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Confederation of Asia-Pacific Chambers of Commerce and Industry

Competing and Cooperating in the Asia-Pacific Region Amid a Changing Technology Landscape:

Leveraging Diversity for Technological Sovereignty and Complementary Strengths

CACCI 2025 TEPAV Policy Paper

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TEPAV Policy Paper

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Abstract

The global landscape has undergone a profound transformation, with technology now central to both economic competitiveness and geopolitical power. As the global technology race intensifies, technological capability has become a dual force: a source of strategic advantage and systemic vulnerability. These trends call for new models of regional cooperation that can balance strategic competition with deeper collaboration. Within this evolving context, CACCI stands out as a diverse and heterogeneous network of economies, differing in scientific and technological capacity, industrial strength, and market scale. While CACCI's high-tech exports have expanded significantly, this growth has yet to translate into technological sovereignty and readiness for frontier technologies. This policy paper analyzes CACCI's positioning in the global technology landscape and outlines actionable policy recommendations for cooperation. It argues that CACCI's diversity and heterogeneity are strategic assets when leveraged through complementary specialization, fostering innovation, technology transfer, and market scaling across the region. Key policy proposals include establishing a CACCI Strategic Foresight Alliance, promoting joint R&D partnerships and a CACCI Technology Investment Fund, and aligning regional standards and certification for critical technologies. Together, these measures aim to bridge the gap between scientific capability and industrial strength and to position CACCI as a proactive actor in shaping a resilient, balanced, and interconnected Asia-Pacific technology ecosystem.

I. Introduction

Technology is no longer just an engine of economic growth, it has become a central element reshaping the global economic and geopolitical landscape. Countries are now striving for technological sovereignty, which refers to their ability to independently develop and control key technologies. Simultaneously, the COVID-19 pandemic exposed the fragility of globally dispersed supply chains, accelerating a shift from global to regional value chains and prompting nations to prioritize both technological competitiveness and supply chain resilience. Unlike previous eras where military power or natural resources determined national strength, today's global hierarchy is increasingly defined by technological capabilities.

This technological centrality has broad implications. The global response to climate change depends on critical technologies' development and deployment. Renewable energy technologies, carbon capture, electric vehicles, and smart grids are not merely environmental solutions but also tools of industrial competitiveness and economic prosperity. Technology is also at the center of global trade tensions and is no longer simply a domain of economic activity but a tool of geopolitical competition and a potential vulnerability.

For several decades, globalization drove the creation of highly specialized, geographically dispersed value chains. Comparative advantage, economies of scale, and efficiency optimization led to production fragmentation, with different stages of manufacturing and service delivery located in different countries. This model delivered significant economic benefits. However, this globalized model has also revealed critical vulnerabilities. However, the pandemic revealed weaknesses in these just-in-time systems. Moreover, technology supply chains have become geopolitical tools. For instance, Taiwan produces over 90% of advanced semiconductors, and China dominates solar panel and rare mineral supply chains. These concentrations create strategic risks. Countries like the US are now increasingly responding with industrial policies, such as the CHIPS Act and the Inflation Reduction Act.

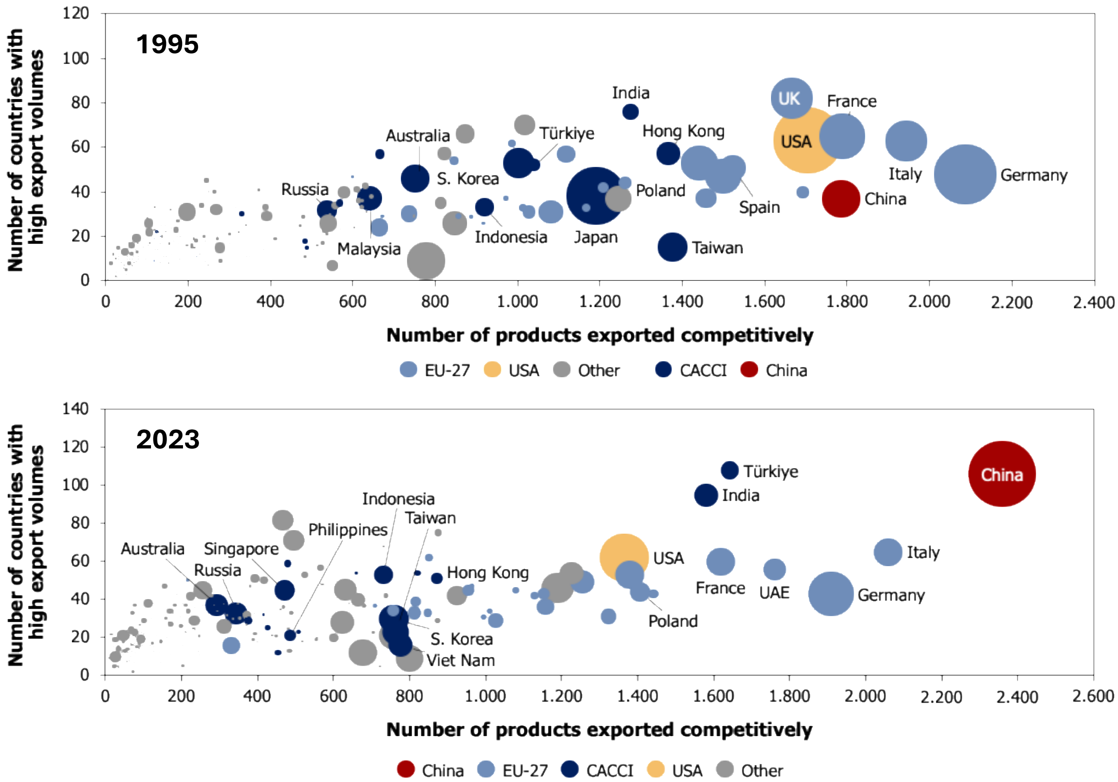
These developments are pushing the world from globalization toward regionalization. Countries now prioritize resilience and security over maximum efficiency. This is not the end of globalization, but a reconfiguration toward regional networks with selective global links. Another emerging idea is the need for differentiated technology pathways, rather than a "one-size-fits-all" approach. A strong regional strategy should support complementary specialization, allowing different countries to focus on different parts of technology value chains.

The Confederation of Asia-Pacific Chambers of Commerce and Industry (CACCI) represents a diverse group of countries across Asia and the Western Pacific. Its 26 member economies include 2.96 billion people and a combined GDP of USD 18.79 trillion. Together, they export USD 5.48 trillion and import USD 5.29 trillion in goods and services. CACCI collectively represents 3 billion people, larger than China, larger than the combined US and EU. This represents an enormous market for technology products and services. This diversity and heterogeneity -geographic, economic, and technological- is often seen as a barrier to cooperation. But this paper argues the opposite: diversity and heterogeneity could be an asset. Different countries can offer different strengths for emerging regional value chains: some are advanced innovators, others are large markets for scale deployment, while others offer opportunities for technology transfer and mutual learning. This can enable complementary partnerships, which are essential for regional resilience and long-term technology competitiveness.

This paper aims to provide a comprehensive analysis of CACCI countries' positioning in global technology era and to propose actionable policy recommendations for regional cooperation. First, we analyze CACCI's position through a technology-focused lens, providing descriptive analysis of where CACCI stands in the global technology landscape. Second, we conduct performance analysis in critical technologies, specifically artificial intelligence, biotechnology, advanced connectivity, and energy technologies. Third, we define policy models for regional cooperation and competition appropriate to the current technological era and CACCI's positioning. Moving from globalization to regionalization requires rethinking both targeted industrial policy and technological cooperation models to achieve regional technology sovereignty while maintaining beneficial global connections.

Figure 1 below compares global competitiveness in 1995 and 2023. The horizontal axis shows the number of products a country can export competitively, while the vertical axis shows the number of countries it can export to competitively. In 1995, global suppliers were mostly Western economies, especially EU countries. By 2023, the picture has changed dramatically: China has become the world's top supplier. Turkey as a CACCI country has significantly increased its product diversity, while South Korea has shifted towards specialization. This shows that while some countries focus on a wide product range, others concentrate on high-value specializations.

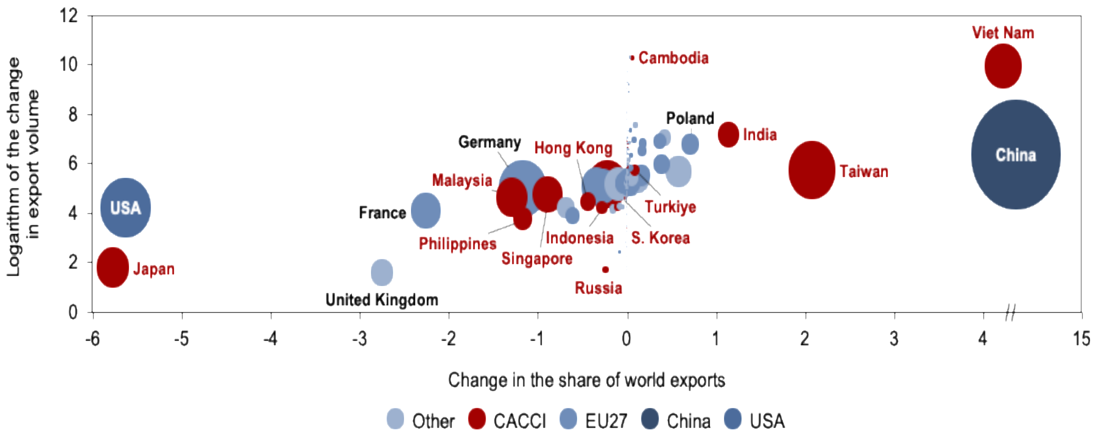
Figure 1 The Global Competitiveness Outlook, 1995-2023



Source: CEPII BACI, TEPAV calculations
Note: The areas of the circles represent the country's export volumes

When looking at global competitiveness specifically in high-tech sectors, China clearly stands out as the world's leading supplier (see Figure 2). China's growing share in global high-tech exports and the scale of its export volumes highlight its rising influence. In contrast, the US and Japan have seen a decline in their global high-tech market share. One particularly notable CACCI member is Vietnam, which has shown a remarkable increase in its high-tech export value. Other CACCI economies showing noteworthy performance include Taiwan and India. Another country that draws attention is Cambodia. Although its high-tech export volume remains small, the growth rate over the last 20 years has been striking. As we will explore in the following sections, this increase is mainly driven by the addition of new electronics products such as diodes, transistors, and similar semiconductor devices, which now make up nearly all of Cambodia's high-tech exports.

