The Twin Transition for Global Value Chains: Key Findings and Recommendations for Asia and the Pacific

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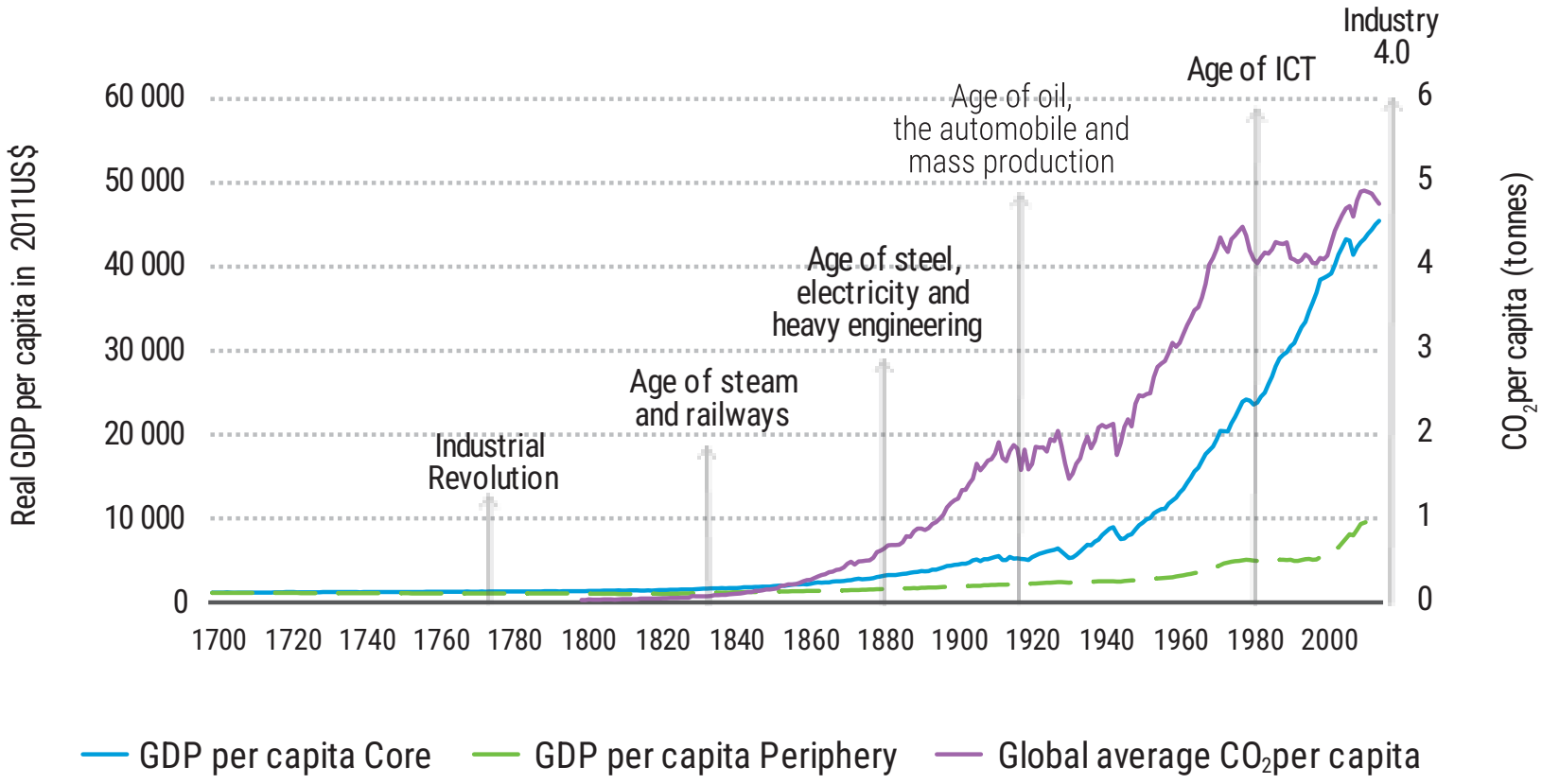
Developing countries must catch the green technological revolution early

