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China's Influence on Global Supply Chains in Green Transition, Digital Transition and Biopharmaceuticals

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I. Introduction

Global supply chains are being reorganized amid intensifying U.S.–China strategic competition, the expansion of economic security legislation, and persistent geopolitical risks. The logic of supply chain management is moving beyond cost and efficiency toward supply security, resilience, and technological and industrial security. As trade, technology, standards, data, industrial policy, and external economic strategy become increasingly intertwined, supply chains are no longer merely channels of production and trade. They have become strategic spaces in which economic competitiveness and security concerns are closely connected.

This reorganization is taking place alongside major changes in the foundations of industrial production and technological competition. The transition toward low-carbon systems is changing the conditions of energy, manufacturing, and key input supply, while the spread of digital technologies is reshaping the technological and material basis of production. The COVID-19 pandemic further exposed the strategic importance of biopharmaceutical supply chains, where public health, supply stability, regulatory capacity, and industrial competitiveness increasingly overlap. In this context, green transition, digital transition, and biopharmaceuticals have become key areas where industrial transformation, supply chain restructuring, and economic security concerns converge.

China's policy agenda has also moved in this direction. China's 14th Five-Year Plan and 2035 Long-Range Objectives, the 15th Five-Year Plan, and sectoral policy frameworks have emphasized digital economy development, green transition, and the bioeconomy as

important directions for industrial upgrading and supply chain strengthening. External initiatives such as the Belt and Road Initiative, the Digital Silk Road, and the Green Silk Road have also extended the reach of China's domestic industrial capabilities through overseas infrastructure, investment, standards-setting, and supply chain networks. In this context, how China's policy priorities and industrial capabilities are reflected in actual trade structures and supply chain relationships has become an important analytical question—yet these three fields have often been discussed separately rather than assessed within a common analytical framework.

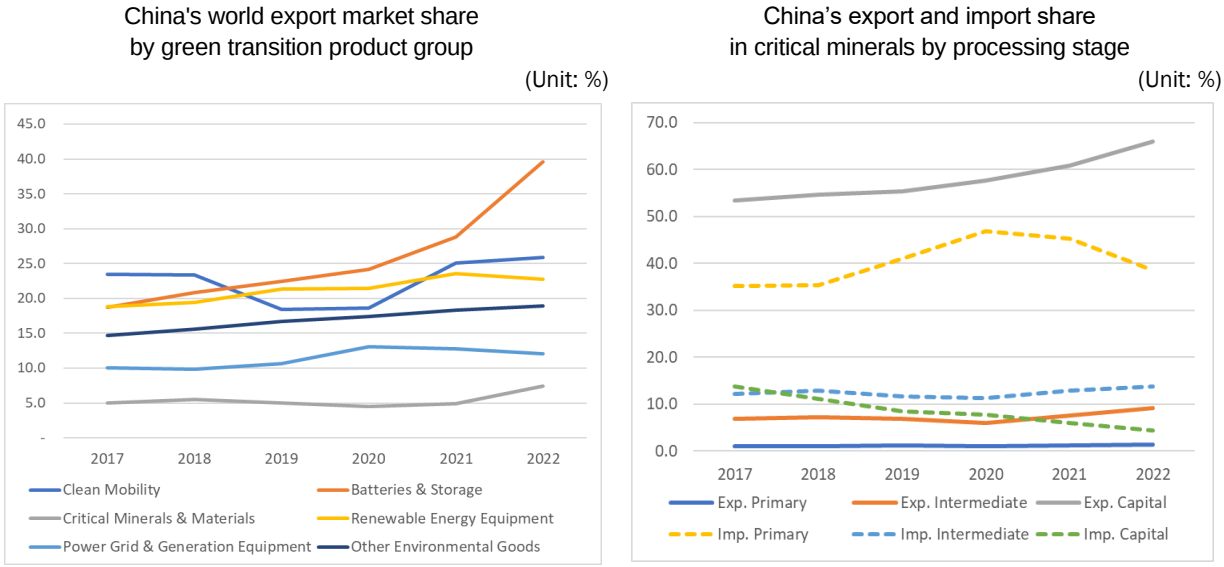
To analyze this influence, this report applies a common method based on trade statistics across the three fields. For each field, HS six-digit items are selected by combining product classification criteria used by international organizations with the U.S. critical supply chain framework under Executive Order 14017, and are then reorganized into field-specific product groups and processing or supply chain stages. Using UN Comtrade data, the analysis examines China's trade structure, world export market share, export competitiveness, trade specialization, processing-stage breakdowns, export destination structure, and major economies' import dependence on China. By applying comparable trade indicators and stage-based classifications across green transition, digital transition, and biopharmaceuticals, this report provides a structured basis for assessing how China's supply chain influence differs across fields, product groups, and stages of the value chain.

