

The Central Asia Regional Economic Cooperation (CAREC) Technology Forum 2026 (7 April 2026)

Market-Driven Strategies for Climate Technology Commercialization Between CAREC and Korea

: Scaling Innovation through the MCTD Model and Public-Private Partnerships

SONG, Jaeryoung (Ph D)

National Institute of Green Technology



01

**Lessons from Korea's Experience,
Technology Development, and Application**

During the Korean War (1950-1953)

Korea transforms from Recipient to Donor



How Asia Works by Joe Studwell



Every economically successful society has been guilty, in its formative stages, of protectionism

1. Land Reform: Maximization of Agricultural Productivity

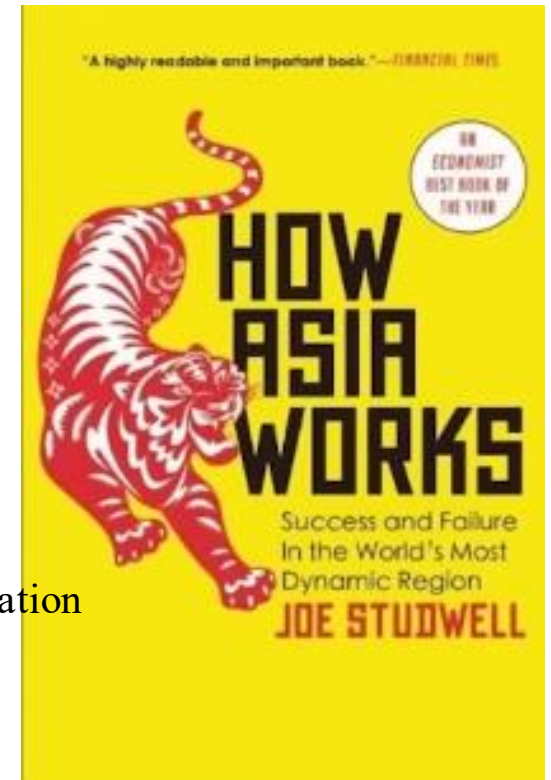
- Normally, two-thirds of the population works in agriculture before industrialization
- Farmland should be distributed fairly and productivity should be maximized
- Rural productivity is a result of land ownership and performance expectations

2. Export Discipline: Fostering export companies in the 2nd industry

- Step-by-step development from primary to secondary industries (ex. India)
- Export-led industrialization is essential, not the domestic market for the domestic market
- Developed countries copied other countries and adopted protectionism in the early stage of industrialization

3. Finance: The Merits of a Short Leash

- Finance must be managed well in accordance with the national policy
- Learn finance from history, not the financial cases of developed countries
- Need to utilize finance for no. 1 and 2.



Why are R&D investment and cooperation important?

Before discussing science and technology and innovation, we should think about R&D.

- R&D can contribute to the development of the **domestic industry and agriculture** (competitiveness and productivity agenda)
- R&D can contribute to addressing **societal challenges like water and energy supply, health, etc.** (social agenda)
- **Catching up** based merely on the acquisition of foreign technology is sub-optimal (Bell and Albu, 1999)
- The two faces of R&D - **not only the generation of new knowledge, but also the absorptive capacity** (Cohen and Levinthal, 1990)
- The interrelationship between R&D investment, **high-level education, and the creation and retention of a scientific community**
- R&D is key to fostering diversification of the economy towards **higher value-added activities**, and this structural change is key to economic prosperity (Hausman and Hidalgo, 2011)

GROWING GREEN

The Environmental Benefits of Public Agricultural Research and Development



Source: <https://thebreakthrough.org/>



Source: <https://doi.org/10.1021/acsnano.9b01730>



Source: <https://rcc.harvard.edu>

Korea's economic growth involved the development and spread of public technology. At the center was the KIST.



▲ 1965년 5월 18일 한미 양국 대통령이 KIST 설립에 관한 공동성명을 발표하고 있다.



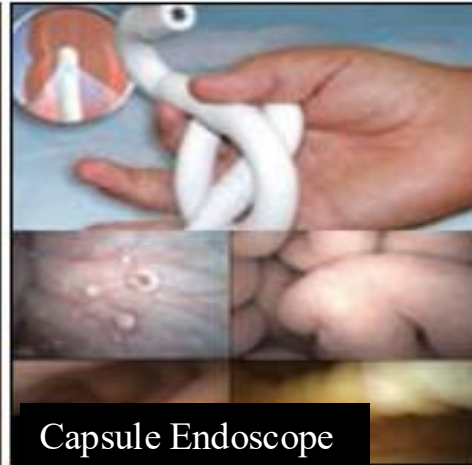
- 1966. 2 KIST is founded
- 1981. 1 KIST and the Korea Advanced Institute of Science (KAIS) combine to form the Korea Advanced Institute of Science and Technology (KAIST)
- 1989. 6 KIST separates from KAIST and is reestablished
- 1996. 2 KIST Europe is established
- 1999. 3 KIST becomes affiliated with the Korea Research Council of Fundamental Science & Technology under the Office of the Prime Minister
- 2003. 5 KIST Gangneung is established
- 2008. 1 KIST Jeonbuk is established
- 2014. 3 Dr. Lee Byung Gwon is appointed president of KIST
- 2017. 7 KIST becomes affiliated with the National Research Council of Science and Technology under the Ministry of Science and ICT



KIST's public technology development has been highly successful in growing the national economy.



Color TV

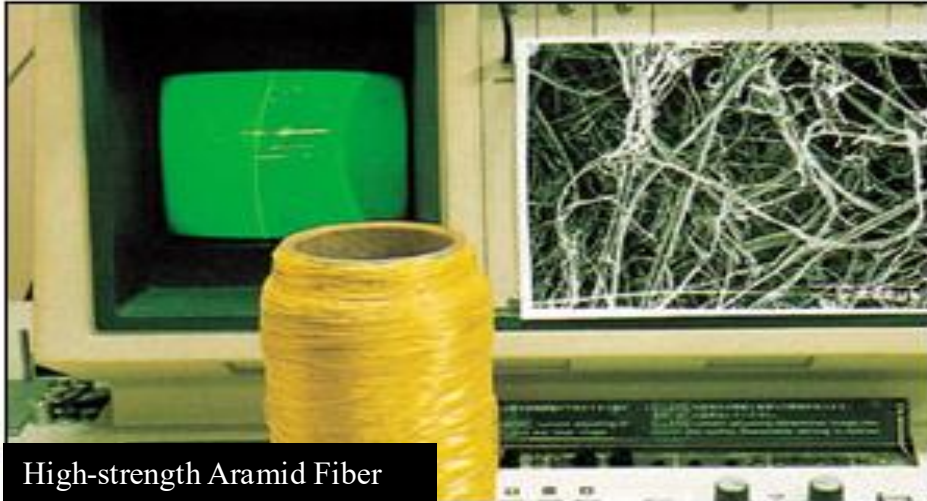


Capsule Endoscope



Establishment of POSCO Steel

KIST's public technology development has been highly successful in growing the national economy.



