UNIVERSITY OF CAMBRIDGE

Cambridge Industrial Innovation Policy

BABBAGE FORUM

JULY 2024

BABBAGE FORUM IN ASIA: RECONFIGURING SUPPLY CHAIN NETWORKS

MEETING REPORT

KEY UPDATES ON ASIAN INDUSTRIAL INNOVATION POLICY

In 2023, Asia contributes to 48% of the world's GDP1, 31% of the world's stockmarket capitalization, 60% of the world's population2, 53% of global goods trade, 59% of trade growth between 2001 and 20213. 49/80 of the world's largest trade routes start and/or finish in Asia4. For decades, industrial innovation policies (IIPs) have consistently taken center stage in Asia due to their role in the region's economic transformation. Amidst post-COVID economic challenges, consolidation of technological races, and rising protectionism, Asian nations adapted industrial innovation policies to ensure the sustainability of their supply chains and value chains. In 2024, Babbage Forum members from South Korea, China, Japan, Thailand, and Taiwan gathered in Seoul to update the status of their countries' IIPs. They underlined the:

Expansion of technological export markets: Chinese companies are going global, with firms rapidly expanding their footprint not only in ASEAN but also in Mexico, Morocco, and Hungary. For China, the decision to go abroad is motivated by intense domestic competitions.

Diversification of S&T supply and value chains: Major South Korean firms are already acting to diversify supplier networks in anticipation of possible supply chain disruptions; to de-risk scientific research, Korea also associated with Horizon Europe. The idea of a science value chain was discussed as a way to reduce R&D dependency on specific countries and to establish mechanisms for collaboration.

Realignment of industrial priorities: The Chinese government is pushing for "new quality productive forces" to drive (1) higher-end products, (2) digitalization of production systems, and (3) greening of Chinese industries. To ensure competitiveness and resilience, supply chains will need to go back to the basics, and become transferable, visible, digitalized, and substitutable.

Preempting supply chain shocks: South Korea has established a special cross-ministerial committee to enhance the resilience of critical supply chains, including research projects to modify processes requiring high-end chemicals facing export restrictions; Taiwan's TSMC is hedging against US sanctions by investigating alternatives to EUV lithography.

Electric vehicles (EVs) as a springboard for industrial change: Several developments in the region's automotive industries are unfolding. In Greater China, Foxconn and BYD collaborated to create an OS to rival Tesla's. Southeast Asia has been historically tied to internal combustion engine firms from Japan, but VinFast in Vietnam offers examples of potential leapfrogging into EVs to spearhead wider industrial transformation.

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1. INTRODUCTION

Hosted within the Institute for Manufacturing at the Engineering Department of the University of Cambridge, the aim of the Babbage Forum is to inform the practice of policy-making related to technology, innovation and manufacturing through a better integration of economic, engineering and management perspectives. The approach has been to gather a small international community of leading figures in economics, engineering and operations and distill effective policy practices. In 2023, the IIP practices of ten countries were explored through national reports, followed by a Forum in Cambridge to review findings and implications and cross-fertilize ideas among industrial innovation policymakers. In 2024, three regional meetings are held to update the status of industrial innovation policy in US, Asia, and Europe.

This report captures findings from the Babbage Regional Meeting Asia, held in Seoul, South Korea on 1st July 2024. Babbage Forum members from Thailand (representing Southeast Asia), China, Japan, Taiwan, and South Korea were first invited to deliver keynotes to provide an update on their regions' IIPs and policymaking contexts. These presentations were followed by open-ended discussions among 19 delegates (Table 1) around the pressing issues in the region: supply chain evolution; decoupling and technological bottlenecks; and emerging technologies.

This report is structured as follows: Section II explores the reasons of supply chain reconfiguration, with a discussion of "technology decoupling", which is believed to be the culprit for such reconfiguration. Section III presents the specific IIP contexts and priorities of countries and regions represented at the Meeting. Section VI provides Asian examples of IIPs instruments employed to support and protect critical or emerging technologies. Section V concludes and sets up discussion points for the Babbage Forum in September 2024.

Unless otherwise specified, all information/data originates from the Meeting.