Figure 2 The global competitiveness outlook for high-technology sectors, 2003-2023



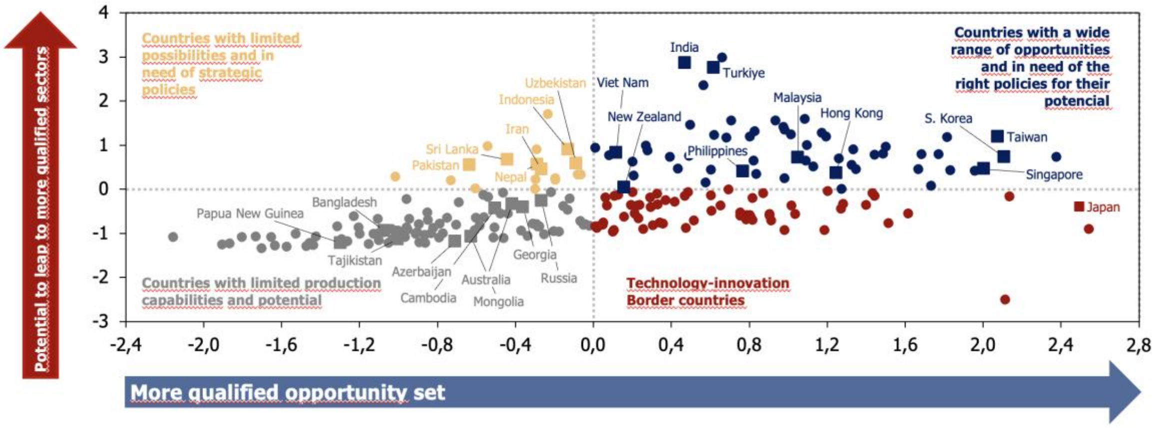
Source: CEPII BACI, TEPAV calculations

Another key indicator related to the technological sophistication of exports is the Economic Complexity Index (ECI), which can be observed in Figure 3. Widely used in development economics over the last 15 years, the ECI measures the complexity of a country's exports to estimate the skill and knowledge required for related production. Figure 3 allows us to reflect on both the current capabilities and future potential of CACCI economies. Once again, CACCI's heterogeneity becomes apparent. The region includes:

- countries close to the technology frontier with strong innovation capacity,
- countries with wide opportunities for growth,
- and countries with limited production capabilities and urgent needs for strategic policy support.

Despite this heterogeneity, a significant concentration of CACCI members including Vietnam, Turkey, India, and Malaysia are positioned in the high-potential "wide range of opportunities" quadrant. This can indicate a strong regional capacity for future growth and technological advancement, provided the right strategies for cooperation and development are implemented.

Figure 3 Countries economic complexity levels and potentials, 2023

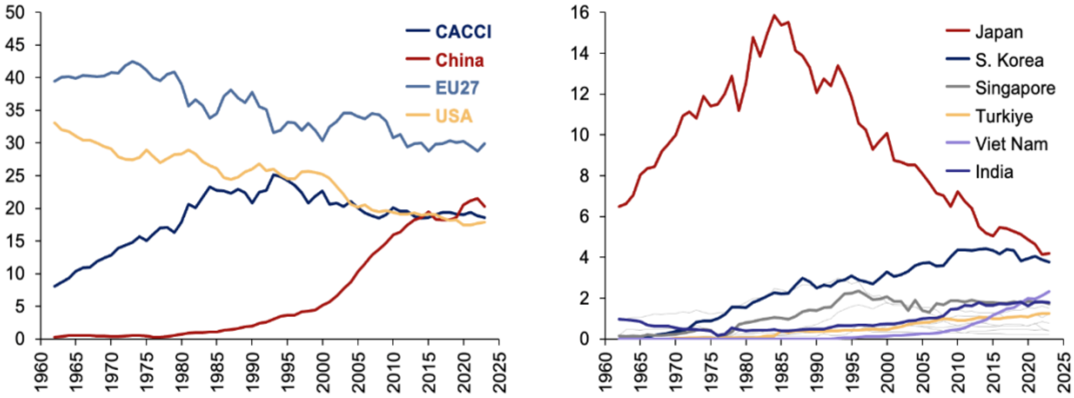


Source: Hidalgo&Hausmann, The building blocks of economic complexity, CEPII BACI, TEPAV calculations

Before moving into a more detailed analysis of CACCI's positioning in recent technology landscape, the final figures in this introduction section explore the

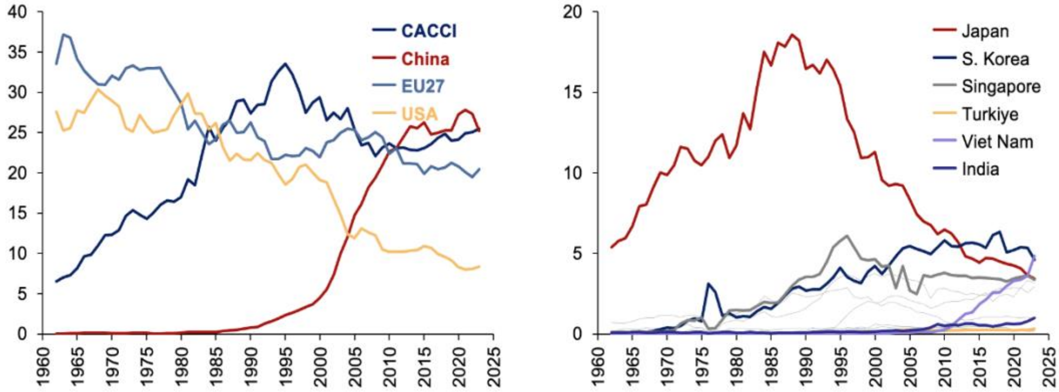
evolution of CACCI's global share in manufacturing and high-tech manufacturing exports. In Figure 4, we observe how CACCI countries' share in global manufacturing exports has changed since 1962. CACCI's share steadily increased until the 1980s and then stabilized. A striking observation is the decline in Japan's share over time. Figure 5 focuses on global high-tech manufacturing exports. CACCI's growth was notable until the mid-1990s, followed by a period of decline. However, in the last decade, we observe a renewed upward trend. The chart on the right clearly shows that this recent increase is primarily driven by Vietnam, underlining its growing importance in the high-tech space.

Figure 4 Countries' share of global manufacturing exports, %, 1962-2023



Source: The Growth Lab at Harvard University, 2025, "International Trade Data (SITC, Rev. 2), TEPAV calculations

Figure 5 Countries' share of global high-tech manufacturing exports, %, 1962-2023



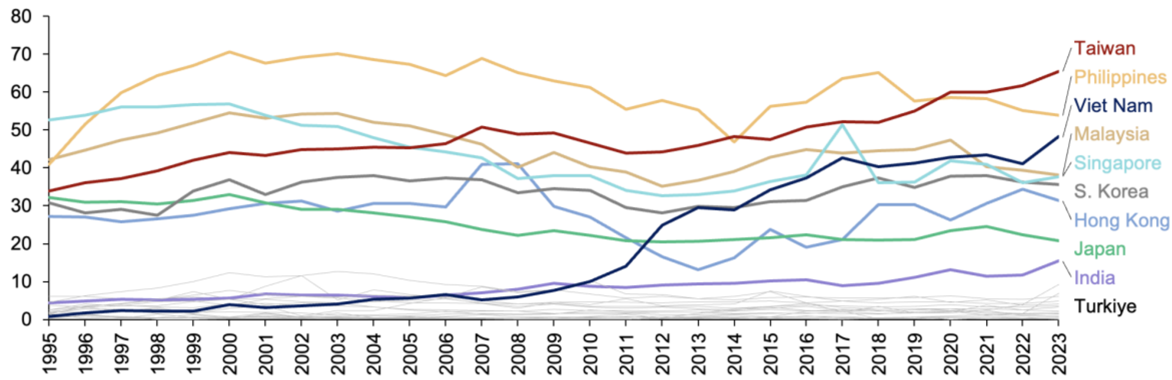
Source: The Growth Lab at Harvard University, 2025, "International Trade Data (SITC, Rev. 2), TEPAV calculations

II. CACCI Positioning in the Global Technology Era

Following the general mapping in the introduction, this section takes a deeper look at CACCI's position in the global technology landscape. We begin with a technology-focused descriptive analysis, followed by a detailed examination of critical technologies. Figure 6 presents the share of high-tech exports in total exports across CACCI countries.

