Sustainability Science and its Global Flourishing

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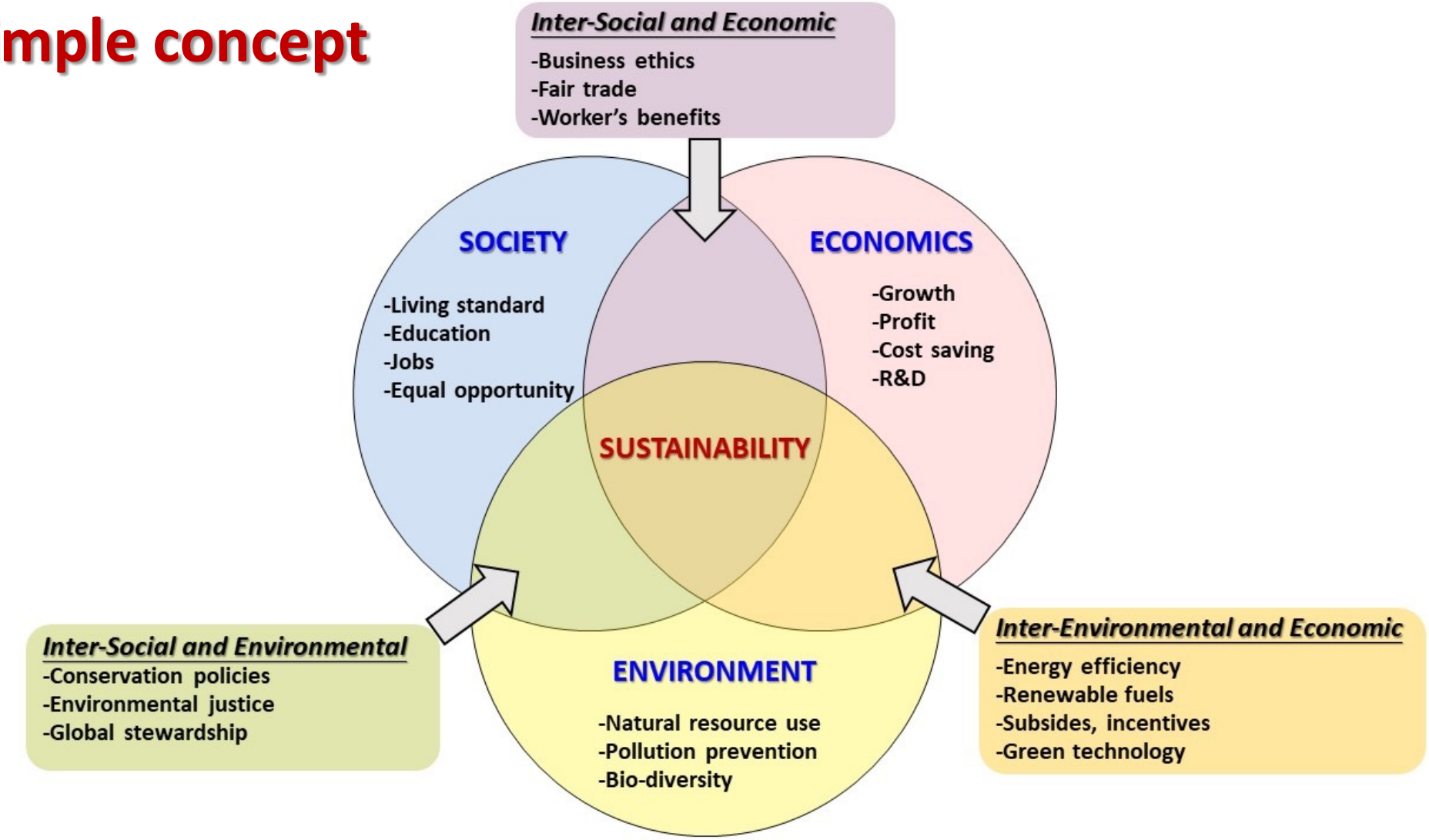
"Sustainability" is "meeting the needs of the present without compromising the ability of future generations to meet their own needs."

Our Common Future, UN Brundtland Commission, 1987

Dimensions: Environment, Society*, and Economics*

***Human**

An old but simple concept



Mark Fedkin. Adopted from the University of Michigan Sustainability Assessment [Rodriguez et al., 2002]

Sustainability vs. Sustainable Development

- Due to Industrialized vs. Developing

But please remember that we have only one mother Earth!

Dilemmas towards sustainability

- Water supply
- Environment deterioration
- Pollutions
- Biodiversity loss
- Food security
- Health threats (Infectious diseases)

- Economic decline
- Energy/electricity problem
- Industry/infrastructure imbalance

- Inequality
- Education Quality
- Well-beings
- Unemployment
- Poverty and homelessness

1972 United Nations Conference on the Human Environment …. A Declaration ……

1992 Earth Summit held in Rio and adopted Agenda 21 (Also Agreement on UNFCCC, replacement of the Fossil Fuel, ……)

2000 Millennium Summit was held at UN Headquarters in New York, leading to the elaboration of eight Millennium Development Goals (MDGs) to reduce extreme poverty by 2015

2002 2nd Earth Summit held at Johannesburg to adopt World Summit on Sustainable Development

2012 3rd Earth Summit was held in Rio (Rio+20, United Nations Conference on Sustainable Development, UNCSD) to develop a set of SDGs to build upon the MDGs and Future Earth was announced.

2013 30-member Open Working Group (countries)