High-strength Aramid Fiber



Fluorine Compound Manufacturing Process



Polyester Film

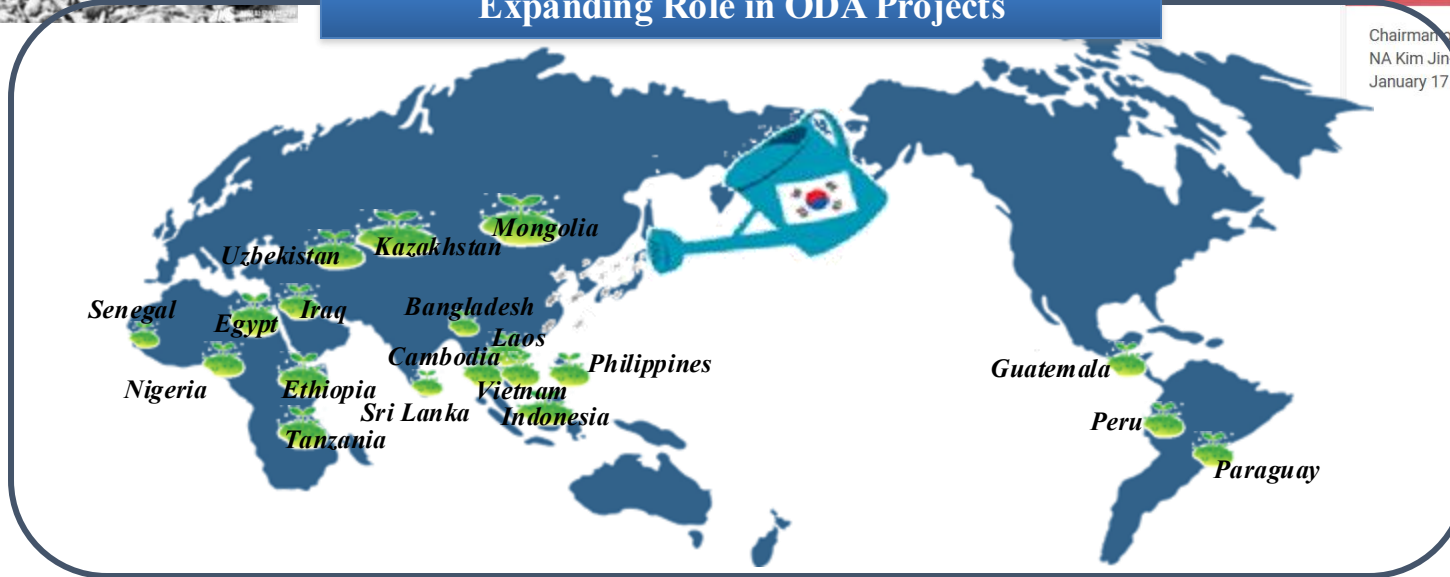


Doping Control

Korea transforms from Recipient to Donor

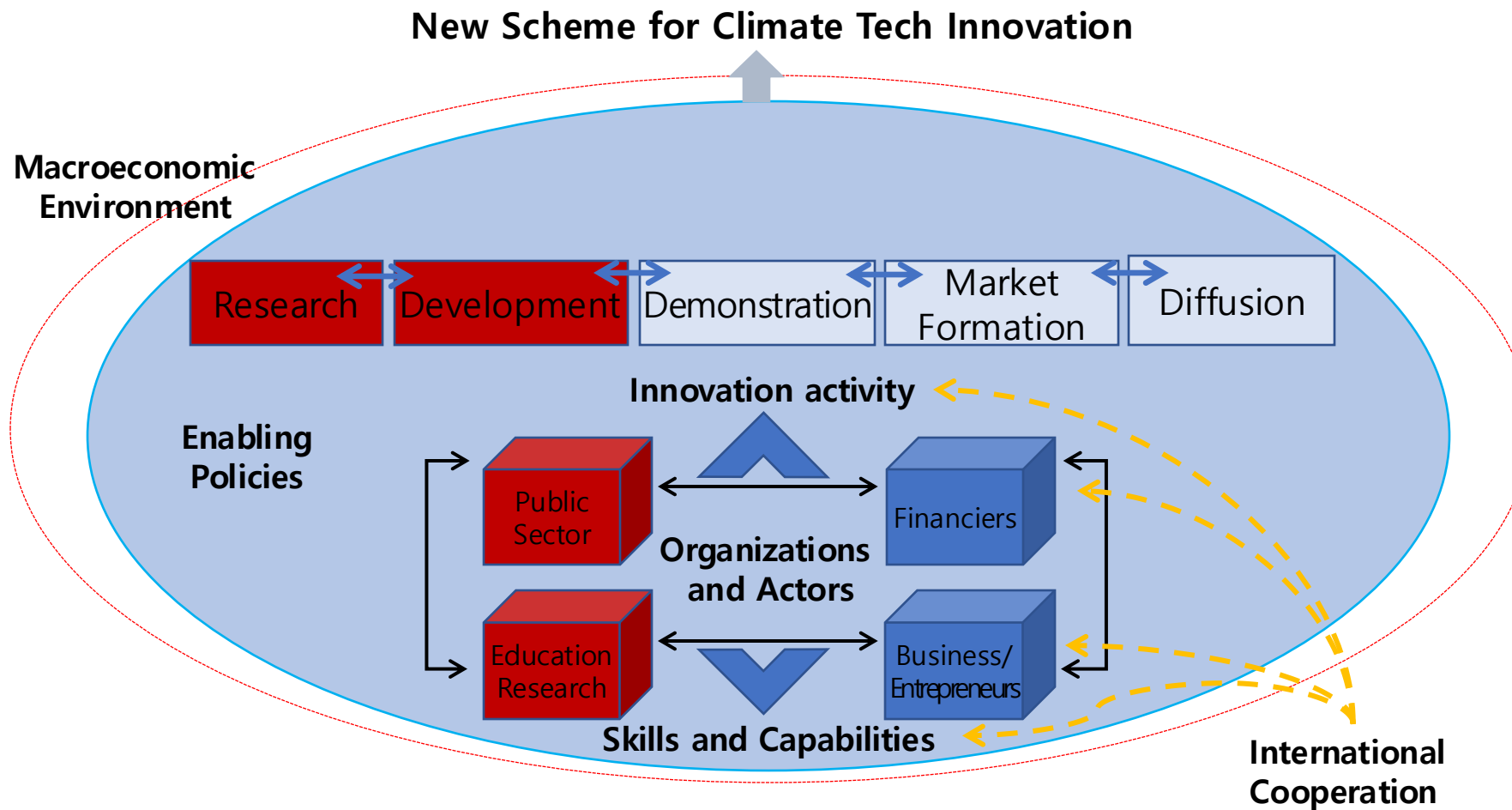


Expanding Role in ODA Projects



Chairman of the Vietnamese NA Vuong Dinh Hue (fourth from right), Speaker of the RoK's NA Kim Jin-wo (fifth from right) and other officials at the VKIST inauguration ceremony on January 17 (photo: VNA)

Climate Technology R&D is a Main Key for Green Growth and Net-zero

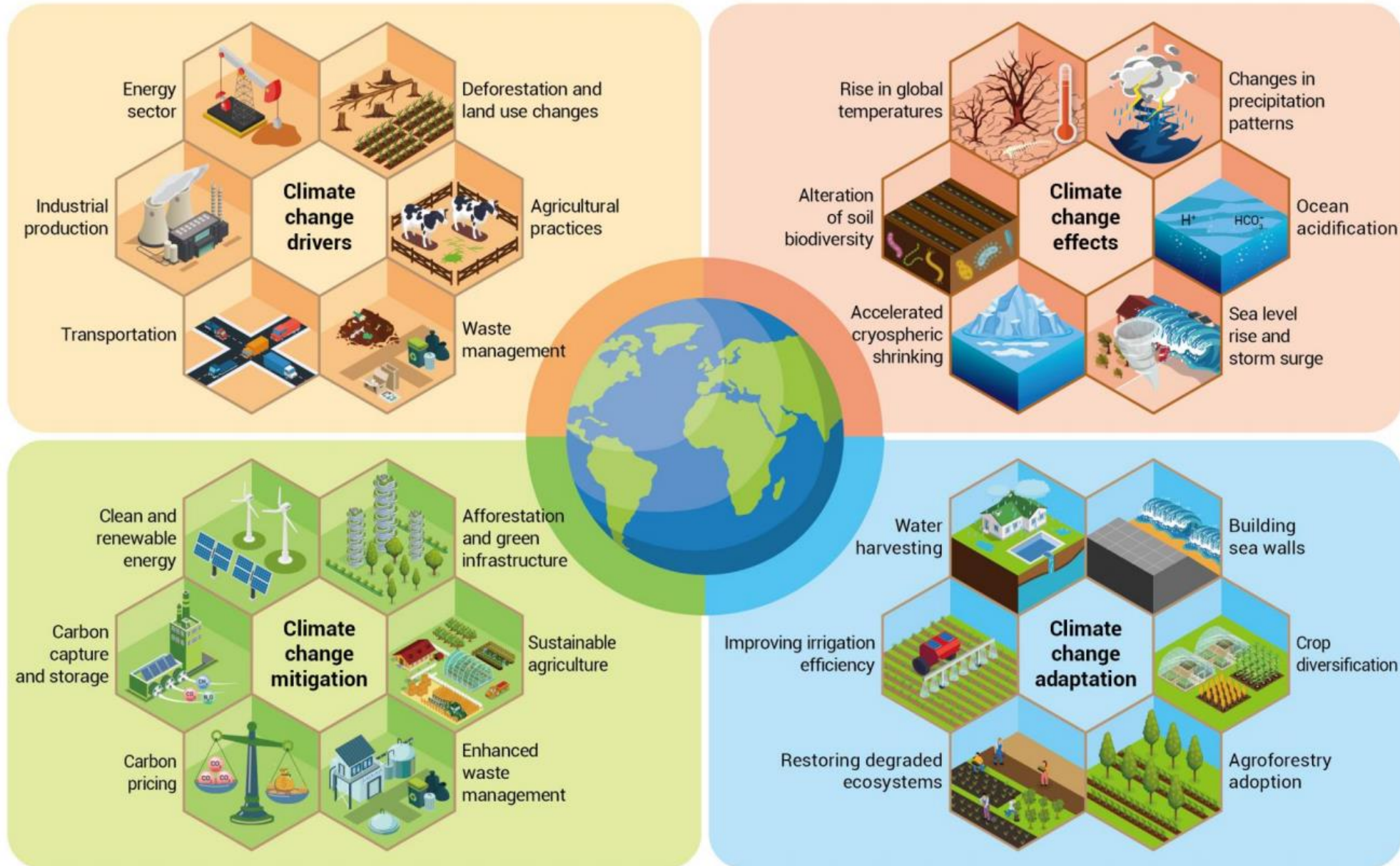


Source: modified from U.N. World Economic and Social Survey, 2011

02

**Korea's Public Technologies:
Lessons and Implications**

R&D for Climate Change and Global Warming



The Korean National Public Ecosystem for Tech Transfer and Commercialization



Ministry of Science and ICT

The **Ministry of Science and ICT (MSIT)** is the central government authority responsible for **formulating national science and technology policies**, coordinating and evaluating R&D programs, and **supporting technology development and commercialization through collaboration among academia, industry, and research institutes.**



nst National Research Council of Science & Technology

The **National Research Council of Science and Technology (NST)**, under the **Ministry of Science and ICT (MSIT)**, operates the **Joint TLO Marketing Office** to support industrial development through technology marketing of government-funded research institutes, while facilitating **technology transfer and joint research with domestic and international enterprises.**

Government-Funded Research Institutes
(23 research institutes in science and fields)



23 R&D institutes in Climate, environment, and energy technologies



Joint TLO Marketing Office

Providers in NST enabling the commercialization of technologies

Private Companies **International Partners**

- ✓ Addressing technological challenges
- ✓ Supporting Entry into New Business Opportunities
- ✓ Providing IP-based Financing and linkage with RD&D Programs

Demand-driven technology solutions for partners

Joint support

Excavation and matching of technology demand

- Excavation of private and public demand
- Matching of demand-supply technology
- Discovery of overseas demand



Domestic and international joint marketing

- Online/Offline technical briefing sessions, consultation conferences



- Introduction of government-funded research institutes' excellent technologies

- Introduction of small amount and free technology

- Support for technology transfer negotiation

- Operation of online platform

- Consultation meeting with invited overseas buyers

Convergence · packaging technology

- Similar industry packaging
- Product · component packaging



Technical support required by the companies



- Discovering and connecting promising technologies tailored to the company

Negotiating and signing contracts



- Technology valuation
- Technology license agreement, negotiation

Support for government project linkage



- Support for R&D, R&BD project linkage
- Joint research linkage support

Other supports



- Technology utilization status check
- Support for the joint use of research equipment

Support for government-funded research institutes

Planning and operation of support programs tailored to government-funded research institutes

- Overseas technology marketing
- Production of technology introduction material
- Professional legal review
- Simple technology valuation, etc.

