



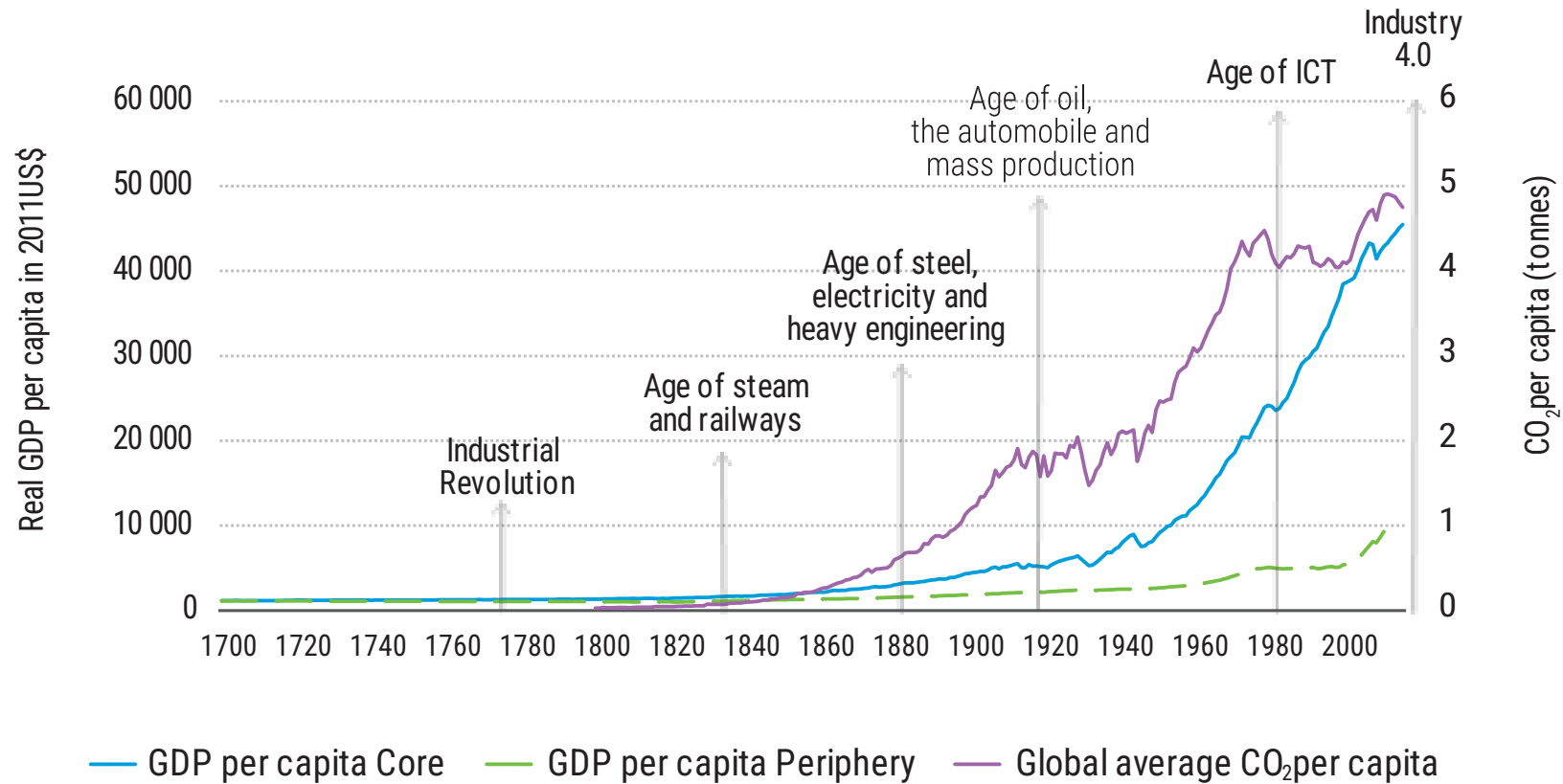
TECHNOLOGY AND INNOVATION REPORT 2023

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



Developing countries must catch the green technological revolution early