II. Green Transition: China as a Processing and Manufacturing Hub

Green transition requires changes not only in energy sources, but also in production systems, infrastructure, mobility, and key inputs. To reflect this broad scope in trade statistics, this report defines green transition goods by combining international environmental goods lists, including those of APEC and OECD/Eurostat, with energy-transition-related items from the U.S. critical supply chain framework. After removing overlaps, 658 HS six-digit items are selected and reorganized by product group and processing stage. This classification is designed to examine how China's role appears across different parts of green transition supply chains, rather than treating green goods as a single aggregate category.

China's green transition policy has been built around the goals of carbon peaking by 2030 and carbon neutrality by 2060. During the 14th Five-Year Plan period, China strengthened the institutional framework for green transition, and the 15th Five-Year Plan continues to emphasize green development. These policy efforts have been accompanied by rapid capacity expansion in renewable energy, electric vehicles, and batteries. In 2024, China's newly installed renewable energy capacity reached 373 GW, while cumulative installed renewable energy capacity reached 1,889 GW, accounting for about 56 percent of China's total power capacity. China also accounted for roughly 64 percent of global newly installed renewable energy capacity.

Figure 1. China's Role in Green Transition Goods and Critical Mineral Supply Chains



Note: Solid lines indicate exports; dashed lines indicate imports. Exp. = exports; Imp. = imports.
Source: Author's analysis based on UN Comtrade data; Adapted from Jung et al. (2025).

The trade data show that China's influence in green transition goods is concentrated in selected midstream and downstream manufacturing segments. China's world export market share in batteries and storage devices rose from 18.7 percent in 2017 to 39.6 percent in 2022, while its share in clean mobility reached 25.9 percent in 2022. Renewable energy equipment maintained a share in the low 20 percent range. By contrast, power grid and generation equipment remained in the low 10 percent range, and the "critical minerals and materials" category within the 658 green transition goods stood at 7.5 percent in 2022. Competitiveness indicators point in the same direction: the RCA for batteries and storage devices exceeded 2.5 in 2022, and the TSI for clean mobility rose above 0.8 after 2020.

The role of critical minerals requires careful interpretation. Under the 658 green transition goods classification, China's share in the "critical minerals and materials" category appears limited. However, under the OECD/WTO critical minerals framework, China's role is more visible as an importer and processor. China accounts for a high share of global imports of primary critical minerals, while its export share is much stronger in capital goods related to critical mineral processing than in primary mineral products. China's role in green transition supply chains is therefore better understood as that of a processing, equipment, and manufacturing hub. It imports upstream mineral resources, processes them, and links them to downstream production such as batteries, electric vehicles, and renewable energy equipment. China's high reliance on imported primary minerals points to upstream procurement risks for China, but these risks can be partly mitigated through overseas resource development, long-term procurement arrangements,

and control over refining and processing networks.