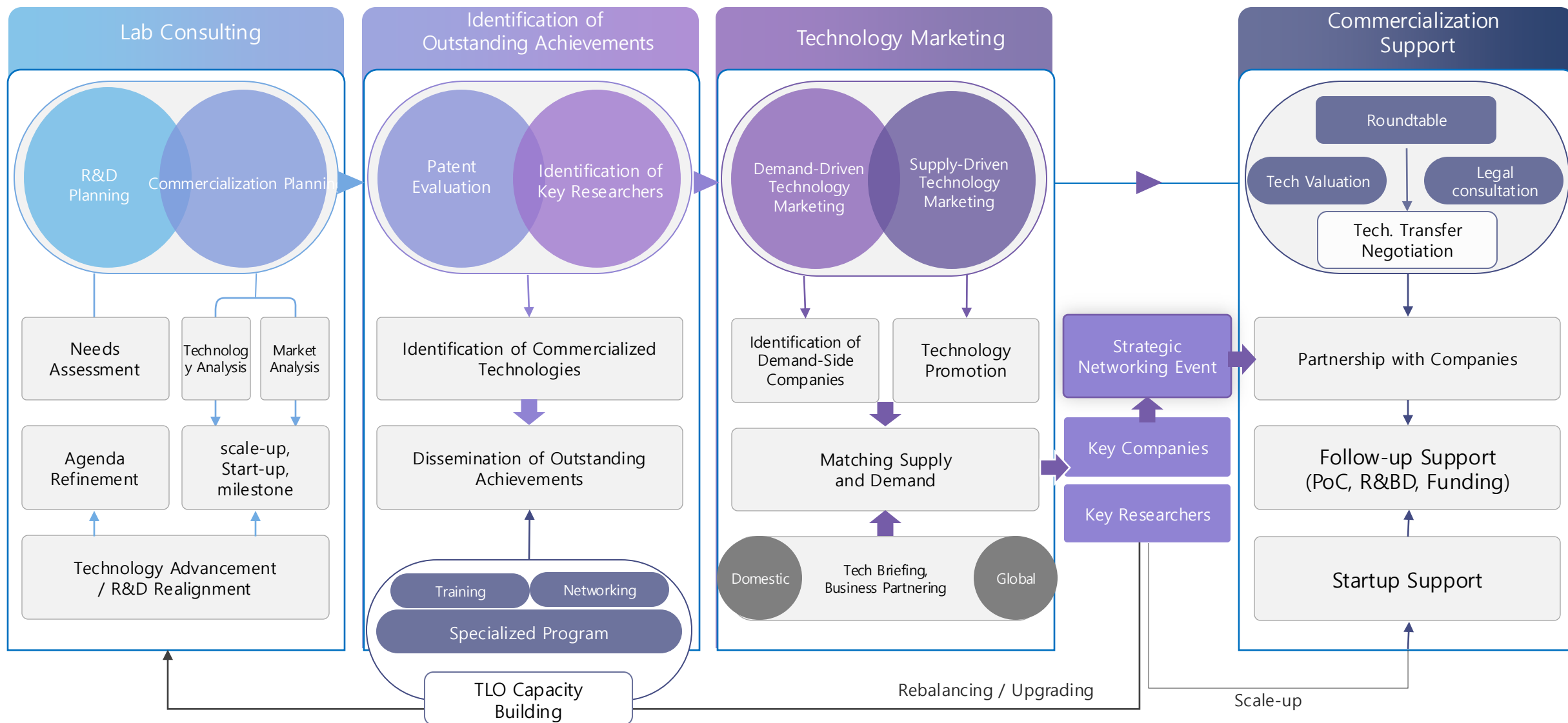
TLO networking

- Networking, exchange meetings, etc.
- Newsletter, booklet publication

Support for researcher startups

- Consulting for the vitalization of researcher startups

NST's Tech. Commercialization Process



Korean GRIs' Integrated Approach to Skills, Systems, and Infrastructure



code division multiple access, CDMA

ETRI's CDMA mobile communication technology development is a leading example of how national strategic technology development fostered an industrial ecosystem



Induced industrial output of over USD 80 billion



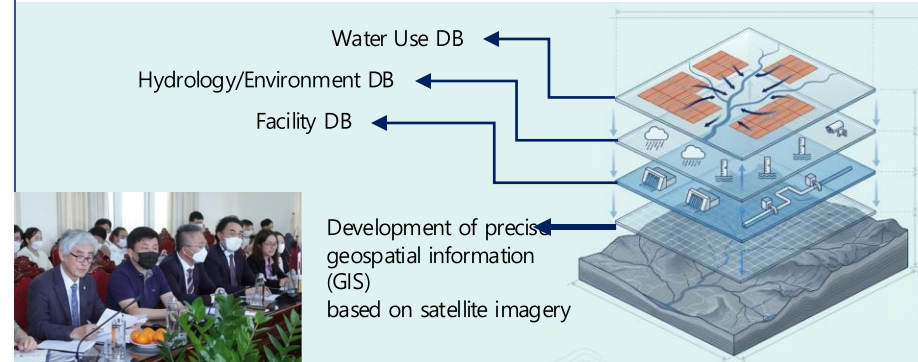
Created more than 500,000 jobs

Development of CDMA digital mobile communication technology and the world's **first commercialization**



Ma River water management digitalization

A case of digitizing local water management with Korean public technology while strengthening local institutional, operational, and research capacity



Establishment of a data-driven decision-making (DSS) system based on GIS-DB integration



USD 9 million in project funding

Contributed to improving livelihoods and productivity by **addressing chronic water issues**

Korean GRIs' Integrated Approach to Skills, Systems, and Infrastructure



Waste recycling technology self-reliance

In collaboration with Hanoi University of Science and Technology (HUST), established a foundation for Vietnam to independently research waste recycling technologies

Institute Establishment

Securing a physical and institutional hub for research activities and a sustainable infrastructure

Advanced Equipment

Building essential hardware infrastructure to enable independent research and demonstration

Expert Training

Fostering key talent through a short training course on policy development and invited training programs by KIGAM

Joint Research

Practical technology transfer and know-how internalization through joint research with KIGAM experts



Established a foundation for self-reliant technology research



Secured 14 specialists through training

Independent **waste recycling technology** development capability



Measurement standards-based capacity building

Strengthening national measurement standards capacity and industrial quality infrastructure for Costa Rica's National Measurement Standards Institute (LCM)

Measurement Field

Description & Industrial Impact (Compressed)

Mass & Pressure

Foundation for basic measurement reliability in industrial processes

Length

Ultra-precision standards for manufacturing and components

Temperature

Thermal quality control for food, medical, and chemical sectors

Acoustics & Vibration

Basis for noise monitoring and structural safety assessment

Gas Analysis

Advanced chemical standards for environmental and greenhouse gas monitoring



Advanced measurement equipment support (18 types)



Technical training in five core measurement areas

Strengthening operational capacity and **technology internalization**

03

**Private Sector-Led Climate & Energy
Solutions from Korea**

Korean Climate Technology Portfolio

Human Knowledge



ODA

Joint R&D



R&D Strategy Report



R&D Knowledge Hub

Water Environment



Membrane Filtration



Water Treatment & Re-use



Power Plant DeSOx



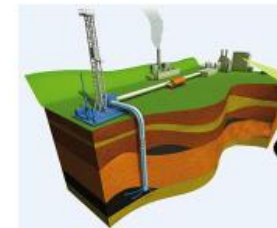
Waste Management

Energy Economy



Green Car

Renewables



CCUS



High Efficiency Ultra-Clean PowerGen




FINEX : Innovative Steel Making

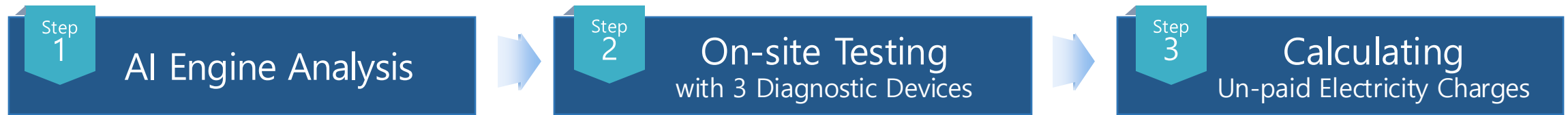
KSTAR Fusion Reactor



KEPCO's Reduce Power Loss

Power Loss	Technical Loss	Non-technical Losses	
Cause	Heat Dissipation ($P_{loss} = 3I^2RL\cos\theta$)	Pilferage	Metering Error
Solution	Costly & long-term	Practically Impossible And needs national-level Economic growth	 LossPro The most cost-effective Tackling the metering error is the most effective solution

LossPro (AI based Metering System(Meter & CT/PT) Fault Detector)



LossPro Benefits (Protect revenue by pinpointing sources of loss before they expand)

- 1 Targeted Diagnostics**
 (From 100% → less than 1%)
- 2 Dramatic Time Reduction**
 (From 5 hours → under 10 minutes)
- 3 Enhanced Safety**
 (No high-voltage work required)
- 4 Revenue Protection**
 (Prevention of under-billing)



Carbon-Free Agrivoltaic WEF Nexus — Aligned with CAREC Energy Strategy 2030

WHO WE ARE

ENVELOPS Co., Ltd. — Seoul-based climate infrastructure developer. We design & deploy **Agrivoltaic (APV) Nexus** projects: integrated Water-Energy-Food solutions co-optimizing solar generation, smart agriculture, and rural livelihoods across developing regions.