The great divide, rise in CO2 per capita, and waves of technological change

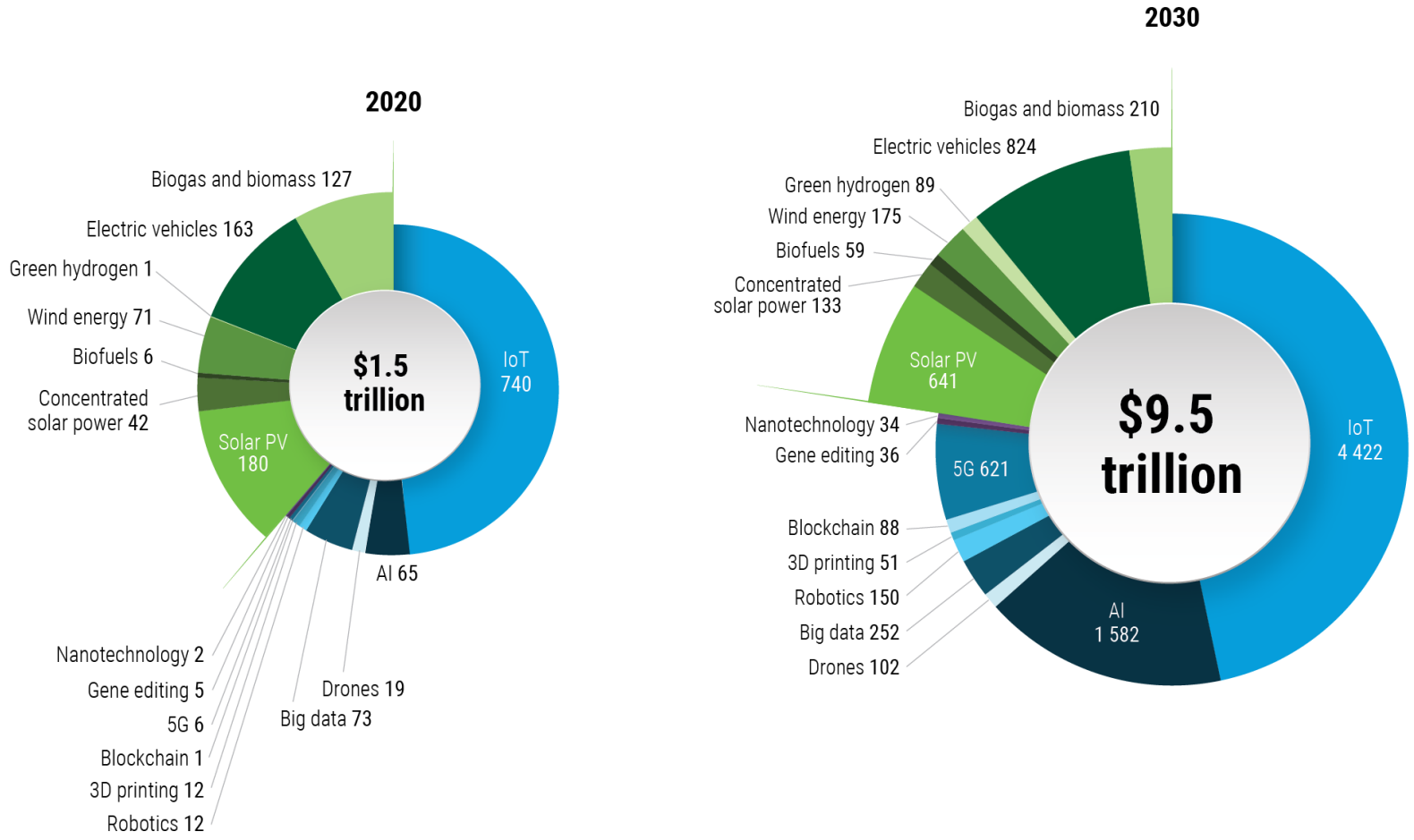


Notes: "Core" corresponds to Western European countries and Australia, Canada, New Zealand, the United States and Japan. "Periphery" corresponds to the rest of the world.

Source: UNCTAD, based on data from Our World in Data and the Maddison Project Database, version 2018, Bolt et al. (2018), Perez (2002), and Schwab (2013).

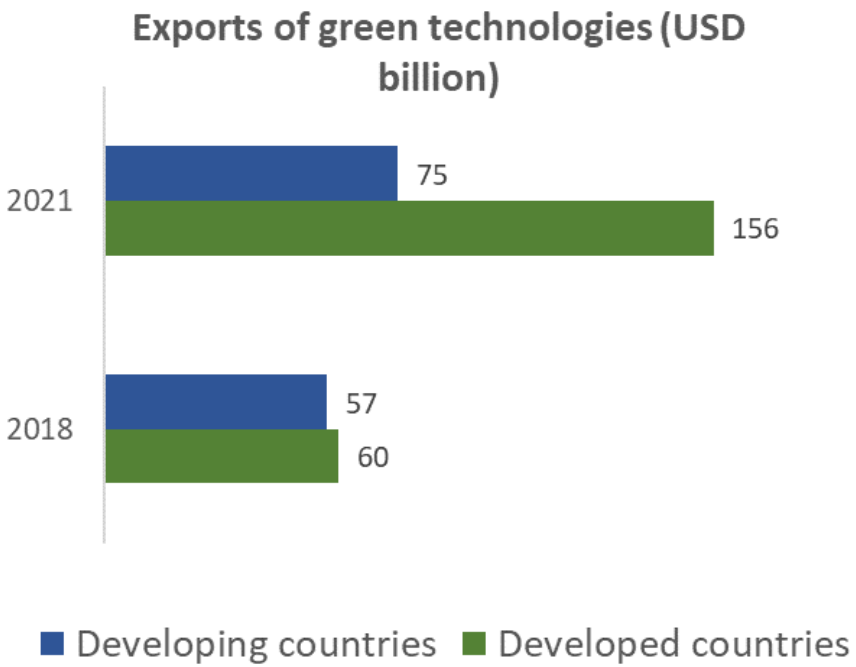
There are enormous opportunities in the development of green frontier technologies

Market size estimates of frontier technologies, $ billion



Source: UNCTAD based on various estimates.