Table 1. **List of Participants in Babbage Asia 2024.**

Participant	Country/Region	Organization
Prof. Alfonso Fleury	Brazil	University of São Paulo
Prof. Zhijian HU **Prof. Xiaobo WU** **Prof. Can HUANG** **Prof. Linan LEI**	China	Chinese Academy of Science and Technology for Development Zhejiang University
Prof. Patarapong Intarakumnerd **Prof. Takahiro Fujimoto**	Japan	National Graduate Research Institute for Policy Studies Waseda University
Prof. Joonmo Ahn **Byungsun Jung** **Prof. Jiwoong YOON** **Prof. Sangook PARK** **Prof. Sungjoo Lee** **Prof. Taeseog Oh**	South Korea	Korea University Korean Institute of S&T Evaluation and Planning Kyunghee University Seoul National University
Prof. Wong Chan Yuan	Taiwan	Sogang University National Tsing Hua University
Prof. Sir. Michael Gregory **Gordon Attenborough** **Sarah Cheung Johnson** **Dr. Carlos Lopez-Gomez** **Dr. Martin Ho**	UK	University of Cambridge

2. SOURCES OF SUPPLY CHAIN SHOCKS IN ASIA IN 2024

In 2024, Asian supply chains are grappling with significant disruptions primarily driven by geopolitical tensions, economic uncertainties, and shifts in global trade dynamics. Asian nations are facing unprecedented challenges in securing, manufacturing, and exporting critical technologies, which are essential for maintaining their industrial competitiveness. The disruptions are particularly acute in sectors such as semiconductors, advanced manufacturing, and digital infrastructure, where dependencies on cross-border supply chains are high. These shocks have led to delays in production, increased costs, and a heightened sense of urgency among Asian economies to reassess their supply chain strategies. We invited experts at the Babbage Meeting to interrogate the sources of supply chain shocks in the region.

Table 2 categorizes experts' views on supply chain shocks into the dimensions of geopolitics, technology, domestic economics, and domestic policies. Needless to say, a most obvious reason to reconfigure supply chains is geopolitical tension manifested through trade barriers. However, as far as the experts are concerned, most of the reconfiguration stem from the expectation of future trade restrictions rather than the resetrictions themselves. This has implications on competitive dynamics too. An interesting example is Taiwan's TSMC reducing reliance on EUV lithography to preempt US sanctions. However, this crowds in TSMC's competitors into EUV as a means to compete. Our Asian observers noted that supply chain reconfiguration can also be driven by technological competitions, whereby first movers in a technology, for example Generative AI (GenAI), prevents certain countries from benefiting from the advancement. Box 1 discusses the extent to which Asian countries perceive they are "decoupling".

While supply chain shocks are often attributed to tensions between countries, the technological and domestic origins of supply chain reconfigurations are often overlooked. The intrinsic uncertainty of emerging technologies' properties and demand subject their accompanying supply chains to the same selective pressures of creative destruction, contributing to constant evolution of supply network configurations. Our Chinese delegates note that Chinese firms, such as those in the EV sector, are likelier to remodel their supply chains due to domestic market saturation than due to circumventing sanctions. The phenomenon of intense internal competition and oversupply of certain technological components — is a trending topic in Chinese media and policymaking and is often described as "involution" (nèijuan) locally and recently by The Economist1. Finally, domestic policies to prioritize homegrown critical or high-value technologies is a major driving force of supply chain reconfiguration. For instance, Vietnam's desire to capture a share of the growing EV market motivated its firms to pivot from ICE to EV supply chains. Meanwhile, South Korea is revisiting the roles of chaebols — national-level entrepreneurs who work closely with government, historical examples being Samsung, LG, and Hyundai — by offering pan-ministry R&D projects across chaebols, research and technology organizations (RTOs), and universities.

To address these shocks, there is a clear need for robust industrial and innovation policies that focus on enhancing supply chain resilience. These policies could include strategies for diversifying supply sources, investing in domestic capabilities for critical technologies, and fostering regional cooperation to mitigate the risks associated with global supply chain disruptions. Such measures will be crucial in safeguarding the future of Asia's industrial and economic stability. The next sections share Asian countries' recent experience in navigating the challenges described above.

Table 2.

Asian supply chains are expected to be reconfigured around critical emerging technologies and geopolitical changes.