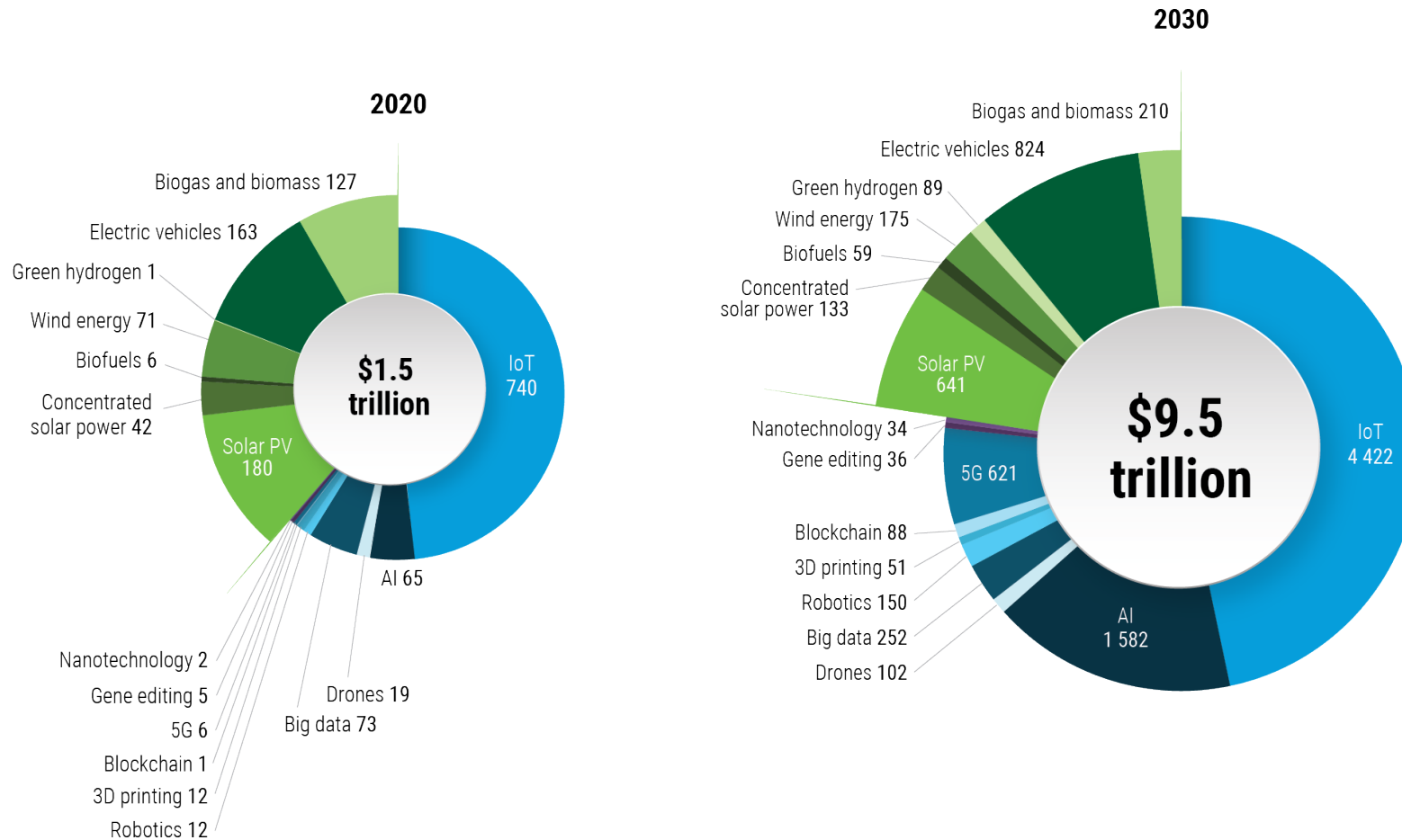
The great divide, rise in CO₂ per capita, and waves of technological change



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).