But so far, developed economies are seizing most of the opportunities

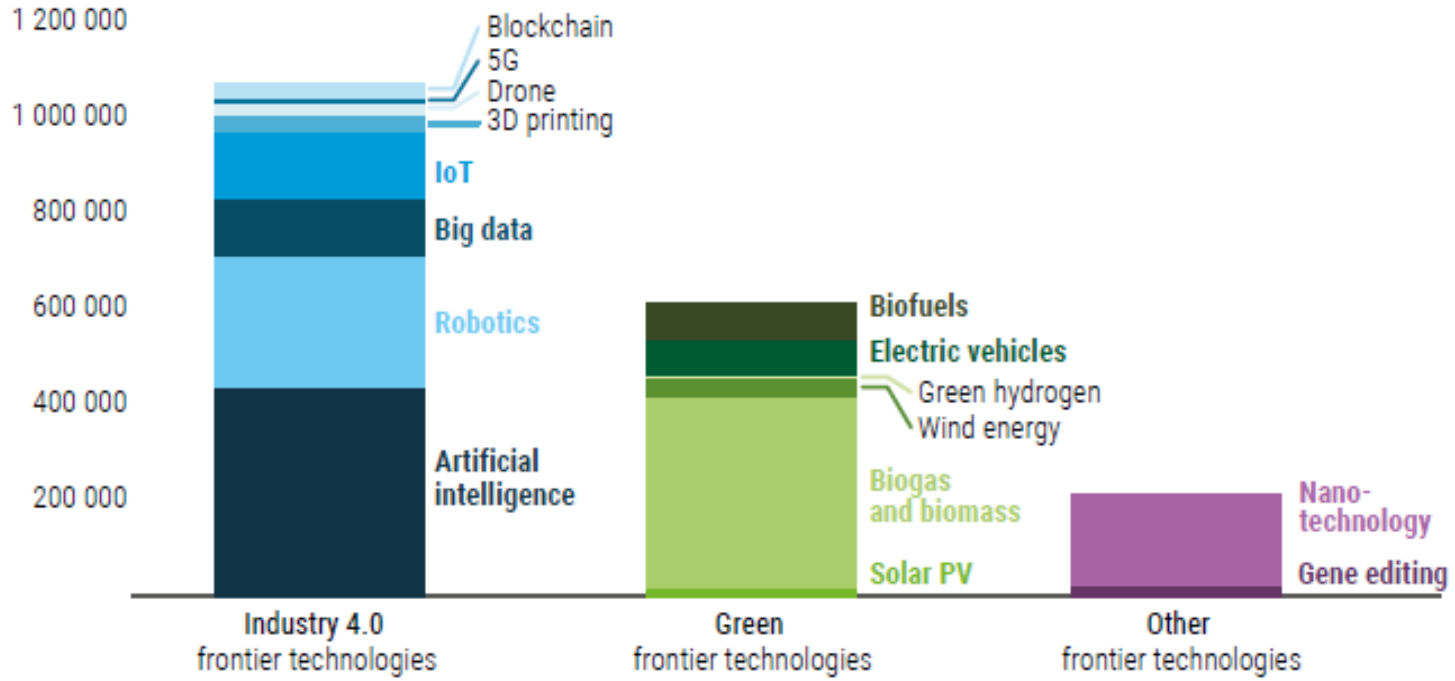


Top green frontier technology providers

Solar PV	Biofuels	Wind energy	Green hydrogen	Electric vehicles	Concentrated solar power	Biogas and biomass
Jinko Solar	Archer Daniels Midland	GE Power	Siemens Energy	Tesla	Abengoa Solar	Future Biogas
JA Solar	ALTEN Group	Mitsubishi Heavy Industries	Linde	Ford	Iberolica Group	Air Liquide
Trina Solar	Louis Dreyfus	ABB	Toshiba Energy	Hyundai	ENGIE	PlanET Biogas Global
Canadian Solar	Brasil Bio Fuels	Siemens Gamesa Renewable Energy	Air Liquide	Chevrolet	NextEra Energy Resources	Ameresco
Hanwa Q cells	BIOX Corp	Goldwind	Nel ASA	BYD	BrightSource Energy	Quantum Green
	Renewable Energy Group	Enercon	Air Products and Chemi-cals	Volkswagen		Envitech Biogas
	Wilmar international		Guangdong Nation-Synergy Hydro-gen Power Technologies	Renault-Nissan-Mitsubishi Alliance		Weltec Biopower

There is significant concentration of knowledge creation in terms of publications

