2026 Survey Results

Technological Cooperation among Korea, China and Japan

Physical AI and Sustainability

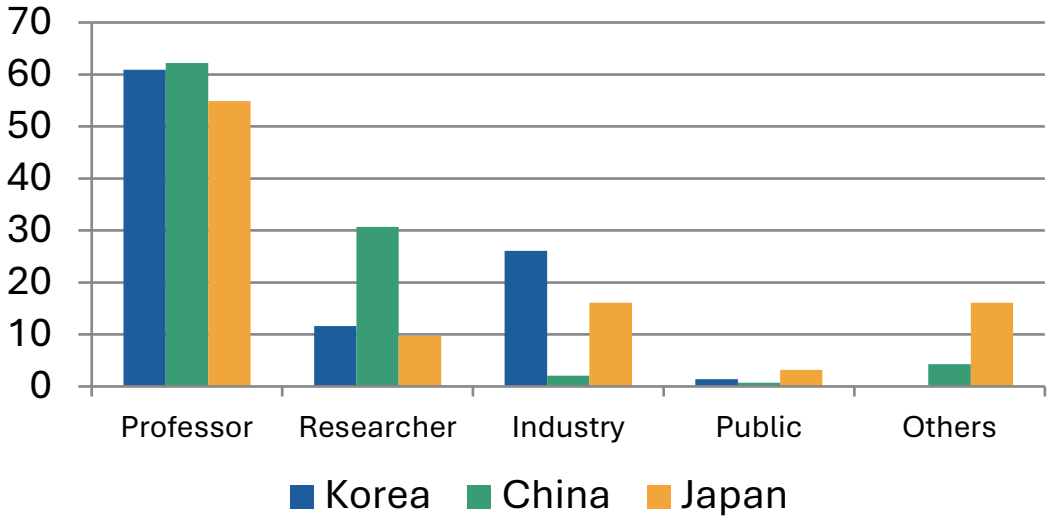
EA-RTM | July 2026

Contents

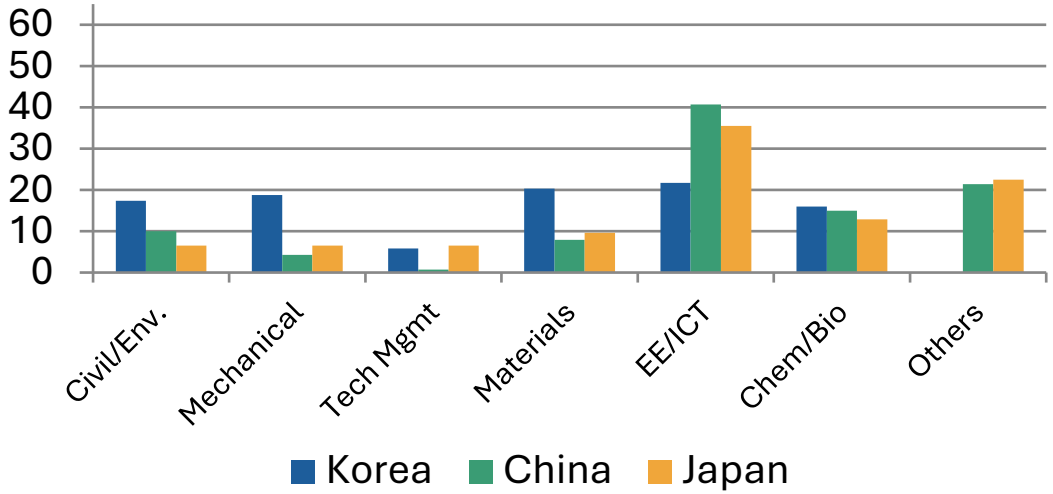
Respondent Profile by Country

Country	Respondents
Korea	**69**
China	**140**
Japan	**31**
Total	**240**

Profession distribution (%)



Specialty distribution (%)



Respondents are senior experts:
over 88% in each country reported more than 20 years of research experience.

Technological Cooperation Index: Methodology

Factor 1
Necessity for cooperation

Factor 2
Expected benefit of cooperation

Factor 3
Quantitative level of cooperation

Factor 4
Qualitative level of cooperation

Factor 5
Future prospect and potential

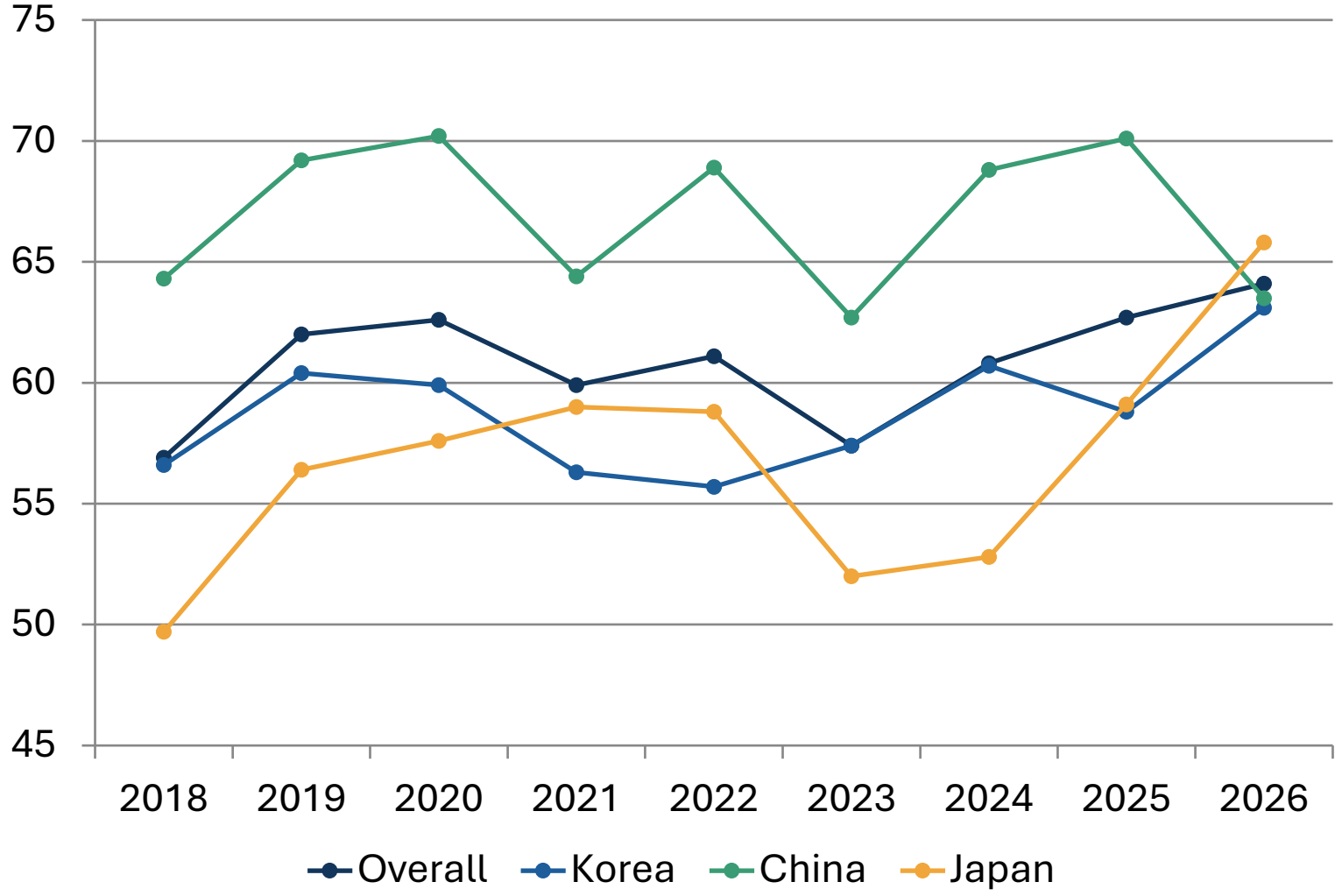
Technological Cooperation Index = arithmetic average of five factors

Response	Score
Strong positive	100
Weak positive	67
Weak negative / neutral	33
Strong negative	0

The index is designed to track both sentiment and perceived cooperation capacity over time. It therefore combines “need” and “benefit” with actual cooperation quantity, quality and future potential.

Technological Cooperation Index: Overall Trend

Overall and country-level index trend (p)



64.1p

Overall index in 2026
Up from 62.7p in 2025

65.8p

Japan country index
Highest among three countries

63.5p

China country index
Slightly above Korea

63.1p

Korea country index
Highest Korea score since 2019

Key Takeaways from the Cooperation Index

High
Need and expected benefit
Korea and Japan rebound strongly

Low
Quantity and quality
Implementation gap persists

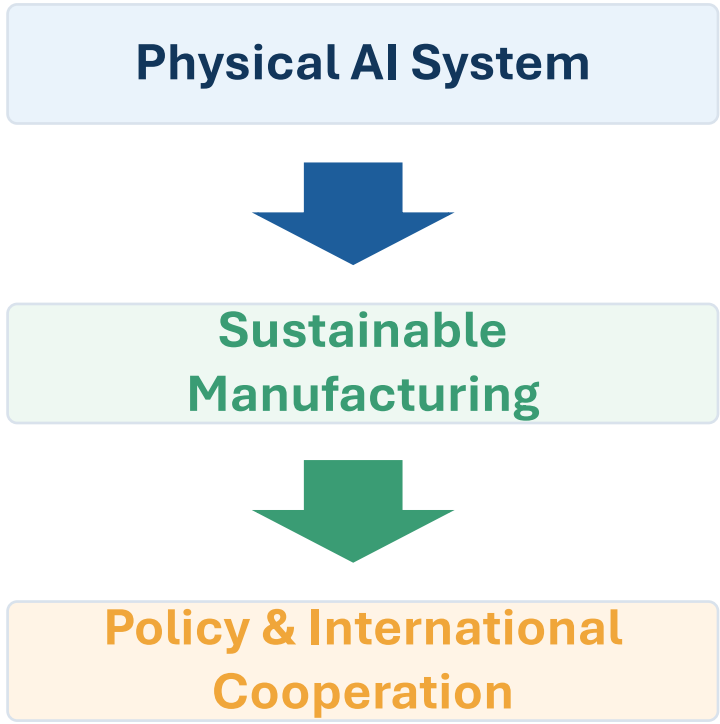
Positive
Future potential
But needs confidence-building

64.1p
2026 overall index
Highest since 2022

- The three countries agree on the importance of cooperation, but actual cooperation volume and quality remain much weaker.
- Korea's perception rebounded in necessity and expected benefits, but Korea still evaluates the actual quality of cooperation relatively low.
- Japan showed the most notable improvement in quantitative and qualitative cooperation scores in 2026.
- China remains positive on future potential but declined in most factor indices compared with 2025.
- The core policy question is **how to convert high demand into regular, outcome-oriented cooperation mechanisms.**