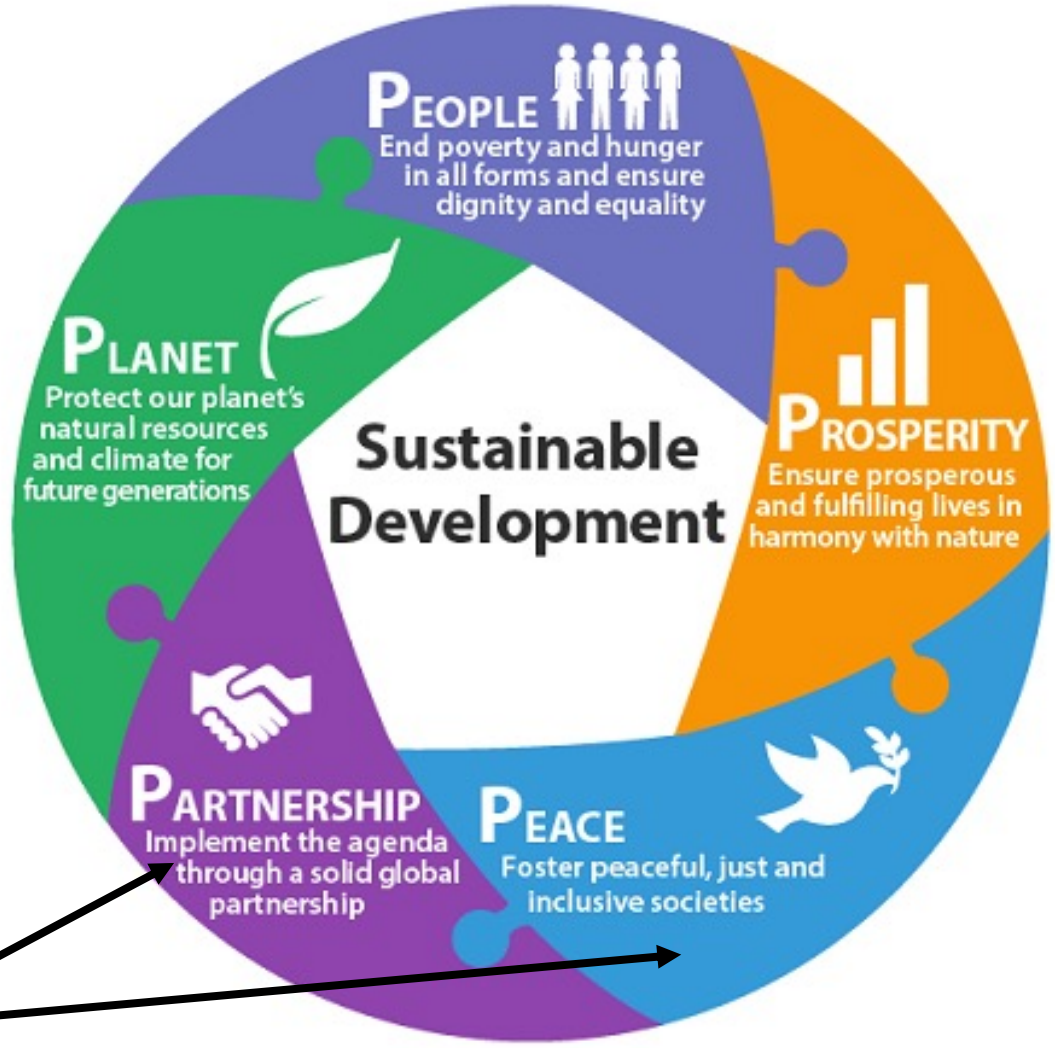
2015 →

- ✓ **Sendai Framework for Disaster Risk Reduction (March 2015)**
- ✓ **Addis Ababa Action Agenda on Financing for the Development (July 2015)**
- ✓ **Transforming our world: the 2030 Agenda for Sustainable Development with its 17 SDGs was adopted at the UN Sustainable Development Summit in New York in September 2015.**
- ✓ **Paris Agreement on Climate Change (December 2015)**

UN Sustainable Development Goals (Published in 2015)

* Also known as 2030 Agenda for Sustainable Development

Insights of SDGs



Keys

Webpage of UNDESA

SDG 7: Affordable and Clean Energy: Ensure access to affordable, reliable, and sustainable modern energy for all

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

7.3 By 2030, double the global rate of improvement in energy efficiency

7.A By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

7.B By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all **in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries**, in accordance with their respective programmes of support

SDG 13: Climate Action: Take action to combat climate changes and its impacts

13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

13.2 Integrate climate change measures into national policies, strategies and planning

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

13.A Implement the commitment undertaken by developed-country parties to the **United Nations Framework Convention on Climate Change** to a goal of mobilizing jointly $100 billion annually **by 2020** from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

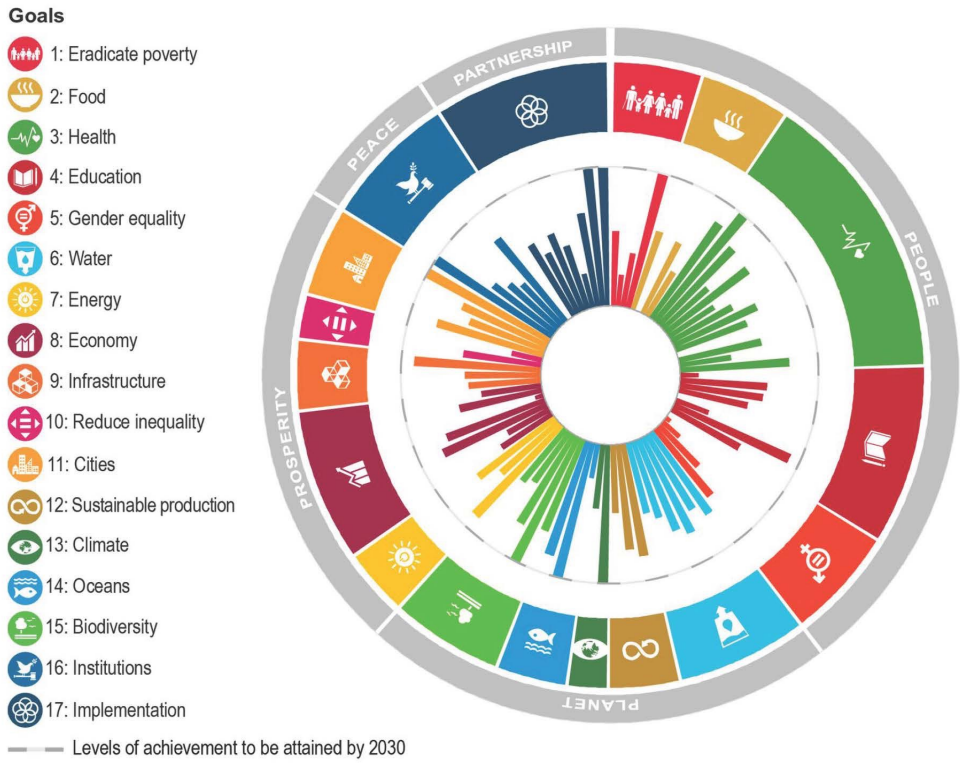
13.B Promote mechanisms for raising capacity for effective climate change-related planning and management in **least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities**

Measuring Distance to the SDG Targets 2019

An Assessment of Where OECD Countries Stand

The SDG Summit of the UNGA High-level Political Forum on Sustainable Development is gathering world leaders to take stock of the progress in implementing the 2030 SDG Agenda. See how far OECD countries are from achieving selected SDG targets.