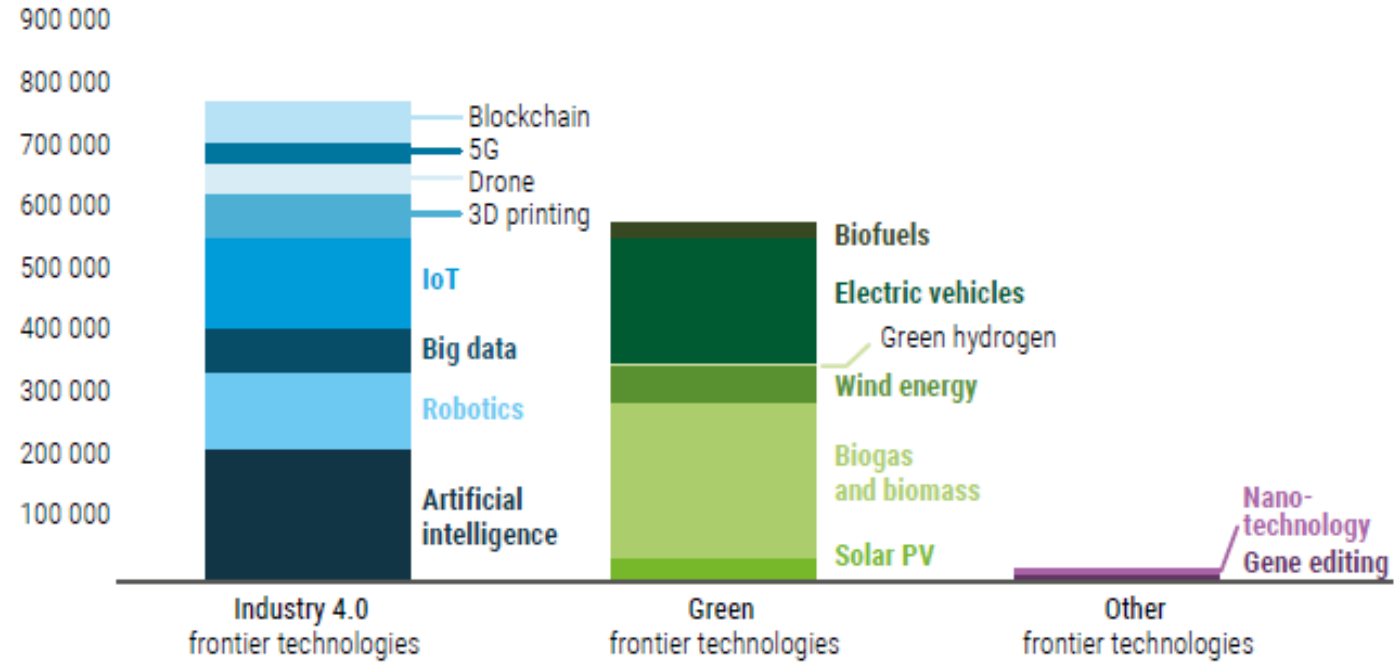
Number of publications on frontier technologies, 2000 – 2021



Source: UNCTAD calculations based on data from Scopus.

…and in terms of patents

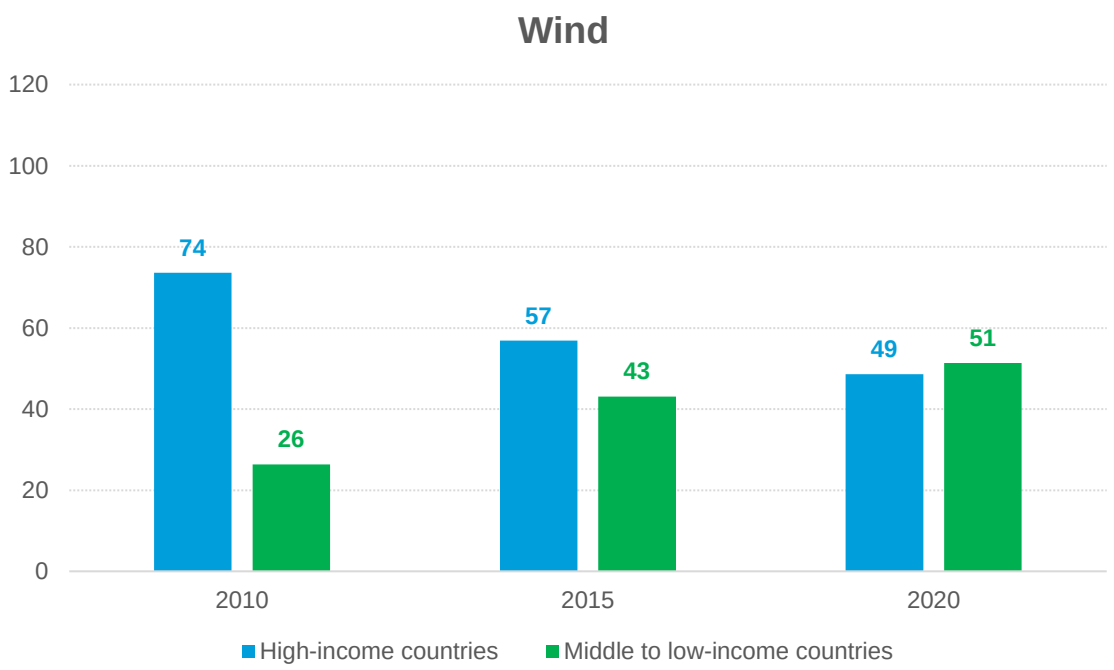
Number of patents for frontier technologies, 2000 – 2021