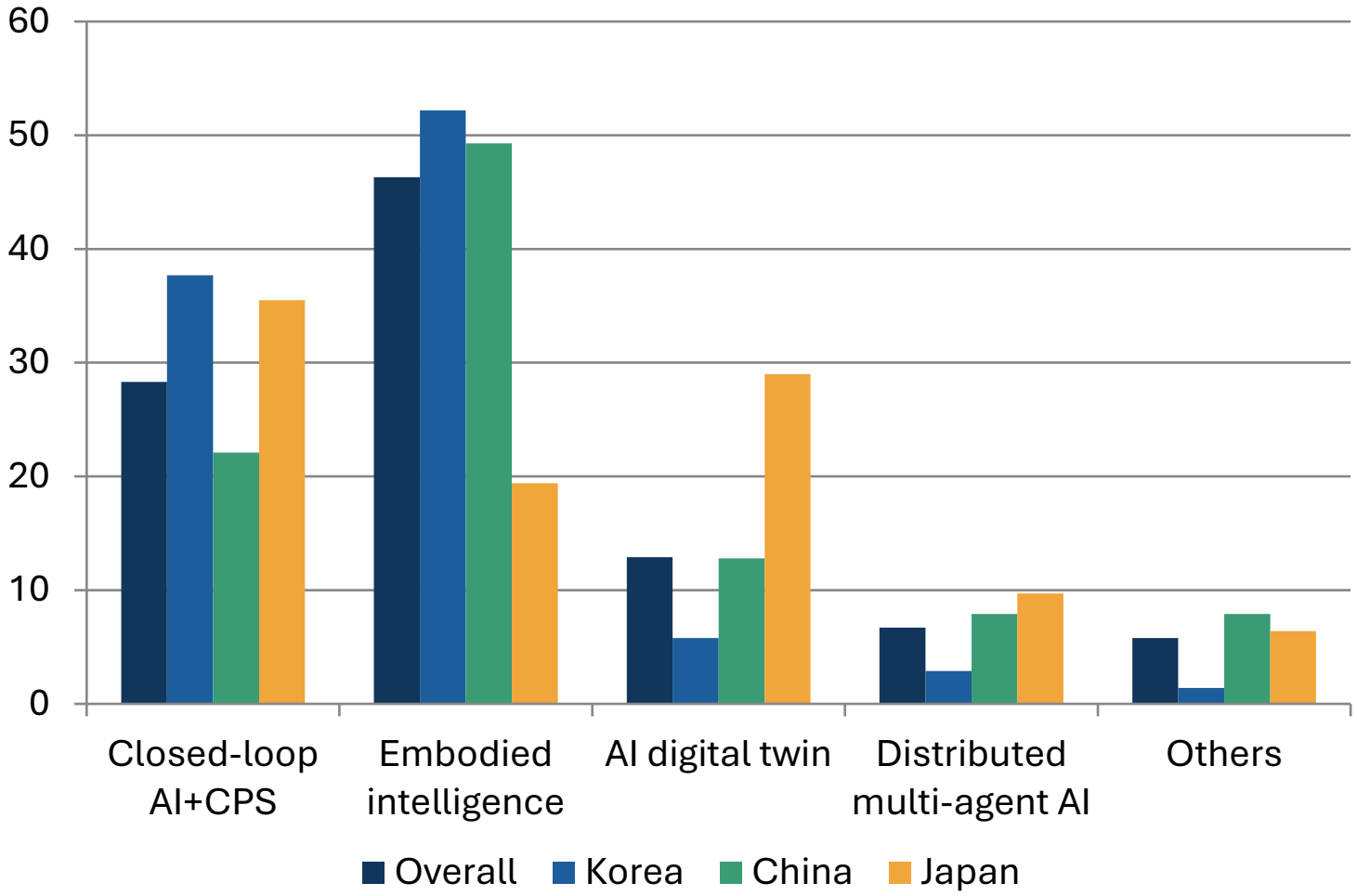
2026 Thematic Survey: Physical AI and Sustainability

- Physical AI is understood as AI that operates in real industrial and physical systems, not only in digital environments.
- The survey examines Physical AI from three angles: system architecture, sustainable manufacturing, and policy/international cooperation.
- The results show a strong need for integration: AI + cyber-physical systems + data infrastructure + safety + sustainability.
- The most consistent cross-country signals are standardization, data governance, safety certification, and joint industrial implementation.



How Experts Define Physical AI

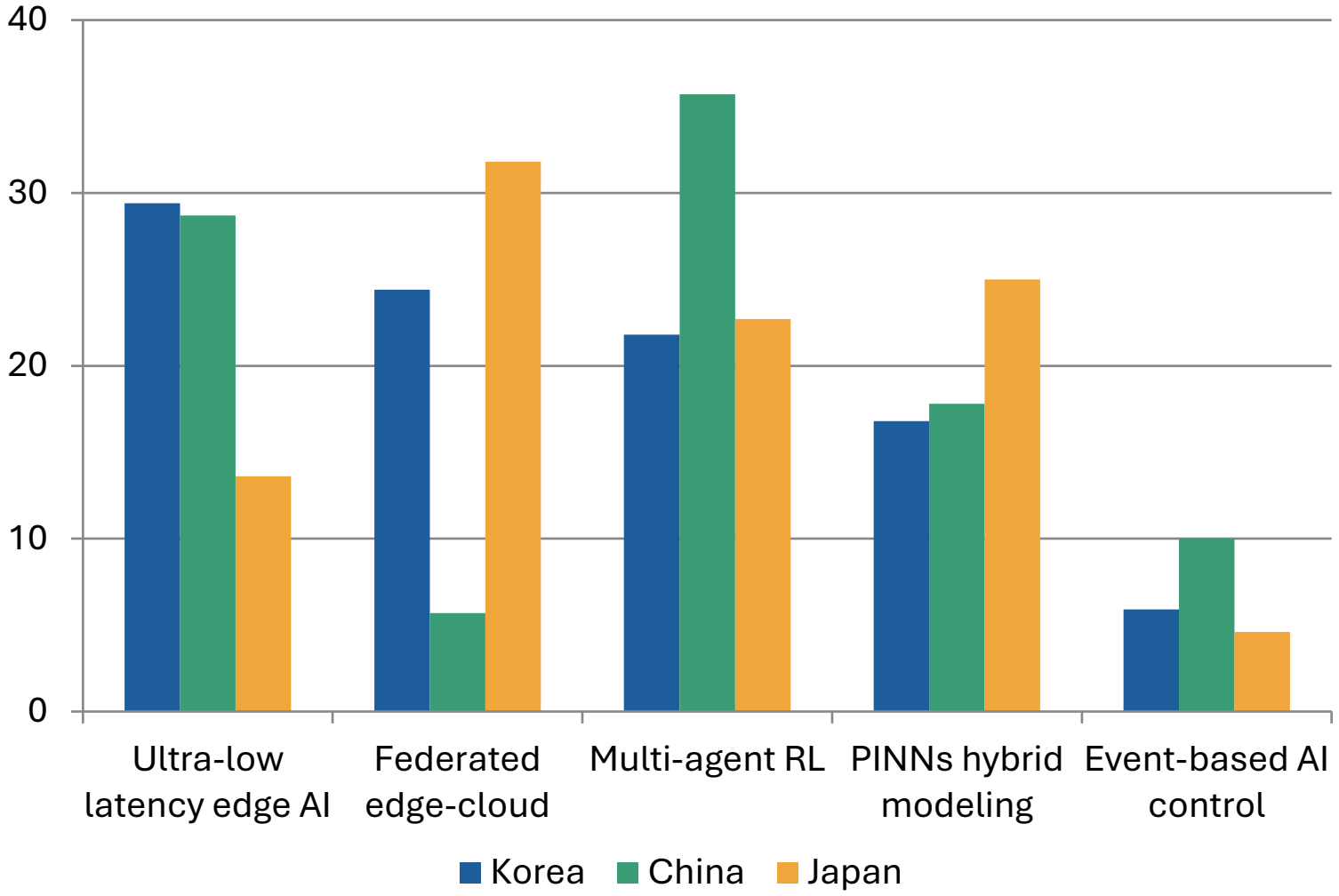
Definition of Physical AI (%)



- Overall top definition: embodied intelligence performing perception, planning and control under uncertainty (46.3%).
- Korea and China strongly favor the embodied-intelligence definition.
- Japan places relatively more weight on AI-based digital twins and closed-loop AI-CPS integration.
- Implication: a shared vocabulary is needed before launching standards or joint projects.

Priority System Architecture for Physical AI

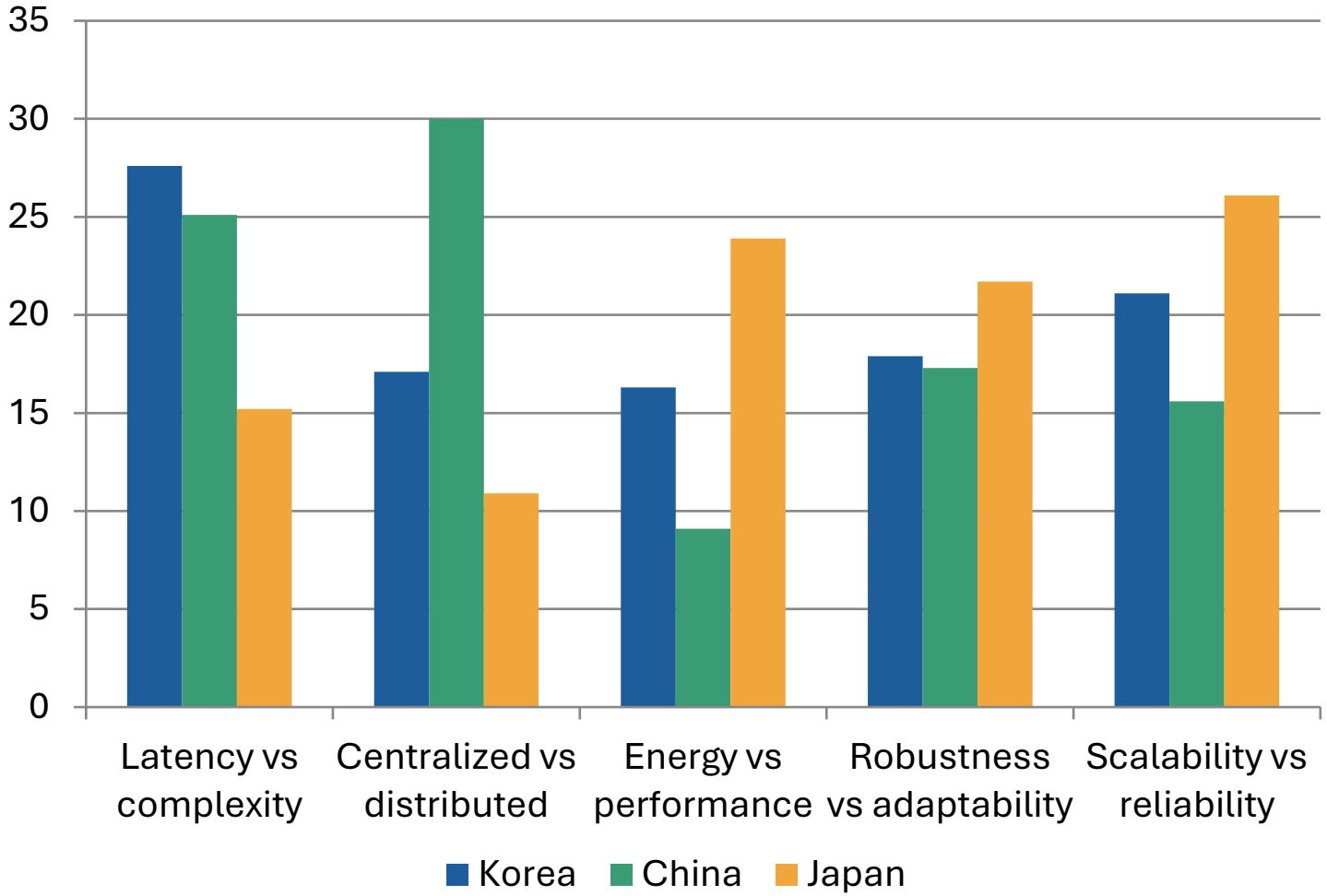
Most important Physical AI system architecture (%)