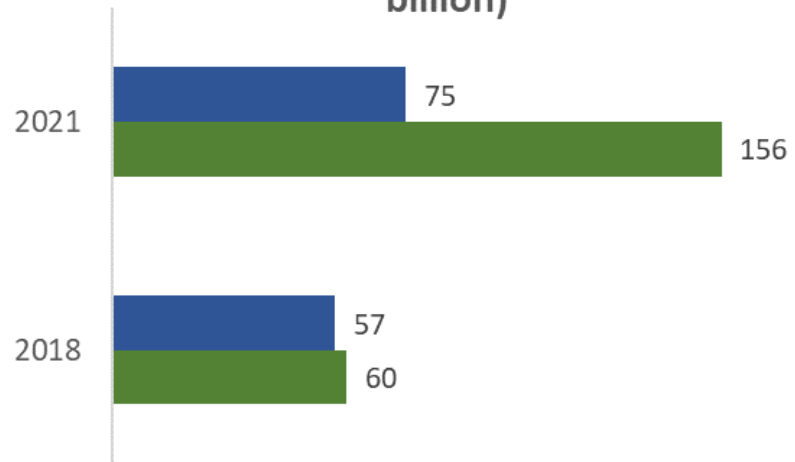
There are enormous opportunities in the development of green frontier technologies

Market size estimates of frontier technologies, \$ billion



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

Exports of green technologies (USD billion)



■ Developing countries ■ Developed countries

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 Chemicals	Volkswagen		Envitech Biogas
	Wilmar international		Guangdong Nation-Synergy Hydrogen Power Technologies	Renault-Nissan-Mitsubishi Alliance		Weltec Biopower