Taiwan and Philippines have consistently maintained a high proportion of high-tech exports. Taiwan stands out with a high-tech export volume of USD 333 billion, driven largely by electronics and machinery. Philippines has reached USD 54 billion in high-tech exports, mainly from the electronics and machinery sectors similarly. A striking example of rapid growth is Vietnam, whose high-tech exports rose from just USD 43,000 in 1995 to USD 204 billion in 2023, with electronic components leading the high-tech export growth. In these countries, investment agreements and foreign direct investment (FDI) has played a key role in boosting high-tech capacity. Among CACCI countries, Singapore continues to attract the highest level of investment and maintains this upward trend. At the same time, Vietnam has also steadily increased its foreign investment over the last 20 years. Although the growth in the Philippines has not been as consistent as in Vietnam, it has also seen a rise in investment during this period. In these countries, targeted investment agreements with multinational companies have played an important role and have contributed significantly to the growth of high-tech exports.

Figure 6 The share of high-tech exports in total exports, %, 1995-2023

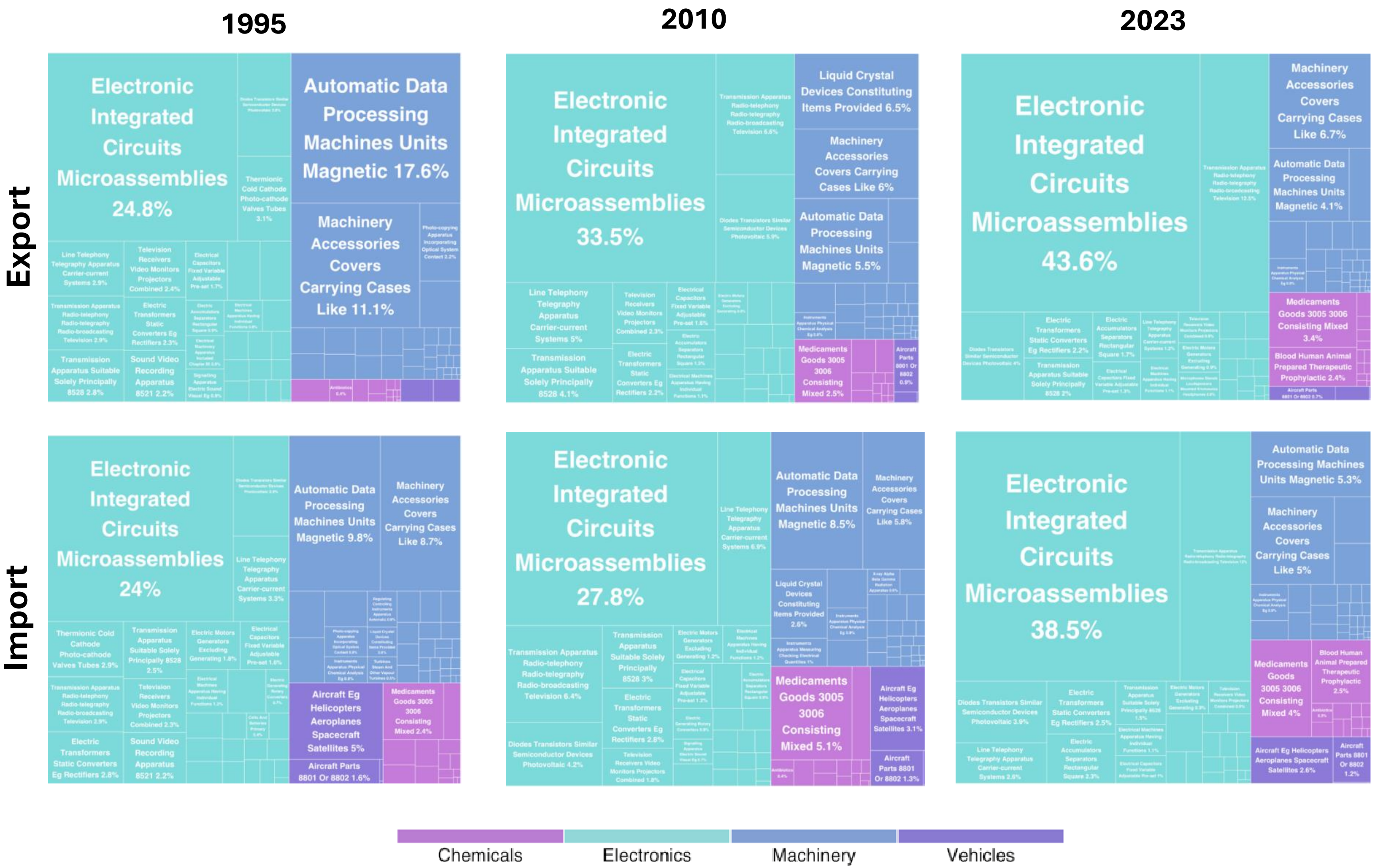


Source: CEPII BACI, TEPAV calculations

To identify the key high-tech sectors within CACCI, Figure 7 shows the sectoral distribution of high-tech exports and imports for 1995, 2010, and 2023. In 1995, CACCI's total high-tech exports amounted to USD 357 billion, increasing to USD 825 billion in 2010 and reaching USD 1.4 trillion in 2023. In 1995, CACCI had a trade surplus in high-tech sectors, with imports at USD 284 billion. However, by 2010, imports had grown to USD 851 billion, surpassing exports. In 2023, high-tech exports and imports were nearly balanced. Interestingly, the sectoral distribution of high-tech exports and imports has remained largely consistent since 1995.

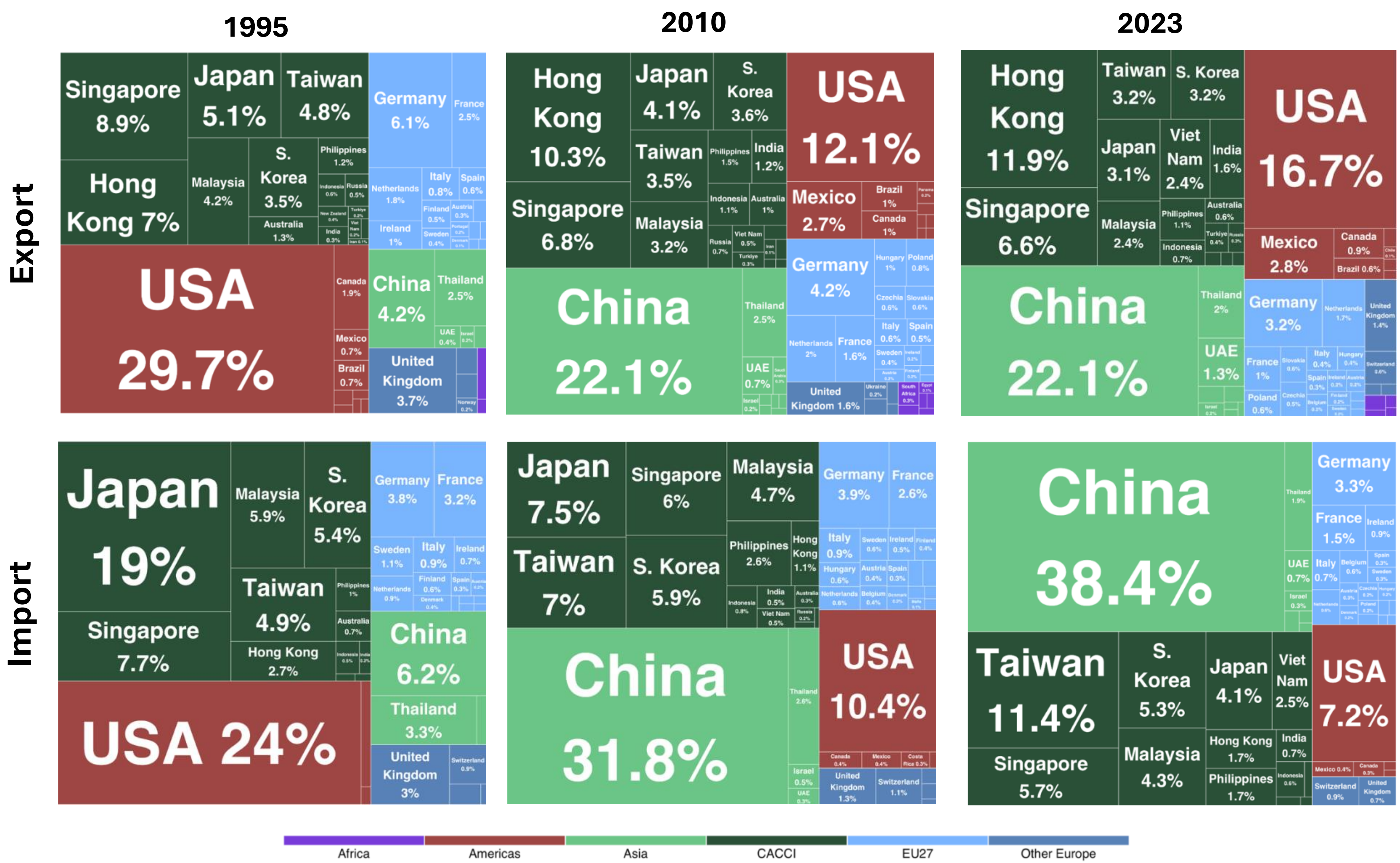
In 1995, both high-tech machinery and electronics were dominant, but over time, electronics have become increasingly central. This trend aligns with the country-specific patterns observed earlier. It also reflects CACCI's role in electronic value chains. In CACCI, exporting high-tech electronics requires importing high-tech electronics components. This brings up an important question: What is CACCI's exact position in the electronic value chain, and to what extent does its high-tech trade rely on intra-regional trade compared to imports from outside the region? Figure 8 provides insight into this by showing CACCI’s high-tech trade partners by country. The most notable change since 1995 is the rising importance of China, especially in imports. While Japan and the US had higher shares in 1995, their roles have declined, and China’s share has significantly increased. Between 2010 and 2023, China’s share in CACCI’s high-tech exports remained stable, but its role as an import partner continued to grow. Meanwhile, the US has begun to regain share in CACCI’s high-tech exports.

