



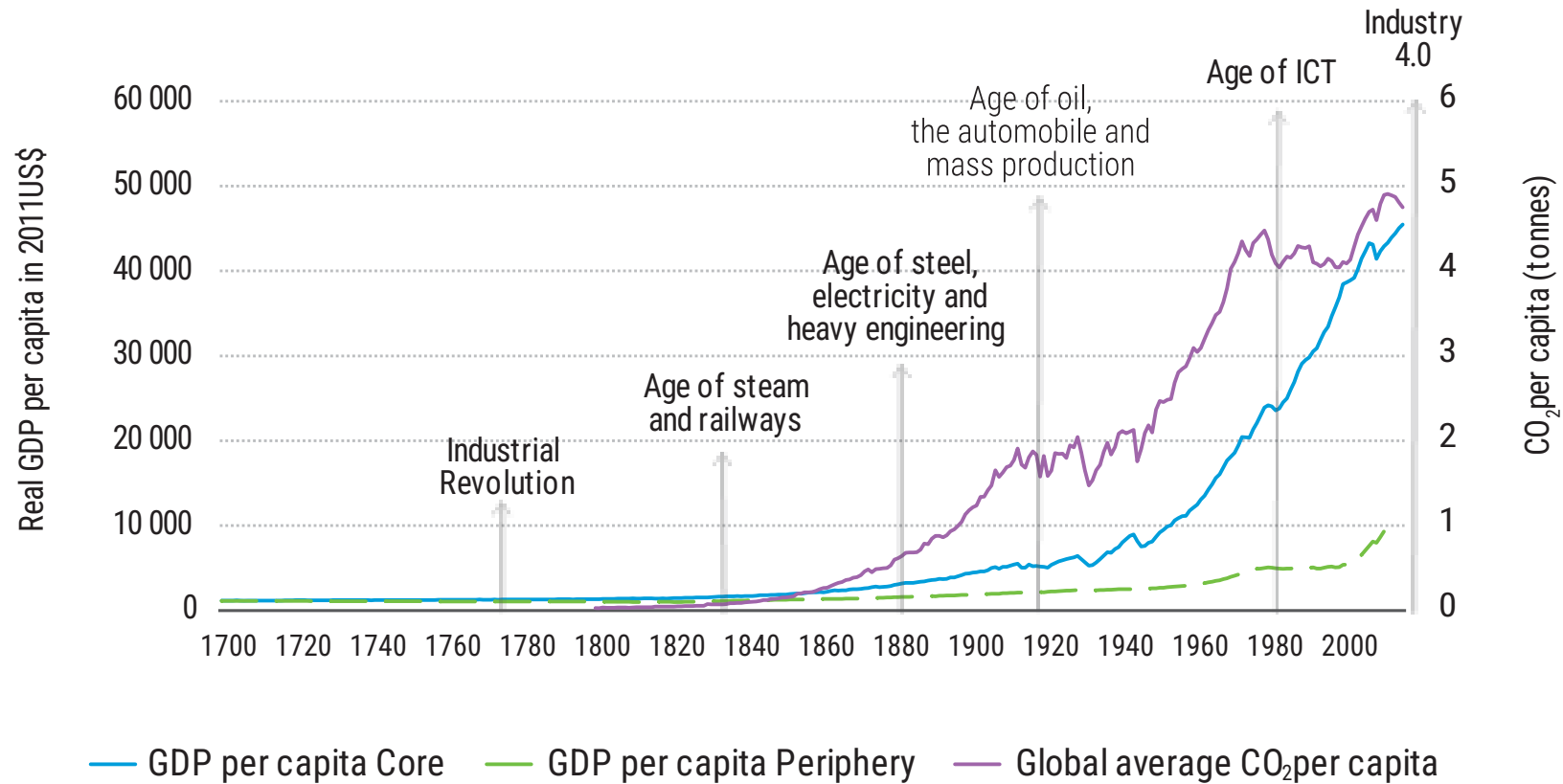
# TECHNOLOGY AND INNOVATION REPORT 2023

**Opening green windows**  
*Technological opportunities  
for a low-carbon world*