5 MWp+
APV Track Record
across the World

WEF Nexus
Water-Energy-
Food Integrated
Model

AI Solution
AI-Based Smart
Agrivoltaic Climate
Tech

CAREC 2030 ALIGNMENT

- ▶ **Renewable Energy Transition**
Solar-agriculture co-development for CAREC's \$136–339B energy investment needs
- ▶ **Green Growth & Carbon Reduction**
10,200+ tCO₂e/yr offset via ITMO-eligible carbon credits
- ▶ **Regional Connectivity**
Replicable APV Nexus model across Uzbekistan, Kazakhstan, Kyrgyzstan

POTENTIAL PROJECT IN CENTRAL ASIA Uzbekistan 10MWp Carbon-Free Cotton APV Nexus

\$21.7M
Total Investment

10 MWp
Bifacial APV (4.5m)

66,000 m²
Smart Farm (2 Units)

121 t/yr
Premium Cotton Yield

VALUE CHAIN

Raw Cotton \$2-3/kg → **RE100 Yarn** (10-20× value-add)

IMPACT

285 Jobs (45% women)

10,200 tCO₂e/yr

67% Water Save

Finance: Equity 25% + DFI 59% + ITMO Grant 16%

Potential Off-takers: LVMH · Kering · Hermès Partners: TSAU · Maison de Dodo

Phase 0 F/S (2026) → Phase 1 Pilot (2027) → Phase 1 Full Build (2028) → Phase 2 Scale-up (2029-30)

What

Integrated AI Digital Twin Platform 'OCTOPUS'

Covering the entire lifecycle — from industrial data collection, analysis, integration, monitoring, 3D visualization, simulation, AI inference, to predictive maintenance — all realized in a single AI integrated platform for Autonomous Manufacturing.

How

OCTOPUS 8 Solutions (Autonomous Cycle System)

8 solutions — Edge → Data Hub → Twin → Simulator → AI Hub → Agentic AI → Physical AI → Robot Hub — are organically interconnected, driving a fully autonomous cycle: Collect → Integrate → Visualize → Simulate → Learn → Predict → Control → Collaborate

Outcome

Autonomous Manufacturing + Competitiveness

Through process optimization, productivity improvement, and AI-driven autonomous decision-making — covering every stage of autonomous manufacturing, from On-Premise deployment to SaaS-based subscription platform.

① Data Collect & Integrate

OCTOPUS Edge + Data Hub

- Multi-Vendor Equipment & Robot Communication Standardization
- Real-Time Data Collection & Processing
- Data Lake · ETL
- Ontology · Customizable Dashboard

② Visualize & Simulate

OCTOPUS Twin + Simulator

- Real-Time 3D Monitoring & Control
- Playback Historical Analysis
- What-if Simulation
- AI-Based Bottleneck Analysis & Optimization

③ Learn & Predict

OCTOPUS AI Hub + Agentic AI

- No-Code AI Model Generation
- Automated AI Training Optimization
- Context-Aware Knowledge Integration
- Autonomous Decision-Making & Optimal Action Execution

④ Control & Collaborate

Physical AI + Robot Hub

- World Foundation Model-Based Synthetic Data Generation
- RL-Based Precision Robot Control
- Multi-Vendor Robot Control
- Task Scheduling & Coordination



Listed on KONEX

2024-Dec
(A495810)



GS Certification
Grade1

Achieved the highest grade
Software Quality Certification



OPC UA

Achieved 3 certification
and first commercialization



Holds Certification

6 Certification
related to Digital Twin

Clients

- Global Automaker H Co.
- Global Secondary Battery S Co.
- Shipbuilding & Marine S Co.
- National Power Grid Operator K Co. and more ...

Shipbuilding

Automotive

Secondary
Battery

Aviation
Logistics

Energy

🎯 What: Digital MRV + Evidence Automation

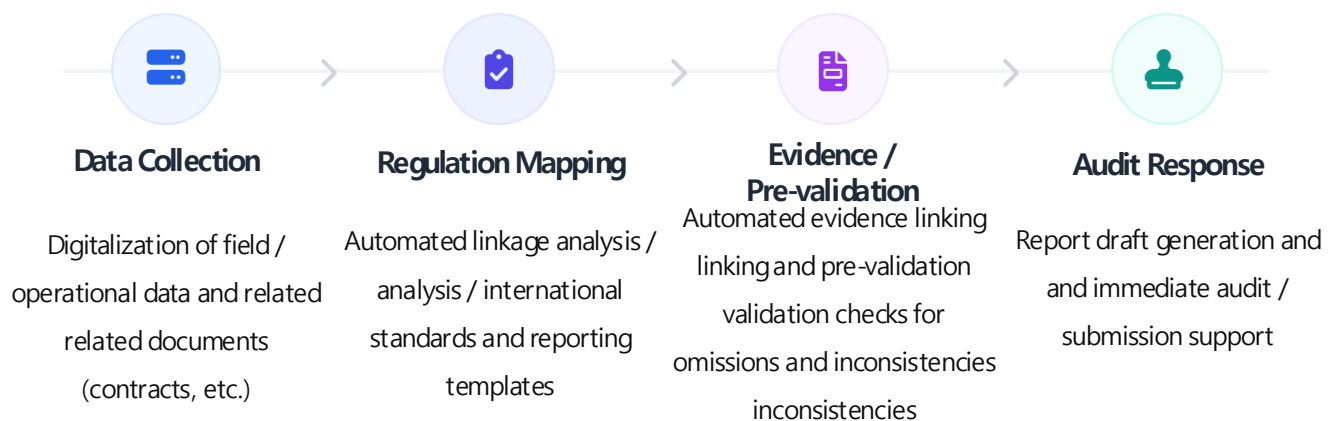
Digitalize the entire process from Measurement, Reporting to Verification of environmental & energy data in public projects to ensure transparency.

⚙️ How: Integrated Workflow Orchestration

AIRUN Harmonize multi-model AI integrates data, documents, regulations, and evidence into a single workflow to ensure audit traceability.

📈 Outcome: Public Administration Efficiency

Enhances project reporting quality, reduces administrative burden, and strengthens compliance with international audit and verification standards.



Potential Application Areas

💧 Water Security & WASH

- ✓ **Water Resources & Irrigation:** Structure operational data (flow, levels) into verifiable reports for efficient resource management.
- ✓ **WASH Infrastructure:** Monitor service delivery metrics and link evidence trails for sanitation projects.

⚡ Energy Infrastructure

- ✓ **Grid & Assets:** Connect operational records with maintenance logs and reporting templates for grid modernization.
- ✓ **Renewables Integration:** Automated pre-validation checks for renewable energy generation data and carbon reduction claims.

INFOSQUARE

Founded 2020

HQ: Ulsan, Republic of Korea

On-premise / Local-first

10+ PoC Projects Completed

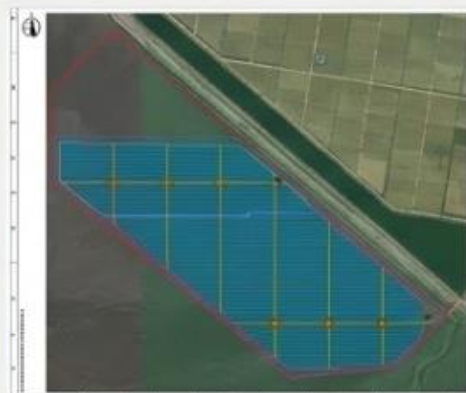
Up to 95% reduction in draft reporting & supporting documentation time (scope-dependent)

Bridging European Market Growth with Proven Korean Implementation Models

ADVANCED SOLAR PV PROJECT CAPABILITIES: FROM CONCEPT TO INNOVATIVE PILOT PROJECTS

1. INTELLIGENT SITE DESIGN & MODULE OPTIMIZATION

FIXED-TYPE STRUCTURE (고정형 구조)



MAXIMIZING EFFICIENCY: PROVEN MODULE LAYOUT (모듈 배치 예시도)

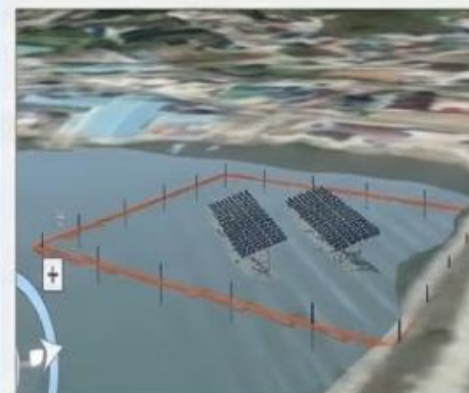
- Data-Driven Site Design
- Efficient Land Use with Fixed Structures
- Regulatory Compliance & Mapping



SITE SELECTION & BOUNDARY ANALYSIS (부지 선정 및 경계 분석)

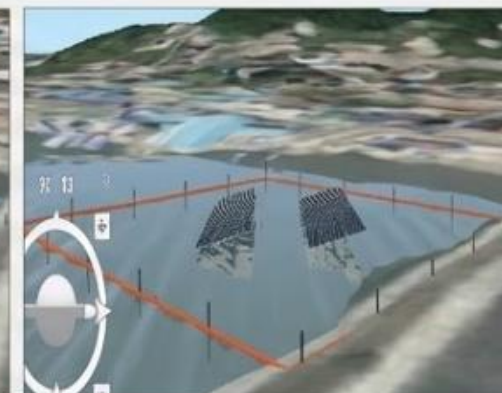
2. INNOVATIVE 3D PILOT PROJECT VALIDATION

WATER-SURFACE SOLAR PV (수면 태양광 파일럿)



EORANJIN-HANG WATER-SURFACE PILOT (어란진항 수면 위 파일럿)

- Validating Innovative Floating Systems
- Environmental Impact Assessment
- Performance Monitoring & Reporting



MULTI-ANGLE ANALYSIS (다각도 분석)

ORIGINATED PROFILE & PARTNERSHIPS

ORIGINATED INC. & ORIGINATEDX CO. LTD.