Source of Supply Chain Shock	Ways Supply Chains are being reconfigured	Examples
Geopolitics	Expectation of trade barriers	Expectations of US trade tariffs causing surge in Chinese FDI in Mexico Taiwanese firms setting up smartphone assembly lines in SEA in anticipation of further conflicts with Mainland China Samsung and LG diversifying supplier networks from China in anticipation of supply chain disruptions US creation of "chockpoints" on China causes TSMC to rely less on EUV to avoid lock-in into a chockpoint created by the US; In contrary, some non-TSMC firms are pursuing EUV as a means to outcompete with TSMC
	Competition of leadership in technological frontiers and erection of entry barriers by first-movers	US banning GenAI services to Chinese users
Technological	Technological change / creative destruction / intrinsic tech uncertainties making supply chain for emerging technologies an tri-al-and-error Ricardian comparative advantage of countries' industries are constantly evolving, hence firms and governments are constantly adjusting their supply networks from past iterations	
Domestic Economics	Domestic market saturation: Chinese and Japanese firms to expand abroad, noticeably in ASEAN and other "friendly" countries	
	"Involution" — excessive internal competition and resource depletion driven by historical manufacturing capacity encouraging Chinese firms to expand to external markets	Chinese firms' expansion to ASEAN and Belt-and-Road countries since 2023
Domestic Policies	Prioritization of homegrown deep-techs and localized R&D	Korea's chaebol — national-level entrepreneurs who worked closely with government; pan-ministry R&D projects involving chaebols, RTOs, and universities
	New industrial standards to digitalize production systems and reconfigure for greener, higher-end products / Industry 4.0	China's new Quality Productive Forces (detailed in Box 2)

HOW REAL IS TECHNOLOGICAL "DECOUPLING" AMONG COUNTRIES?

What do policymakers mean by "technological decoupling"?

To maintain a technological advantage in critical sectors, many countries perceive that some degree of separation from competitors is necessary, but not so much as to harming a country's own interests. In addition, domestic supply chain vulnerabilities exposed during COVID, strengthened some countries' resolve to pursue technological self-sufficiency. "Decoupling" entered the IIP lexicon a few years ago, and many policymakers have scrambled to educate themselves on the supply networks that connect their countries to many other friends and foes. "Decoupling", a headline-worthy phase a couple of years ago seems to have become part of our reality today.

According to Bateman (2022) at the Carnegie Endowment for International Peace, "technological decoupling" can in the strongest form, mean a "total technological divorce" between countries, while in its weaker form, refers to a "marginal reduction of technological interdependence between countries". Decoupling is also sector- and technology-specific, and can apply to technology end products and/or technology inputs. The former primarily applies to flows of goods and services, while the latter may include supply chain components, such as raw materials and data; know-hows and human capitals; funding and investments.

To cover the myriad of element in technology value chains, tactics to decouple may include export/import controls, investment restrictions, equipment authorizations, visa restrictions, financial sanctions, public procurement rules, and technology transaction rules — many of which have been exercised between the US and China in recent years, often under the rhetoric of national security, "bringing 'stolen' jobs back", and retaliation.

How decoupled are Asian nations?

As many existing studies have already attempted to assess the extent to which countries are technologically decoupling — by mapping out changes in policies, scientific collaborations, trade flows, foreign direct investments, and international student numbers — the focus of the remainder of this Box is to capture practitioners' perception of decoupling at the Babbage Asia Meeting.

Despite being at the epicenter of US-initiated technological decoupling, China notes that Chinese businesses and exports are still expanding overseas, primarily in ASEAN, Belt-and-Road, and Latin American nations. For our Chinese colleagues, the concern for decoupling is less pronounced on the downstream of the technological value chain but on the upstream: Faltering scientific collaborations adversely affects talent cultivation for reaching technological frontiers. The shift in US rhetoric around technological collaboration and investments renewed concerns over China's reliance on western technologies and products. Hence, the IIP reaction to decoupling is the expansion of domestic industrial innovation capabilities, while strengthening trade and technological ties with countries that remain open.

Other regions at the Meeting have to play the balancing act of maintaining profitability and technological sovereignty while circumventing the west's growing lists of sanctions against China — the largest import and export partner of Japan, South Korea, ASEAN, and Taiwan — or risk becoming a collateral damage. Our South Korean colleagues enrich the picture by stating decoupling can be in terms of workforce, value chain, and supply chain. In anticipation of supply chain decoupling, South Korea is creating strategic stockpile for critical technologies; Korean MNCs such as Samsung and LG are also diversifying their supplier networks from China in anticipation of supply chain disruptions. In Southeast Asia, trade decoupling is less pronounced as both intra- and extra-ASEAN trades have been growing.

Box 1.