# Developing countries must catch the green technological revolution early

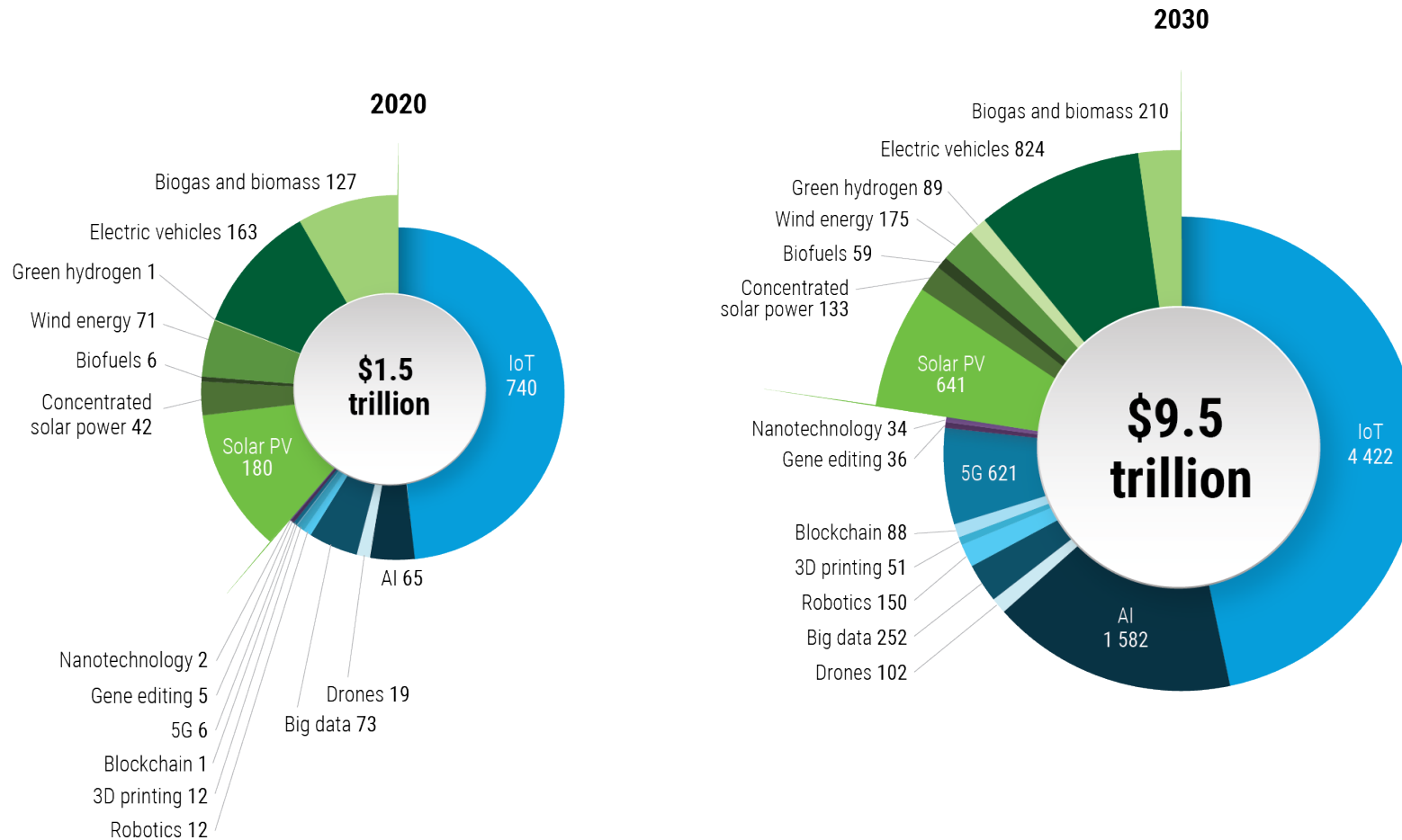
**The great divide, rise in CO<sub>2</sub> per capita, and waves of technological change**