- Full-Cycle Development (Solar PV, Wind, SAF, Hydrogen, Bioenergy)
- Project Structuring & Financing (DEVEX, CAPEX)

EXCLUSIVE KOREAN PARTNER OF GREENVOLT GROUP (KKR OWNED)

STRATEGIC PARTNERS

- Greenvolt Group (Solar PV & BESS Exclusive), EDF, KYGP, TTGS (Wind)
- Renewables Plus, GS Global (Biochar), Infosquare (AI)

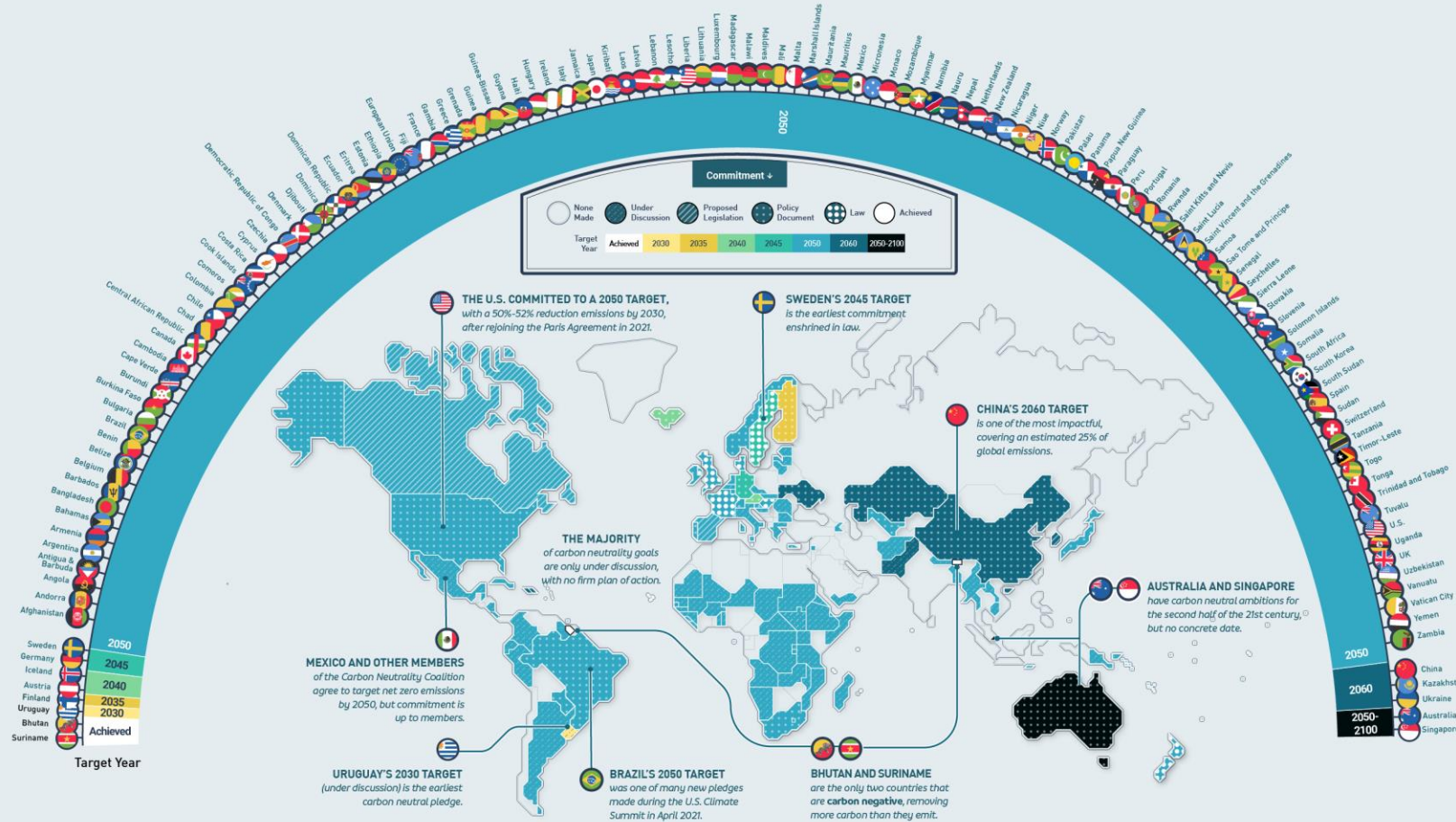
04

**Korean Government in Action:
Enabling Climate Tech Commercialization**



RACE TO NET ZERO CARBON NEUTRAL GOALS BY COUNTRY

Which countries have made a carbon neutral pledge?
This map breaks down pledges by target year and level of commitment.



- The "Race to Net Zero" map shows a spectrum from Uruguay's 2030 goal to China's 2060 target, with most nations aiming for 2050.
- South Korea has set an ambitious **2030 NDC target to reduce greenhouse gas emissions by 40%** compared to 2018 levels. To achieve this goal, the government has allocated 37.5 million tons of CO₂e—**approximately 12.8% of the total reduction target**—to be secured through overseas mitigation projects. This substantial requirement for international credits establishes a critical need for **strategic climate partnerships** between Korea and resource-rich regions like Central Asia.

Presented by

motivepower
ideas, implemented



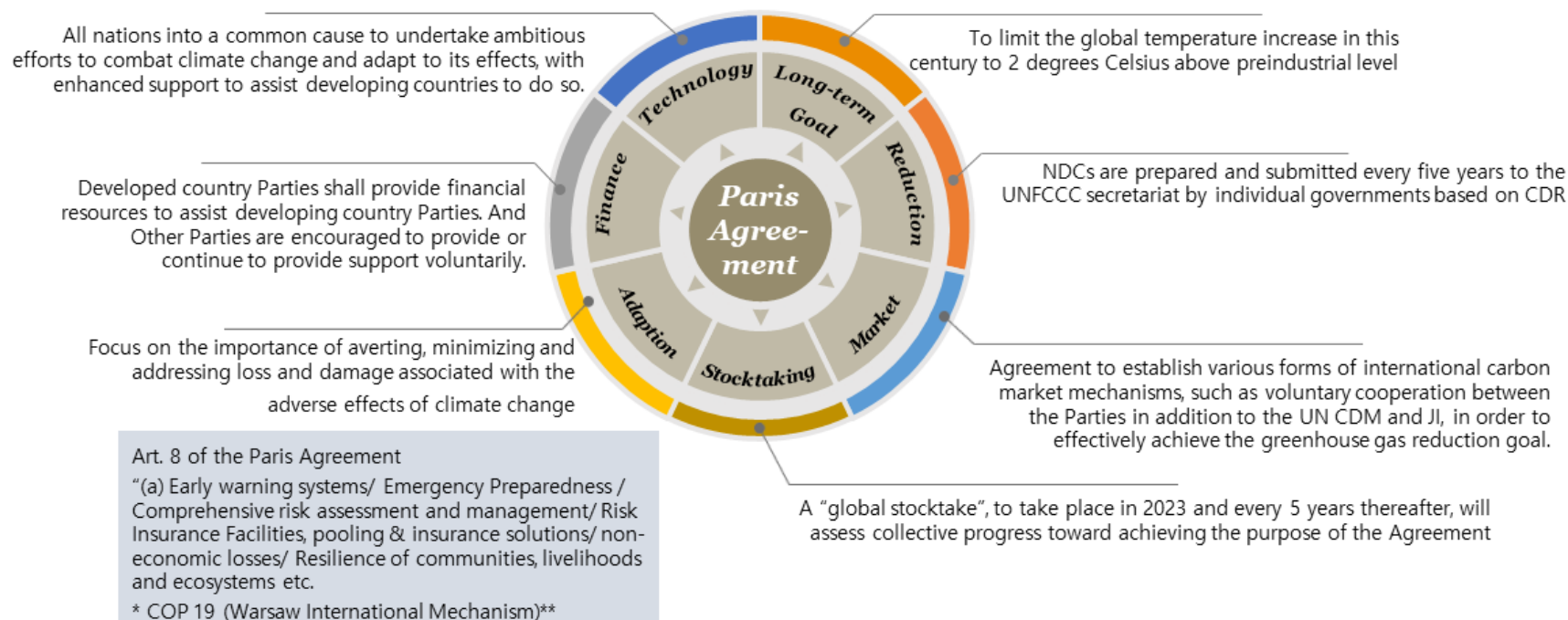
VISUAL CAPITALIST

Facebook, Twitter, LinkedIn, Instagram, YouTube

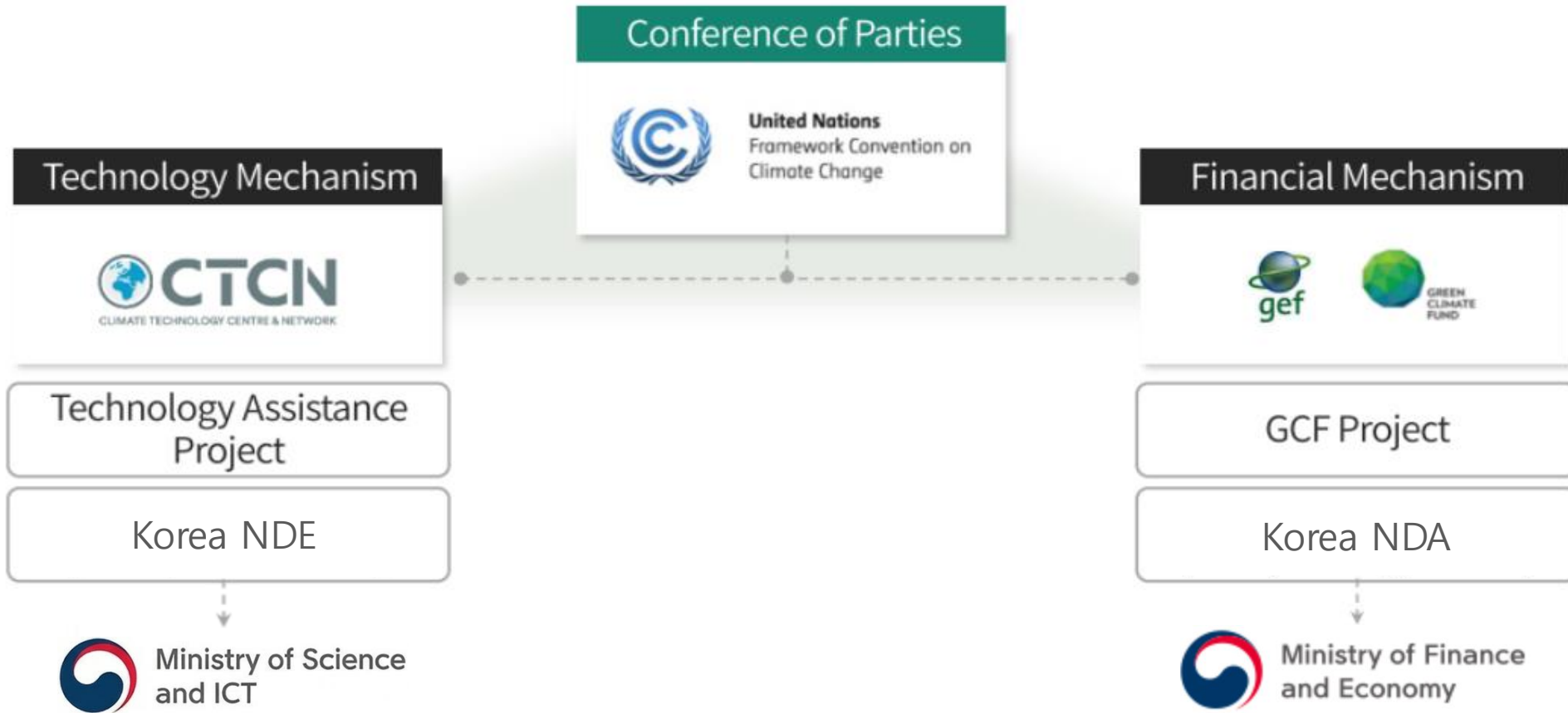
SOURCES: Energy and Climate Intelligence Unit, Carbon Neutrality Coalition, Climate Action Tracker

