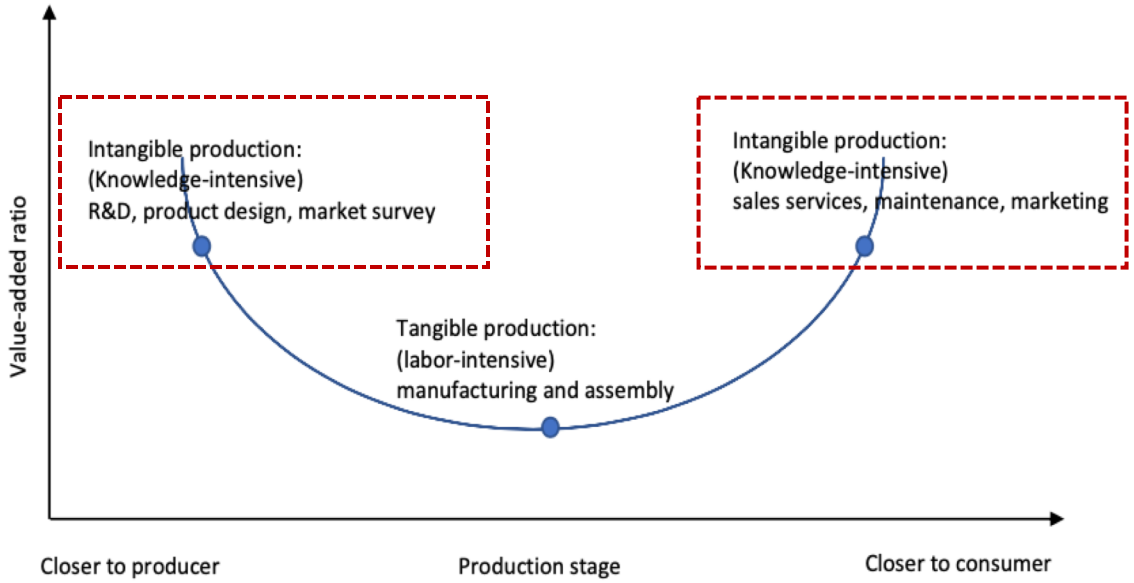
Fourth Industrial Revolution (4IR) Technologies and GVC Upgrading

Cartography of 4IR Inventions

Core technologies	Enabling technologies	Application domains
•IT hardware •Software •Connectivity	• Data management • User interfaces • Core artificial intelligence (AI) • Geo-positioning • Power supply • Data security • Safety • Three-dimensional (3D) support systems	• Consumer goods • Home • Vehicles • Services • Industrial • Infrastructure • Healthcare • Agriculture

J. Pose-Rodriguez et al., *Patents and the Fourth Industrial Revolution: The Global Technology Trends Enabling the Data-driven Economy* (Netherlands: European Patent Office (EPO), 2020)

The Smiling Curve



Adapted from Asian Development Bank (ADB) et al., *Global Value Chain Development Report 2021: Beyond Production* (ADB, 2021), 17

- Two ends of the 'smile' have higher gain in terms of value-added compared to the middle point
- But they are also knowledge and technology-intensive