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**





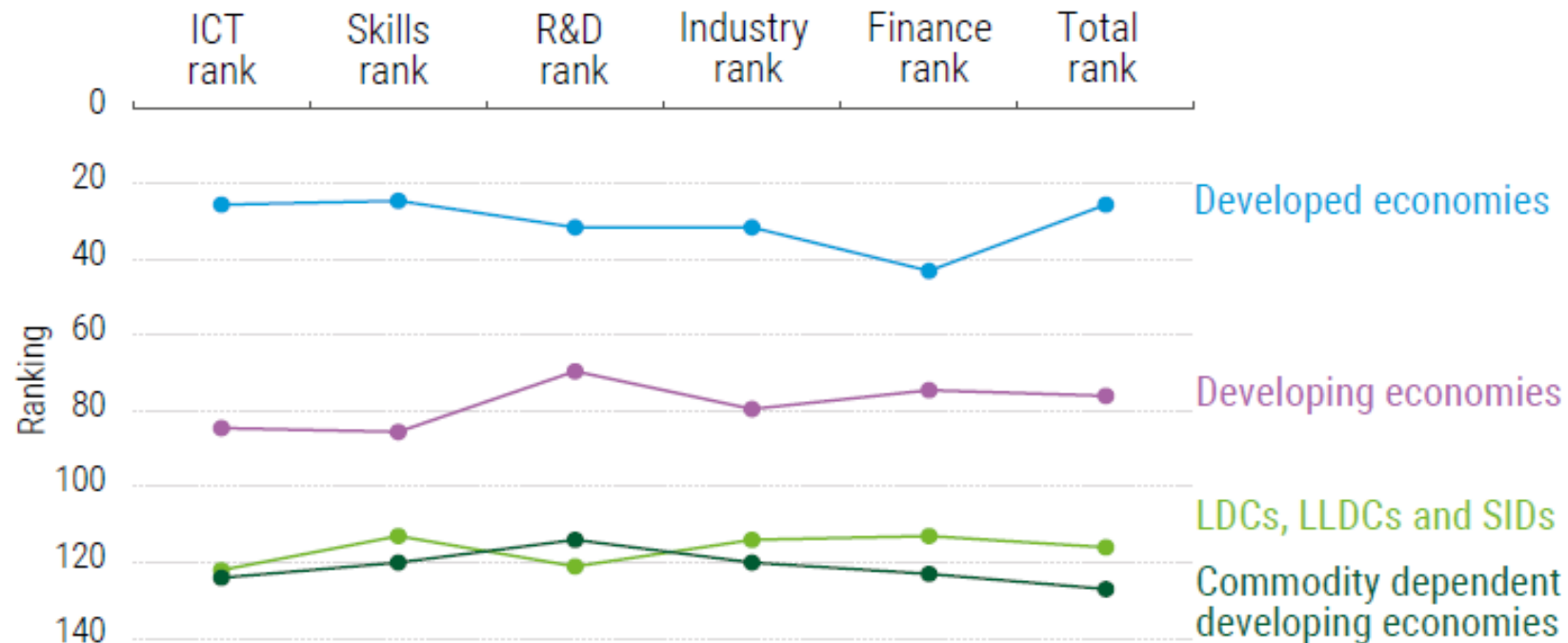
## But so far, developed economies are seizing most of the opportunities

### Top frontier technology providers

AI	IoT	Big data	Blockchain	5G	3D printing	Robotics	Drone technology	Gene editing	Nanotechnology	Solar PV
Alphabet	Alphabet	Alphabet	Alibaba	Ericsson	3D Systems	ABB	3D Robotics	CRISPR Therapeutics	BASF	Jinko Solar
Amazon	Amazon	Amazon Web Services	Amazon Web Services	Huawei (network)	ExOne Company	FANUC	DJI Innovations	Editas Medicine	Apeel Sciences	JA Solar
Apple	Cisco	Dell Technologies	IBM	Nokia	HP	KUKA	Parrot	Horizon Discovery Group	Agilent	Trina Solar
IBM	IBM	HP Enterprise	Microsoft	ZTE	Stratasys	Mitsubishi Electric	Yuneec	Intellia Therapeutics	Samsung Electronics	Canadian Solar
Microsoft	Microsoft	IBM	Oracle	Huawei (chip)		Yaskawa	Northrop Grumman	Precision BioSciences	Intel	Hanwa Q cells
	Oracle	Microsoft	SAP	Intel		Hanson Robotics	Lockheed Martin	Sangamo Therapeutics		
	PTC	Oracle		MediaTek		Pal Robotics	Boeing			
	Salesforce	SAP		Qualcomm		Robotis				
	SAP	Splunk		Samsung Electronics		Softbank				
		Teradata				Alphabet/Waymo				
						Aptiv				
						GM				
						Tesla				
Biofuels	Wind energy	Green hydrogen	Electric vehicles	Concentrated solar power	Biogas and biomass					
Archer Daniels Midland	GE Power	Siemens Energy	Tesla	Abengoa Solar	Future Biogas					
ALTEN Group	Mitsubishi Heavy Industries	Linde	Ford	Iberolca Group	Air Liquide					
Louis Dreyfus	ABB	Toshiba Energy	Hyundai	ENGIE	PlanET Biogas Global					
Brasil Bio Fuels	Siemens Gamesa Renewable Energy	Air Liquide	Chevrolet	NextEra Energy Resources	Ameresco					
BIOX Corp	Goldwind	Nel ASA	BYD	BrightSource Energy	Quantum Green					
Renewable Energy Group	Enercon	Air Products and Chemicals	Volkswagen		Envitech Biogas					
Wilmar international		Guangdong Nation-Synergy Hydrogen Power Technologies	Renault-Nissan-Mitsubishi Alliance		Weltec Biopower					

## Frontier technologies readiness index shows developing countries have lower rankings for ICT connectivity and skills

Average index ranking by building block (selected country groupings)



Source: UNCTAD.