African countries are at risk of missing current technological opportunities

	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

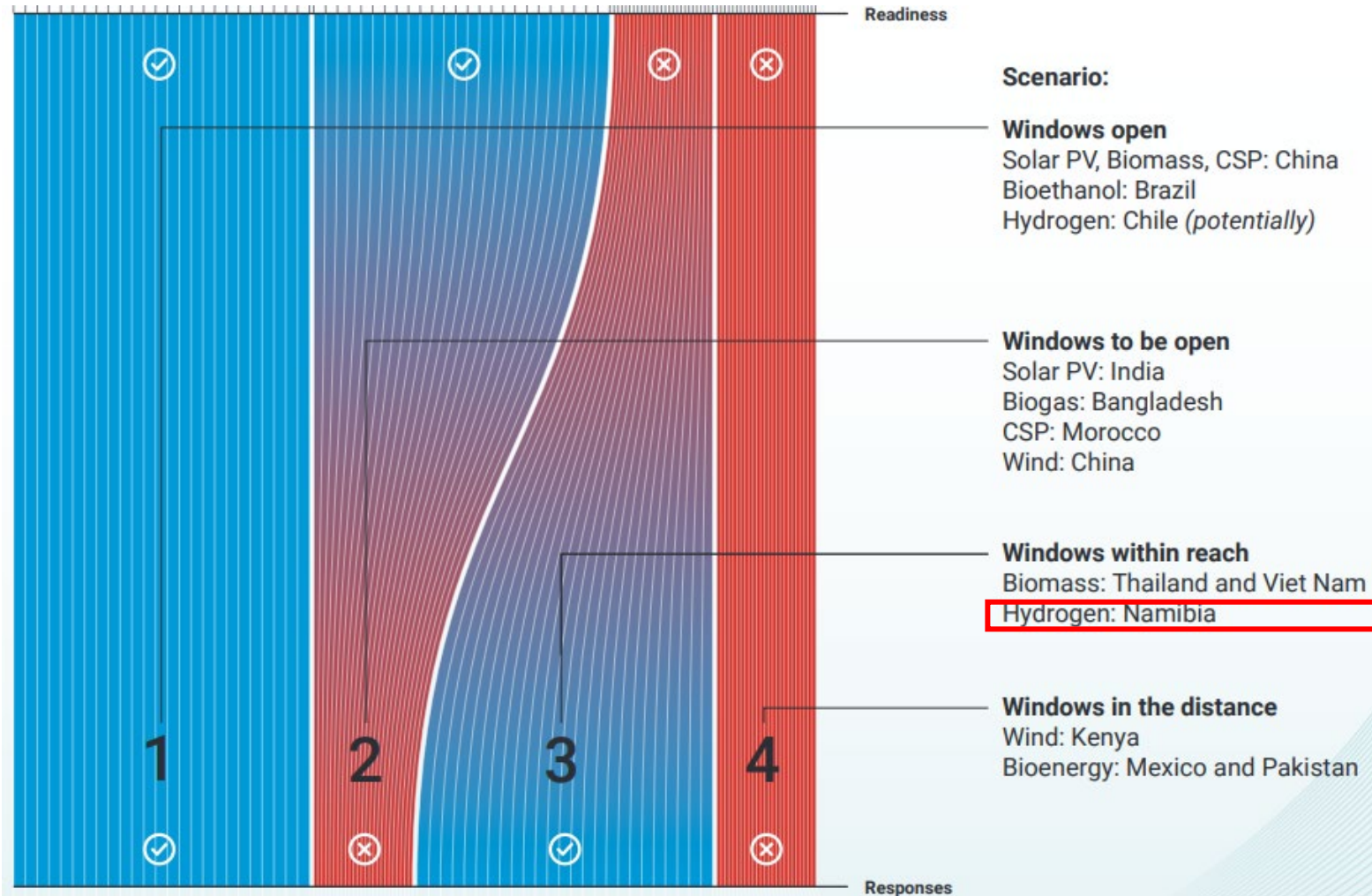
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Developing and using
renewable energy
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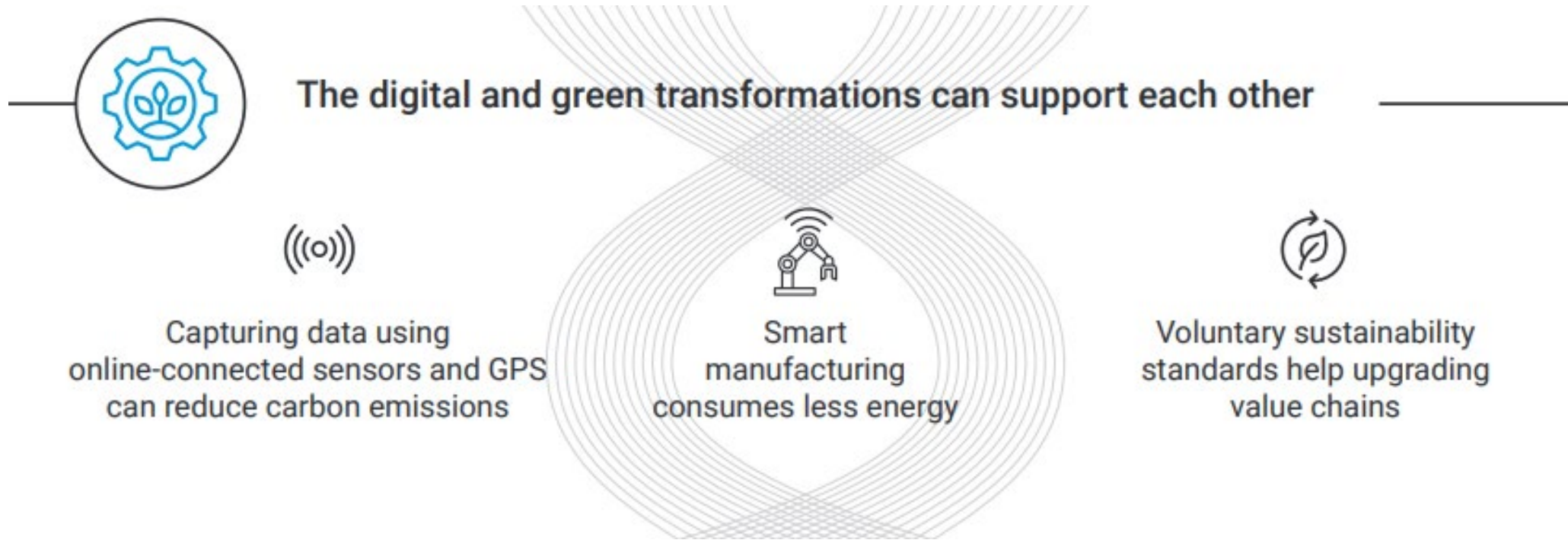
OPENING GREEN WINDOWS