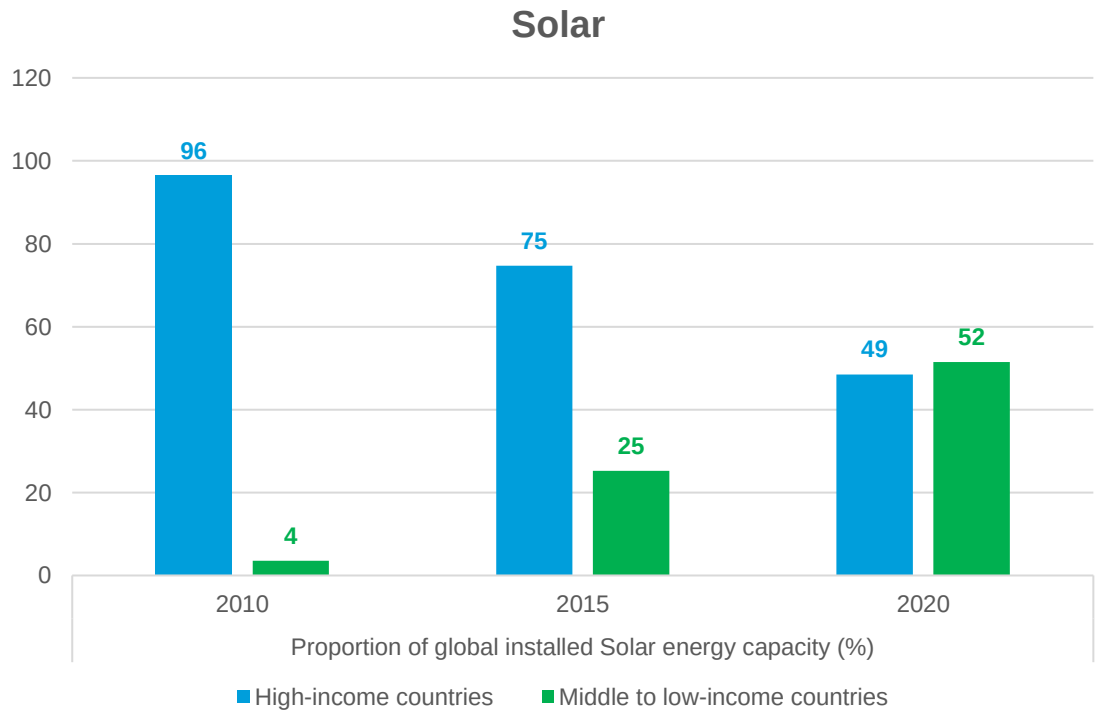


Source: UNCTAD calculations based on data from PatSeer.

Installed capacity is expanding in middle- and low-income countries

Installed renewable energy capacity by regions (percentage of world total)





Source: UNCTAD based on various estimates.

Readiness index combining ICT, skills, R&D, industrial capacity and finance indicators

	Rank in 2022	Rank in 2021	Movement in rank	ICT ranking	Skills ranking	R&D ranking	Industry ranking	Finance ranking
Top 10								
United States of America	1	1	–	11	18	2	16	2
Sweden	2	4	▲	6	2	16	11	18
Singapore	3	5	▲	7	8	17	4	17
Switzerland	4	2	▼	21	13	12	5	5
Netherlands	5	6	▲	4	9	15	10	31
Republic of Korea	6	7	▲	15	26	3	9	7
Germany	7	9	▲	24	17	5	12	40
Finland	8	17	▲	22	5	21	20	30
China, Hong Kong SAR	9	15	▲	9	23	29	2	1
Belgium	10	11	▲	13	4	23	19	48
Selected transition and developing economies								
Russian Federation	31	27	▼	43	32	13	54	69
China	35	25	▼	117	92	1	8	4
Brazil	40	41	▲	50	55	18	51	57
India	46	43	▼	95	109	4	22	75
South Africa	56	54	▼	71	77	36	67	25

