Eurasian Development Bank

The Architecture of Industrial Transformation in Developing Economies

Working Papers 26/10

Almaty — 2026

Vinokurov, E., Ahunbaev, A., Kuznetsov, A., Chuev, S., Kabylbayev, D. (2026). *The Architecture of Industrial Transformation in Developing Economies*. Reports and Working Papers 26/10. Almaty: Eurasian Development Bank.

Abstract

How can developing economies create the conditions to attain and sustain high-income status while reducing their dependence on commodity cycles? For many of them, industrial upgrading is a central mechanism of sustained growth. Outcomes, however, depend not on expanding output alone, but on combining a developed production base with human capital, technological capabilities and domestic innovation capacity. Drawing on international experience and the approaches of leading institutions, this report proposes a modular, three-stage architecture of industrial development: from a basic production foundation, through an industrial platform, to a knowledge economy and greater technological sophistication. Its operational component comprises screening filters and criteria for selecting sectoral modules, alongside requirements for institutions, quality infrastructure, workforce development and financing at multiple levels. Applying this architecture to the Eurasian region shows how natural resources, accumulated industrial capabilities and regional cooperation can ease constraints of scale and open viable niches in higher value-added production. The report thus provides a framework for the transition to growth driven by productivity and technological learning.

Keywords: developing countries, Eurasian region, transition to high-income status, architecture of industrial transformation, higher value-added production, industry, human capital, innovation, technological learning.

JEL: O14, L16, L52, O25, L60, O31.

An electronic version of this document is available on the Eurasian Development Bank website: https://eabr.org/analytics/special-reports/

EXECUTIVE SUMMARY

Industry is once again at the centre of the long-term development agenda. The global economy is entering a new phase of industrial development, marked by the transition from Industry 4.0 to the emerging Industry 5.0: a model based primarily on cost minimisation and extended global value chains is giving way to a more technology-intensive and resilient configuration in which physical production is integrated with digital systems, artificial intelligence, automation, new materials and environmentally efficient solutions. Geoeconomic turbulence, market fragmentation and the reconfiguration of supply chains are increasing demand for supply reliability, the localisation of critical capabilities and the ability to adopt and scale up new technologies rapidly. Manufacturing is therefore re-emerging as a source not only of output and employment, but also of productivity, technological learning, innovation and strategic resilience: advanced economies are returning to reindustrialisation, while developing economies have an opportunity to build their own industrial base and move into more sophisticated production.

For many developing economies, the central challenge today is not simply to sustain growth, but to change its underlying model. Many have built basic infrastructure, urbanised, reallocated labour to more productive activities, accumulated capital and adopted imported technologies. As incomes rise, however, the returns to these drivers diminish. Economies need to shift from capacity expansion and resource-based advantages towards productivity growth, technological capabilities and innovation. The scale of the challenge is substantial: 108 economies, home to around 6 billion people, belong to the middle-income group, and only 34 economies have moved from this group to high-income status since 1990. These figures demonstrate the difficulty of attaining and sustaining high-income status, but do not imply that every country is already in a trap.

Economies that must make this transition while remaining commodity-dependent are particularly vulnerable. According to UNCTAD, 95 of 143 developing economies remained commodity-dependent in 2021–2023: commodities accounted for more than 60% of their merchandise exports; this group included over 80% of the least developed countries. Such a model can generate high incomes in favourable market conditions, but leaves output, public finances, exchange rates and private investment sensitive to price shocks. It also perpetuates the investment cycle's dependence on imported machinery, components, speciality chemicals, pharmaceuticals and other complex goods. Maintaining high growth rates therefore does not, by itself, establish a sustainable engine of growth.

This leads to the central argument of the report, which continues the EDB's series of industrial studies: **to attain and sustain high-income status, a developing economy needs its own industrial capabilities.** This does not mean autarky, rejecting foreign investment or seeking to produce everything domestically. It means the ability

to select technologies, operate them reliably, adapt them to local conditions, improve them, develop suppliers and, over time, design more effective products and processes. Openness remains essential, but its success should be measured by the extent to which equipment imports, foreign direct investment and participation in value chains increase domestic value added, capabilities and production resilience.

Industry connects investment with innovation by making production a continuous learning process. It creates demand for standards, metrology, engineering services, production management, suppliers and skilled jobs. Firms develop the human capital required for technological transition: highly skilled workers, technicians, engineers, process engineers, quality specialists, production managers and applied researchers. These are the people who turn imported equipment from a physical asset into productive knowledge. The sequence is clear: an industrial base builds skills; skills enable technology absorption and adaptation; technological mastery opens the way to domestic innovation.