OECD countries' average distance from achieving SDG targets



Detailed metadata

bit.ly/to-SDG-targets

OECD (2019), Measuring Distance to the SDG Targets 2019: An Assessment of Where OECD Countries Stand, OECD Publishing, Paris

OECD

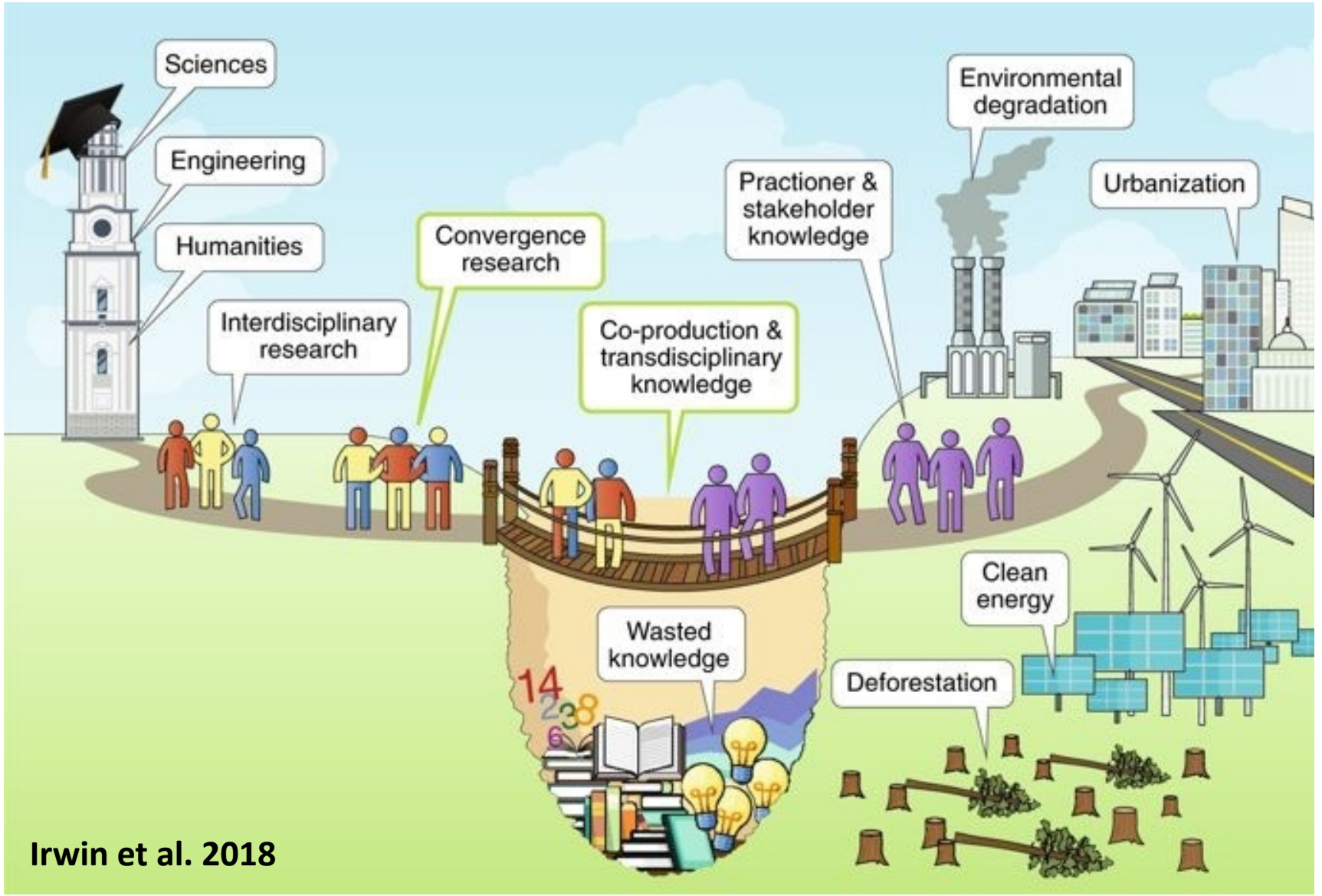
Sustainability Science

- ✓ Emerging in 1980's: It is "defined by the problems it addresses rather than by the disciplines it employs" and "serves the need for advancing both knowledge and action by creating a dynamic bridge between the two" (Clark, 2007).
- ✓ a "Birth Statement" at the World Congress "Challenges of a Changing Earth 2001" in Amsterdam organized by the International Council for Science (ICSU)
- ✓ "…an emerging field of research dealing with the interactions between natural and social systems, and with how those interactions affect the challenge of sustainability: meeting the needs of present and future generations while substantially reducing poverty……" (PNAS website)

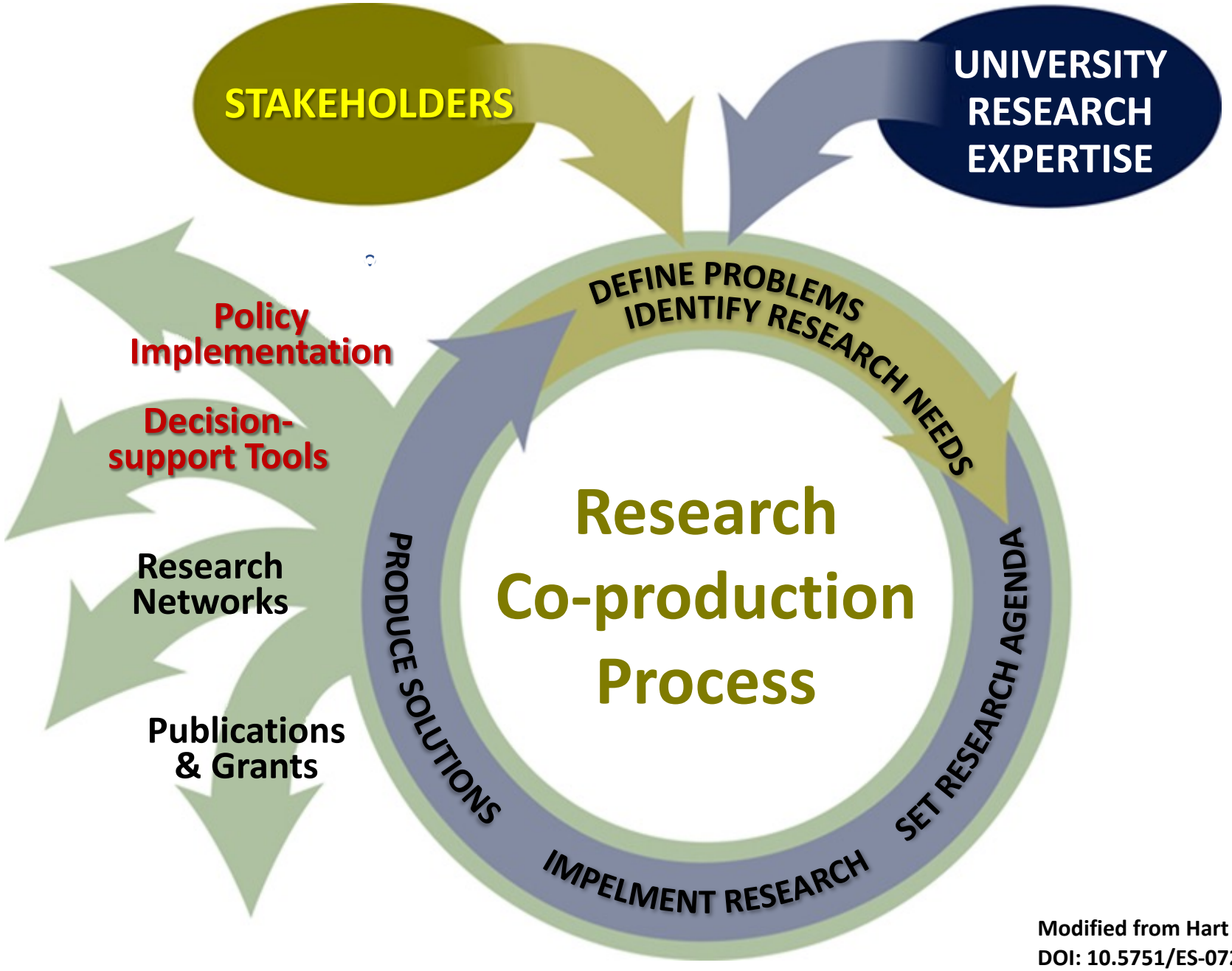
Sustainability Science

- ✓ different kind of science that is primarily use-inspired with significant fundamental and applied knowledge components, and commitment to moving such knowledge into societal action. (Kates, 2011)
- ✓ …… is defined by the problems it addresses rather than the disciplines it employs. It thus draws as needed from multiple disciplines of the natural, social, medical and engineering sciences, from the professions, and from the knowledge of practice." (Harvard Univ., 2008)