Technology has been a key in our battle against climate change

- Paris Climate Agreement emphasizes the technology sector as its main content. In particular, the importance of science and technology to actively respond to climate change through **the technology development and transfer of climate change response and the revitalization of international cooperation is emphasized.**
- According to J. Song (2022), addressing the challenge of climate change requires global collaboration based on **full implementation of policy on inter-governments' agenda, openness, mutual solidarity, and cooperation.** Also, he emphasizes that **climate technology R&D can be used as a means of international cooperation in science and technology.**

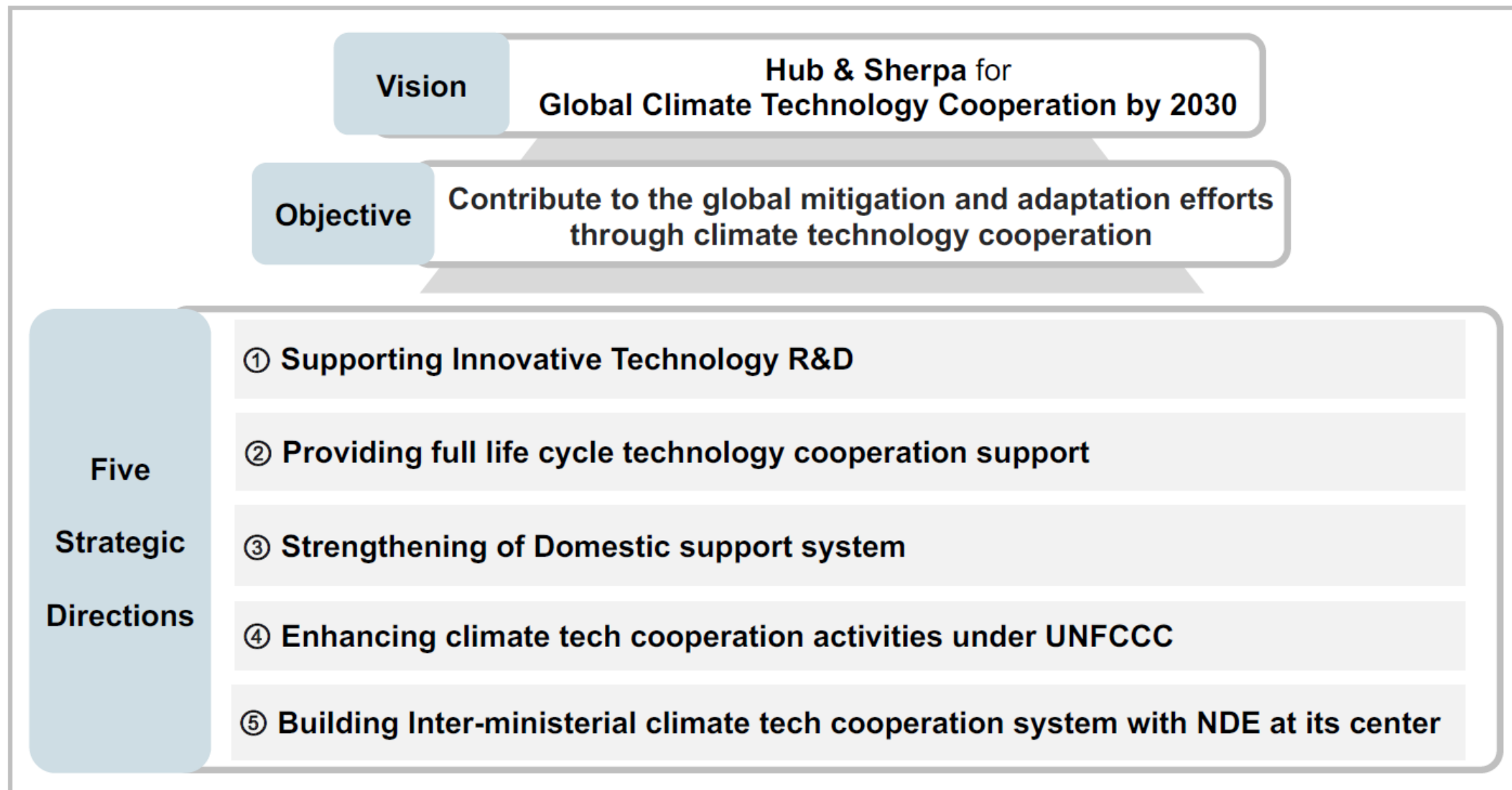


Linking Technology and Finance under the UNFCCC Architecture



Korean NDE's Vision and Way Forward





The Korea NDE facilitates climate technology cooperation in three areas.

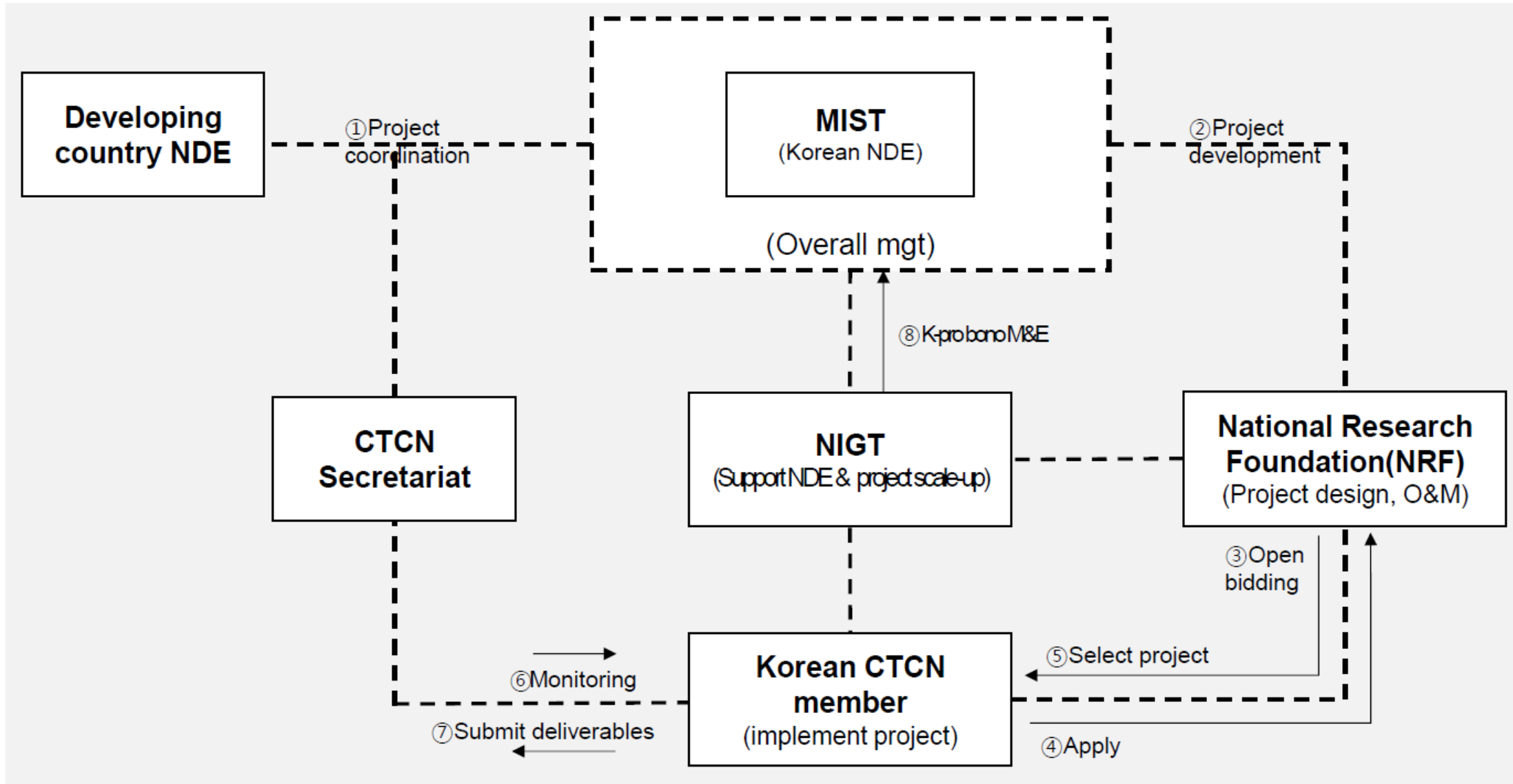


Actions

- (Domestic) Korean CTN member committee
- (International) Cooperation Activities with CTCN and NDEs

- CTCN TAs
- CTCN Pro bono Contributions

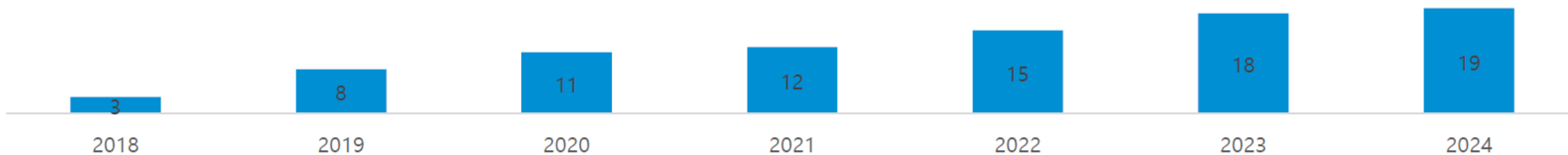
MSIT's R&D program for CTCN pro bono support