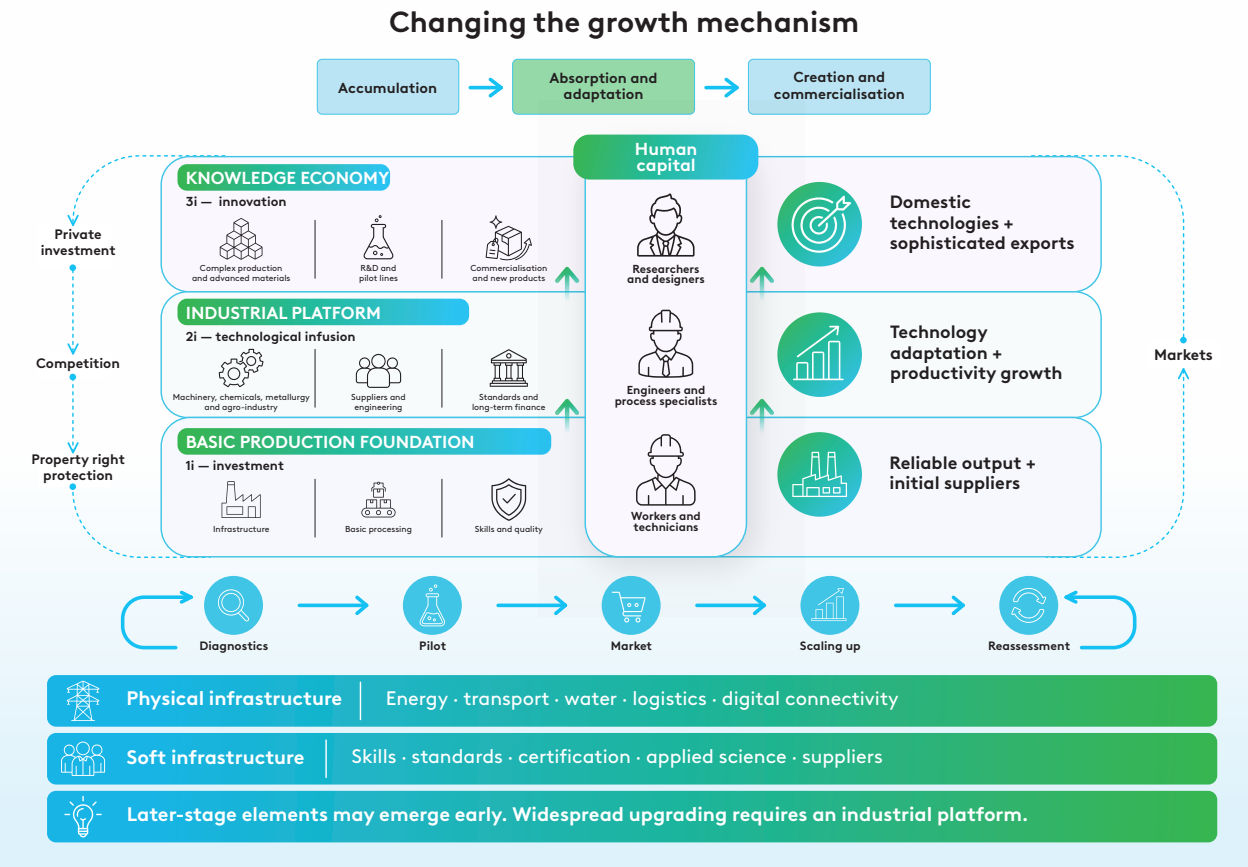
Empirical evidence confirms that this mechanism operates across the economy. UNIDO estimates that manufacturing development was associated with 64% of economic growth episodes over the past 50 years. On average, one manufacturing job supports a further 2.2 jobs in related sectors, expanding demand for transport, logistics, construction, services, education and applied science. Industry accounts for 53% of global R&D, and industrial firms held almost 60% of green patents in 2023. Its significance therefore lies not only in direct output, but also in its ability to build ecosystems, diffuse knowledge and raise productivity in other sectors.

The report translates this argument into a practical architecture of industrial transformation. Its purpose is to show how economies can move from raw materials and low value-added activities to more sophisticated production without replacing market selection with administrative choices. Private firms invest, compete, bear entrepreneurial risk and validate the viability of new niches. Public institutions provide what individual firms cannot create on their own: shared-access infrastructure, standards, skills, project preparation and risk-sharing mechanisms. Results are assessed not only through capacity commissioning and output, but also through productivity, the adoption of new processes, supplier development, engineering and technical employment, and the commercialisation of research and development.