  ➡ Access to technology is crucial for GVC upgrading

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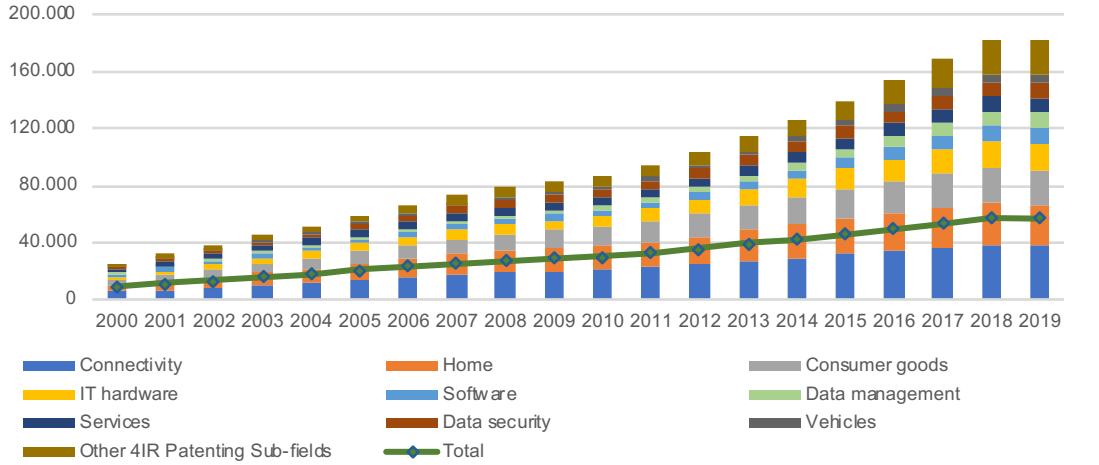
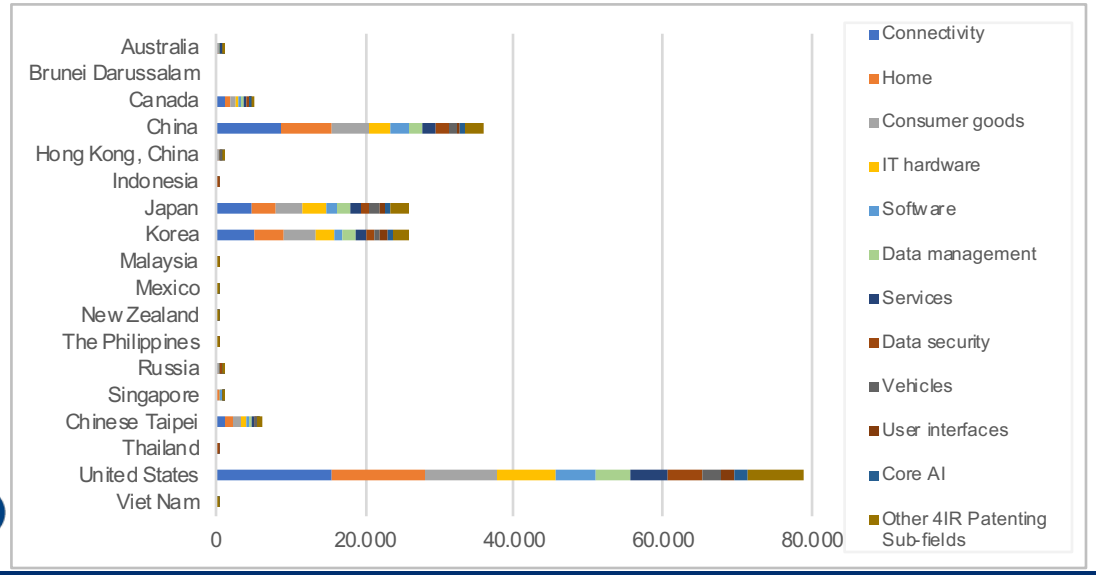
4IR Technologies and Innovation Landscape in APEC