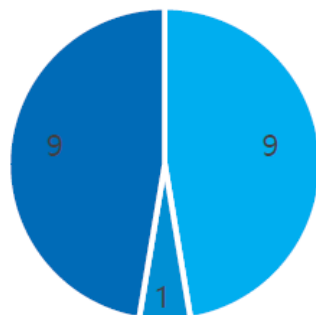
K-Pro bono and how it all started

- Korea started its first pro bono support in 2018
- Since then, 19 K-pro bono TAs (approximately 3.31 Billion KRW) were supported,
- Support budget came from both the Korean NDE(Ministry of Science and ICT) and the Korean CTC Network Members

TAs Provided(accumulated)

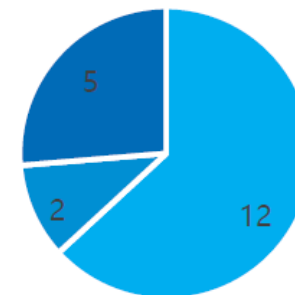


TAs provided by region



■ Africa ■ Europe ■ Asia

TAs provided by objective



■ Mitigation ■ Adaptation and Mitigation ■ Adaptation

Federal Democratic Republic of Ethiopia



Financing Strategy for Transit Oriented Development

- Devise an effective funding strategy for the realization of the pilot TOD investment in Ethiopia

Democratic Socialist Republic of Sri Lanka



Development of Framework for climate-smart City

- Formulate a Climate-smart city framework for the City of Kurunegala

Republic of Serbia



Incorporating renewable and waste heat technologies to District Heating

- Identify potential projects of renewable and/or waste heat supply to the City's district heating network.

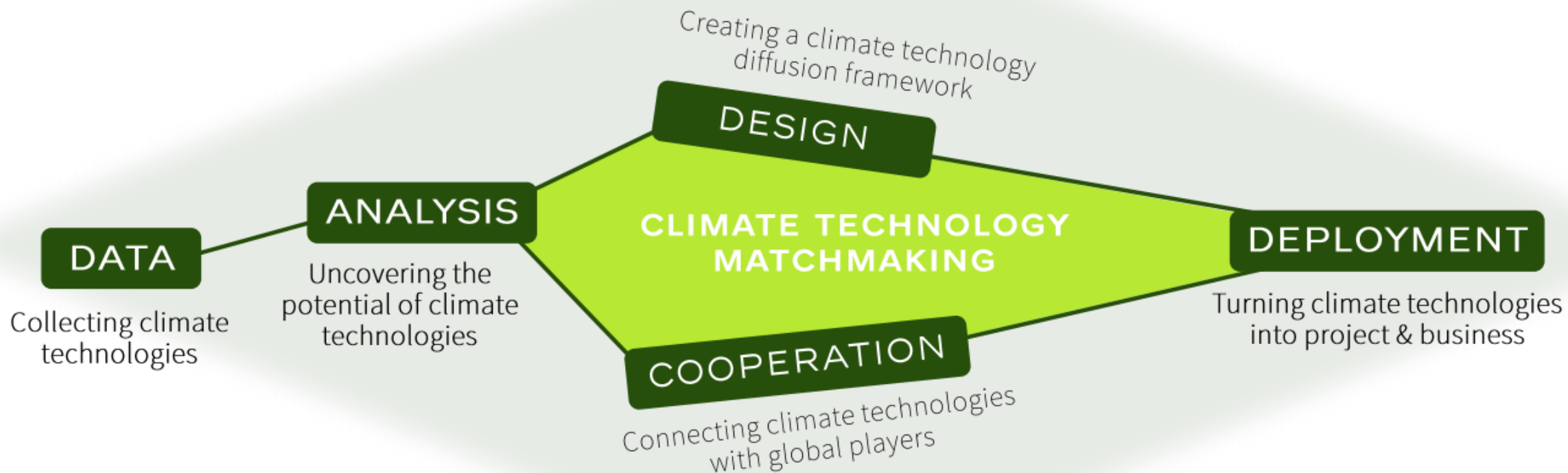


- Provide support to partner countries in response to their technology needs
- Motivate the participation of climate technology stakeholders in the country

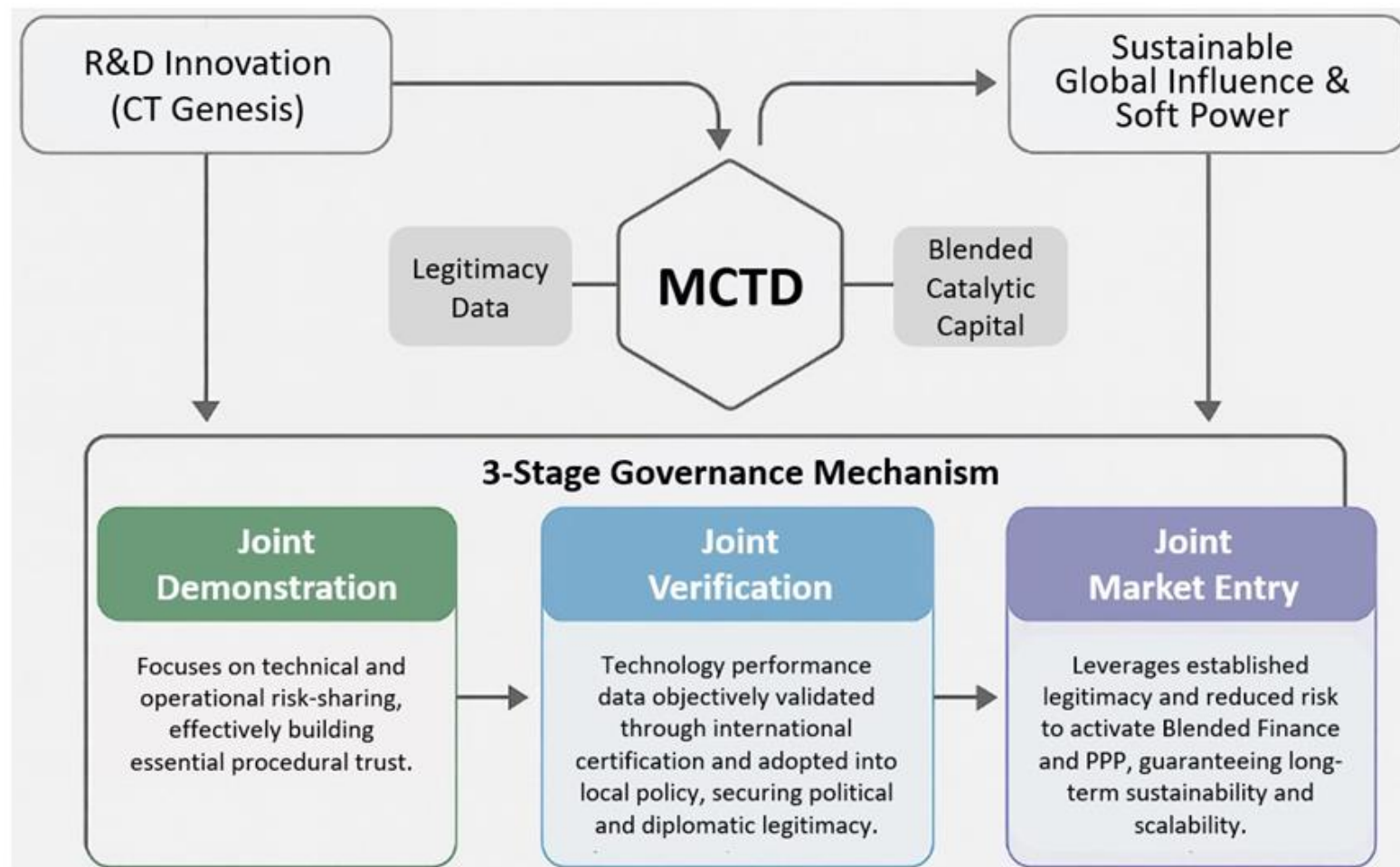
05

**Conclusion:
Bridging the Implementation Gap**

A Simple Model for International Deployment



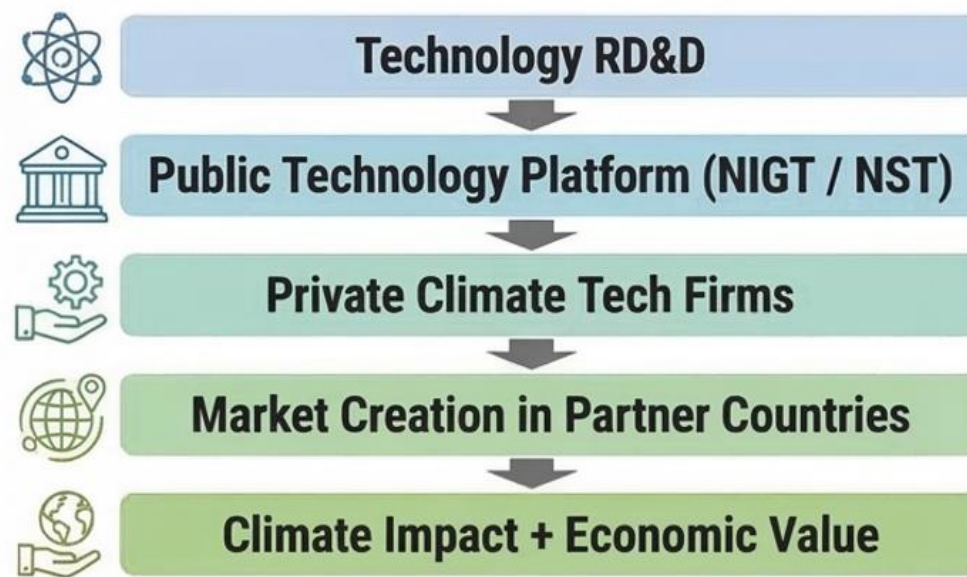
Market-Driven Climate Technology Diplomacy (MCTD) Model



Note: This figure illustrates how climate technologies originate from R&D (Source) and are transformed into diplomatic assets (Process) through a three-stage pathway—Joint Demonstration, Joint Certification, and Joint Market Entry—enabled by legitimacy data and blended catalytic capital, and ultimately generate sustainable global influence and Soft Power (Outcome).