3. INDUSTRIAL INNOVATION POLICY PRIORITIES IN ASIA IN 2024

The Babbage national reports for South Korea, China, Japan, and Singapore from 2023 highlighted Asian IIPs' focus on innovation as a means to spur economic growth and global competitiveness, with China and South Korea particularly focused on leveraging R&D to enhance technological self-sufficiency and Japan and Singapore emphasizing the integration of R&D with broader socioeconomic goals, such as healthy aging and sustainability, across multiple government agencies. All four surveyed nations closely aligned innovation policies with industrial policies to bolster key sectors through technological advancement. In particular, China, Singapore, and South Korea emphasized digital infrastructure (e.g. AI, 5G networks, semiconductors, cybersecurity), biotechnology, and advanced manufacturing (e.g. robotics, automation); while Japan underlined green technologies (e.g. renewable energies), digital technology, and healthcare technologies which are closely related to its demographic challenges. However, differences exist in how these Asian nations frame IIP. China and South Korea — both subjects of trade sanctions from US and Japan, respectively — place a heavier emphasis on strategic technologies, such as semiconductors, to secure technological sovereignty, whereas Japan and Singapore's IIP are framed in terms of societal transformation (e.g. through smart cities).

Fast forward in 2024, with the exacerbation of geopolitical tensions, China and South Korea, in particular, continue to focus on self-reliance in critical technologies but we also witness new strategies to enhance science and technology offerings, as shown in Table 3.

South Korea sees IIP as a means to increase national resilience. Korea is uniquely challenged by high technological and economic complexities1, low natural resource endowments, coupled by the export-driven nature of its economy. A case in point is Japan imposing export control on fluorinated polyamide and hydrogen fluoride to Korea in 2019 affecting electronic exports. The tariff imposed by flagship protectionist programs abroad, such as US's CHIP and Science Act and Inflation Reduction Act (IRA), China's Made in China 2025, and the EU's Carbon Border Adjustment Mechanisms (CBAM) also impacts South Korea's technological trades with third parties.

These challenges prompted South Korea to define 12 national strategic technologies — semiconductor, battery, advanced mobility, next-generation nuclear energy, AI, advanced robots and manufacturing, advanced biology, aerospace and maritime, hydrogen, cybersecurity, next generation communication, and quantum. Each of these strategic technologies commands a portfolio of IIP and internalized innovation capability. In response and anticipation to trade restrictions, South Korea is also enhancing its inventory management and stockpiling of Economic Security Items in a bid to stabilize supply networks. For instance, Korea is expanding the number of stockpile items from 200 to 300 and extending the stockpile quantity from 0-30 days and up to 180 days for rare-earth elements, and is building special storage facilities for its stockpiles.

China considers industrial innovation an important opportunity for economic growth and sectoral upgrades. Externally, Chinese industries face the challenges of western sanctions, global inflation, and supply chain relocations. Chinese-made green transition technologies, such as solar panels, batteries, and EVs, face particular difficulties in exporting to European countries and US as these destinations take a protectionist turn. Internally, critical technology bottlenecks appear to concentrate in foundational research. On the downstream of the science and technology value chain, "involution" (nèijuan) increasingly characterizes the domestic technology market as being over-saturated and over-competitive, leading to low marginal returns and the need to export abroad.

The Chinese response to these challenges can be summed up by systems integration and coordination. In response to intrinsic technological bottlenecks and increasing hostility towards international research collaborations, Chinese research institutions have adopted a more interdisciplinary approach. Semiconductor research centers, for example, sprung up in some universities to encourage collaborations between basic scientist, applied scientists, and engineers. Facing supply chain disruption, either due to sanctions or shortages, China accelerated supply chain digitization and the transition to interconnected supply networks to improve efficiency. Another important IIP narrative that emerged in 2024 is the notion of new quality productive forces, pivoting from growth-oriented IIPs to IIPs that are focused on developing homegrown disruptive and future-oriented technologies backed by resilient supply chains that minimizes vulnerability in critical sectors. Box 1 explores this concept in detail.

Southeast Asian nations characterize IIPs as government interventions that change the domestic economy towards sectors and technologies that offer better prospects for economic growth and sectoral welfare. The unique challenges facing Southeast Asia is the lack of recognized technology brands from the region, compounded by competitive imports from foreign countries. For instances, it was mentioned that Chinese EVs face no import tariffs in Thailand.