The concept of Transdisciplinary



Irwin et al. 2018



Modified from Hart et al., 2015
DOI: 10.5751/ES-07283-200204

Earth System Sciences

Knowledge from:

Physics + Chemistry + Bio-science + Earth Science + ……

→Natural Processes

To reposition our research towards Sustainability Sciences on relevant Sustainability Problems.

Ex. Seismology or Earthquake Science

Knowledge:

1. Physics and mechanics
2. Seismic wave propagation and PGV/PGA
3. Recurrence interval and deformation behavior

Actions:

1. Warning and forecasting
2. Hazard simulation and evaluation

Stakeholders:

1. Engineer, Social Scientist, Practitioner, Government Officer

Global Efforts in flourishing Sustainability Science

- **Governmental Structure**: UNSDG(UNCED to UNCSD), UNFCCC (Conferences of the Parties, COP), UN-IPCC
- **Institutional Approach**: ISC, STA for Global Sustainability, STS forum
- **Funding Organization**: Belmont Forum, Global Forum of Funders (ISC)
- **Scientist Mobilization**: Future Earth, WCRP

Introduction to Belmont Forum

- 前身為 1990成立的IGFA (The International Group of Funding Agencies for Global Change Research) ，我國為正式會員國，國科會代表參加。
- IGFA主要成員國於2009年成立貝蒙論壇(Belmont Forum)，2014年貝蒙論壇正式取代IGFA 。
- 國科會自然處處長為參加代表，目前林敏聰副主委為執行委員會成員。

Belmont Challenge: To support international transdisciplinary research providing knowledge for understanding, mitigating and adapting to global environmental change

Collaborative Research Actions (CRAs)

- 貝蒙論壇之CRA是全球關注的重要環境變遷與永續發展議題。
- CRA參加的會員組成協調小組(Group of Program Coordinator, GPC)及並由主導會員負責計畫辦公室 (Thematic Programme Office, TPO)。

BF CRAs 2019-2023

Year	CRA Title	TPO
2019	Disaster Risk Reduction and Resilience - Funded	NSTC
	CEH: Climate, Environment and Health - Funded	UKRI
	Arctic II: Resilience in Rapidly Changing Arctic Systems - Funded	NSF and RFBR
2020	Food Systems and Climate – Funded (Canceled)	ANR
	Sustainable Soil and Groundwater (Critical zone) - Funded	ANR
	Pathways to the SDGs - Funded	NSF
2021	..... (COVID)	
2022	Migrations - Funded	NRF and NSF
	Sustainable Consumption and Production - Funded	NSTC
2023	CEH II: Climate, Environment and Health - Call published	NSF
	Urban Blue and Green Spaces - Call published	NERC
Scoping	Driving Urban Transition - NSF The Amazon & Tropical Forests - FAPESP and IAI Cultural Heritage & Climate Change Future Leaders - NSF Environmental Peace Making - Future Earth Pathways II - NSF Vulnerability and Resilience (DR3 II) - ANR & NSTC	N/A

我國參與CRAs的現況

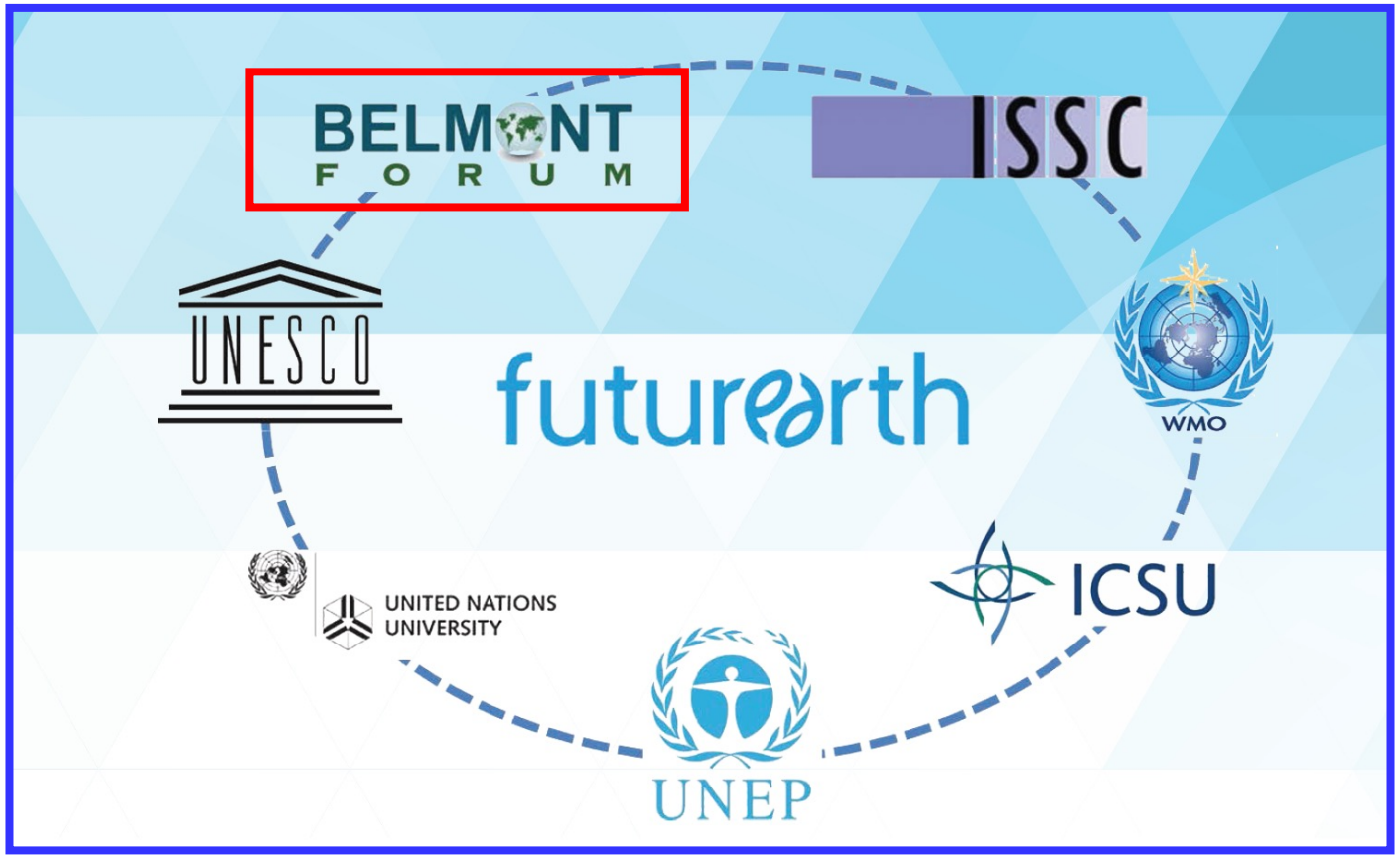
21 CRAs launched by 2023

Number of Taiwanese teams awarded:

CRAs	Lead	Joint
CEH	0	1
DR3	1	1
FEW	1	3
SEI	0	1
Soils	0	3
Pathways	1	2
SSCP 2022	0	3
CEH 2	--	--
Urban G & B	--	--
Total	3	14

NSTC Taiwan is Thematic Program Offices in Taiwan (TPO)

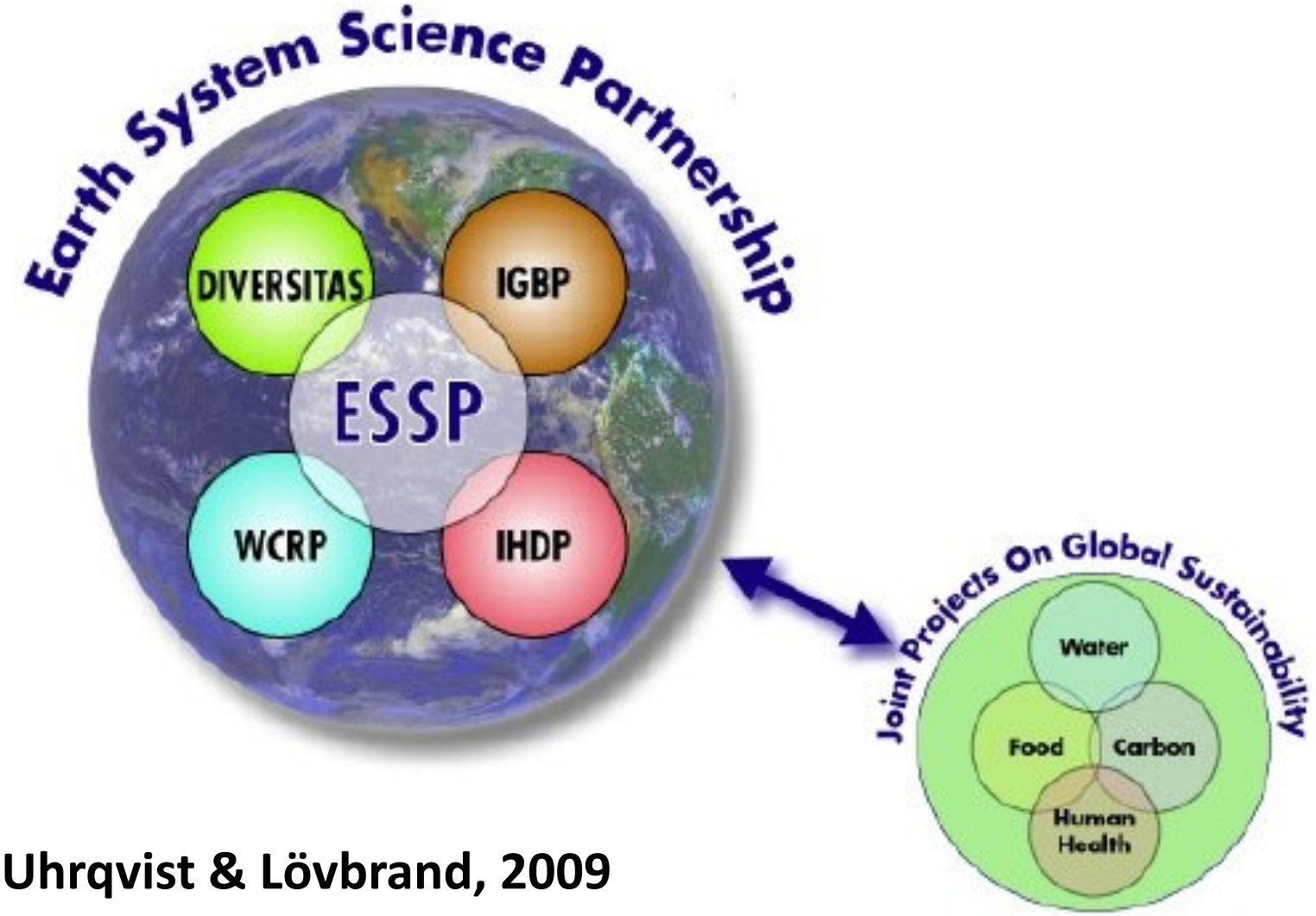
The Birth of Future Earth



- Future Earth 是全球永續發展科技聯盟(STA, Science and Technology Alliance for Global Sustainability)所啟動新階段的國際科學倡議

Global Research Projects (GRPs)