- Korea: ultra-low-latency edge AI is the top priority.
- China: multi-agent reinforcement learning is most emphasized.
- Japan: federated edge-cloud operation is the top priority, followed by PINNs-based hybrid modeling.
- Architecture priorities differ, which may create complementary cooperation opportunities.

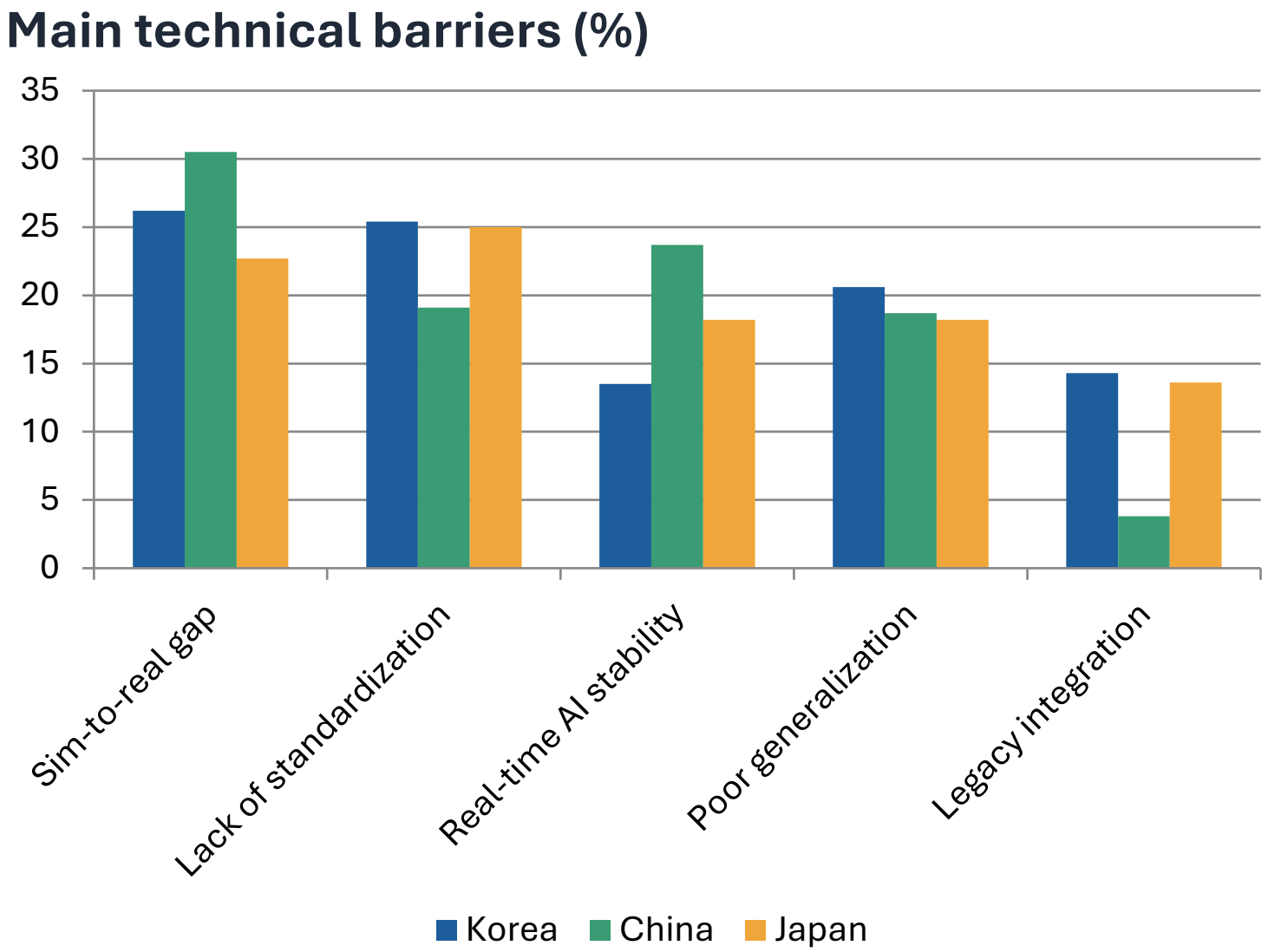
Key Trade-offs in Applying Physical AI

Most important trade-off (%)



- Korea and China emphasize system design decisions linked to latency and intelligence distribution.
- Japan emphasizes reliability and energy-performance balance.
- The results suggest that Physical AI requires not just better AI models but engineering trade-off management.
- Joint guidelines could help compare architectures under common evaluation criteria.

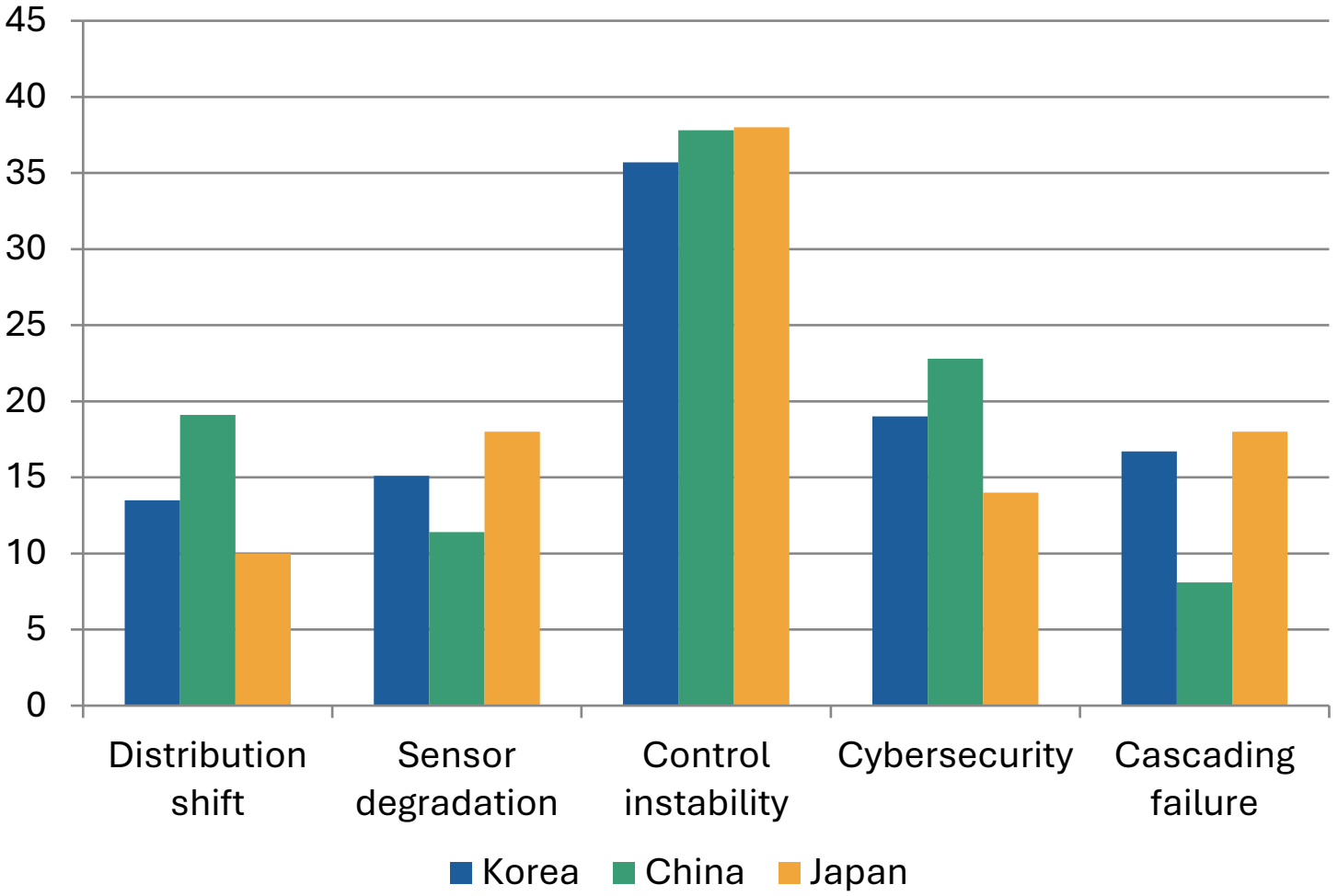
Major Technical Barriers to Physical AI Implementation



- Sim-to-real gap is the top or near-top barrier in all three countries.
- Korea and Japan show strong concern about insufficient standardization between data and systems.
- China shows relatively higher concern about real-time AI operational stability in safety-critical environments.
- Joint testbeds can directly address these barriers by linking simulation, field data and evaluation protocols.