III. Digital Transition: ICT Export Strength and Improving Component Capabilities

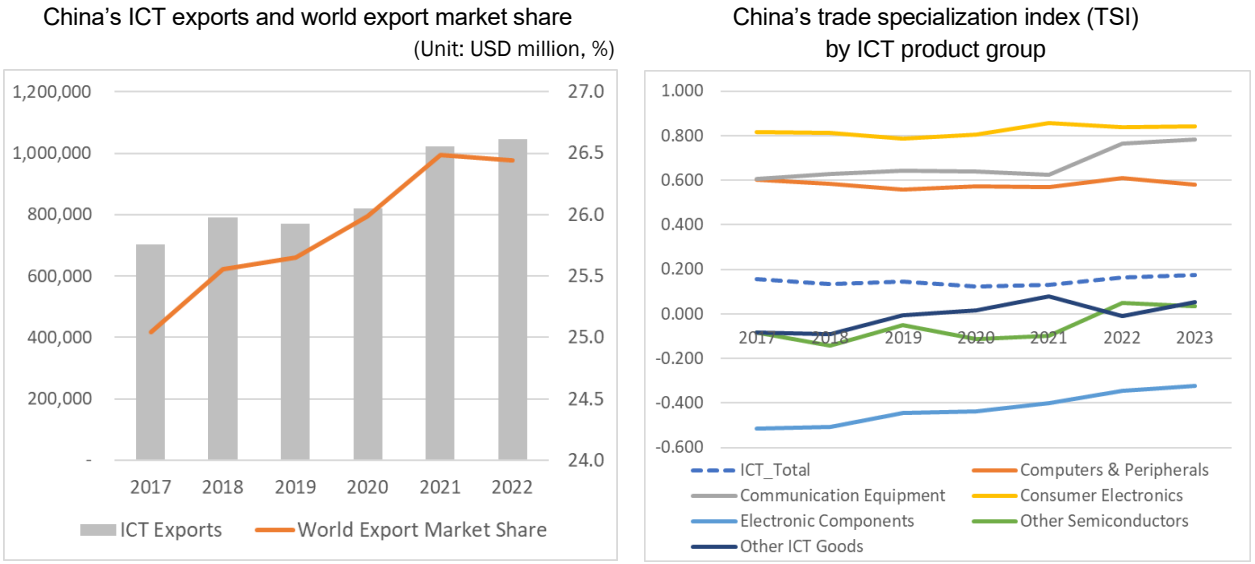
Digital transition is a broad concept that includes data, platforms, software, cloud services, digital infrastructure, AI, and other emerging technologies. Existing approaches to measuring digital transition often use indicators such as digital economy size, digital infrastructure, data flows, platform activity, or digitally enabled services. These indicators are useful for capturing the broader process of digitalization, but they are less suited to identifying product-level supply chain positions through internationally comparable trade statistics. For this reason, this report focuses on ICT goods as the core product scope for analyzing China's influence in supply chains related to digital transition. ICT goods do not represent the entire digital economy, but they provide a measurable basis for examining the manufacturing and material foundation of digital transition.

To mitigate the limitations of analyzing digital transition through ICT goods alone, this report constructs the product scope by combining three criteria. First, it reflects UNCTAD's ICT goods list, which provides a standard basis for identifying ICT goods in merchandise trade. Second, it incorporates HS items linked to the OECD definition of the ICT sector, focusing on ICT manufacturing industries. Third, it adds ICT-related items from the U.S. critical supply chain framework, including semiconductors, communication equipment, computer equipment, audiovisual equipment, and other electronic components. By combining these criteria, the analysis broadens the coverage of ICT-related goods and captures semiconductor-related and technology-security items that are important for assessing China's influence in digital transition-related supply chains.

China's digital transition policies have emphasized both the institutional foundations of the digital economy and the upgrading of technology-intensive industries. The establishment of the National Data Administration, the development of an integrated data market, and state-led projects such as "East Data, West Computing" reflect efforts to strengthen the digital economy base. China has also promoted semiconductor and AI capabilities, and more recently issued an action plan to build digital and intelligent supply chains using digital technologies such as AI, the Internet of Things, and blockchain.

Trade data show that China remains one of the world's largest ICT export hubs, maintaining a world export market share of roughly 25 to 27 percent in ICT goods. By processing stage, China's share in consumer goods remains particularly high at around 50 percent, while its share in capital goods has gradually

Figure 2. China's ICT Export Position and Trade Specialization



Note: "Other Semiconductors" refers to semiconductor-related items additionally identified through the U.S. critical supply chain framework but not included in semiconductor items already covered under the international ICT classification. TSI ranges from -1 to 1, where positive values indicate net export specialization and negative values indicate net import specialization
Source: Author's analysis based on UN Comtrade data; Adapted from Jung et al. (2025).

risen to the low- to mid-20 percent range. Intermediate goods have also trended upward. By contrast, China's share in primary products has declined, confirming that its export influence is concentrated in manufacturing rather than raw material stages.