## Paths to seize benefits from the new 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



**Developing and using  
renewable energy  
technologies**

**OPENING GREEN WINDOWS**

Technological opportunities for a low-carbon world

# Combining strong initial conditions and strong responses make up the best scenario to seize GWOs but weak conditions can be compensated by strong efforts

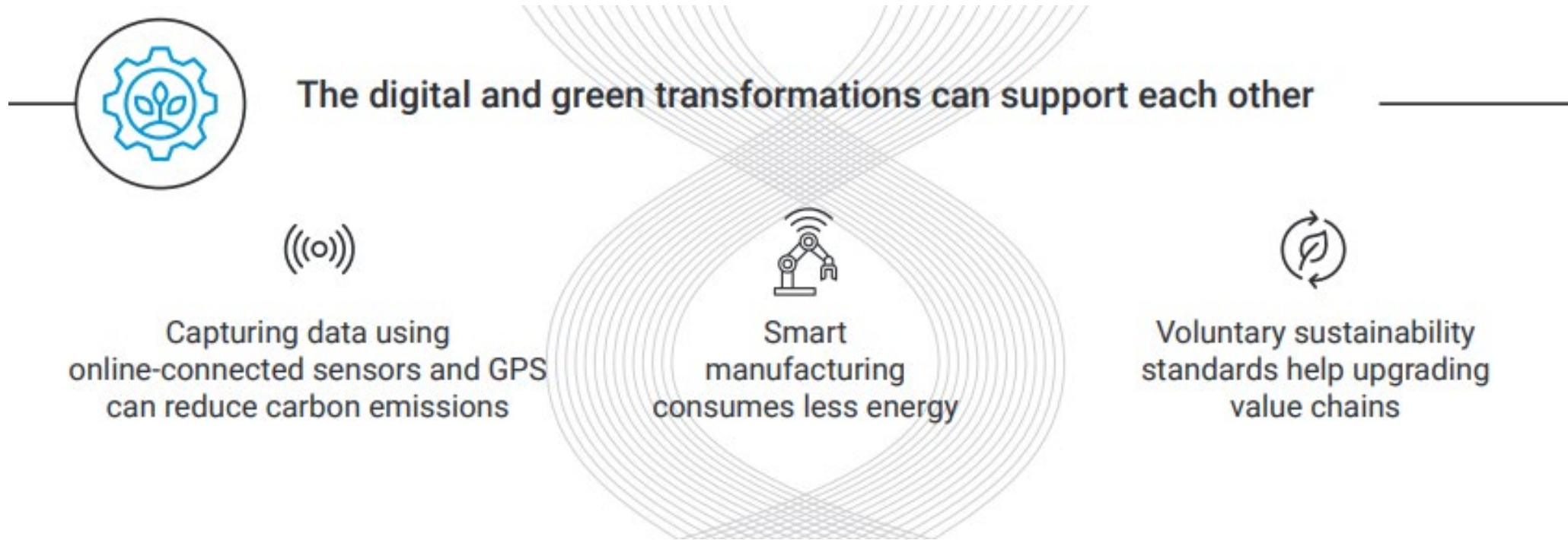
**Four green window scenarios**

		Responses	
		Strong	Weak
Preconditions	Strong	<b>Scenario 1: Windows open</b>  Solar PV, Biomass, CSP – China  Bioethanol – Brazil  Hydrogen – Chile (potentially)	<b>Scenario 2: Windows to be open</b>  Solar PV – India  Biogas – Bangladesh  CSP – Morocco  Wind – China
	Weak	<b>Scenario 3: Windows within reach</b>  Biomass – Thailand and Viet Nam  Hydrogen – Namibia	<b>Scenario 4: Windows in the distance</b>  Wind – Kenya  Bioenergy – Mexico and Pakistan

Source: UNCTAD.