Operational Risks in Industrial Deployment

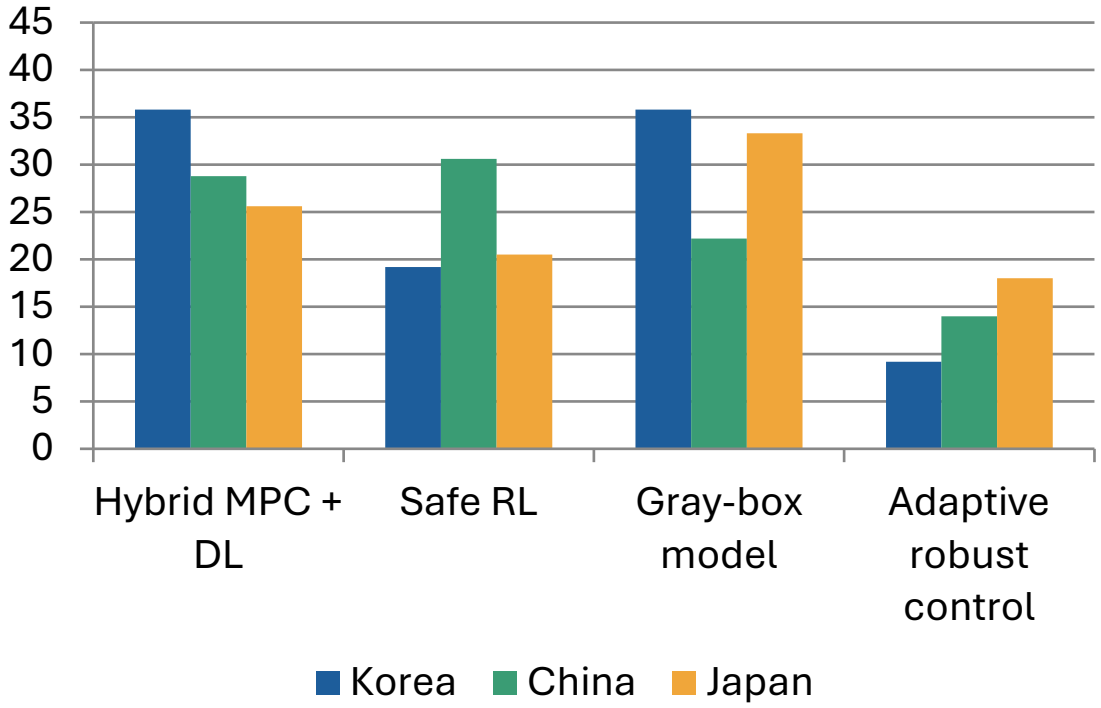
Most concerning issue when applying Physical AI (%)



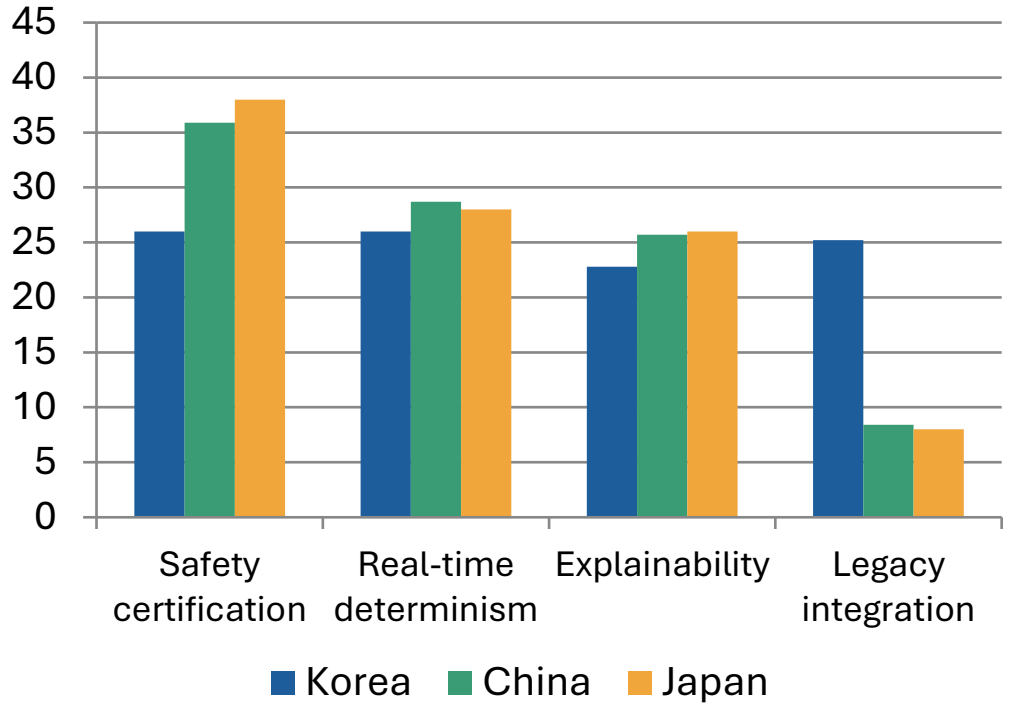
- All three countries identify control instability under uncertainty as the most serious operational concern.
- Cybersecurity is the second-largest concern in China and a notable concern in Korea.
- Japan shows relatively higher concern about sensor degradation and cascading failure.
- Safety assurance and resilience should be core cooperation themes.

Control Approaches and Constraints

Most suitable control approach (%)



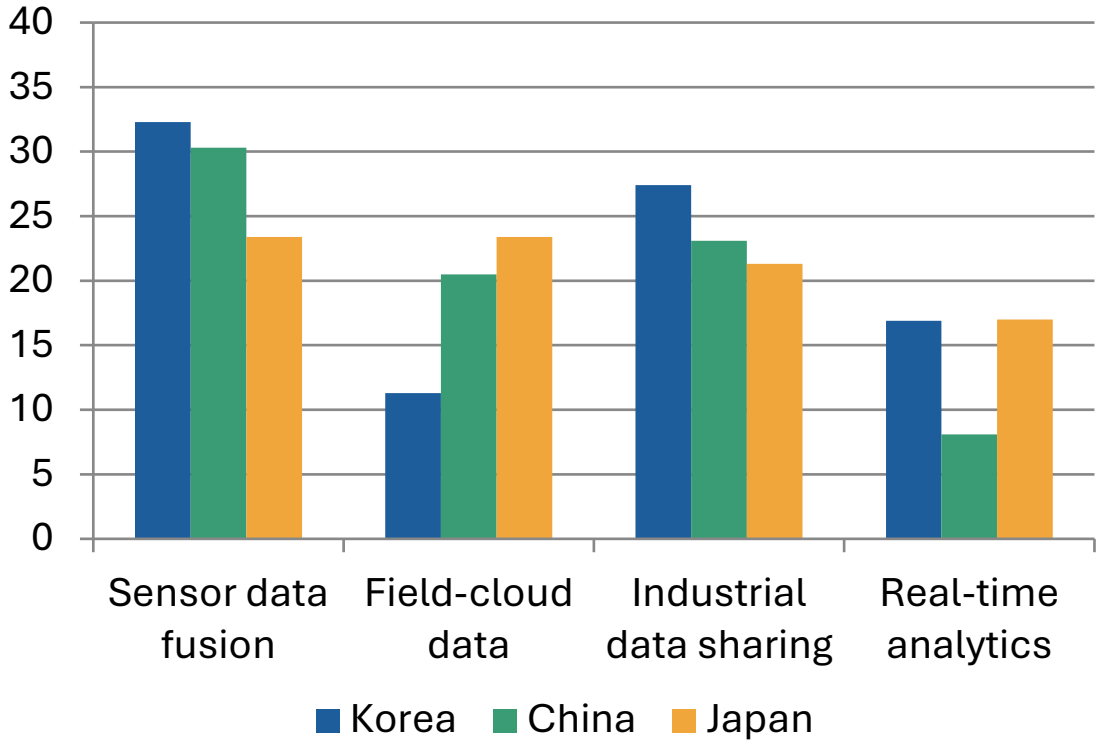
Main constraints in AI-based control (%)



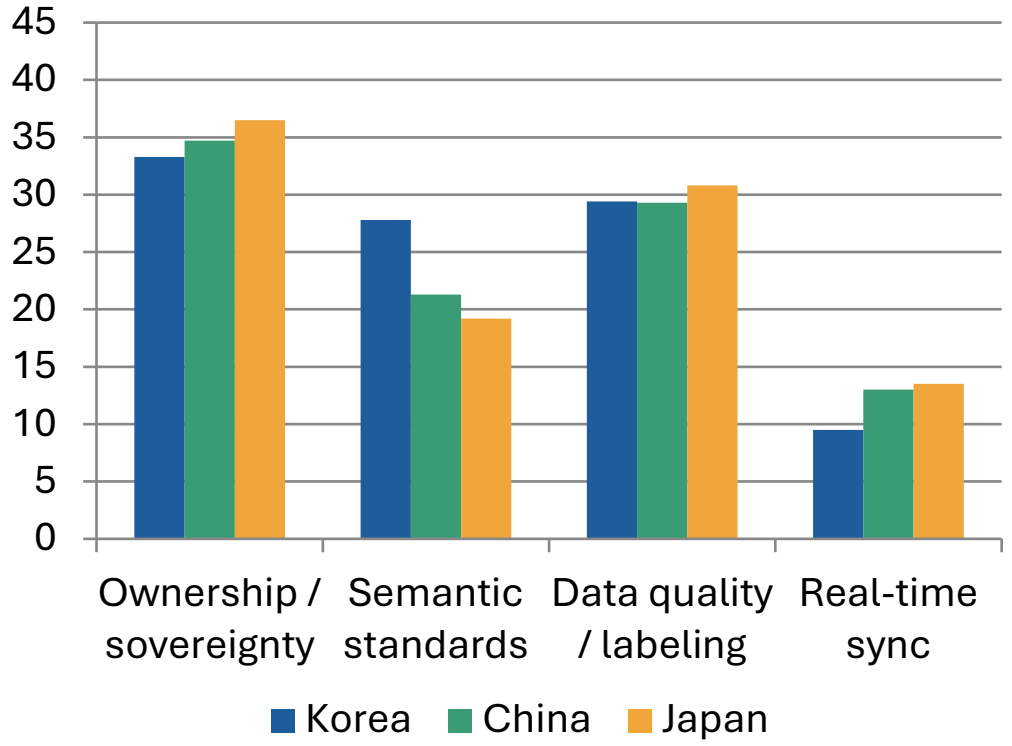
The core message is “**hybrid intelligence with safety assurance**”: model-based control, AI learning, explainability and certification must advance together.