Competitiveness indicators show a differentiated structure. China's RCA in ICT goods declined from around 2 in 2017 to about 1.6 in 2022, but remains above 1. Computers and peripherals, communication equipment, and consumer electronics continue to show high RCA values. The pattern is different in electronic components and semiconductor-related items: their RCA values remain close to or slightly below 1, while the TSI for electronic components, including semiconductors, remains negative, indicating a continued net import structure. However, the TSI has been moving closer to zero, suggesting a gradual narrowing of import dependence. Against the backdrop of U.S. semiconductor restrictions, these changes are notable because they may indicate an improving position in more technology-intensive intermediate segments, although China has not yet established a dominant position in core components and semiconductors.

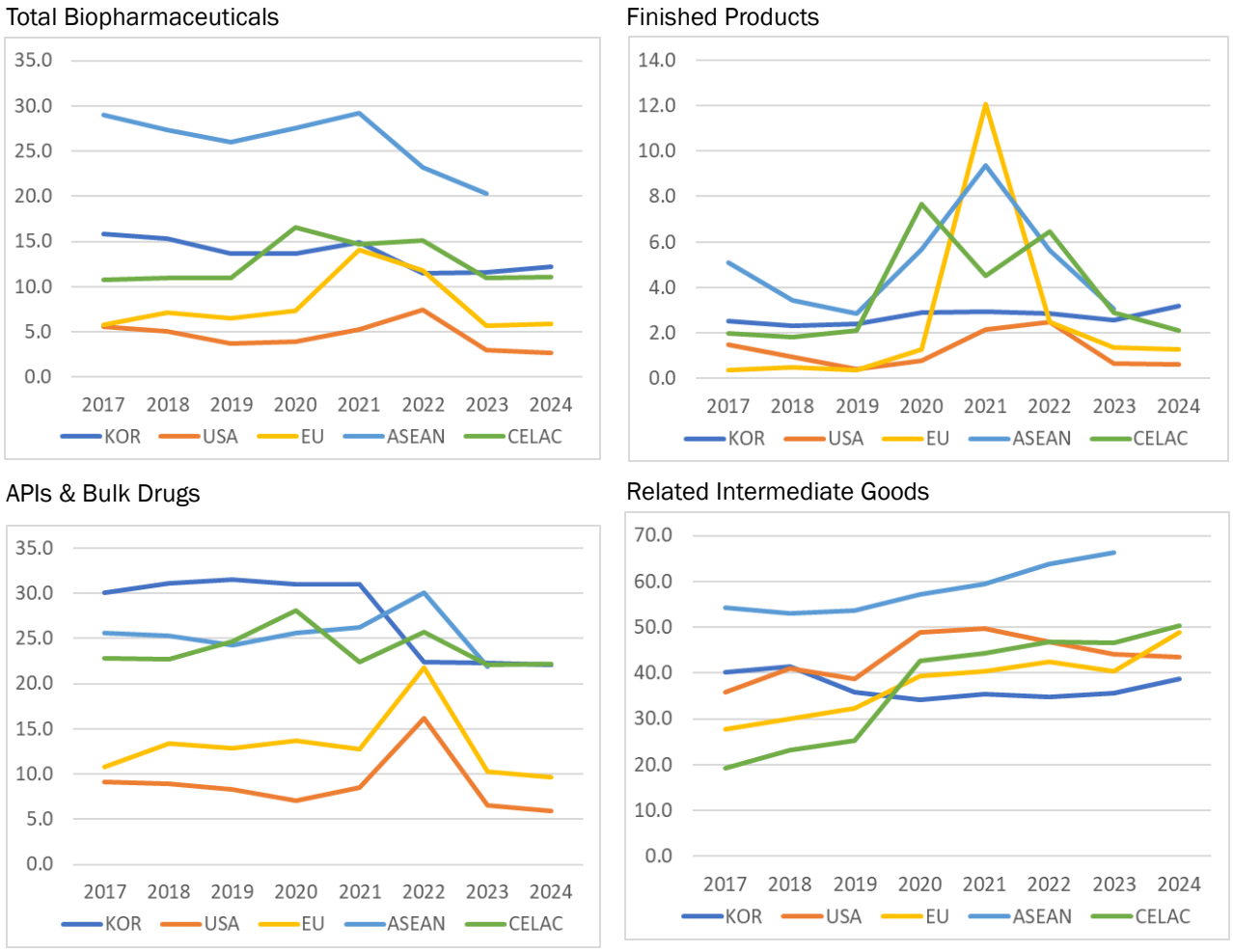
IV. Biopharmaceuticals: Upstream Inputs and Innovation Pipelines