Paths to seize benefits from the green technological revolution

1

Developing and using renewable energy technologies

2

Greening traditional global value chains by switching to digital technologies

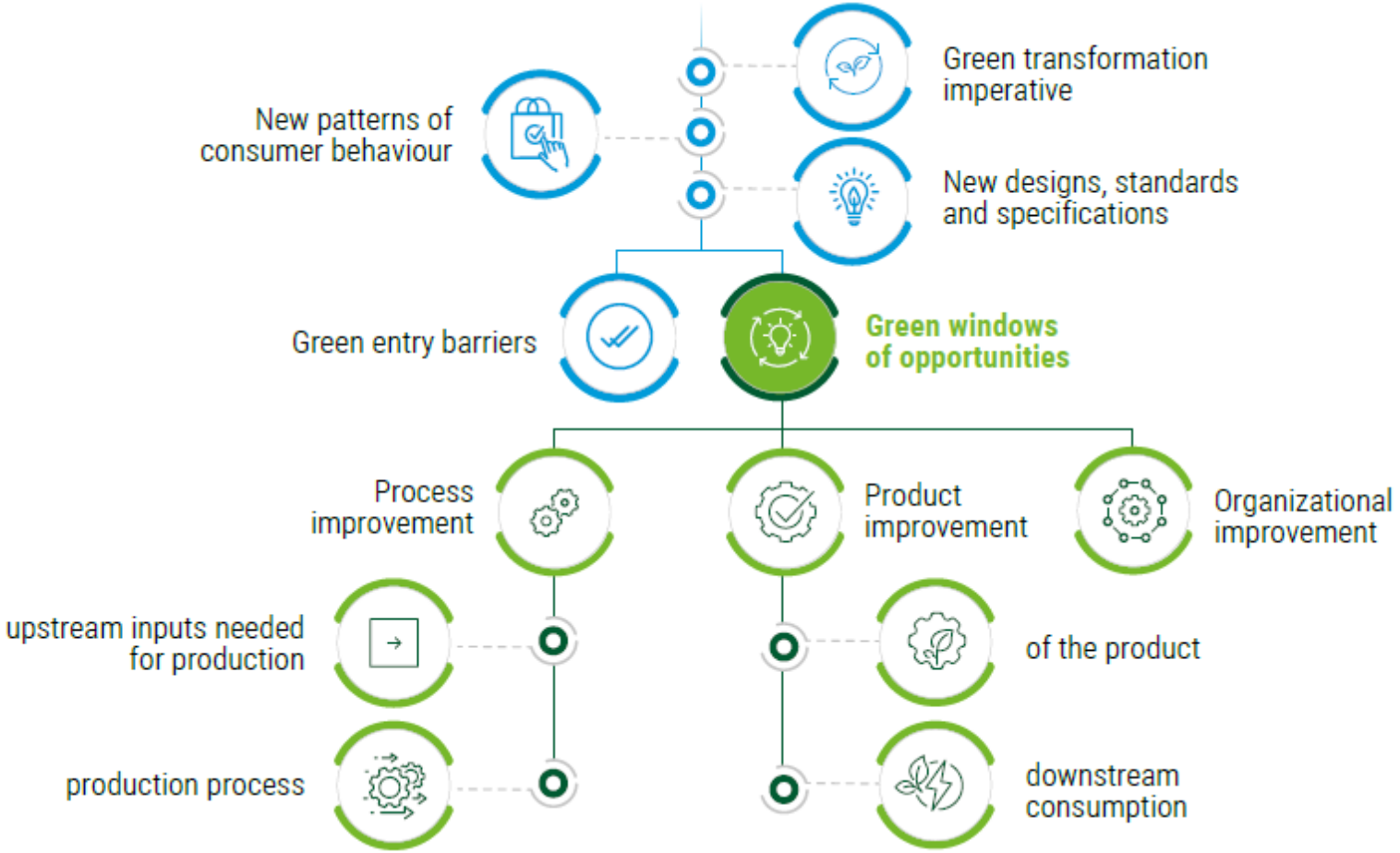
3

Diversifying towards production sectors that are more complex and greener

Global value chains (GVCs) have become the cornerstone of the world economic system

Social, environmental, economic and technological upgrading

The greening of GVCs



Smart manufacturing and service technologies & Data processing technologies

Smart manufacturing and service technologies		
Industrial robots		Robots are programmable machines that carry out actions and interact with the environment via sensors and actuators, either autonomously or semi-autonomously. Industrial robots usually replace workers, automating almost entirely the processes on the factory floor. Examples are spot welding robots used in the auto industry.
Cobots		Cobots are robots that collaborate with humans. They are easily re-programable, for example, by a worker guiding the arm of the cobot through a new path. They can be used in machine tools in a manufacturing plant, packaging and palletizing.
3D printing		3D printing, also known as additive manufacturing, produces three-dimensional objects based on digital information. 3D printing can create complex objects, with little waste. 3D printers are used for prototyping and also for final production in manufacturing.
Internet of Things (IoT)		IoT refers to internet-enabled physical devices that collect, share and act based on data. The IoT is vast; typical fields include wearable devices, smart homes, smart healthcare, smart cities and industrial automation. In manufacturing, IoT connects traditional machinery and tools with actuators and sensors.
Actuators		An actuator is a component of a machine that is responsible for moving and controlling a mechanism or system. It could be pneumatic, hydraulic, electric, thermal or magnetic. Actuators could, for example, measure heat or motion to determine the resulting action in the machine.
Sensors		Sensors detect external and internal conditions of equipment and products and send that information through the digital network. They can measure temperature, humidity, pressure, proximity and level, and visual and infrared rays.