Data Infrastructure: Priorities and Challenges

Most important data infrastructure (%)



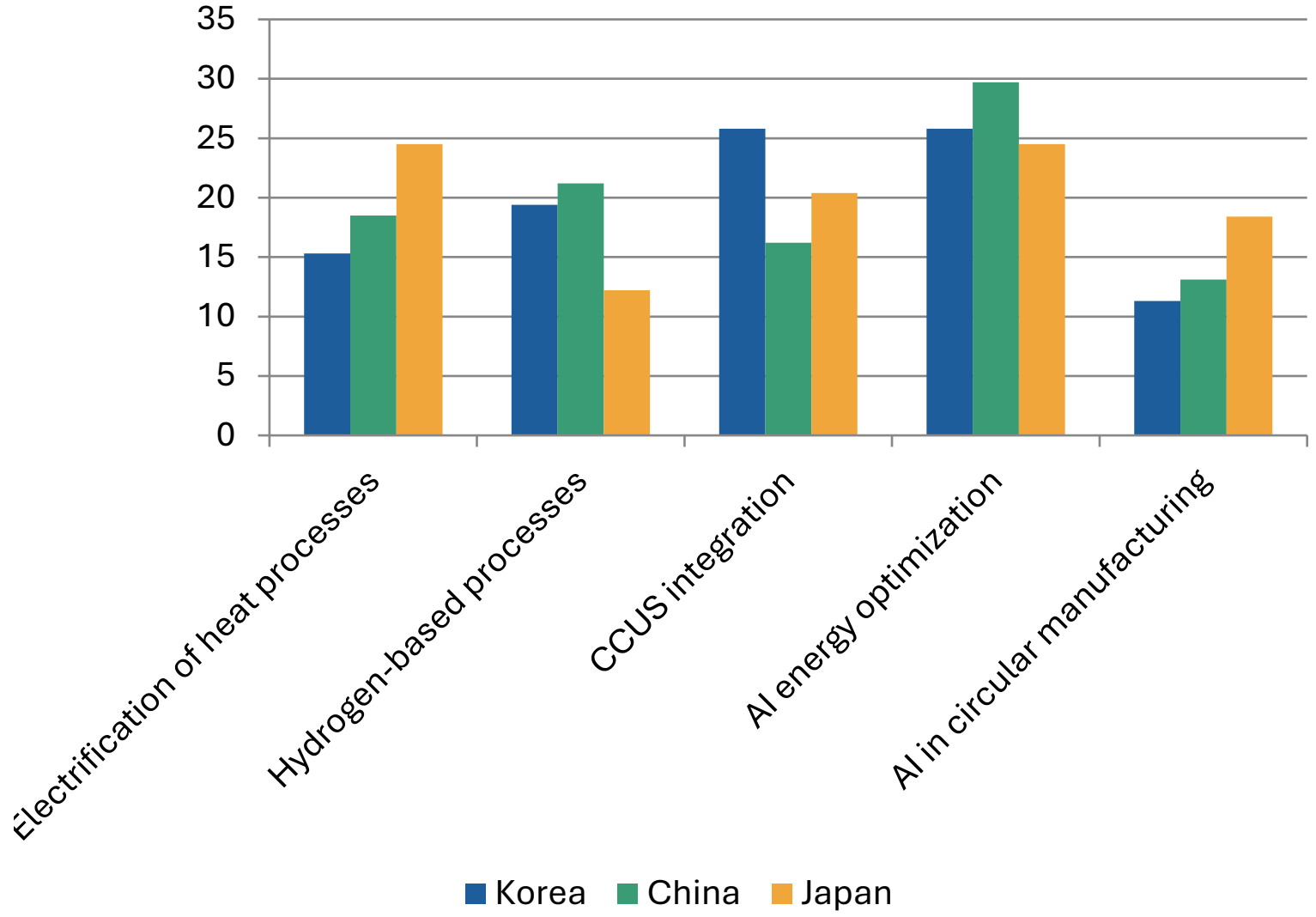
Main data infrastructure challenge (%)



Data is the shared foundation: sensor fusion, industrial data sharing, data quality and data sovereignty are all central to Physical AI implementation.

Green Innovation: Effective Decarbonization Pathways

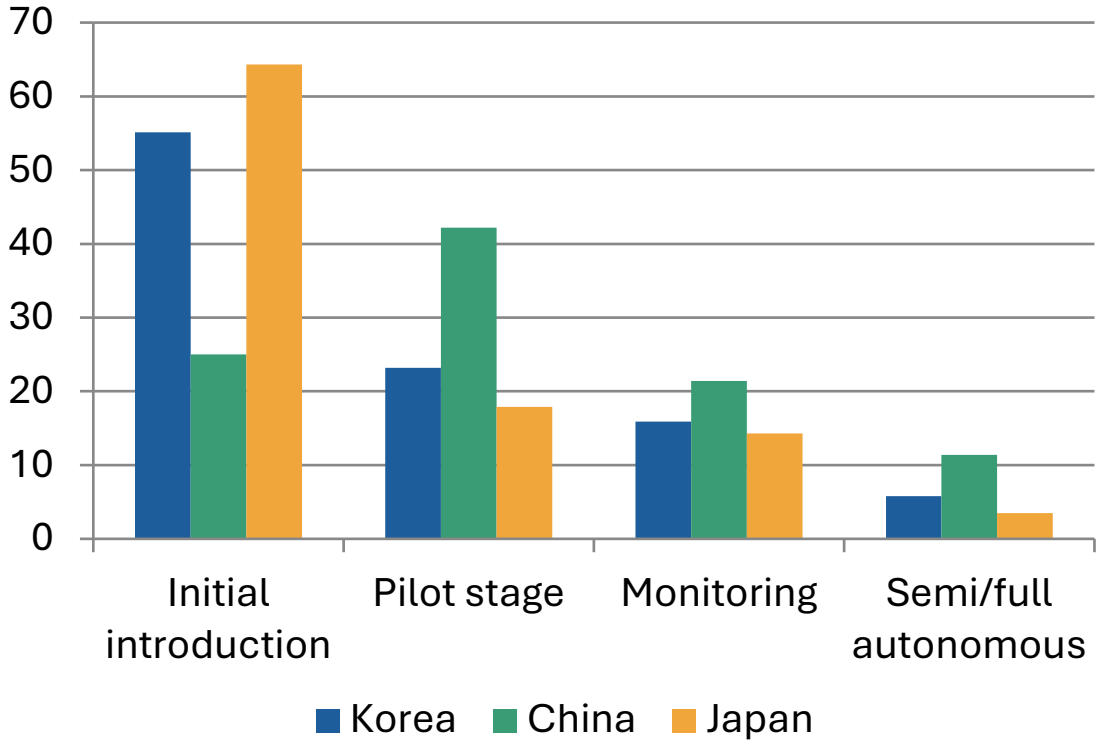
Most effective decarbonization pathway (%)



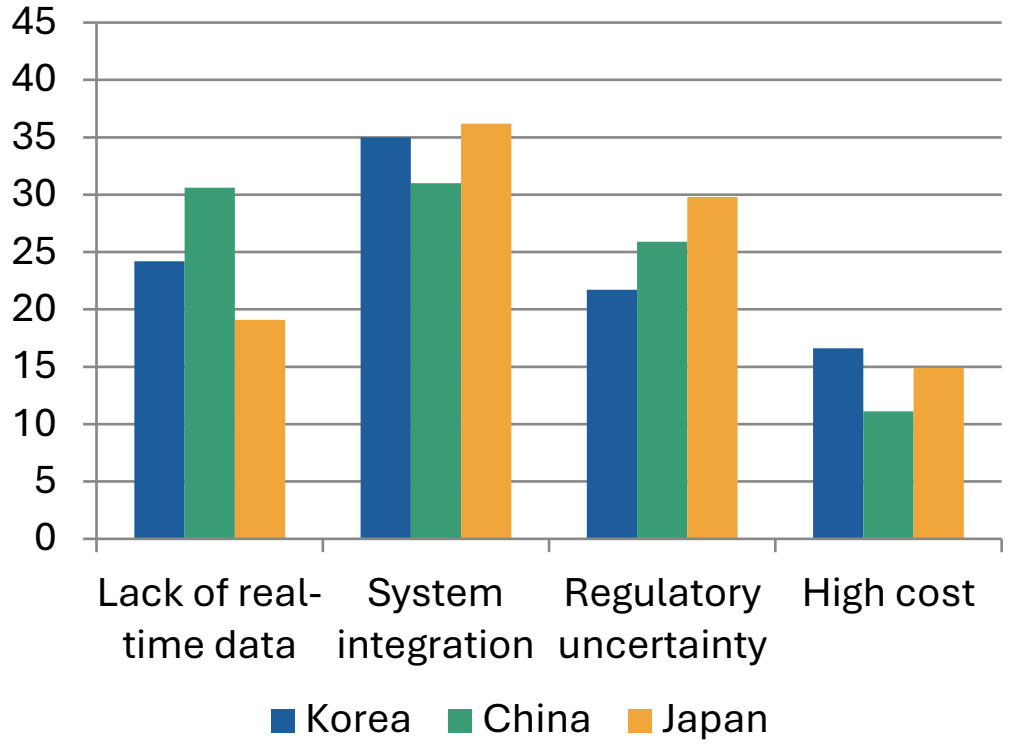
- AI-based energy-system optimization is a leading option across all three countries.
- Korea also places high importance on CCUS integration.
- Japan highlights electrification of heat processes and AI energy optimization equally.
- Decarbonization is viewed as a portfolio challenge, not a single-technology solution.

Physical AI in Industrial Energy Systems: Adoption and Barriers

Current utilization level (%)



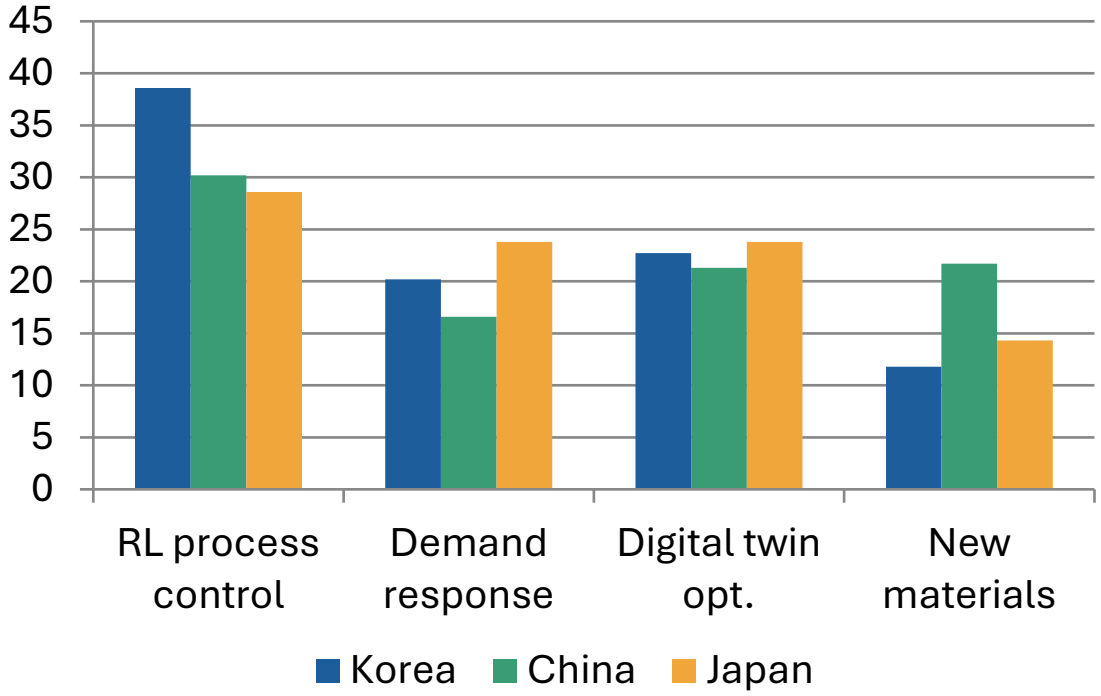
Main diffusion barrier (%)