When it comes to IIPs, one of the stated objectives for Southeast Asia is to emerge from the middle income trap. Echoing the view from Babbage's 2023 Singapore report, this objective would be achieved by transitioning from being mere subcontractors to a knowledge-based economy. To this end, Southeast Asian IIPs are explicitly pivoting towards more vertically integrated industries to give rise to regional value chains in specific high-growth, high technological uncertainty sectors where leapfrogging is possible. Another IIP trend is the specialization in specific industries. For example, Vietnam's steady supply of good engineers allowed it to remain the top three mobile phone manufacturers in the world. Finally, Southeast Asia is witnessing a post-COVID diversification of IIP instruments, including workforce development and digitalization. Table 3 summarizes the IIP updates.

> *"Huawei was the beginning and sets an example for other Chinese tech firms to be resilient from supply chain sanctions"*

Table 3.

An update on industrial innovation policies in South Korea, China, Japan, and Southeast Asia.

Key lessons from Babbage 2023	New findings from Babbage 2024		
	How is industrial innovation policy framed?	**Challenges**	**Policy trends and examples**
South Korea. Private sector R&D drives industrial innovation; but they do not tend to affect IIPs All manufacturing sectors are export-oriented Lack international collaborations Korean IIPs are coordinated across ministries	IIP increases national resilience	**Internal/Intrinsic** High technological complexity. **External/Geopolitical** As an export-driven country without natural resource endowments, being exposed to direct1 and indirect2 trade barriers	Define 12 national strategic technologies with a portfolio of IIP instruments to support each Internalize innovation capability for strategic technologies3 Diversify the science value chain4 Stabilize supply networks via inventory management of economic security item
China. Top-down integrated governance mechanism of IIP with low policymaking participation from industry IIP serves to strengthen, integrate, and upgrade industrial capacity Lack of quantitative evaluation mechanisms for IIPs	Industrial innovation is an important opportunity for growth and sectoral upgrades	**Internal/Intrinsic** Industry 4.0 transformations Bottlenecks in critical technologies concentrated in upstream of value chain (basic research) Involution (neijuan) of sectors and the need to expand abroad **External/Geopolitical** US sanctions Supply chain relocations6 Global inflation	Balancing between incumbent and emerging industries Five-Year Plans guided by central and local governments and the market; and constant fine-tuning to these Plans Increasing focus on systems integration to address technical bottlenecks
Southeast Asia. Taken from Singapore: Transitions from subcontractors to knowledge economy Lacks inter-ministerial collaboration on IIPs Increasing R&D investments with a mix of mission-oriented research, research institution	IIP as government interventions that change the domestic structure of technologies	**Internal/Intrinsic** Lack of recognized technology brands from SEA **External/Geopolitical** Competitive imports from foreign countries8	SEA industries became more vertically integrated through explicit industrial policies Rise of regional value chains Post-COVID diversification of IIP instruments

CHINA'S NEW HIGH QUALITY PRODUCTIVE FORCES

Context and Rationale

China's concept of "New High-Quality Productive Forces" (HQPF) has emerged as a strategic response to the challenges and opportunities posed by the current global economic landscape. Amidst concerns about deflation, a deepening property crisis, and increased youth unemployment, China's manufacturing sector faces multiple challenges, including reduced industrial capacity utilization and declining domestic and international demand . In this context, China aims to transition from traditional, resource-intensive economic models to one driven by technological innovation and high-efficiency production, aligning with the broader goal of achieving "high-quality development".

What is HQPF and How It Is Implemented?

The policy of "New High-Quality Productive Forces" represents a shift from traditional production methods to a focus on advanced technologies, innovation, and the development of new industries. This concept, first introduced by President Xi Jinping in 2023, emphasizes three key areas:

Technology and Innovation: The core driver, focusing on the development of disruptive technologies and domestic innovation to spearhead new industries.

Future Industrial Development: Transformation of traditional industries through digitalization and decarbonization, alongside the fostering of emerging and future-oriented industries.

Industrial Chains: Strengthening supply chain resilience and sovereignty by focusing on key technologies and materials.

The implementation involves a coordinated effort across various levels of government and industry, emphasizing the need for regional adaptation and leveraging local strengths in research and development. Key enablers include reforms in economic and innovation systems, fostering talent, and ensuring environmental sustainability.