This framework draws on a common lesson from history: successful industrialisation combined markets with institutions that accelerated learning and removed systemic barriers. Early industrialisers demonstrated the importance of scale, infrastructure and long-term capital; East Asia highlights export discipline, workforce development and technology adoption; former socialist economies show the limits of creating capacity without competition and market feedback. Costa Rica and Viet Nam show that small and medium-sized economies can enter sophisticated niches through openness, investment and human capital. What can be transferred is not a ready-made recipe, but the principle of phased, adaptive and market-compatible policy.

The architecture of industrial transformation organises this logic into a three-stage sequence that echoes the World Bank's 1i–2i–3i approach: investment, technological infusion and innovation. The first stage establishes the physical and workforce foundations of production. In the second, external technologies spread across firms, are adapted to local conditions and become domestic engineering and organisational capabilities. In the third stage, the economy gains the capacity to create and commercialise its own solutions. The stages overlap, so individual laboratories, digital firms or technology niches may emerge earlier. Widespread upgrading, however, requires an industrial platform, suppliers, standards, skills and long-term financing.

↓ Figure A. The architecture of industrial transformation: from an industrial base to a knowledge economy.



Source: compiled by EDB experts.

The first stage establishes a basic production foundation and operational reliability. It encompasses energy, transport, water, industrial sites, logistics, utility connections, digital connectivity, basic quality infrastructure and technical and vocational skills. These foundations support agro-processing and food processing, basic chemicals and construction materials, primary and secondary processing of raw materials, simple metal and plastic products, repair, maintenance services and economically viable assembly. The principal outcome is not capacity commissioning itself, but firms' ability to produce consistently to specified quality standards, master equipment, reduce defects and downtime, and establish initial supplier networks.

The second stage connects individual production activities into an industrial platform, while the third turns that platform into a source of knowledge and new products. Technological infusion develops machinery manufacturing, more advanced chemical and metallurgical processing, electrical engineering, pharmaceuticals, sophisticated agro-processing, supplier networks, export certification and project finance. At this stage, external technology becomes a domestic capability. The innovation stage adds applied R&D, intellectual property, pilot production lines and commercialisation. Industrial AI, robotics, biotechnology and new materials do not replace basic and medium-technology industries: they improve their productivity, quality and resilience.

Human capital connects all three stages, and its composition must evolve alongside production. The first stage requires practical skills at scale: skilled workers, supervisors, technicians, maintenance specialists and line managers. The second calls for engineers, process engineers and specialists in quality, digitalisation, procurement and production systems management who can adapt equipment and develop suppliers. In the third stage, researchers, design engineers, technology entrepreneurs and commercialisation managers become increasingly important. Education yields the greatest returns when it addresses firms' real operational needs.

Infrastructure, both physical and soft, plays the same cross-cutting role. Energy, transport, warehouses, industrial sites, water, utility networks, cold chains and digital connectivity determine production costs and reliability. Standards, certification, metrology, vocational and engineering education, applied science, export and investment support, project offices and supplier-development programmes ensure compatibility and confidence in quality. In the first stage, these resources establish basic reliability; in the second, they allow the platform to function as a system; in the third, they provide access to more sophisticated technologies and markets. These are shared productive resources that expand opportunities for many firms.

This logic implies that a major industrial leap is feasible primarily in selected niches and, at the economy-wide level, through accelerated and partly parallel progress through the foundational stages, rather than by skipping them. It requires accumulated resources and capabilities, related production activities and verified demand, together with the synchronisation of infrastructure, skills, standards, technologies and long-term financing. Implementation should begin with pilots, scaling up only those solutions that demonstrate productivity, quality and commercial viability. A leap shortens the time needed to turn investment and external technologies into domestic capabilities, but does not eliminate the need for an industrial platform.

To prevent this policy from becoming a collection of sectoral aspirations, **the report proposes a reproducible selection procedure using a priority heatmap.** Activities pass through five preliminary filters: market scale; critical resources and capabilities; technological and product relatedness to established activities; infrastructure readiness; and institutional and financial feasibility. They are then assessed for market

potential, multiplier effects, supply-chain resilience, export competitiveness, cooperation and project feasibility. First-choice instruments are infrastructure, skills, industrial sites, quality and market access. Subsidies, tax incentives and other more costly measures are permissible only with transparent competitive selection, private co-financing, measurable indicators, a limited duration and the withdrawal of support where results are not achieved.

The report's analytical novelty and practical contribution lie in bringing together approaches usually considered separately. Historical lessons, contemporary theories of industrial policy and implementation requirements are integrated into a single sequence: diagnostics, selection, piloting, scaling up, financing and evaluation. Within the contemporary debate, the report adopts a pragmatic synthesis: markets select and validate solutions, while public institutions remove infrastructure, skills, coordination and financing barriers. This approach shows how investment and external technologies become domestic production capabilities, technological mastery and home-grown innovation, with human capital playing a role throughout.