Figure 7 Sectoral distribution of CACCI's high-tech exports & high-tech imports, 1995-2010-2023



Source: CEPII BACI, TEPAV calculations

Figure 8 CACCI's high-tech trade partners by country, 1995-2010-2023



Source: CEPII BACI, TEPAV calculations

Another key indicator of high-tech trade dynamics, which could contribute to this assessment, is the quality of new products added to export baskets over time. Figure 9 shows the number of competitive export products added by each CACCI country from 2008 to 2023, along with the total value and per capita value generated by these new exports. Countries like Uzbekistan, Cambodia, Vietnam, Georgia, Iran, and Turkey have significantly diversified their export baskets. However, not all have created high value through this diversification. For example, Vietnam added 37 new products and generated USD 71 billion in value (USD 712 per capita), largely driven by electronics. Turkey, by comparison, added 32 new products, but generated only USD 6 billion (USD 75 per capita), mostly from agriculture, livestock, and chemical products. This shows that the technology level of new products is as important as diversification itself. Other countries such as Azerbaijan and Papua New Guinea also stand out in Figure 10 for generating high export value from a small number of new products. However, most of these are petroleum products and not relevant to our technology agenda. In countries like Indonesia and Malaysia, new export products are concentrated in metal sectors (e.g., aluminum, steel, precious stones), though Malaysia also includes medical devices and chemicals. In Cambodia, nearly half of the new exports are electronics. South Korea's new products are mainly in chemical cosmetics (70%), while Singapore's are dominated by food preparations and some medical devices.

Figure 9 Number of competitive products added to the export basket and their total values between 2008 and 2023

Country	New products	USD per capita	USD (million, total value)
Australia	2	$4	$102
Azerbaijan	8	$976	$9,890
Bangladesh	9	$2	$283
Georgia	28	$85	$318
Hong Kong	6	$174	$1,310
Indonesia	16	$6	$18,000
India	17	$7	$9,410
Iran	39	$14	$1,200
Japan	4	$1	$118
Cambodia	49	$452	$7,690
S. Korea	16	$215	$11,100
Sri Lanka	14	$2	$181
Mongolia	2	$53	$186
Malaysia	24	$358	$11,800
Nepal	10	$2	$78
New Zealand	2	$1	$7
Pakistan	23	$7	$1,650
Philippines	25	$36	$3,990
Papua N.G.	2	$421	$5,180
Russia	15	$112	$16,300
Singapore	12	$1,250	$7,420
Tajikistan	12	$15	$155
Turkiye	32	$75	$6,400
Taiwan	7	$31	$714
Uzbekistan	68	$59	$2,140
Viet Nam	37	$712	$71,400

Source: The Growth Lab at Harvard University, TEPAV visualization

As discussed earlier, technology now lies at the heart of not only trade but also security and sustainability. New technologies can simultaneously drive productivity and environmental progress, while also blurring sectoral boundaries. High-tech sectors such as electronics and aerospace no longer operate in isolation. They now function as platforms, integrating with cutting-edge fields like materials science, artificial intelligence, and energy technologies. A country's competitiveness in high-tech sectors depends heavily on its ability to lead in these frontier technology areas. The added value of new export products also reflects this trend. Competing globally in high-tech requires adapting to changing demand while maintaining efficiency. This depends on countries' absorptive capacity which can be defined as their ability to adopt, adapt, and integrate new technologies. Areas like advanced materials, AI, and robotics are preconditions for sustained global competitiveness in high-tech industries.

One way to assess this capacity is through the UNCTAD Frontier Technology Readiness Index, which measures how prepared countries are to adopt and use frontier technologies. Figure 10 presents CACCI countries' index rankings from 2010 to 2023. The results show high variation again:

- High readiness countries include South Korea, Singapore, Japan, and Australia- global leaders
- Moderate readiness countries include New Zealand, India, Russia, Turkey, and Malaysia
- Emerging readiness countries include Vietnam, Philippines, Indonesia, and Iran
- Limited readiness countries include Azerbaijan, Pakistan, Bangladesh, and Cambodia

Interestingly, high-tech export volume does not always align with frontier technology readiness scores. This suggests that export growth-often driven by foreign firms-does not necessarily reflect a country's internal technological ecosystem. Building sustainable capacity requires a functioning technology ecosystem, as seen in South Korea's long-term success.

Figure 10 Frontier Technology Readiness Index - CACCI Countries' Rankings

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Australia	11	10	10	10	14	15	8	15	16	18	17	15	15	16
Azerbaijan	94	84	83	80	89	96	100	100	94	94	95	99	113	102
Bangladesh	122	122	120	126	114	115	115	108	102	102	116	120	117	111
Cambodia	152	149	136	122	120	121	108	113	111	109	113	104	109	109
Georgia	76	80	73	70	72	66	74	73	75	74	74	77	77	78
Hong Kong	20	22	14	22	15	17	17	17	17	14	7	10	10	14
India	56	50	45	45	46	48	49	53	49	48	47	48	42	35
Indonesia	78	83	78	83	81	67	76	74	69	76	80	72	75	75
Iran	79	85	79	81	80	79	71	77	77	72	75	73	71	72
Japan	9	13	16	16	17	18	19	20	19	19	20	20	18	20
Malaysia	44	43	42	44	44	47	41	38	36	34	33	34	35	42
Mongolia	106	102	99	89	93	100	94	106	101	98	104	90	89	94
Nepal	117	111	107	107	107	116	110	120	91	100	100	103	99	95
New Zealand	22	14	19	18	20	20	22	24	25	23	21	21	21	23
Pakistan	116	118	122	121	124	129	126	133	134	134	134	130	124	121
Papua New Guinea	151	145	139	131	130	132	133	150	140	136	140	138	138	140
Philippines	60	58	65	61	50	54	54	52	54	56	61	58	58	60
Russia	35	34	32	29	25	25	26	28	28	28	31	33	32	33
S. Korea	3	4	5	5	8	8	6	8	9	12	10	9	7	7
Singapore	10	15	17	7	5	3	4	5	5	3	6	4	4	5
Sri Lanka	98	94	92	99	90	90	90	87	86	83	82	84	84	87
Tajikistan	123	124	123	133	132	137	138	140	152	147	159	156	151	154
Turkiye	47	54	54	60	57	56	52	48	46	47	45	46	46	43
Uzbekistan	102	109	108	111	108	114	116	115	106	93	93	89	80	86
Viet Nam	66	65	66	68	73	68	63	62	61	64	63	53	61	64

Source: UNCTAD Frontier Technology Index 2023 Data, TEPAV visualization

As emphasized earlier, sustainable technology development depends not only on production, but also on research and development (R&D). Corporate R&D, in particular, plays a vital role in activating the broader technology ecosystem, including universities, research institutes, and startups. It also supports long-term human capital development. According to the 2024 EU Industrial R&D Scoreboard, 85% of global private-sector R&D spending comes from just 2,000 firms. Among these, 681 are US-based, making up 42% of the total. From the CACCI region, 10 countries have companies on this list. As seen in Figure 11, CACCI representation includes: Japan with 185 companies, Taiwan with 55, and South Korea with 40. In addition, 15 to 1 firms from India, Singapore, Australia, New Zealand, Turkey, Indonesia, and Vietnam are also represented at the list. This confirms that while CACCI is diverse, it includes several countries with strong private-sector innovation ecosystems.