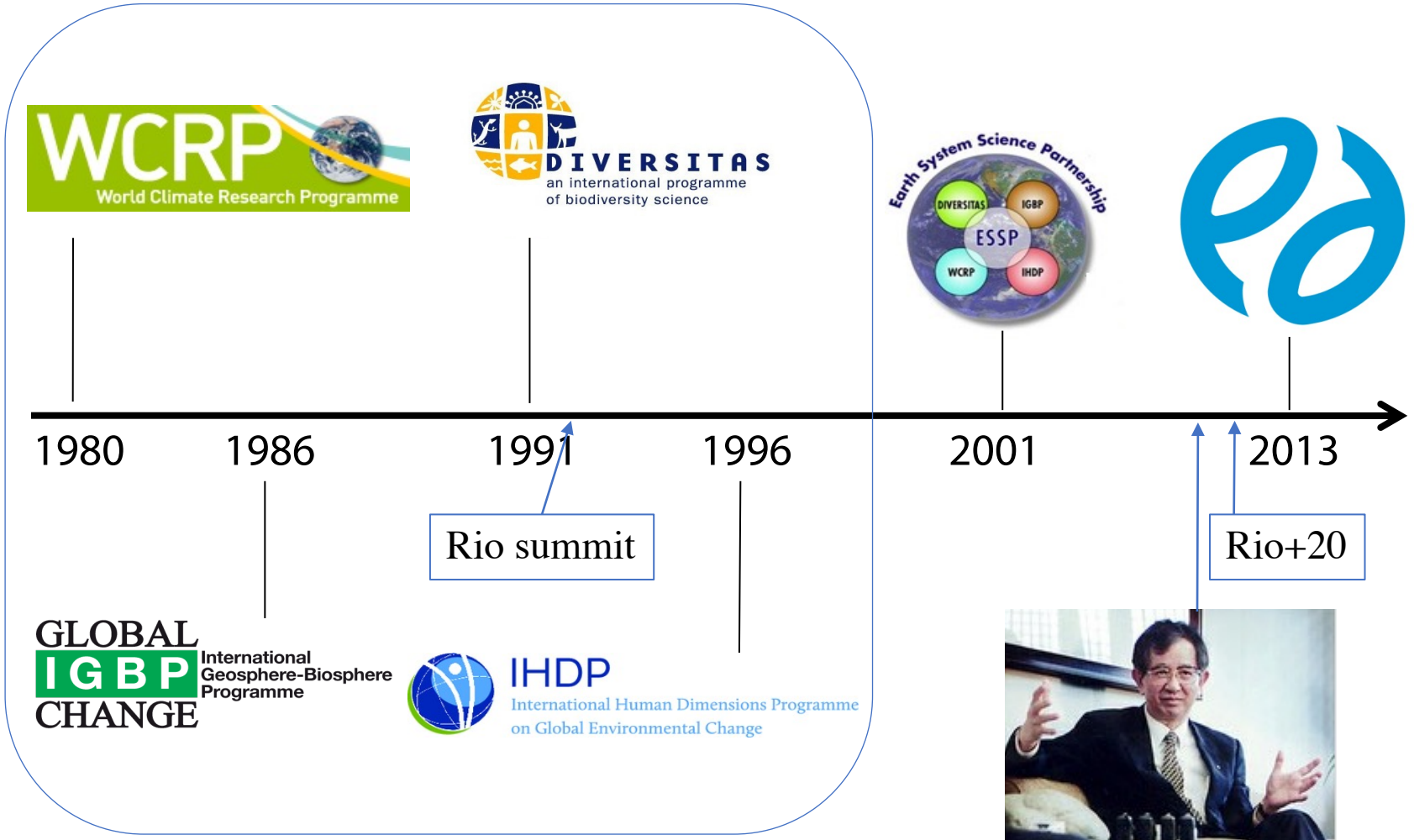
AIMES Analysis, Integration and Modelling of the Earth System	**bioDISCOVERY**	**bioGENESIS**	**ecoSERVICES**	**ESG** Earth System Governance	**Future Earth Coasts**	**GCP** Global Carbon Project
GLP Global Land Programme	**GMBA** Global Mountain Biodiversity Assessment	**IGAC** International Global Atmospheric Chemistry	**IHOPE** Integrated History and Future of People on Earth	**iLEAPS** Integrated Land Ecosystem-Atmosphere Processes Study	**IMBeR** Integrated Marine Biosphere Research (formerly IMBER)	**IRG** Integrated Risk Governance Project
MAIRS-FE Monsoon Asia Integrated Research for Sustainability	**oneHEALTH** (formerly ecoHEALTH)	**PAGES** Past Global Changes	**PECS** Programme on Ecosystem Change and Society	**SOLAS** Surface Ocean–Lower Atmosphere Study	**UGEC** Urbanization and Global Environmental Change (closed 2017)	**Water Futur** Sustainable Water Future Programme



Uhrqvist & Lövbrand, 2009

Historical Context of Future Earth

Integration of Global Environmental Change (GEC) programmes under International Council for Science (ICSU)



ICSU President
Prof. YT Lee, 2011-2014

Governing Council of Future Earth (Before the transformation in 2021)
Science and Technology Alliance for Global Sustainability

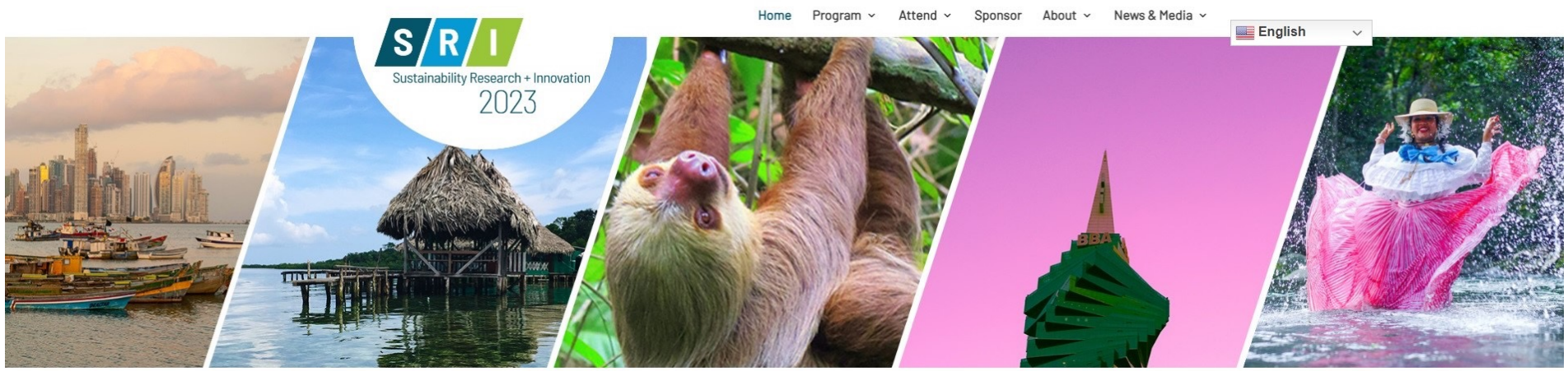
Knowledge-Action Networks (KANs)(Before the transformation in 2021)

- The Future Earth Secretariat will actively support the 7 KANs marked in red

1. Water-Energy-Food Nexus	2. Ocean
3. Transformations	4. Natural Assets
5. Sustainable Development Goals	6. Urban
7. Health	8. Finance & Economics
9. Systems of Sustainable Consumption and Production	10. Decarbonization
11. Emergent Risks and Extreme Events	* Future Earth Taipei accordingly established 8 + 3 Working Groups

(1) Young Scientist, (2) Sustainability in Digital Age, and (3) NGOs


futureearth
research for global sustainability
BELMONT
FORUM
Call for Applications:
Transdisciplinary Research for
Pathways to Sustainability



SRI2023 is not over yet! Join us online 10-12 July 2023 for the Asia Spotlight Event

PROGRAM TICKETS

THANK YOU FOR JOINING US!