Technological opportunities for a low-carbon world

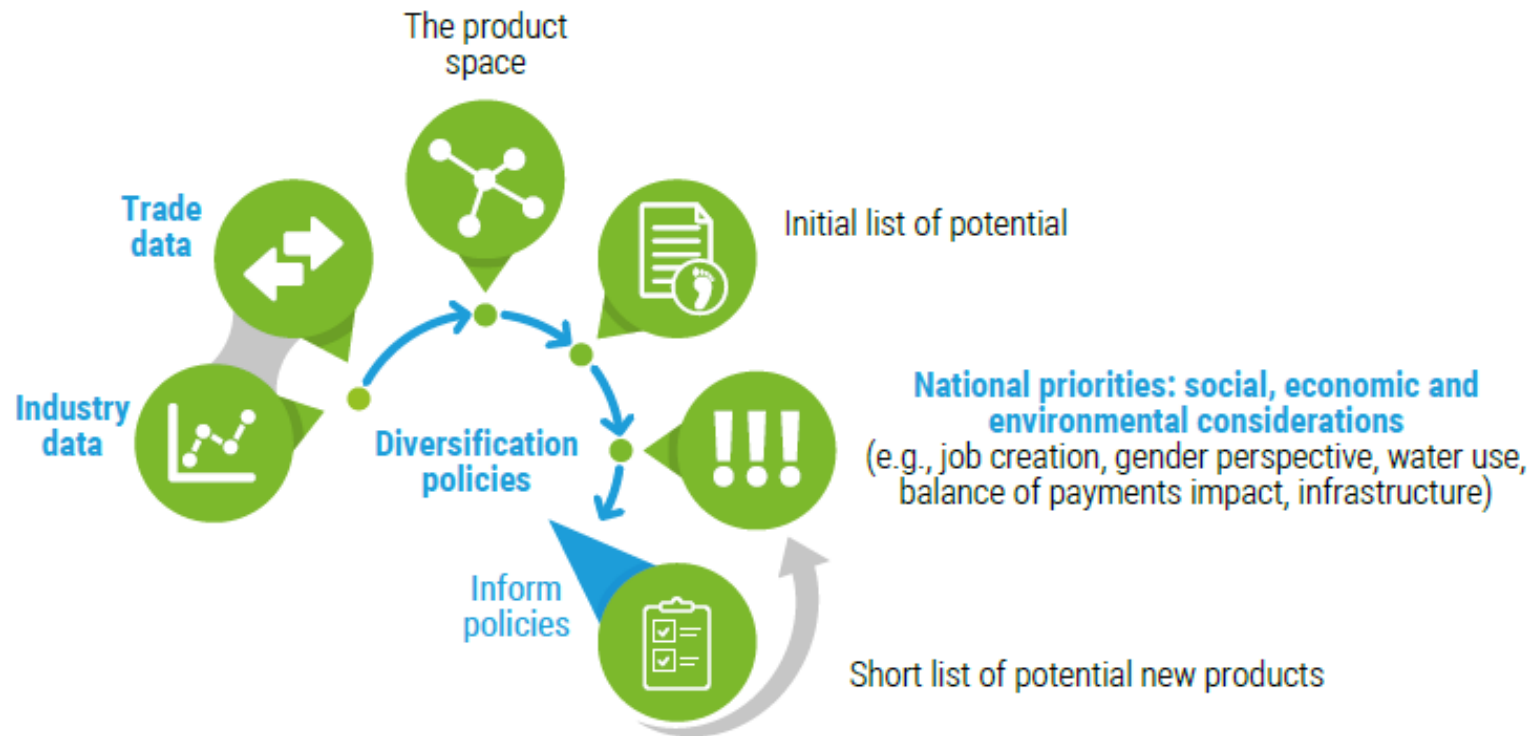
Combining strong initial conditions and strong responses make up the best scenario but weak conditions can be compensated by strong efforts



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

Technologies already exist

Political will needed

Developing countries should catch the green technological revolution early

Thank you!



UNITED NATIONS
UNCTAD