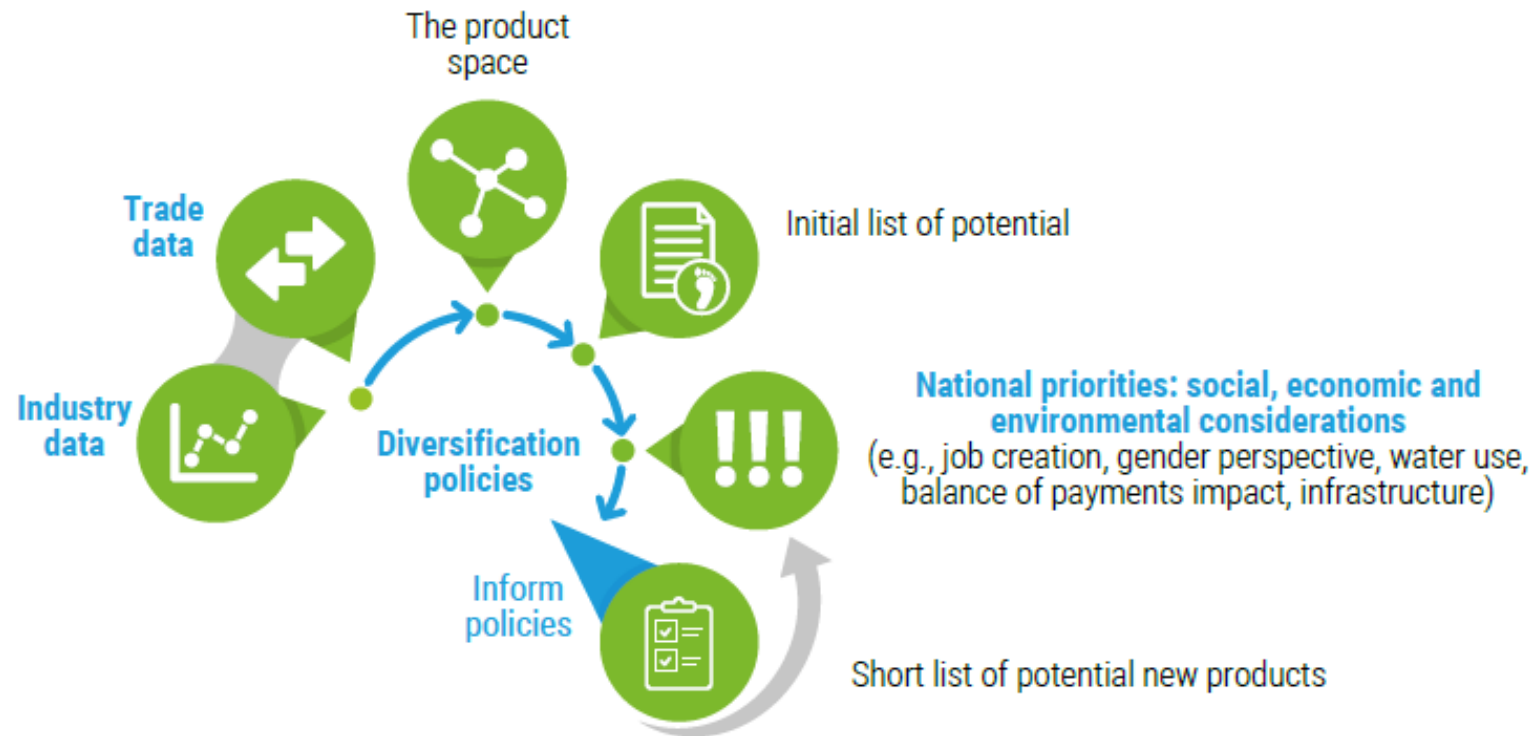


# The digital and the green transformations can be twins if there are strong enough policy responses





## Identifying and prioritizing sectors that more complex and greener



Source: UNCTAD.

## Opening green windows



### Set the direction towards green technologies and innovation

Align environmental and industrial policies  
Invest in more complex and greener sectors  
Incentives and infrastructure to shift demand



### Build green productive and innovative capacities

Invest in R&D  
Raise awareness of green technologies  
Develop digital infrastructure and skills

## International cooperation

Trade rules should permit developing countries to protect infant green industries through tariffs, subsidies and public procurement

Consistency between international agreements on trade, intellectual property and climate change is critical for green technology revolution

Intellectual property should have greater flexibilities for developing countries with regard to green technologies

## Conclusion

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Technologies already exist

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Political will needed

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Developing countries should catch the green technological revolution early

# Thank you!



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