Figure 11 Distribution of companies with the highest R&D expenditures, 2024

Country	Region	Total R&D Expenditure (€ million)	Number of Company
USA	USA	531858.3	681
China	China	215813.8	524
Japan	CACCI	104790.5	185
Germany	EU27	111923.2	106
UK	Other	35441.9	63
Taiwan	CACCI	24794.9	55
France	EU27	33675.1	50
S. Korea	CACCI	42548.4	40
Switzerland	Other	36214.7	39
Netherlands	EU27	29853.7	33
Canada	Other	8241.9	24
Ireland	EU27	10371.9	24
Denmark	EU27	9878.3	23
Sweden	EU27	15278.0	22
Israel	Other	3713.3	19
Italy	EU27	5427.7	17
India	CACCI	5318.7	15
Spain	EU27	5666.9	11
Austria	EU27	1952.0	11
Finland	EU27	5426.4	9
Belgium	EU27	3169.6	9
Singapore	CACCI	2694.2	8
Australia	CACCI	4167.1	7
Brazil	Other	1751.9	4
Luxembourg	EU27	1910.2	3
Saudi Arabia	Other	1666.1	2
Norway	Other	784.7	2
New Zealand	CACCI	327.3	2
Türkiye	CACCI	263.7	1
Colombia	Other	494.6	1
UAE	Other	335.9	1
Hungary	EU27	204.5	1
Thailand	Other	102.5	1
Indonesia	CACCI	205.6	1
Malta	EU27	94.8	1
Portugal	EU27	222.3	1
Slovenia	EU27	178.6	1
Vietnam	CACCI	95.5	1
Iceland	Other	94.5	1
Liechtenstein	Other	489.1	1

Source: EU Industrial R&D Scoreboard 2024 , TEPAV visualization

CACCI's positioning in the global technology era can be described as diverse-heterogeneous and rapidly evolving. Following the general technology landscape overview, this section focuses more specifically on critical technology areas. This helps clarify how CACCI, both as a region and as sub-regions or individual countries, stand at the critical technologies competition and how they can strengthen competitiveness in key fields. Understanding where CACCI stands in these areas will also allow us to shape targeted cooperation models and policy suggestions. This section applies a structured methodology adapted from the European Commission's study "Analysis of the EU's Positioning in Critical Technology Value Chains" by Frontier Economics[1]. This analysis measures proximity to global best practice, comparing CACCI countries to global leaders using several indicators. We focused on four critical technology domains, based on available OECD data and aligned with the EU study:

- Artificial Intelligence (AI): Includes machine learning, neural networks, natural language processing, and related fields.
- Biotechnology: Focuses on health-related applications like pharmaceuticals, biologics, and medical biotechnology.
- Advanced Connectivity: Involves telecommunications and ICT networks for high-speed, secure communication.
- Energy Technologies: Primarily covers renewable energy, storage, and smart energy systems in addition to the current traditional industrial strength.

[1] DigitalEurope, The EU's Critical Tech Gap (Brussels, 2024); Frontier Economics, Analysis of the EU's Positioning in Critical Technology Value Chains: https://cdn.digitaleurope.org/uploads/2024/06/REPORT Economic-Security-Strategy-analysis-study-FINAL-STC.pdf

Each domain is assessed using two main pillars and the indicators used are listed at the Figure 12 below[2]: Scientific Performance (33%) and Industrial Strength (67%). For each indicator, a country's value is divided by the global leader's value, generating a "proximity to best practice" score from 0-100%. To determine the value of the 'Scientific Performance' and 'Industry Strength' pillars, we calculate the geometric mean of the proximity to the global frontier for each indicator within the pillar. The geometric mean helps to maintain the general trend of each country. Finally, we averaged the values of Scientific Performance and Industry Strength to calculate the overall score for each technology, giving them weights of 33% and 67%, respectively. The 67% weight on industry strength reflects that current industrial capability matters more than research potential alone for capturing value in technology value chains. However, scientific performance remains important as it indicates future potential and the ability to absorb and adapt.

Figure 12 Scientific performance and industry strength indicators

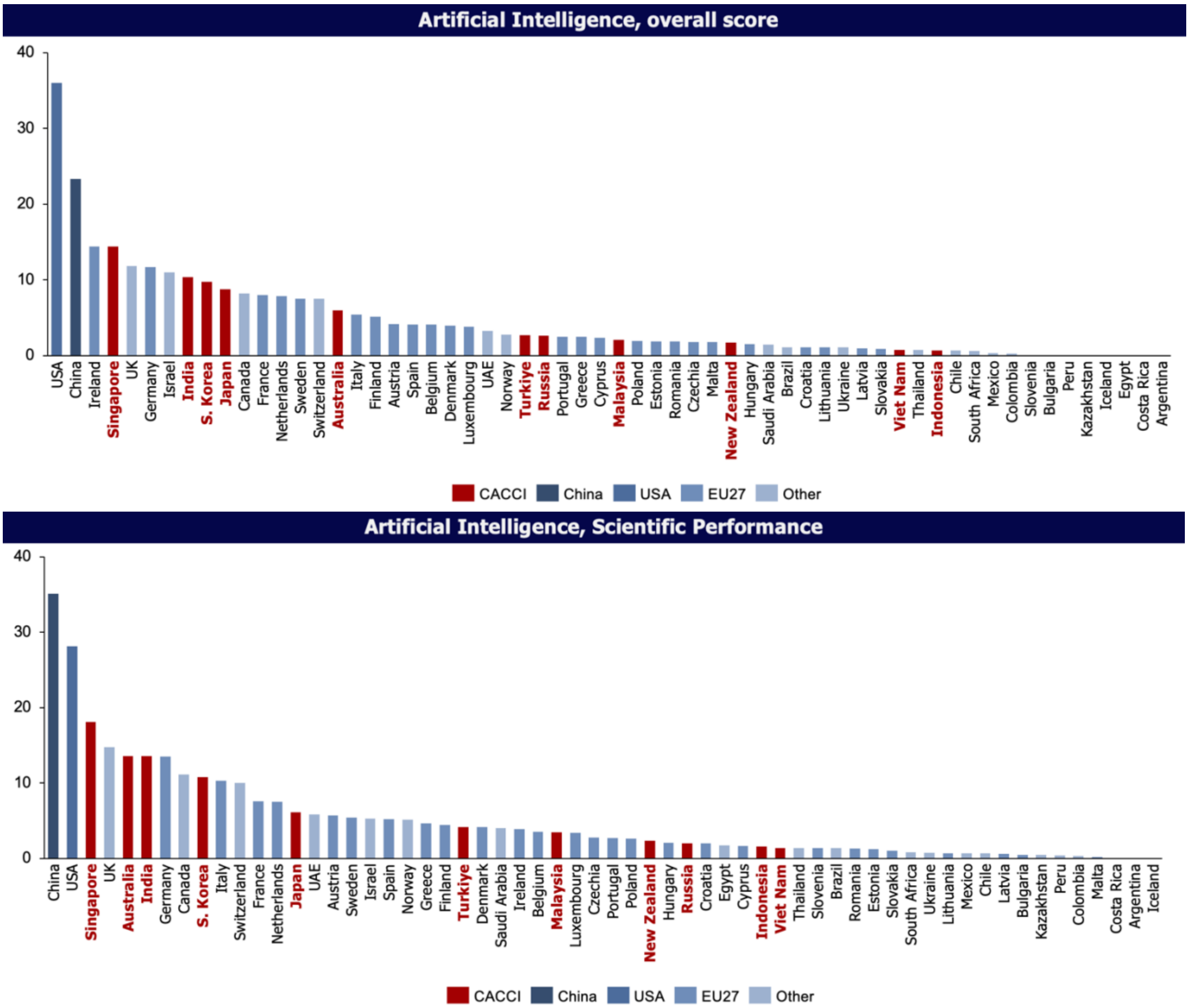
Pillar	Indicator	Reasoning
Scientific performance	Number of scientific publications	Measures scientific expertise though quantiy of publications
	Number of scientific publications, per 1 million population	Measures scientific expertise though quantiy of publications, relative to that country's resource base
	Number of leading scientific publications	Measures scientific expertise though quantiy of publications
	Number of leading scientific publications, per 1 million population	Measures scientific expertise though quantiy of publications, relative to that country's resource base
Industry strength	A country's share of global production for related sectors	Measures business capability throgh quantity of production
	Count of leading global R&D businesses	Measures innovative track record
	Business patent applications	Measures innovative track record
	Business patent applications, per 1 million population	Measures innovative track record, relative to that country's resource base
	A country's share of global gross exports for related sectors	Measures business capability and specialisation relative to other countries, though strong sales in international markets
	Exports for related sectors as a proportion of total exports for a country	Measures business specialisation, through a greater exporting outperformance for the technology, relative to the country's broder exporting performance
	Domestic value added that is embodied in foreign exports, as a share of a country's gross exports	Measures business specialisation in collaboration with other countries in the supply chain, where a country's exports are re-exported by the destination country
	A country's share of global exports of intermediate goods in related sectors	Measures business specialisation in collaboration with other countries in the supply chain, by exporting products used in production overseas

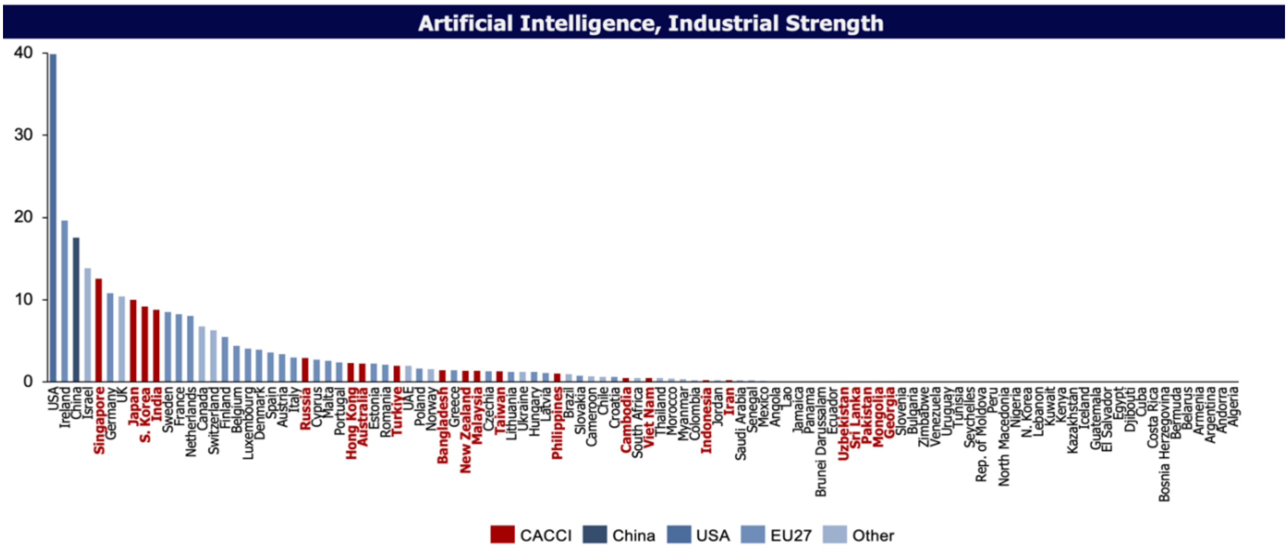
This section presents the comparative performance scores for individual countries across the four critical technology domains. For each technology, we present three perspectives: the overall score, scientific performance, and industry strength. It is important to note that because scientific performance data is more limited for CACCI countries, fewer countries appear in the overall score and scientific performance charts compared to the industry strength charts, where