Implications on Chinese supply chains

China's "New High-Quality Productive Forces" policy is designed to strengthen the country's supply chains by addressing several of the key issues highlighted in Table 2:

Geopolitical Challenges: As global trade tensions rise, particularly between the US and China, the policy's emphasis on technological self-sufficiency and innovation reduces reliance on foreign technology and materials. By developing advanced domestic industries, China can mitigate the impacts of trade barriers and maintain the resilience of its supply chains. This is crucial as Chinese firms face increasing difficulties in accessing foreign technology due to geopolitical pressures.

Technological Uncertainties: The competition over technological leadership and the creation of entry barriers by first-movers are critical challenges. China's policy aims to make significant advancements in high-tech industries, such as artificial intelligence, biotechnology, and renewable energy, allowing it to overcome these barriers. By fostering domestic innovation and cutting-edge technology, China aims to create new industries that can compete globally, thereby securing its position in key technological sectors.

Box 2.

Domestic Economic Pressures: With domestic markets becoming increasingly saturated, Chinese companies are encouraged to expand abroad, especially into ASEAN and Belt-and-Road countries. The development of new quality productive forces enables Chinese firms to innovate and create high-end products that can compete internationally, thus easing the pressure of domestic market saturation. Additionally, by focusing on high-quality development, these forces help Chinese firms to avoid the pitfalls of "involution," where excessive internal competition depletes resources.

Domestic Policies: The focus on new high-quality productive forces aligns with the need for domestic policies that prioritize deep-tech and localized R&D. By fostering innovation and supporting the growth of emerging industries, this policy ensures that China remains at the forefront of technological advancements. This strategic focus will enhance China's industrial capabilities and ensure that its supply chains are less dependent on foreign technologies and more resilient to external shocks.

Lessons for other countries

The challenges and strategies outlined in China's approach to developing high-quality productive forces offer a perspective that could be of interest to other nations, including those facing similar supply chain disruptions:

1. **Building Technological Sovereignty:** Other countries might consider how enhancing domestic technological capabilities can reduce reliance on external sources, particularly during geopolitical tensions. Investing in R&D and fostering innovation domestically could strengthen supply chains against external pressures.
2. **Strategic Industry Development:** There is value in identifying and nurturing key emerging industries that align with future global trends, as seen in China's focus on sectors like renewable energy and advanced manufacturing. Fostering such industries could contribute to building resilient supply chains less susceptible to global market shifts.
3. **Regional and Global Expansion:** Encouraging companies to expand into new markets, similar to how Chinese firms are moving into ASEAN and Belt-and-Road regions, may help mitigate risks associated with market saturation and supply chain disruptions. Supporting industries in exploring new markets could lead to more diversified and robust supply chains.
4. **Policy Alignment and Coordination:** A coordinated approach to policymaking, where government strategies align with industrial and technological goals, has been beneficial in China. Ensuring that resources are effectively utilized and that new industries are supported by appropriate regulatory and financial environments might be considered by others as a way to enhance economic resilience and innovation capacities.

In drawing from these examples, countries can explore tailored approaches to enhance their own supply chain resilience and ensure sustainable economic growth in an increasingly complex global environment.

Further readings

CIIP published a review of New High-Quality Productive Forces in April 2024, available here.

Box 2.

4. ASIAN COUNTRIES DEPLOY A DIFFERENT PORTFOLIO OF INDUSTRIAL INNOVATION POLICIES TO SUPPORT CRITICAL TECHNOLOGIES

Stemming from different IIP constraints and objectives and target critical technologies, delegates from South Korea, China, and ASEAN provided examples of IIP instruments used to spur critical technologies, as captured in Table 4. Notable IIP principles mentioned during the Meeting include the diversification of R&D partners, piloting mission-oriented R&D models, the application of GenAI both in policymaking and digitalizing supply networks and sectors.

At the meeting, both our China and Southeast Asia delegates mentioned EVs and associated battery technologies as a focus area. On the upstream, China facilities data transfer to domestic and foreign automobile firms to accelerate development of autonomous vehicle algorithms, whereas Vietnam's VinFast recruits engineers from foreign automobile firms to fill its talent gap in the area. On the downstream, EV companies in China form regional supply chain clusters to benefit from agglomeration effect; whereas Vietnam opt for vertical integration and localizes battery production for its EVs to maximize value capture.