Number of 4IR Patent Families by Technology Fields in APEC, 10-year cumulative



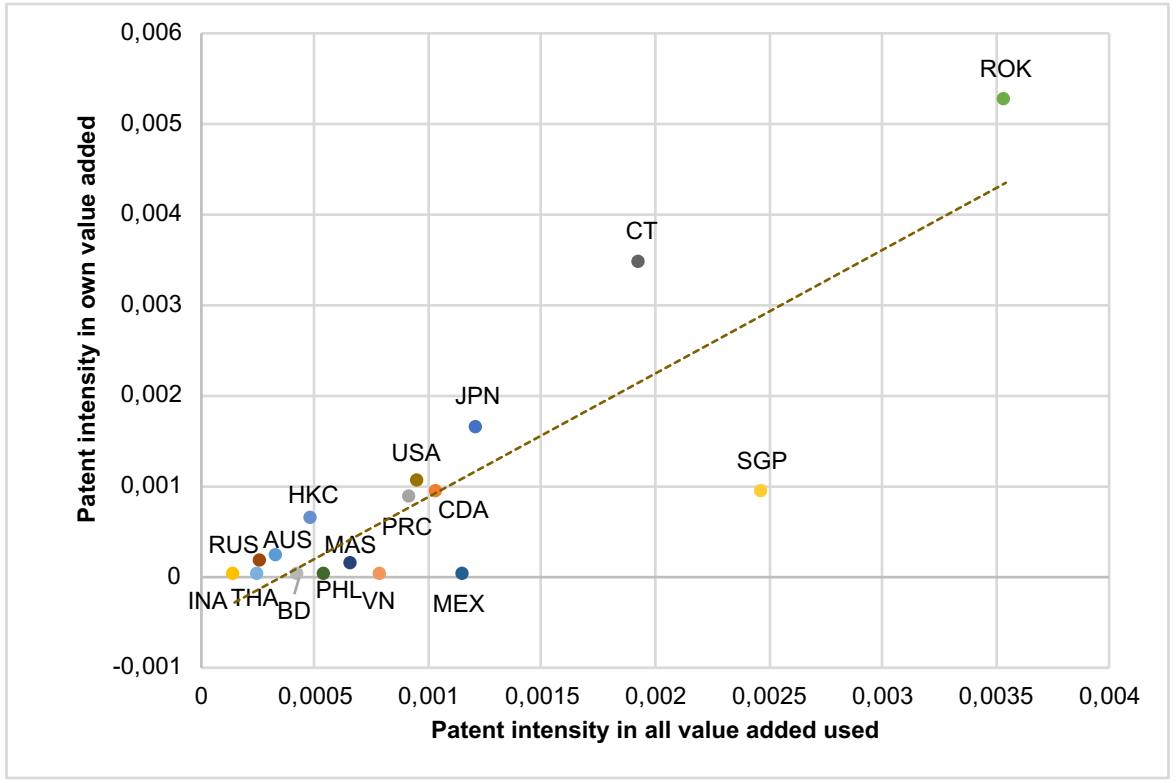


Exports and Imports of 4IR Products, 2019

Economy	4IR exports (USD '000)	Share of total APEC 4IR exports	4IR imports (USD '000)	Share of total APEC 4IR imports
Australia	789,752	0.11%	9,829,052	1.84%
Brunei Darussalam	2,868	0.00%	90,152	0.02%
Canada	4,887,503	0.70%	9,728,001	1.83%
Chile	26,666	0.00%	1,419,094	0.27%
China	330,000,000	47.24%	113,000,000	21.21%
Hong Kong, China	8,022,879	1.15%	82,900,000	15.56%
Indonesia	2,408,226	0.34%	6,467,969	1.21%
Japan	46,500,000	6.66%	32,700,000	6.14%
Korea	46,300,000	6.63%	22,400,000	4.20%
Malaysia	30,000,000	4.29%	14,000,000	2.63%
Mexico	42,900,000	6.14%	20,700,000	3.88%
New Zealand	185,258	0.03%	1,315,433	0.25%
Papua New Guinea	1,213	0.00%	74,360	0.01%
Peru	7,543	0.00%	849,045	0.16%
The Philippines	17,400,000	2.49%	8,098,484	1.52%
Russia	840,152	0.12%	9,390,245	1.76%
Singapore	15,900,000	2.28%	21,100,000	3.96%
Chinese Taipei	57,200,000	8.19%	15,900,000	2.98%
Thailand	32,900,000	4.71%	15,300,000	2.87%
United States	38,200,000	5.47%	128,000,000	24.02%
Viet Nam	24,100,000	3.45%	19,600,000	3.68%
APEC	698,572,060	100.00%	532,861,836	100.00%
World	870,339,561	--	844,919,916	--

4IR Technologies in APEC GVCs

4IR Patent Intensity in Value-added Content of APEC Economies, 2019



(Patent intensity: the number of patent families per USD 1 million value added)

APEC as an innovation hub

- 71% of world's total patent families in all technologies (2010–2019 cumulative)
- 82 % of world's total 4IR patent families (2010–2019 cumulative)
- 80% (USD 699 billion) of global exports of 4IR products (2019)
- 63% (USD 533 billion) of global imports of 4IR products (2019)
- Although number of 4IR patent families increased more than six-fold during 2000–2019, less than 3% of all patent families in APEC are 4IR

4IR in APEC GVCs

- ✓ Economies with patent-intensive production (higher patent content in own value added) use more patent-intensive inputs in their value chains (higher patent content in all value-added content used)
- ✓ Economies active in patenting show high patent content embedded in their value chains (Canada; China; Japan; Korea; Chinese Taipei; USA).