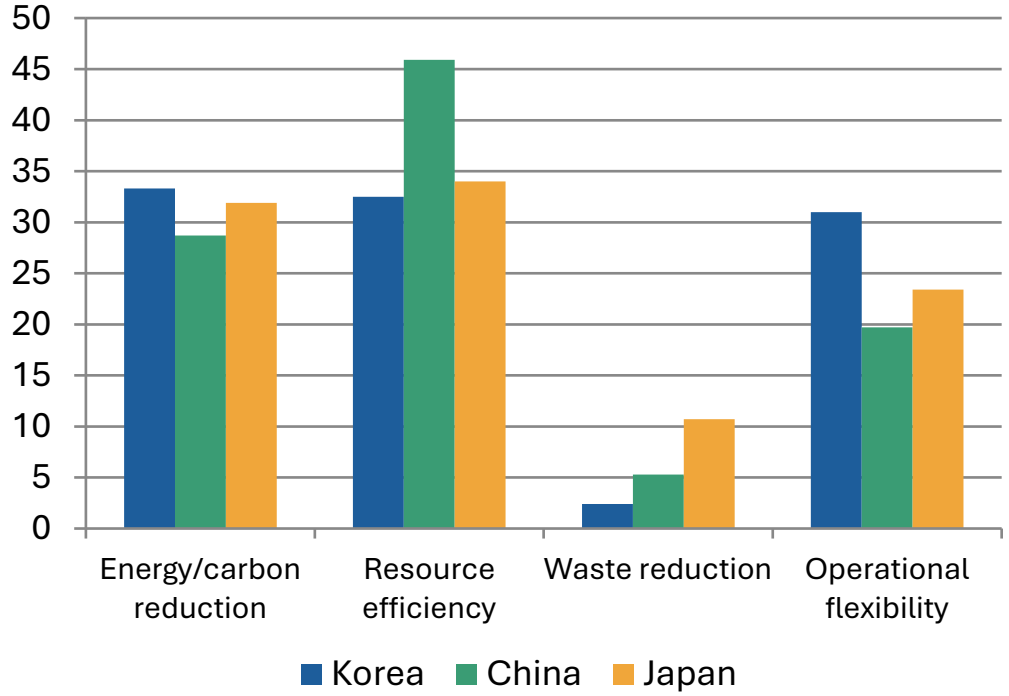
Physical AI is still mostly **at the initial or pilot stage** in industrial energy systems; **system integration** is the most common diffusion barrier.

Industrial Applications and Expected Benefits

Applications where Physical AI will have the largest impact (%)



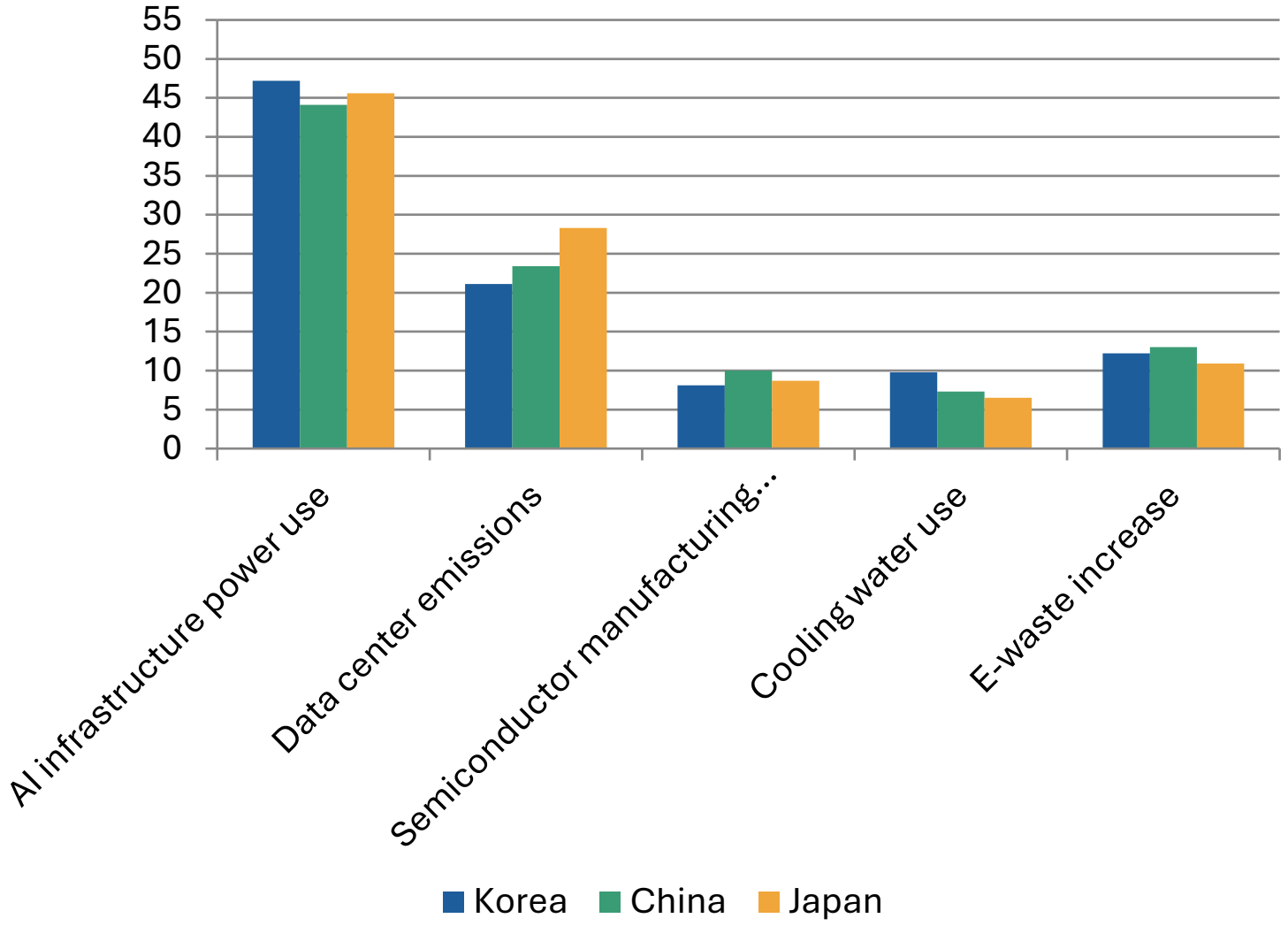
Expected effects of adoption (%)



The main expected value of Physical AI is not only automation, but better resource efficiency, energy reduction, and flexible industrial operation.

Sustainability Issues from the Spread of Physical AI

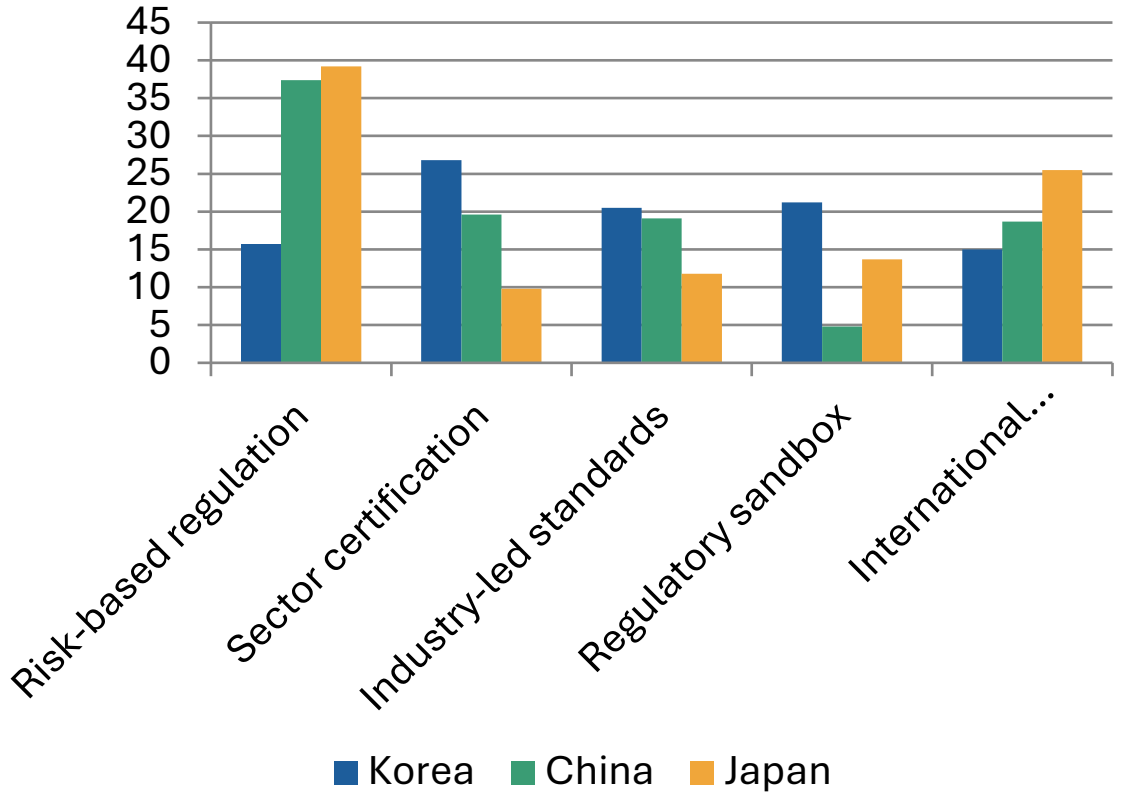
Sustainability concerns in Physical AI diffusion (%)



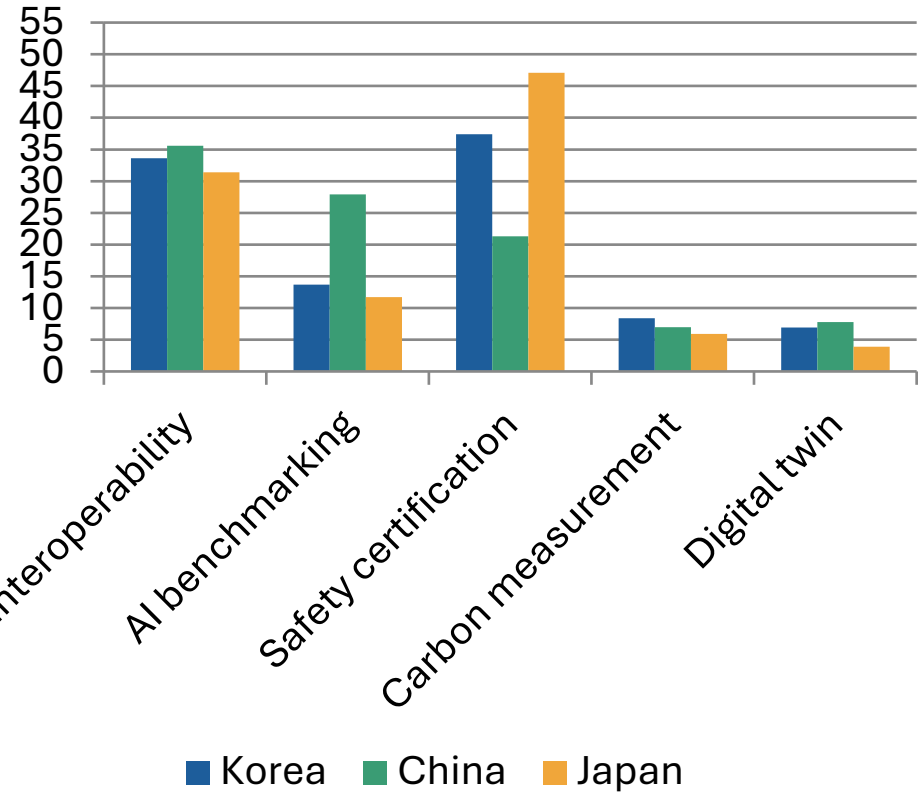
- AI infrastructure power consumption is the top sustainability concern in all three countries.
- Data center carbon emissions are the second major concern, especially in Japan.
- The sustainability agenda must include the environmental cost of AI infrastructure itself.
- This creates room for cooperation on energy-efficient AI, green data centers and lifecycle assessment.