In terms of semiconductors, although China is facing hurdles obtaining photolithography machines and latest generation semiconductors, it has mastered domestic production of 16/17nm chips, which are sufficient for automotive electronics, IoT devices, and a range of industrial applications. In the meantime, China has increased policy guidance in conducting interdisciplinary foundation research on semiconductor. Southeast Asia has also seen a state-coordinated effort in securing technological leadership in semiconductors. Singapore earmarked an initial US$85 million to open a National Gallium Nitride Technology Centre by 2025; Malaysia announced in National Semiconductor Strategy in May 2024, with a target to court US$112 billion of investment in semiconductor fabrication, train and upskill 60,000 Malaysian engineers in semiconductors, and provide at least US$4.5 billion to operationalize the plan; Thailand has similarly set up a semiconductor consortium to coordinated efforts of MNCs, local suppliers, and universities, particularly diversifying semiconductor FDIs from solely Japan to also US, China, and Germany. South Korea illustrates their strategy to nurture critical technologies through diversification of scientific collaborations and supply chains. Interestingly, when Japan banned the export of fluorinated amides to South Korea, Korea researched on the use of lower quality fluorides that can be readily imported from Russia.

> *"Every Asian country wants to prioritize developing their own high-tech industries"*

Table 4.

Industrial innovation policy instruments by region and critical technology.

Critical technologies	Supporting industrial innovation policies / policy instruments surveyed at Babbage Meeting 2024		
	South Korea	China	Southeast Asia
Electric vehicles and batteries	Not discussed at the Meeting	Regional supply chain clusters around EV companies Specifying five development phases for EV scale-up Allow transfer of domestic driving data to companies' home country to train models	Pick EVs have higher technological uncertainty and room for leapfrogging Localizing battery production Vertical integration Recruitment of foreign engineers from established automobile firms (e.g. Vinfast)
Semiconductors	Diversify raw materials sources and develop strategies to cope with different import standards	Mastering domestic production of 17nm chips Increased policy guidance in semiconductor foundational research	Singapore to open National Gallium Nitride Technology Centre by 2025 Thai semiconductor firms set up Thailand Printed Circuit Association in 2019 Diversify semiconductor FDIs from Japan to also include US, China, Germany
For all critical technologies	Defined 12 national strategic technologies, each with a different portfolio of policy instruments to provide increased R&D investments and tax support Mission-oriented R&D model Diversification of R&D partners (e.g. joining Horizon Europe) Inventory management and stockpiling for economic security items Consider supporting chaebols + RTOs + universities again as supply chains reconfigure Use of GenAI tools to support policymaking	Interdisciplinary systems coordination to solve technological bottlenecks Apply Gen/AI to drive supply network innovation Create sector-specific AI models Diversifying/recofiguring supply chains to avoid US sanctions Accelerating supply chain digitalization	Role transition from localized OEMs to regional R&D center Pick spearhead technologies to upgrade other industries to Industry 4.0

5. OUTLOOK AND NEXT STEPS

Asia faces a new set of industrial innovation policy challenges as it navigates post-pandemic recovery, geopolitical tensions, and rapid technological change. The region, a global economic powerhouse, must balance economic growth with technological sovereignty while ensuring the resilience of supply chains and the competitiveness of its industries. These challenges are compounded by the ongoing technological race and rising protectionism, which threaten to fragment global trade and disrupt established industrial ecosystems.

In response, Asian countries have adopted diverse strategies to address these challenges through IIPs. China is focusing on technological self-sufficiency and the development of new quality productive forces, while South Korea emphasizes national resilience through strategic technologies and supply chain diversification. Southeast Asian nations are leveraging IIPs to move from subcontracting roles to developing knowledge-based economies, with particular focus on emerging technologies such as electric vehicles and semiconductors.

Despite the varied approaches, common themes have emerged, such as the importance of technological self-reliance, the need for regional collaboration, and the pursuit of digital transformation. However, differences are apparent in the emphasis on specific industries and the degree of government intervention. Outstanding questions that merit further discussion include the sustainability of current IIPs in the face of evolving geopolitical pressures, the effectiveness of regional collaboration in mitigating supply chain risks, and the potential for technological decoupling to reshape the industrial landscape.

As we look forward, key areas to watch include the realignment of industrial priorities in response to technological advancements, the evolution of supply chain strategies amidst ongoing geopolitical tensions, and the role of emerging technologies in driving industrial transformation. These will be critical topics for the upcoming Babbage Forum in September 2024, where members will continue to explore strategies to navigate the complex interplay of innovation, industrial policy, and global competition.

> *"Current models of industrial innovation policies appear inaccurate… Are there comparable historical precedence to describe the technological challenges we are facing today?"*