[2] Several limitations should be noted: Data availability varies across countries and technologies. Some CACCI countries have limited data, particularly smaller economies. Some technologies are nascent with limited historical data. Aggregating diverse CACCI countries into a single "CACCI" entity is conceptually challenging. Unlike the EU, CACCI has no formal institutional structure or common market. Our CACCI aggregates should be interpreted as the combined capability of CACCI countries, not as a unified actor. We use the same methodology for calculating the scores of the regions as we did for the country. The only distinction lies in the aggregation procedure: all underlying data are consolidated to derive indicators for the four regions -CACCI, EU27, China, and the United States- each treated as a single composite economy. The sole exception to this approach concerns the indicator "Domestic value added embodied in foreign exports as a percentage of gross exports" which is computed differently. The indicator in question is computed as the mean value for the corresponding region, rather than being aggregated as a single economy. Technology landscapes change rapidly. Our analysis is based on the most recent available data (typically 2020-2023), but current realities may already differ.Despite these limitations, the analysis provides the most comprehensive, systematic, evidence-based assessment of CACCI's technology positioning currently available.

data availability allows us to assess a broader range of CACCI members. Figure 13 shows the overall score in AI, followed by scientific performance and industry strength components. The US is the clear global leader in overall AI competitiveness. Among CACCI members, a distinct performance hierarchy is visible; South Korea, Japan, South Korea, and India demonstrate high industrial strength comparable to leading countries. The scientific performance chart shows that CACCI countries have notable research capabilities in AI, with several members appearing in the upper half of global rankings. The industry strength chart reveals greater variation, with some CACCI countries showing strong commercial AI capabilities while others remain at earlier development stages. Overall, CACCI demonstrates moderate competitiveness in AI, with clear leaders but also significant gaps that need to be addressed through regional cooperation.

Figure 13 Overall Score in AI

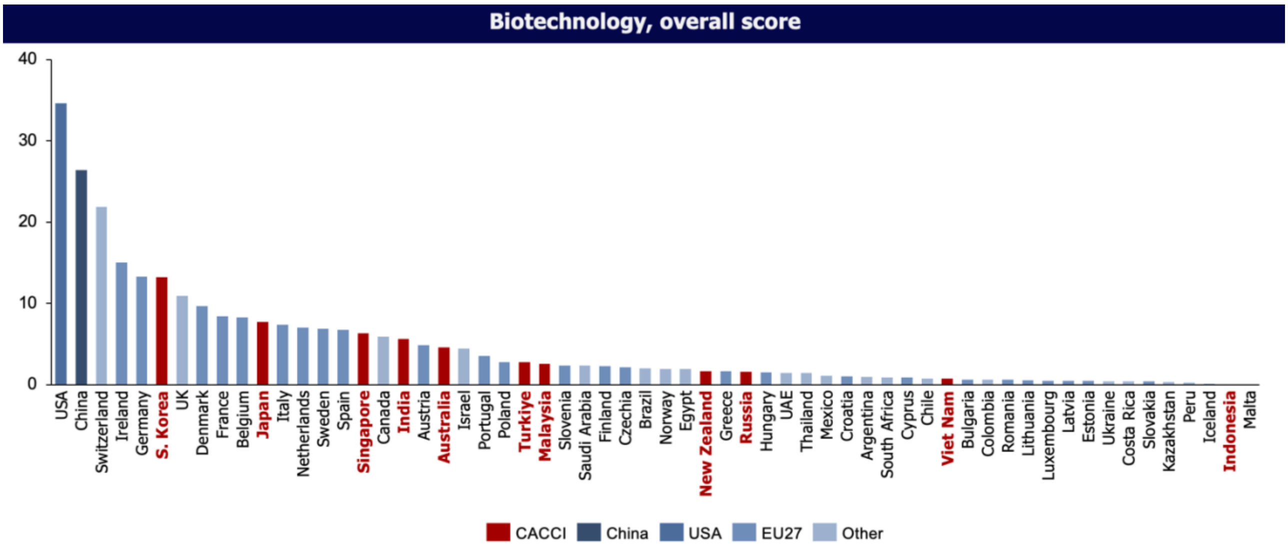


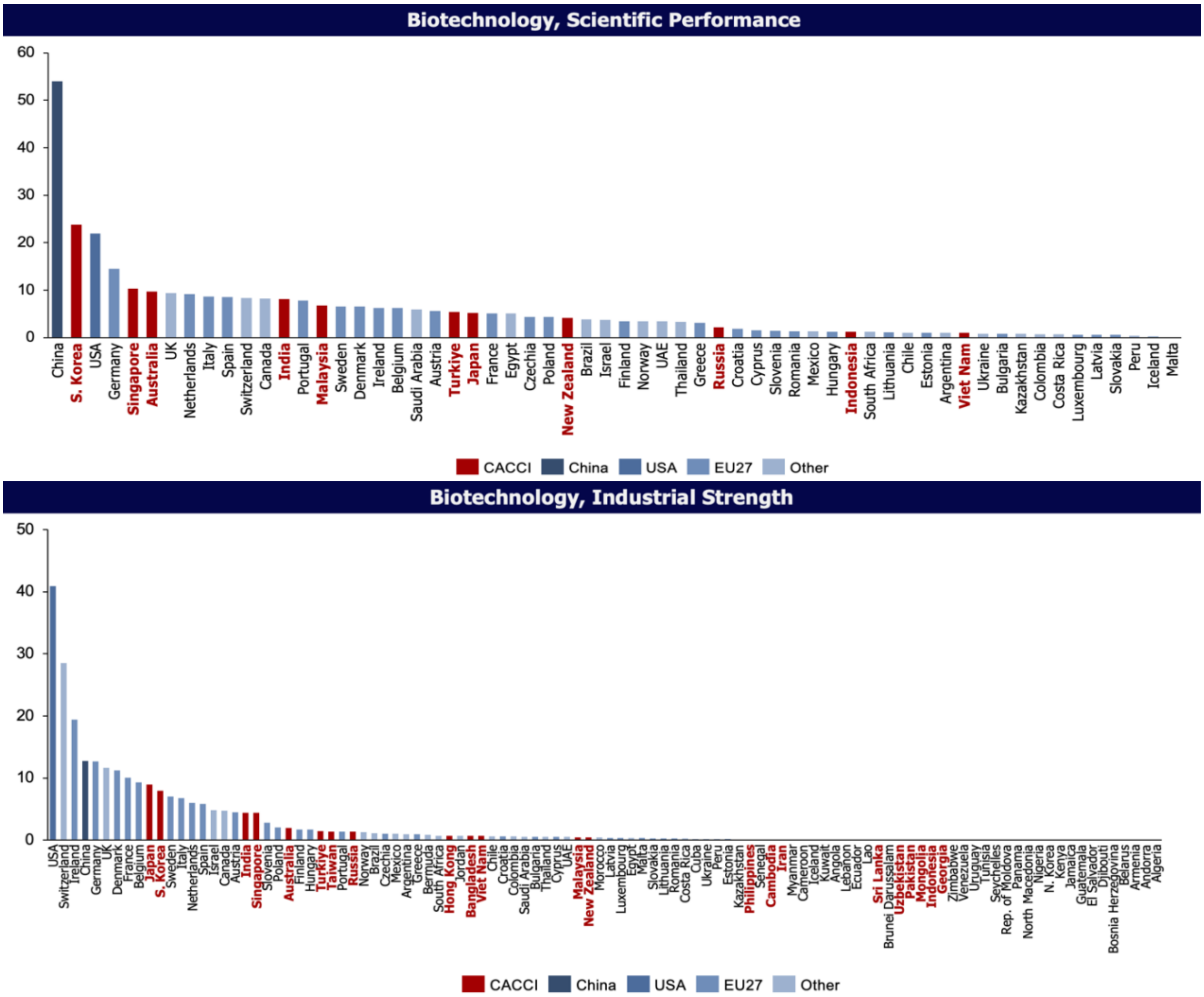


Source: OECD Statistics, TEPAV calculations

The analysis of biotechnology performance, shown in Figure 14, reveals a competitive landscape led by the US. Among CACCI countries, industrial strength is generally stronger than scientific performance, reflecting a common trend across the region. In scientific performance, China leads by a large margin, but it still lags behind the US in industrial strength and overall performance. Among CACCI countries, South Korea follows China in scientific performance and, together with Japan's strong industrial capacity, both countries place CACCI in the global top 10 for overall biotechnology performance. Other CACCI countries such as India, Singapore, Australia, and Malaysia show developing potential in biotechnology. The different components of biotechnology performance also reveal a common challenge: there is a clear gap between research output and commercial application.