Biopharmaceutical supply chains have become an important area where public health, industrial competitiveness, regulatory capacity, and economic security increasingly overlap. Unlike conventional manufacturing goods, biopharmaceutical products are closely linked

to quality control, regulatory approval, production infrastructure, and the stable supply of upstream inputs. For this reason, China's influence in this field should be examined not only through finished pharmaceutical products, but also through active pharmaceutical ingredients, bulk drug substances, and related intermediate goods used in production processes.

In this report, the product scope is defined by combining international definitions of biological medicinal products with the U.S. critical supply chain list for pharmaceuticals and APIs. Based on definitions commonly used by the WHO, EMA, and FDA, the analysis identifies key biopharmaceutical products and classifies them by supply chain stage. It then adds a separate group of related intermediate goods used directly in biopharmaceutical production processes—such as inputs for cell culture, fermentation, formulation, and stabilization. As a result, the analysis distinguishes among finished products, APIs and bulk drugs, and biopharmaceutical-related intermediate goods. This classification is important because

Figure 3. Major Economies' Import Dependence on China in Biopharmaceutical Products



Note: Import dependence refers to the share of imports from China in each economy's total imports of the relevant product group.
Source: Author's analysis based on UN Comtrade data; Adapted from Jung et al. (2025).

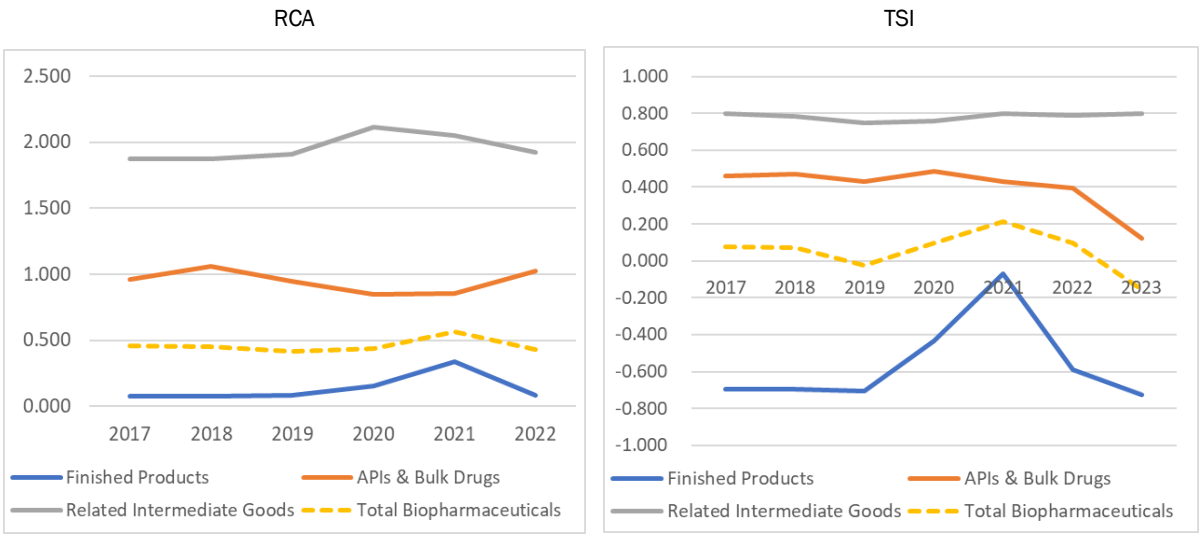
supply chain risks in biopharmaceuticals often arise not only at the final product stage, but also in upstream raw materials and process-related inputs.