Regulation and Standardization Priorities

Most appropriate regulatory approach (%)



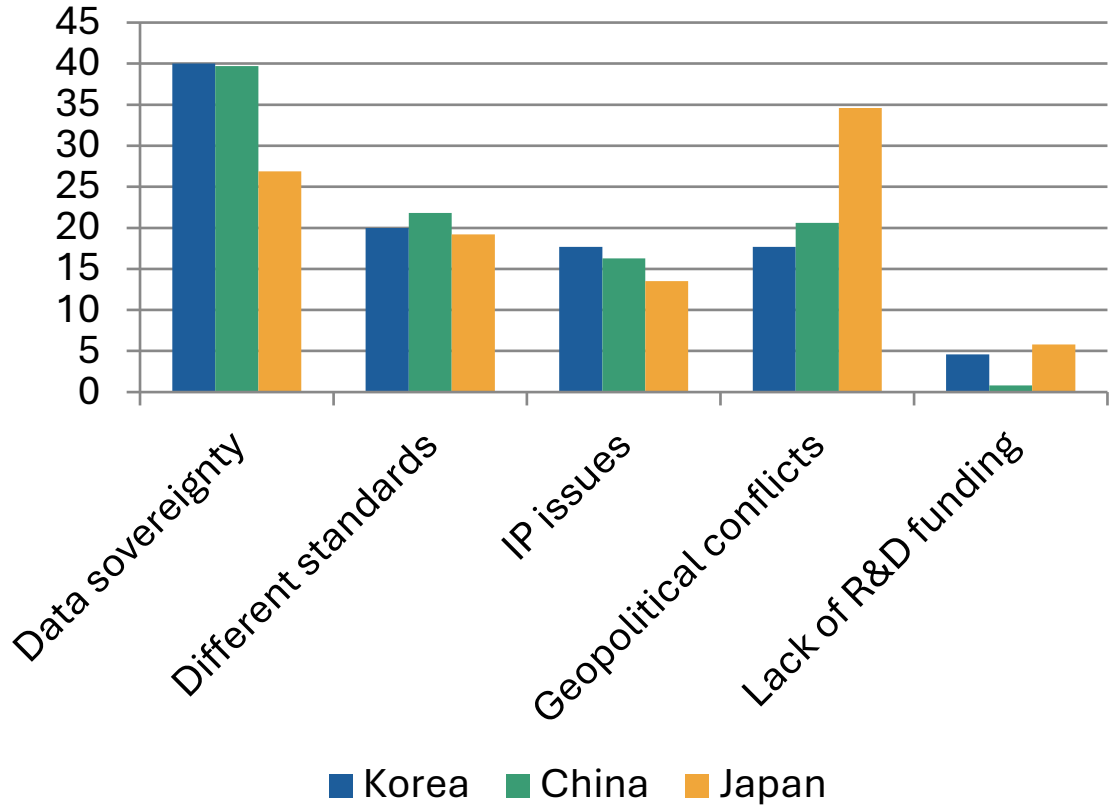
Most urgent standardization area (%)



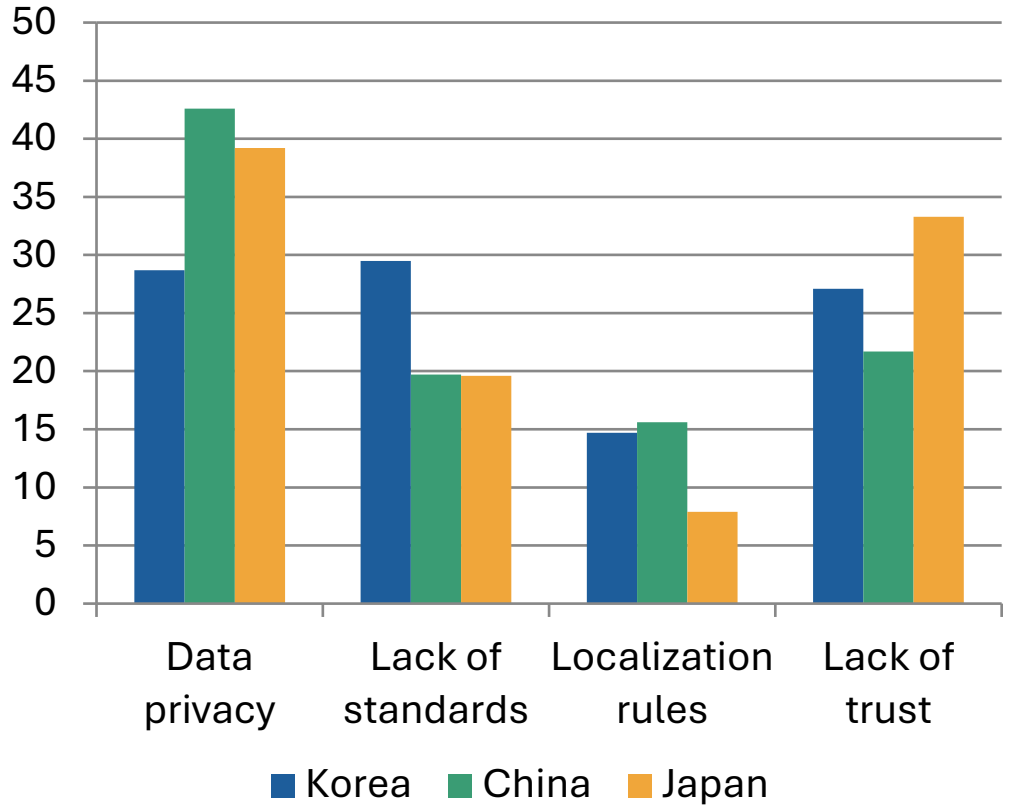
Standardization priorities converge around **data interoperability and safety verification**, while preferred regulatory approaches differ by country.

Barriers to International Cooperation and Data Sharing

Main factor hindering international cooperation (%)



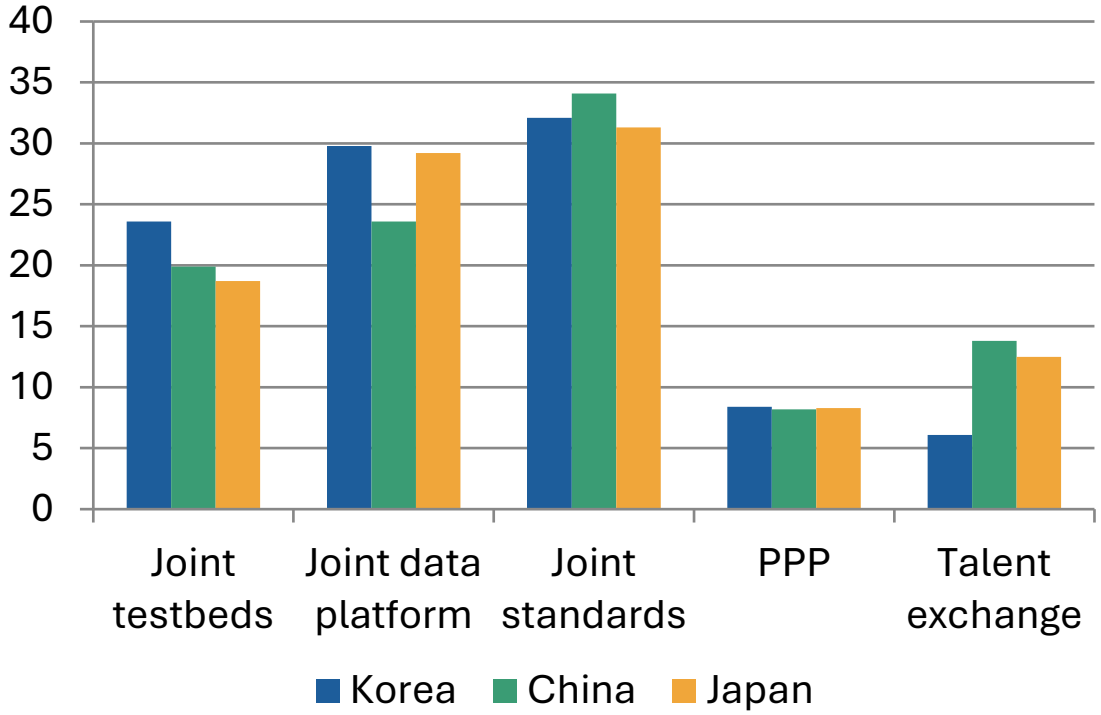
Difficulties in cross-border industrial data sharing (%)



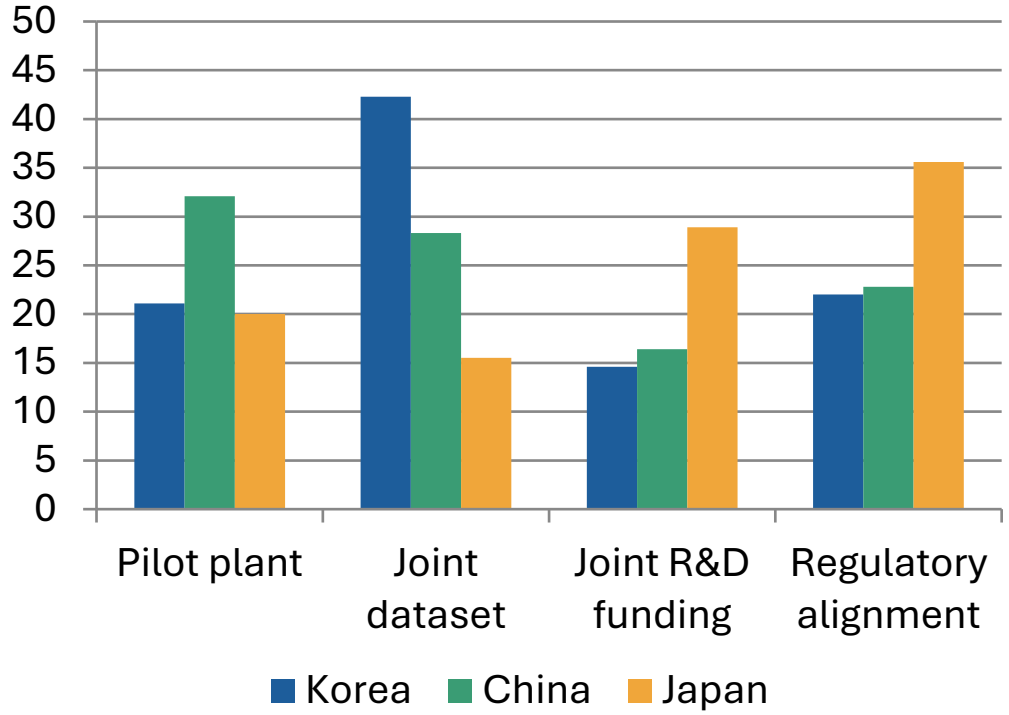
International cooperation will depend on trust-building mechanisms for data governance, privacy, standards and geopolitical risk management.