Figure 14 Overall Score in Biotechnology

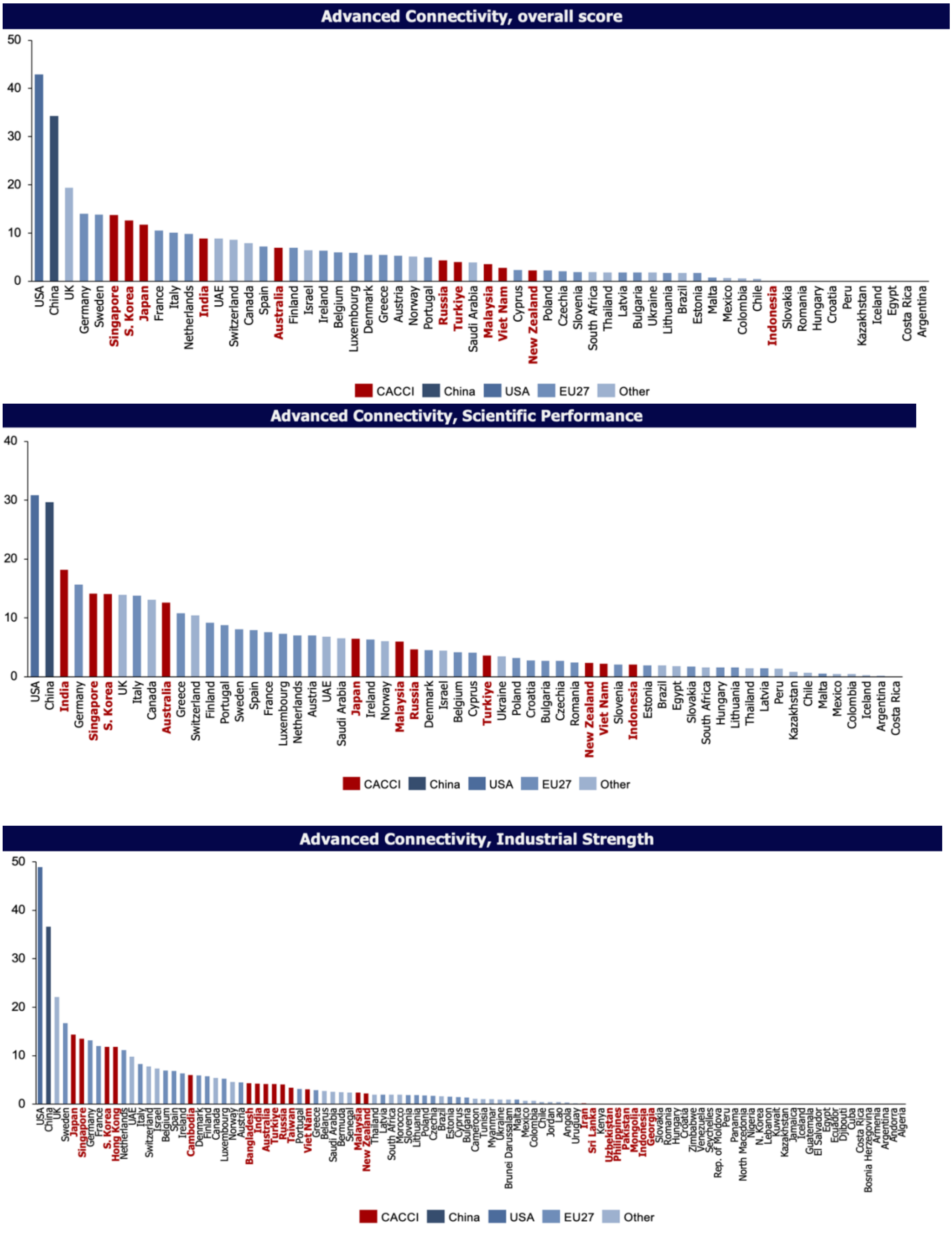




Source: OECD Statistics, TEPAV calculations

Figure 15 shows the overall scores in advanced connectivity, along with breakdowns for scientific performance and industrial strength. In this area, the US clearly leads across all indicators, showing strong dominance in both research and industry. China follows closely, maintaining a solid position, particularly in scientific performance. Among CACCI countries, India stands out with a notable overall performance, especially in scientific indicators. However, India's industrial strength remains relatively weaker, indicating that while research capabilities are improving, they are not yet fully translated into industrial competitiveness.

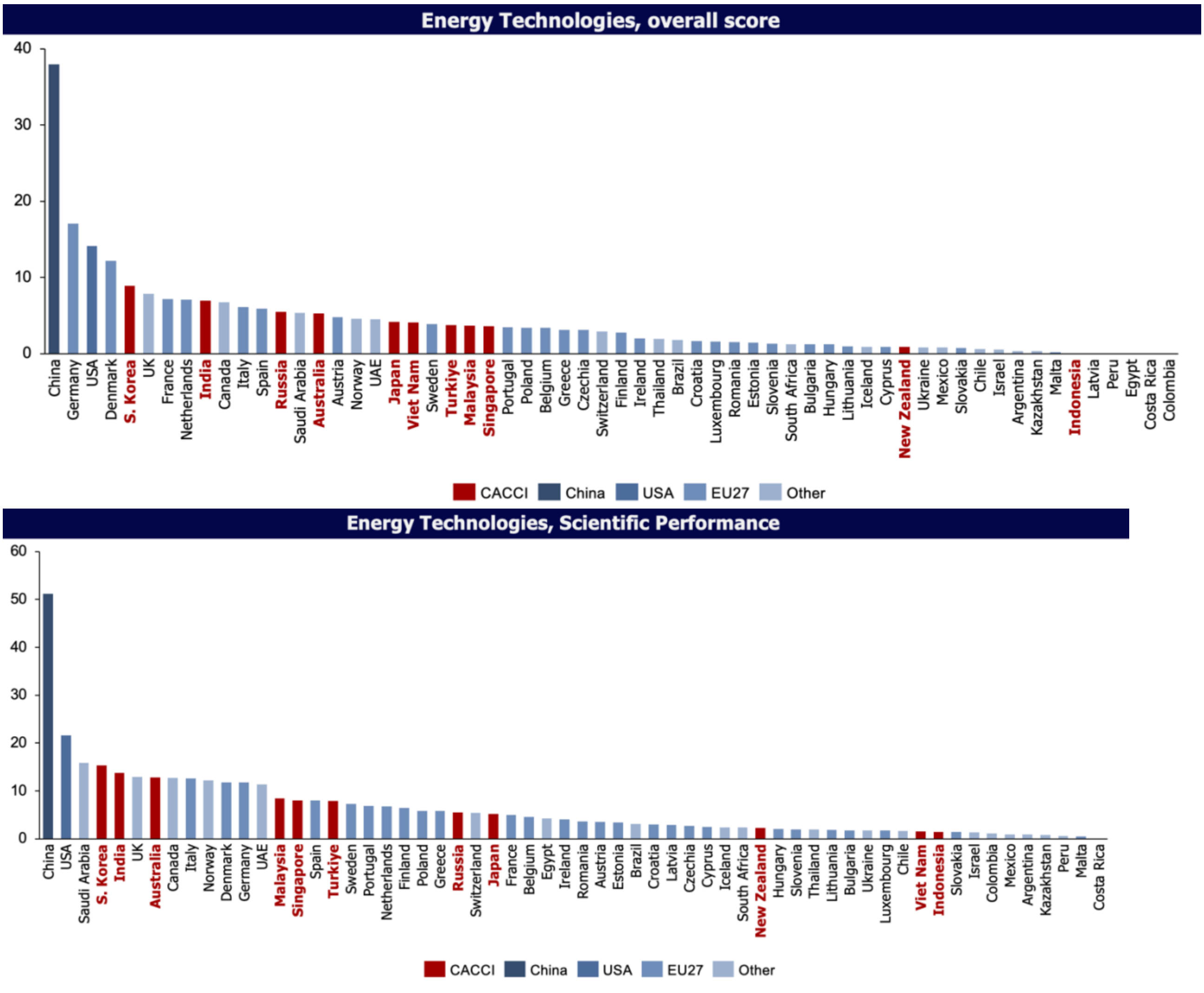
Figure 15 Overall Score in Advanced Connectivity