China's biopharmaceutical policy has evolved toward a broader strategy combining manufacturing self-reliance, innovation capacity, regulatory reform, and global cooperation, reflected in its Bioeconomy Development Plan, pharmaceutical regulatory reforms, and support policies for innovative drugs.

The trade data show that China's influence is concentrated more strongly in upstream and intermediate stages than in finished products. Major economies' import dependence on China for finished products generally remains in the single-digit range. By contrast, dependence on China for APIs and bulk drugs reaches the 20 to 30 percent range in Korea, ASEAN, and Latin America. Dependence is even more pronounced in biopharmaceutical-related intermediate goods, exceeding 50 to 60 percent in ASEAN, reaching 40 to 50 percent in the United States, and approaching 50 percent in the EU and Latin America.

Competitiveness indicators confirm this pattern. Biopharmaceutical-related intermediate goods show high RCA values and a positive TSI of around 0.6 to 0.7, indicating that China functions as a clear net exporter in this product group. APIs and bulk drugs also maintain a positive TSI, although the index declines somewhat in the later period. Finished products show a different pattern, with RCA below 1 and negative TSI in most years. At the same time, China's role extends beyond upstream supply. License-out deals by Chinese pharmaceutical firms exceeded USD 5 billion in 2024 and approached USD 6.6 billion in the first half of 2025, indicating that China is also emerging as an important source of innovation pipelines in global pharmaceutical markets.

Figure 4. China's Export Competitiveness in Biopharmaceutical Supply Chains



Note: RCA indicates revealed comparative advantage, and TSI indicates the trade specialization index.
Source: Author's analysis based on UN Comtrade data; Adapted from Jung et al. (2025).

V. Implications

The analysis shows that China's supply chain influence is not comprehensive or uniform. It varies by field, product group, and stage of the value chain. In green transition, China's influence is strongest in processing, equipment, and midstream and downstream manufacturing. In digital transition, China remains highly competitive in ICT finished goods and equipment, while gradually improving in components and semiconductors. In biopharmaceuticals, China's structural influence is stronger in APIs, bulk drugs, and related intermediate goods than in finished products, while its innovation pipeline is also expanding.

These findings suggest that responses to China's supply chain influence are unlikely to take the form of a single, uniform strategy. A full-scale separation from China-centered supply chains is unlikely to be realistic or efficient across all fields. A more practical approach involves product- and stage-specific risk management, including supplier diversification, China+N strategies, strategic stockpiling, and minimum domestic or regional production capacity. The findings also suggest that supply chain resilience can no longer be defined only by the physical availability of goods. Standards, certification, regulatory capacity, data governance, quality control, and technology-security rules are becoming integral parts of supply chain competitiveness across all three fields.

For Korea, these findings point to the need for differentiated strategies by field and value-chain stage. In green transition, Korea should strengthen cooperation in mineral procurement, refining, and material processing, while diversifying key materials and components and reinforcing its capacity to respond to carbon-related regulations and supply chain traceability requirements. In digital transition, Korea needs to manage risks in sensitive areas such as semiconductors, AI, and data infrastructure, while selectively identifying areas for cooperation including green digital infrastructure, digital ODA, and standard-setting in third-country markets. In biopharmaceuticals, upstream vulnerabilities in APIs, intermediates, and related intermediate goods require diversification of supply sources and strengthening of regulatory and quality capabilities.

The inclusion of biosecurity-related provisions associated with the BIOSECURE Act in the U.S. FY2026 National Defense Authorization Act further signals that biopharmaceutical supply chains are becoming more closely linked to economic security and regulatory compliance. Korea therefore needs to design biopharmaceutical supply chain policy as a strategic framework that integrates supply stability, market access, industrial competitiveness, regulatory preparedness, and supply chain resilience.

Overall, the key is to identify where China's influence creates supply risks, where interdependence remains unavoidable, and where Korea can strengthen its own competitiveness or pursue selective cooperation. KIEP

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