MCTD Model as a Commercialization Pathway

Moving from Technology Supply to Market-Driven Deployment

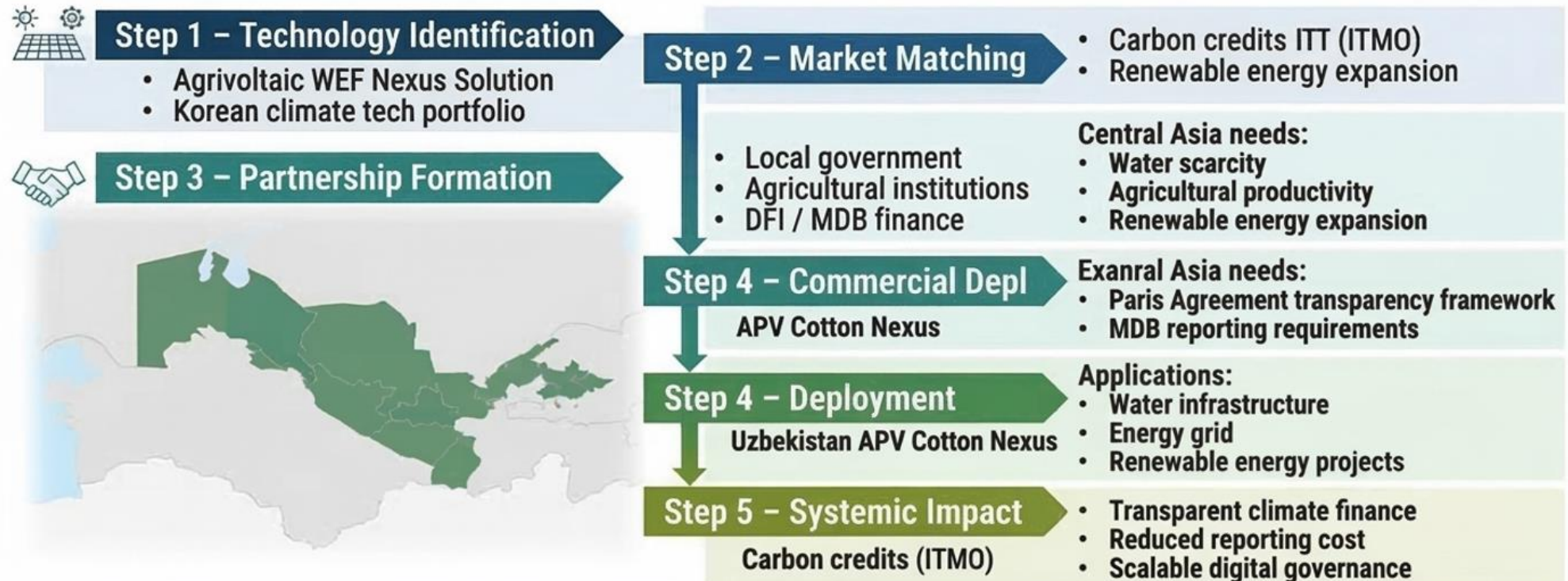


Climate Technology Diplomacy must integrate:
public R&D, private entrepreneurship, and international partnerships

MCTD enables climate technologies to move from laboratory to international markets.

Case 1: Agrivoltaics Deployment Pathway (ENVELOPS)

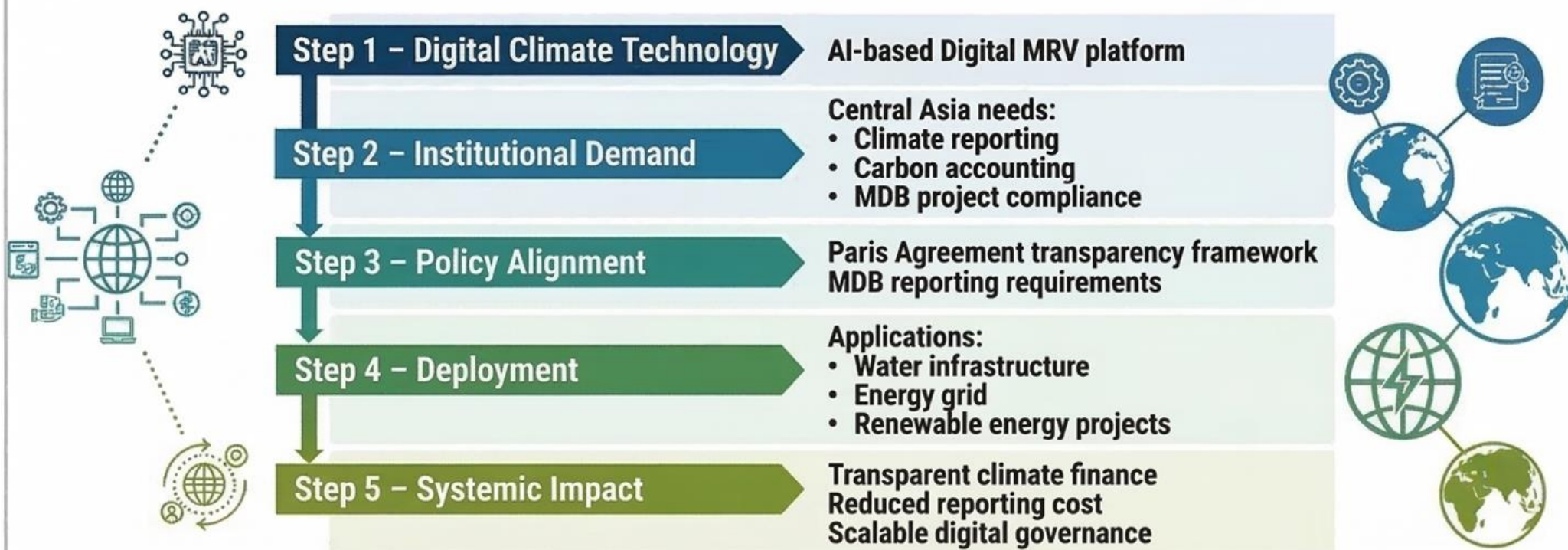
Integrated WEF Nexus Solution for Central Asia



Agrivoltaics demonstrates how Korean climate technology can create integrated WEF nexus solutions in Central Asia.

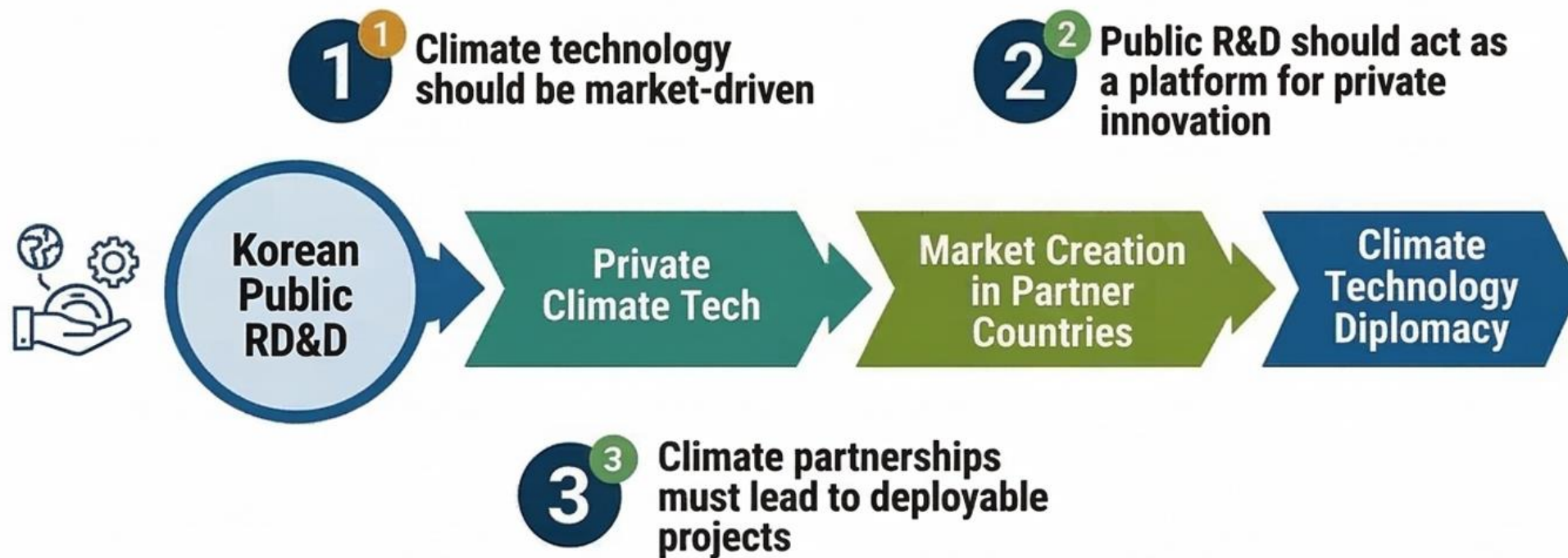
Case 2: Digital MRV Deployment Pathway (INFOSQUARE)

Building Digital Climate Infrastructure



Digital MRV enables trust, transparency, and scalable climate investment.

From Technology Transfer to Market Creation



The MCTD model provides a pathway for scaling Korean climate technologies across CAREC economies.

- **'If you want to go fast, go alone. If you want to go far, go together.'** Carbon neutrality is a long way. Even if a country reaches carbon neutrality, it doesn't count if another country doesn't reach carbon neutrality. We should go a long way in helping each other as friends. Starting from now, we should share best practices, encourage each other, and learn from each other" (H.E. Chung, Raekwon).
- Now is the time when we need the wisdom to identify problems together and collaborate on technology and innovation instead of focusing on competition and conflicts for the long-lasting journey toward Net-zero.



Thank you!

makingbetterworld@nigt.re.kr