Data processing technologies	
Big data	Big data refers to datasets whose size or type is beyond the ability of traditional databases to capture, manage and process. Big data also refers to the used of traditionally inaccessible or unusable data for making decisions.
Artificial intelligence (AI)	AI is normally defined as the capability of a machine to engage in cognitive activities typically performed by the human brain. AI is already widely used for applications that focus on narrow tasks, such as recommending what to buy online, spotting spam or detecting credit card fraud.

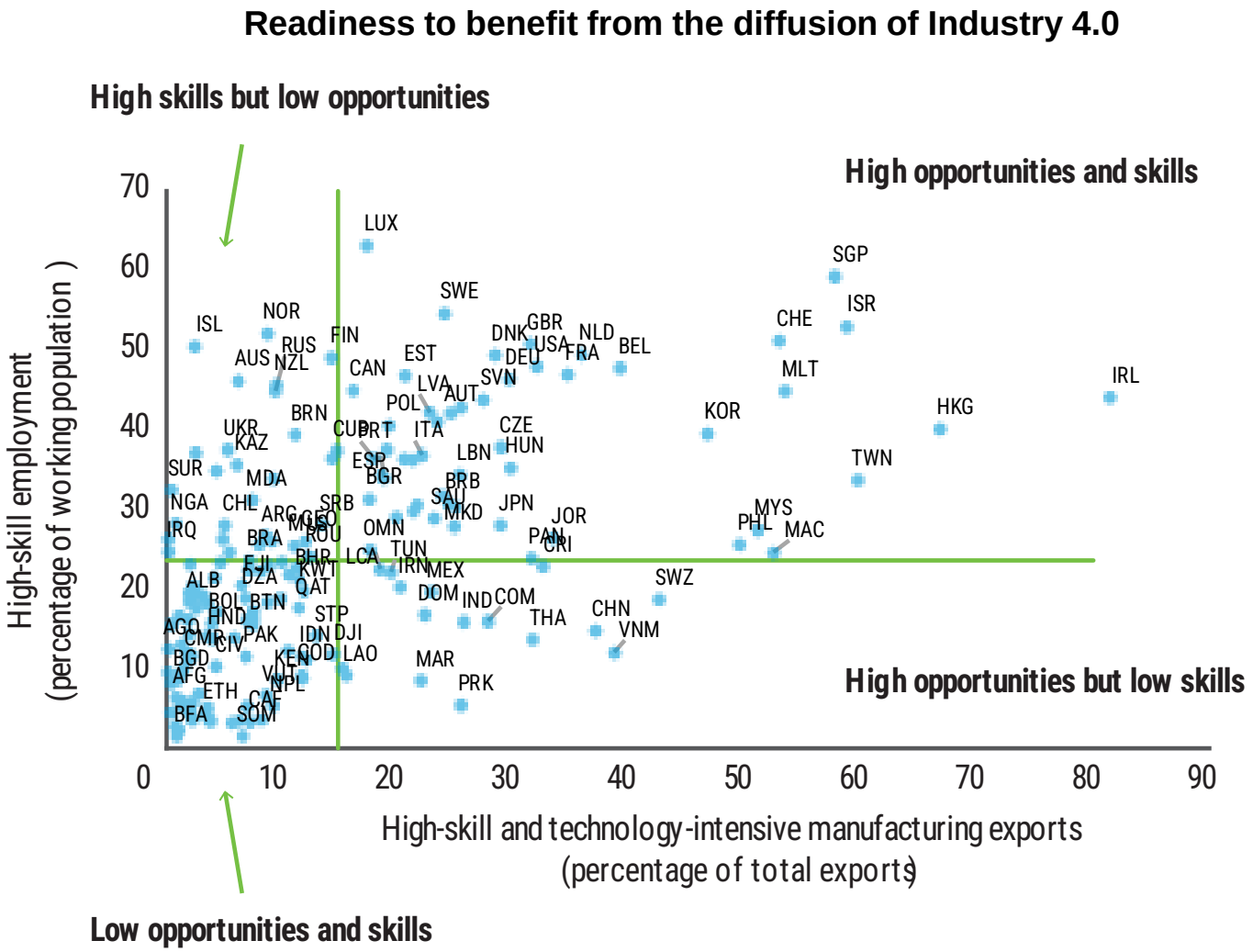
Greener relationships along the value chain