Most Effective Cooperation Models and Execution Tools

Most effective cooperation method (%)



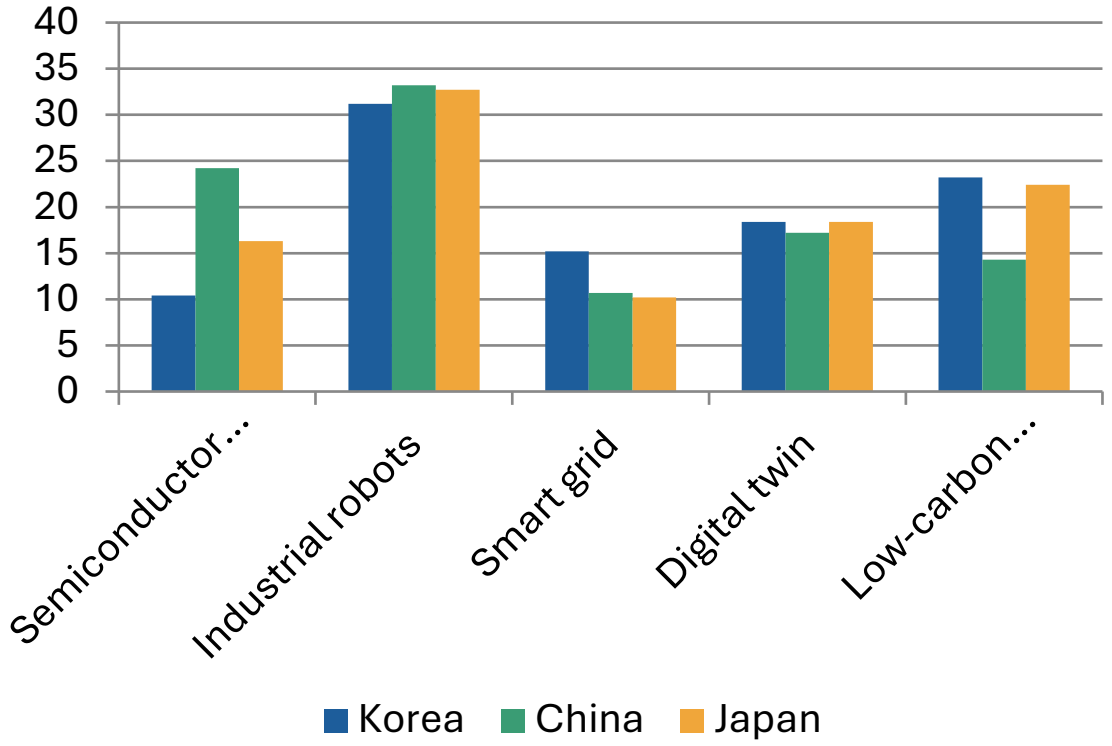
Most effective implementation instrument (%)



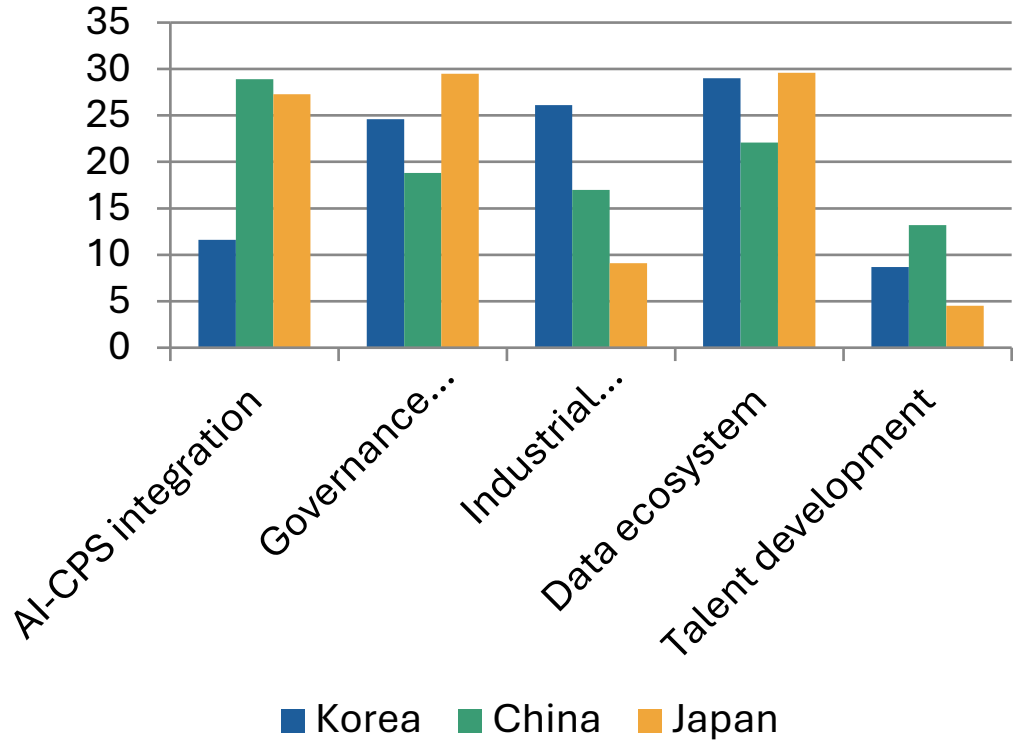
The preferred cooperation model is **practical and standards-oriented**: joint standard development, joint data platforms, testbeds, pilot plants and datasets.

Priority Cooperation Areas and Enablers

Most suitable fields for trilateral cooperation (%)



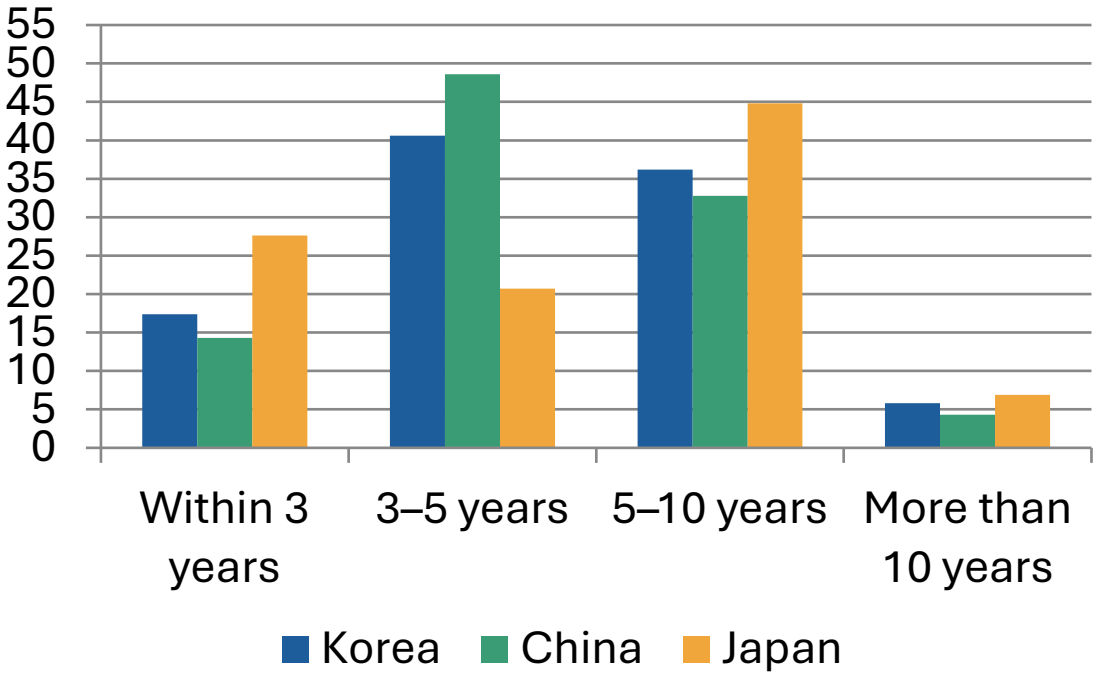
Key enablers for development (%)



Industrial robots are the most commonly selected cooperation field across all three countries; **data ecosystem and governance** are central development enablers.

Realization Timeline and Open-ended Recommendations

Expected timing for key enablers to be realized (%)



- Most respondents expect key enablers to be realized within 3–5 years or 5–10 years.
- Open comments emphasized long-term and consistent policy frameworks, rather than short-lived policy trends.
- Physical AI should be treated as an integrated engineering framework linking materials, manufacturing, robotics, sensing, digital twins and sustainability.
- Joint testbeds, shared evaluation methods and international standardization were repeatedly highlighted as important.

Conclusion: What the 2026 Survey Tells Us

- The demand for Korea-China-Japan technological cooperation remains strong, and the 2026 overall index rose to 64.1p.
- However, actual cooperation quantity and quality remain much lower than the perceived necessity and expected benefit.
- Physical AI is seen as an integrated engineering agenda involving AI, CPS, data, control, safety, industrial systems and sustainability.
- Common priorities include data interoperability, safety certification, joint standard development, industrial robots, joint data platforms and practical testbeds.
- The next step should be to move from dialogue to implementation: shared standards, joint datasets, pilot plants, testbeds, and regulatory alignment.

> Key message: Physical AI and Sustainability can become a practical platform for trilateral cooperation if the three countries jointly build standards, data infrastructure and trusted implementation mechanisms.

THANK YOU

FOR YOUR ATTENTION