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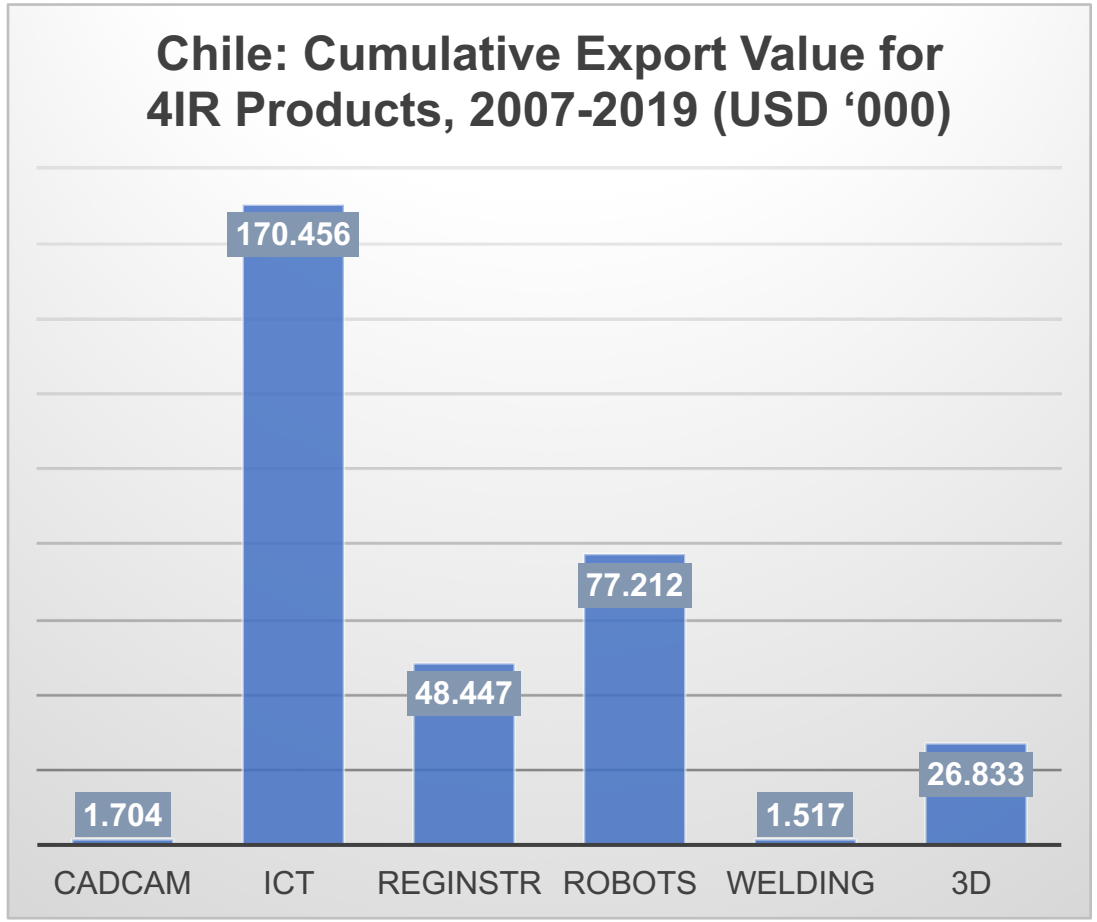