Sustainability Research + Innovation Congress 2023

SRI 2023

Contact us: sri@futureearth.org

STAY UPDATED

BELMONT FORUM

futureearth

Center for Sustainability Science, Academia Sinica

Research Program of Sustainability Science

1. Energy and Decarbonization Technology
2. Food, Air, and Water Security and Safety
3. Transformation towards Sustainable Society
4. Health and Environmental Changes
5. Earth System under Global Changes
6. Disaster Prevention, Reduction, and Recovery

International Program for Sustainability Science,

1. Future Earth Taipei; 2. Global Secretariat Hub Taipei; 3. IRDR ICoE Taipei; 4. Belmont Forum


CLIMATE
ACTION
NOW!
CLIMATE
ACTION
NOW
HANDS

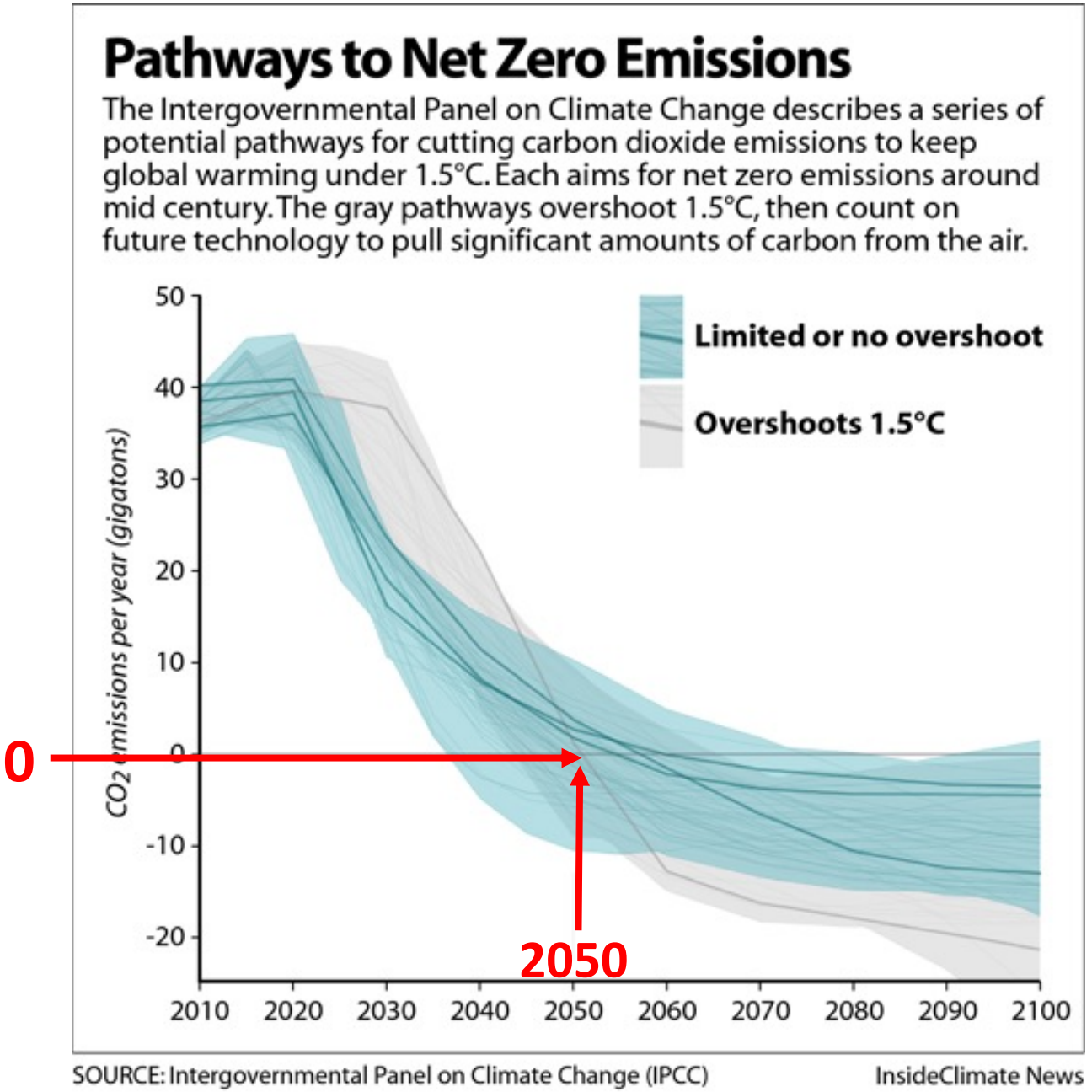

CLIMATE
EMERGENCY

- **What can we do for the climate action?**

- **IPCC have told us to limit the T increase < 1.5 (the pathway of RCP 2.6) ; the action must be relevant with how to make it.**

- **System Transitions towards Net Zero by 2050**

- **IPCC published SR15 in 2018 revealed to limit temperature increase under 1.5 ℃ needs to reach Net Zero emission before 2050**



Four system transitions

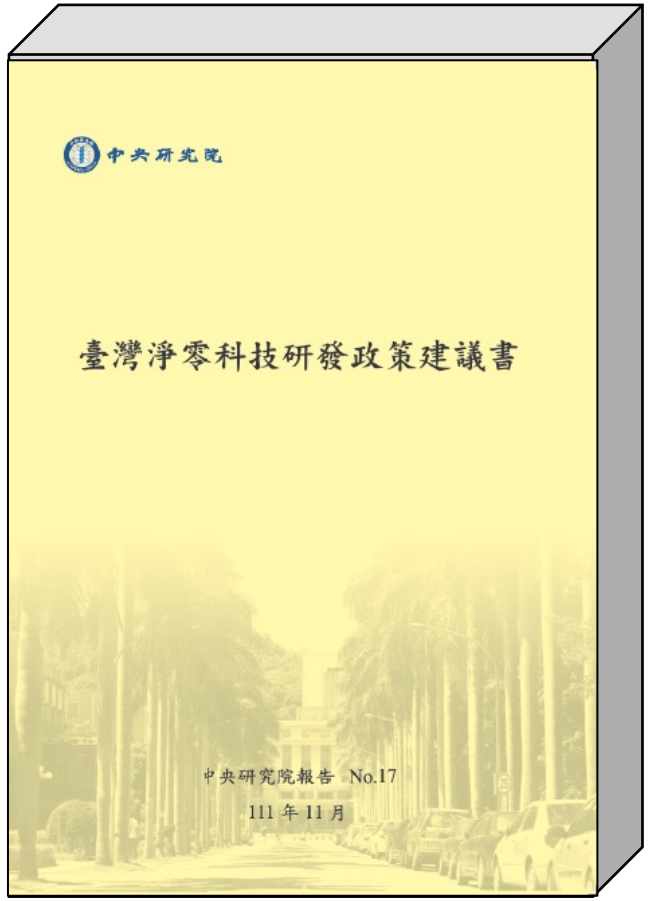
"….. require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems."

Rapid; Far reaching; Unprecedented

Scientists can play key roles for the transition ……..