Five types of GVC governance

Type	Description
Market	This type has a low degree of explicit coordination and power asymmetry. Market linkages do not have to be completely transitory, as is typical of spot markets; they can persist over time, with repeat transactions. The essential point is that the costs of switching to new partners are low for both parties.
Modular	Typically, suppliers in modular value chains make products to a customer's specifications, which may be more or less detailed. Often, 'turn-key services' suppliers take full responsibility for competencies surrounding process technology, use generic machinery that limits transaction-specific investments, and make capital outlays for components and materials on behalf of customers.
Relational	In these GVCs, interactions between buyers and sellers are complex, which often creates mutual dependence and high levels of asset specificity. This may be managed through reputation or more trust-based ties. Spatial proximity may support relational value chain linkages, but trust and reputation might well function in spatially dispersed networks where relationships are built up over time. This type has an intermediate degree of explicit coordination and power asymmetry.
Captive	In these networks, small suppliers are transactionally dependent on much larger buyers. Suppliers face significant switching costs and are, therefore, 'captive'. Such networks typically have a high degree of monitoring and control by a lead firm.
Hierarchy	This governance form involves vertical integration. The dominant form of governance is managerial control, flowing from managers to subordinates, or from headquarters to subsidiaries and affiliates. This type has a high degree of explicit coordination and power asymmetry.

Voluntary sustainability standards

Challenge: Low level of existing technological and innovative capacities



Creating a twin transition

- Aligning digital and green strategies
- Developing digital infrastructure
- Building digital skills
- Building international partnerships
- Setting standards and regulations
- Providing financial support

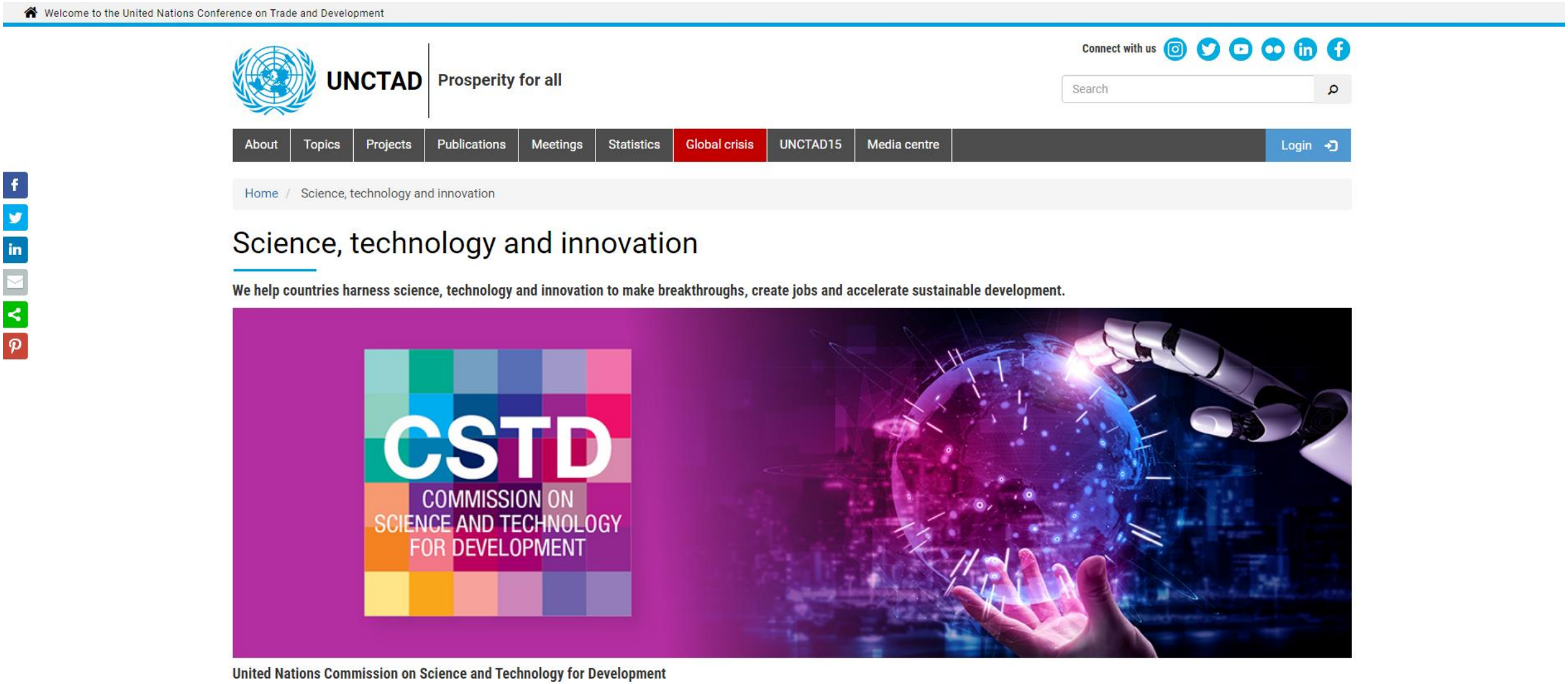
Conclusion

Technologies already exist

Political will needed

Developing countries should catch the green technological revolution early

For more information about UNCTAD's work on Science, technology and innovation



Thank you!

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