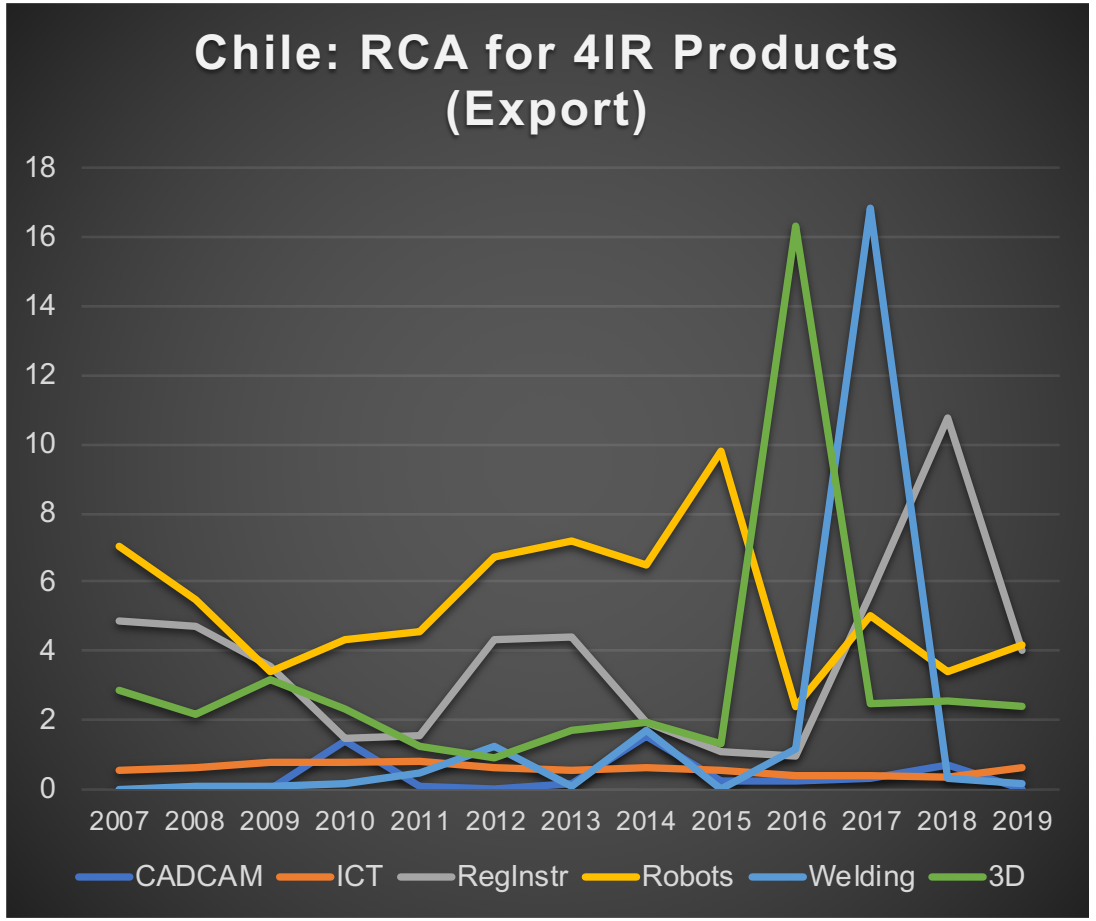
Chile: Export and Revealed Competitive Advantage of 4IR Products