Strategic Recommendations for Science and Technology Actions towards Net Zero Emission in Taiwan

- 18 committee members
- Over 300 participants
- 7 committee meetings
- 16 expert meetings
- Two-years
- Published on Nov. 30, 2022
- 475 pages



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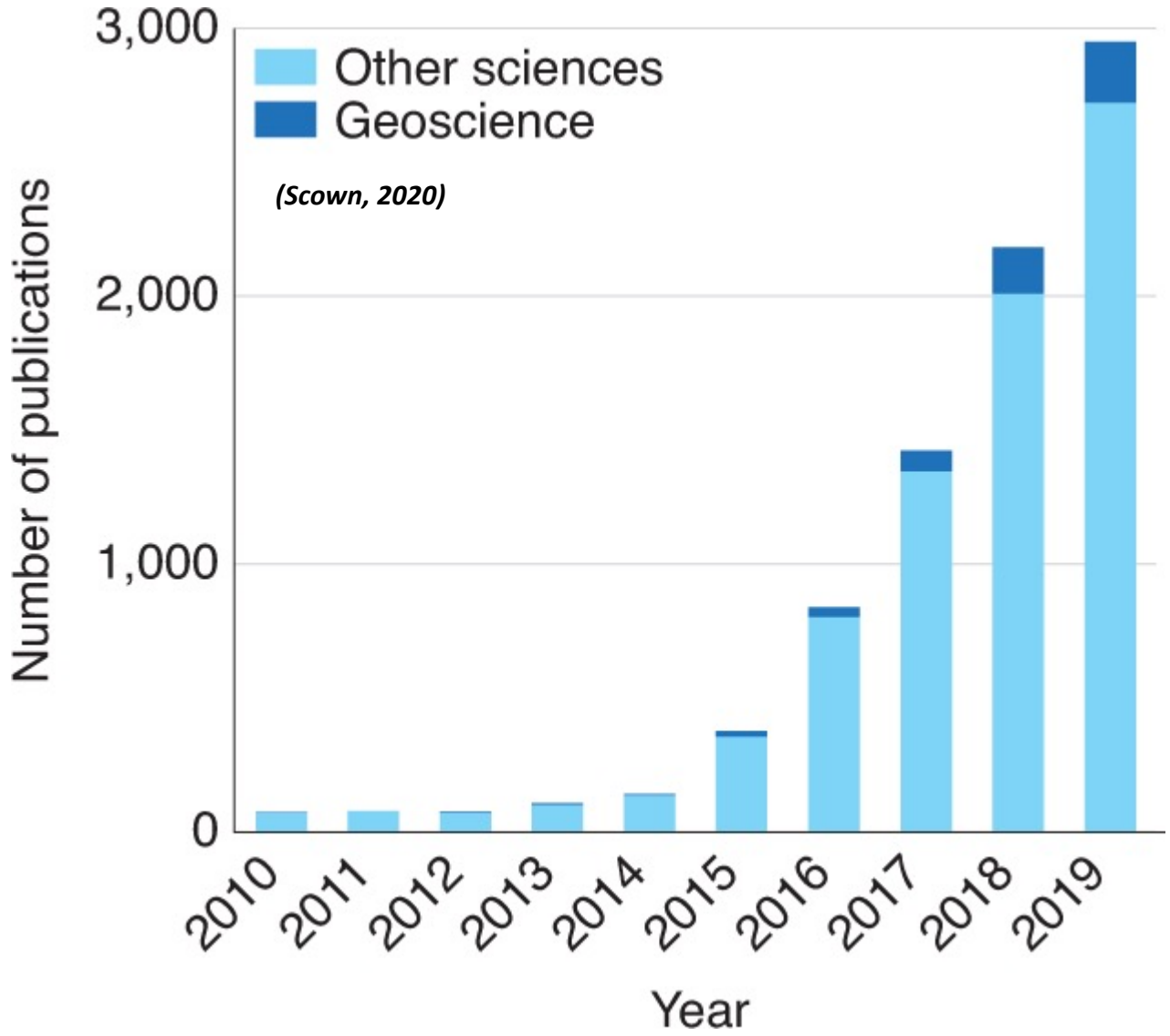
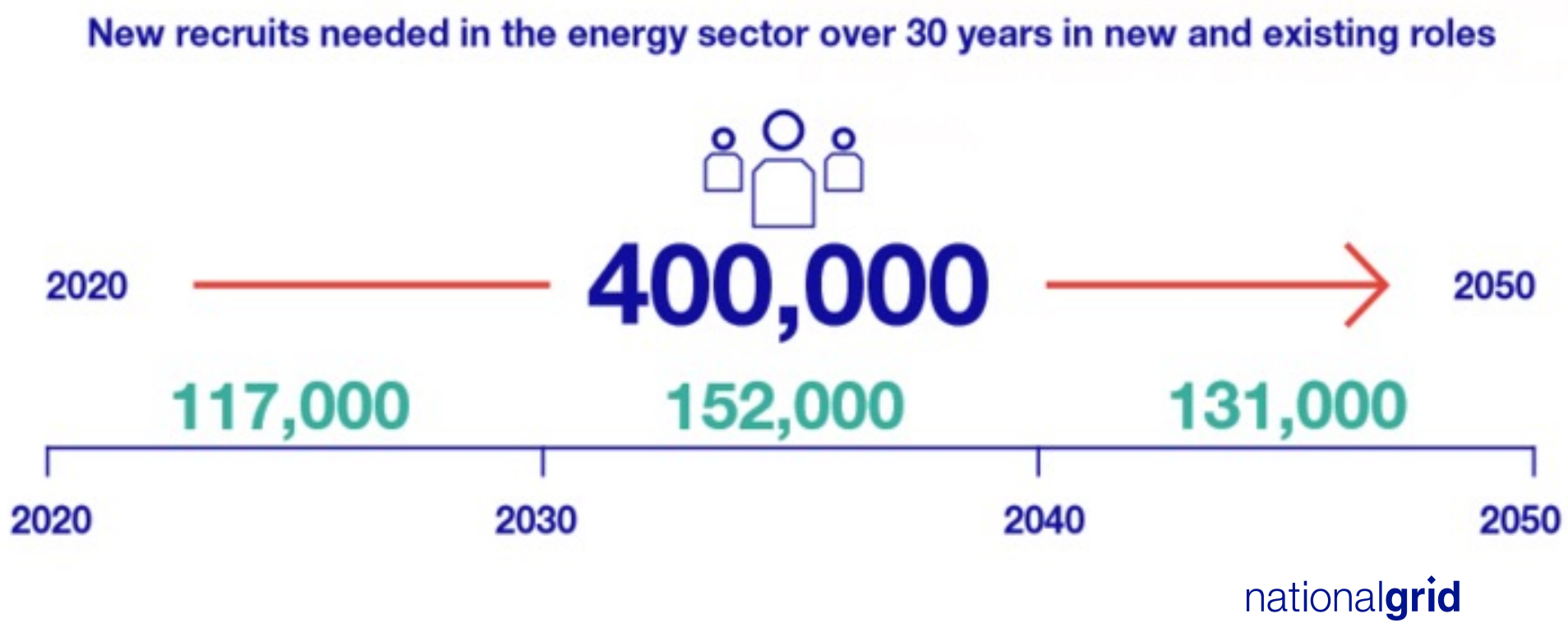


For UK only ……



More opportunities for scientists in coming future !

Thanks a lot for your listening