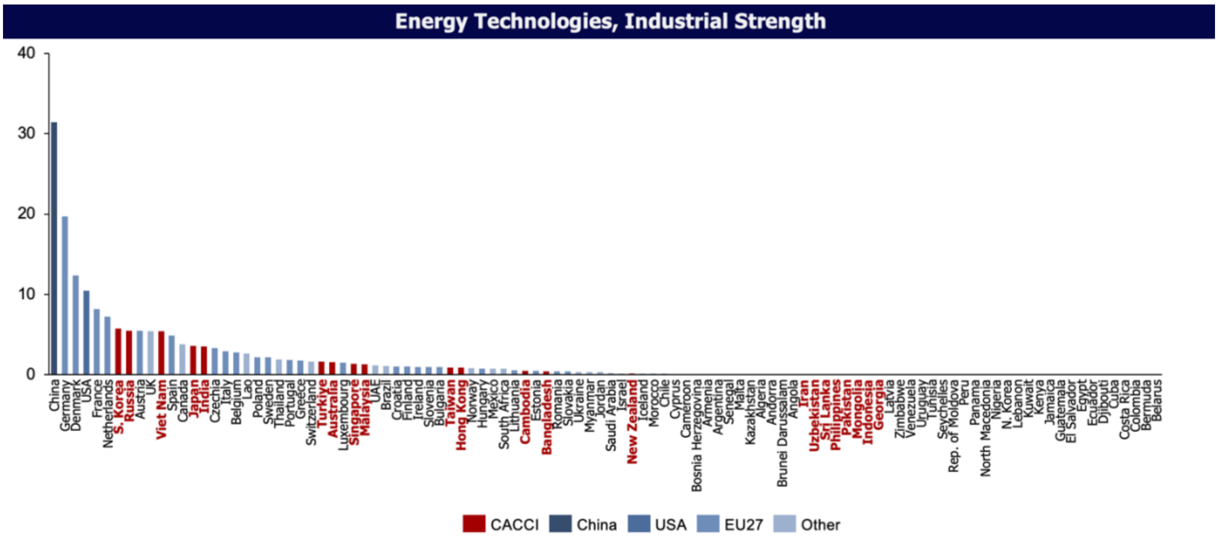


Source: OECD Statistics, TEPAV calculations

Figure 16 shows the overall scores in energy technologies, along with each country's scientific performance and industrial strength again. Unlike the other three technology areas, China leads clearly in this area, driven by its strong performance in both science and industry. A notable difference here is the appearance of Germany in second place overall, largely thanks to its high industrial strength, even though it is not a CACCI country. Among CACCI members, South Korea and India show relatively strong overall performance. Interestingly, in the industrial strength dimension, Russia and Vietnam also rank near the top, indicating their growing role in energy-related manufacturing and deployment. This suggests that in energy technologies, CACCI's strengths are more diverse, with different countries excelling in different components of the value chain.

Figure 16 Overall Score in Energy Technologies





Source: OECD Statistics, TEPAV calculations

Now we turn to CACCI's overall proximity to global best practice across the four critical technology areas. As shown in Figure 17, the US leads in Artificial Intelligence (AI). Interestingly, despite its strong scientific performance, China is the farthest from the global best practice in AI overall, mainly due to its weaker industrial performance. In contrast, CACCI as a group appears closer to the AI global frontier than China, indicating relatively balanced capabilities. The situation is different in biotechnology, where the US again holds the leading position. However, CACCI performs noticeably weaker in this field overall. Despite South Korea’s strong scientific output and the industrial strength of Japan and India, CACCI still ranks far from the global frontier in biotechnology. This suggests that strong performance in individual countries does not yet translate into regional competitiveness.

A similar pattern can be observed in advanced connectivity. The US is once again the leader, but CACCI performs better in this area compared to biotechnology, especially in scientific performance, where some CACCI countries score highly in individual indicators. In energy technologies, the global leader is China, marking a shift from the previous trends. In this field, even the US ranks far from the global frontier, and CACCI shows a weak performance overall. This suggests that energy technologies present one of the biggest challenge for CACCI in terms of catching up with global leaders. In summary, CACCI is relatively closer to global best practice in AI and advanced connectivity, but faces more serious gaps in biotechnology and energy technologies. Still, it is important to emphasize the high heterogeneity among CACCI countries. Some members are close to global leaders, while others are still building their technology foundations. This diversity must be considered when designing regional cooperation strategies.

Figure 17 Overall CACCI proximity to global best practice in AI, Biotechnology, Advanced Connectivity, and Energy Technologies

AI	Overall score	Scientific Performance (Weight 33%)	Industry Strength (Weight 67%)
CACCI	52%	47%	55%
China	49%	81%	33%
EU27	62%	57%	64%
USA	73%	70%	75%

BIOTECHNOLOGY	Overall score	Scientific Performance (Weight 33%)	Industry Strength (Weight 67%)
CACCI	28%	30%	27%
China	51%	95%	30%
EU27	65%	54%	70%
USA	64%	48%	72%

ADVANCED CONNECTIVITY	Overall score	Scientific Performance (Weight 33%)	Industry Strength (Weight 67%)
CACCI	61%	60%	62%
China	63%	69%	60%
EU27	71%	68%	72%
USA	73%	71%	74%

ENERGY TECHNOLOGIES	Overall score	Scientific Performance (Weight 33%)	Industry Strength (Weight 67%)
CACCI	43%	39%	44%
China	78%	99%	67%
EU27	69%	62%	72%
USA	46%	53%	42%

Source: OECD Statistics, TEPAV calculations

III. Key Takeaways and Forward-Looking Policy Recommendations

CACCI's diversity is both a challenge and an opportunity for regional technology cooperation. Our analysis throughout this paper has shown that CACCI countries are situated in very different positions in the global technology landscape. Some members like South Korea, Japan, and Singapore are close to the technology frontier with strong innovation ecosystems. Others like India, Vietnam, and Turkey are in the "wide range of opportunities" category with significant growth potential. Meanwhile, countries such as Cambodia, Bangladesh, and Pakistan are still building their basic technology capabilities. This heterogeneity means that a single, uniform approach to technology development will not work for CACCI. However, it also creates opportunities for complementary partnerships, where different countries can contribute different strengths to regional value chains.

High-tech export growth does not always reflect exact technological capability and readiness for frontier technologies. Our analysis reveals an important distinction between export performance and technology capacity. Countries like Vietnam have achieved remarkable growth in high-tech exports, rising from USD 43,000 in 1995 to USD 204 billion in 2023. However, this growth has been largely driven by foreign direct investment and integration into global value chains driven by this trend. This suggests that while export-oriented strategies can generate economic benefits, they do not automatically build domestic technology ecosystems or long-term innovation capacity. On the other hand, scientific performance does not automatically translate into industrial strength across CACCI like other countries and regions in the world. A recurring pattern in our analysis is the gap between research capabilities and commercial application. Intra-regional trade and technology cooperation within CACCI remain limited. Our trade analysis shows that CACCI's high-tech trade is heavily dependent on external partners, particularly China and the US. While China's role as both export destination and import source has grown significantly since 1995, intra-CACCI technology cooperation remains weak. Most CACCI countries operate as individual nodes in global value chains rather than as an integrated regional network.

It is evident that a "one-size-fits-all" policy approach is inappropriate for the diverse CACCI region. To move from globalization to regionalization successfully, CACCI needs to rethink its industrial policy tools and cooperation models to support regional technology sovereignty. The following recommendations are therefore designed to leverage CACCI's unique heterogeneity to build a resilient, cooperative, and competitive technological future.

- **Building a CACCI Strategic Foresight Alliance:** Regional technology planning requires shared tools and knowledge. A Regional Strategic Foresight Alliance can be established to support long-term decision-making. This platform can include shared data systems, trend monitoring, and scenario planning tools to help countries align strategies and respond to global shifts more effectively.
- **Focus on high-potential technology areas and create regional technology clusters linking multiple CACCI countries:** Instead of each country trying to build complete value chains independently, CACCI can promote cross-border technology clusters. The performance analysis shows that CACCI is closest to global best practices in AI and Advanced Connectivity. These areas can be prioritized for regional cooperation and investment. At the same time, more targeted strategies are needed to catch up in Biotechnology and Energy Technologies, where the region still lags behind. Starting point could be securing leadership in AI and Advanced connectivity by establishing a regional data-sharing frameworks, co-investing in next-generation connectivity infrastructure, and creating common standards for digital services and IoT devices to facilitate the growth of regional digital economy.
- **Developing Binational and Regional R&D Partnerships:** To increase innovation and technology capabilities, joint R&D programs between member countries could be expanded, especially in critical technology areas. Governments can support these partnerships with co-funding schemes for private-sector cooperation and risk-sharing mechanisms for early-stage technologies. Research should also focus on commercial applications with market potential to strengthen technology diffusion across the region.
- **Establishing a CACCI Technology Investment Fund:** To support early-stage R&D and commercialization efforts in critical technology areas like biotechnology and energy technologies across CACCI countries to bridge the defined gaps in that areas. This would also complement joint R&D platforms and the proposed Regional Strategic Foresight Alliance, turning strategic plans into funded technology initiatives.

- **Rethinking trade and investment policy & Aligning standards and certification for critical technologies across the region:** Trade and investment agreements in the region can be updated to reflect critical technology priorities. Policies can support joint product development, allow for technology licensing across borders, and create investment incentives for regional technology capabilities. For joint product development to succeed, technical standards, testing procedures, and certification systems can be harmonized across CACCI countries. Regulatory alignment can speed up product deployment and reduce costs for firms operating in multiple markets.

This policy paper provides a foundational analysis that introduces a technology-focused lens to assess CACCI's position in the global landscape. However, this is only the beginning. In following studies, the models and recommendations outlined here should be further developed into more detailed tools through technology-specific, country-specific, and value chain–specific analysis. As a key example, upcoming study could assess CACCI's presence across the stages of technology value chains specifically and identify where strategic gaps or dependencies exist. This would help determining not only the region's competitiveness, but also its overall risk to economic security, particularly in technologies with high external supply risk. These future analyses will also form part of the practical workstreams of the proposed Regional Strategic Foresight Alliance. One of the alliance's core roles will be to carry out this kind of forward-looking, evidence-based research. By doing so, it can support better policy coordination, shared strategic planning, and early warning mechanisms for CACCI in the global technology landscape.