Source: APEC Policy Support Unit (PSU) calculations using ADB-ADBI Innovation and Structural Transformation Database.

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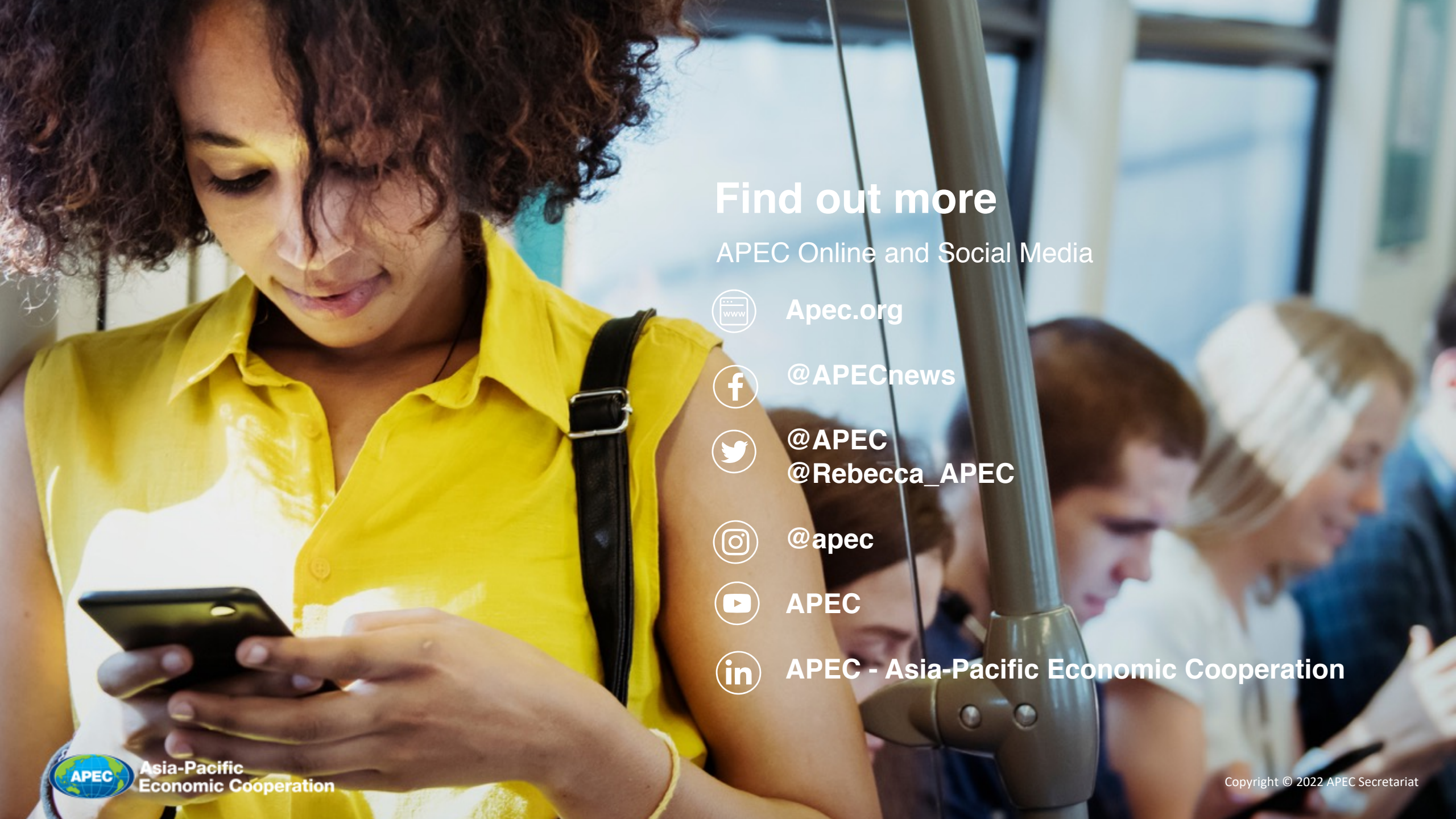
Strategies for Upgrading

- The development and adoption of 4IR technologies helps economies upgrade their GVCs by :
  - improving production efficiency,
  - creating new and better products and services, and
  - enabling technological upgrading
- Investing in 4IR technologies could be a forward-looking strategy to help economies move upward into the higher value-added stages along GVCs
- Success of imposing 4IR technologies depend on several factors:
  - Digital literacy
  - Training and upskilling of the local workforce
  - Domestic market size
  - Dynamic involvement of multinational corporations and FDI
- Economies could consider developing policies to attract high-quality FDI with potential extensive technology transfer necessary for GVC upgrading
- Economies can follow a non-linear path in upgrading, and leapfrog to higher stages

Possible Responses to 4IR by Economy Group

	Group A	Group B	Group C
Main feature	Domestic manufacturing base	FDI-based manufacturing	Weak manufacturing base
Examples	China, Rep. of Korea, Brazil	Malaysia, Thailand Brazil, Mexico	Indonesia, India, Philippines Africa, Argentina
Promising responses	Leapfrogging into smart factory	Automation and upgrading	4IR-related service start-ups
Main initiator	Public-private partnership	MNC decision	Local entrepreneurs introducing business model innovations
Key enabling factors	Industrial policy providing funds and technologies	Local existence of skills and training institutions	Initial financing; venture capital
Risks	Waste of public funds	Relocation to cheaper wage sites	Entry by, & competition with large foreign businesses

Source: Lee, Keun, Economics of Technological Leapfrogging (2019). UNIDO Department of Policy, Research and Statistics Working Paper 17.



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