Applying this logic to the Eurasian region shows why both the scale and the quality of industrial growth matter. The region has a large industrial sector, a substantial resource and energy base, an engineering legacy, growing markets and considerable production capabilities. In many countries, however, exports remain concentrated in commodities and low value-added products, while the investment cycle depends on imports of machinery, equipment, pharmaceuticals, fine chemicals, and electronic and electrical components. The central task is to turn growth and investment into productivity, supplier networks, engineering skills and innovation.

A scenario estimate from the EDB's previous study illustrates the scale of untapped opportunities. Realising the potential of four interconnected industrial complexes—chemicals, machinery manufacturing, high-value-added metallurgy and food processing—could generate over US$510 billion in additional annual output at 2019 prices. Around US$71 billion is associated with export growth, US$81 billion with replacing part of critical imports, and US$361 billion with indirect and induced effects. For Kazakhstan, the Kyrgyz Republic, Tajikistan and Uzbekistan, the combined estimate approaches US$57 billion a year, or about 13% of their 2019 output.

The quantitatively assessed core sets the direction but does not exhaust the portfolio of industrial upgrading opportunities. The priority heatmap complements it with electrical equipment and cables, agricultural and irrigation machinery, industrial repair and engineering, packaging, construction materials, pharmaceuticals and medical devices. Over a longer horizon, opportunities may include critical and advanced materials, energy equipment, industrial automation and software, electronics and components, environmentally efficient equipment, bioindustries and nuclear technologies. Such niches become near-term priorities only when demand, capabilities, quality infrastructure, private-sector interest and project feasibility are established, rather than because a technology is fashionable.

Differences between countries call for complementary specialisation. Russia and Belarus can develop the most sophisticated links: equipment, components, standards, engineering, servicing, testing and selected technology niches. Kazakhstan and Uzbekistan can turn their resource, energy and agricultural bases, together with growing demand, into chemical and materials value chains, higher value-added metallurgy, electrical engineering and equipment for mining, energy, agribusiness and transport. Armenia, the Kyrgyz Republic and Tajikistan can strengthen regional chains through specialised components, services, textiles, agri-food production, packaging, pharmaceuticals and materials-related segments.

A country's income group does not determine its stage of industrial development. A single economy may simultaneously host basic first-stage production, second-stage platform industries and selected third-stage innovation niches. The three-stage sequence should therefore be applied to each country–sectoral module combination. For one module, the priority may be reliable infrastructure and mastering standard technology; for another, supplier development and engineering adaptation; for a third, domestic R&D and commercialisation. This unit of analysis avoids both a uniform policy package for all countries and premature investment in high-technology projects without an adequate production foundation.

Regional cooperation within this architecture is a way to overcome constraints of scale. National markets are too small for many capital-intensive activities, whereas the combined EAEU and Central Asian market of roughly 180–220 million people can provide initial demand. The region already accounts, on average, for around 59% of sales of second-stage processed products. The most promising chains are: polymers–packaging–pharmaceutical chemicals; cable feedstock–electrical equipment–machinery in metallurgy; manufacturing–components–servicing–modernisation in machinery; advanced agricultural raw materials processing–packaging–cold-chain logistics; and: pumps–pipes–irrigation equipment–servicing in the water sector. External markets retain their role in testing technological performance and competitiveness.

For these chains to materialise, sectoral decisions must be linked to an integrated infrastructure framework. The Eurasian Transport Network enables the movement of raw materials, semi-finished goods, components and finished products; modern warehouses and cold chains support food processing, pharmaceuticals, packaging, component manufacturing and exports. Central Asia's water and energy complex generates demand for pumps, pipes, irrigation and energy equipment, electrical equipment, agro-processing and services. Investment in energy and digital systems has the greatest impact when it raises firm productivity, supply reliability and the depth of domestic capabilities.

The next element is a financial architecture capable of supporting projects from preparation through to scaling up. Private capital, commercial banks, bond markets, strategic investors, foreign direct investment, export credit agencies,

public–private partnerships, national development institutions and multilateral banks should complement one another. Public and quasi-public resources should focus on project preparation, shared-access infrastructure, early-stage risk sharing, guarantees, certification, industrial sites and pilot production. Scaling up should rest on commercial viability, co-financing and transparent risk assessment.

Multilateral development banks are particularly important in the transition from strategy to a bankable portfolio. Their comparative advantage lies not only in capital, but also in preparing complex projects, early-stage currency and political risk sharing, providing long-term financing, mobilising private investment and connecting national initiatives into regional chains. In 2008–2025, international financial institutions and multilateral development banks provided US$71 billion in non-sovereign financing to the region; US$17 billion, or 24%, went to industry. The EDB contributed US$6.6 billion, or 38.1% of these institutions' cumulative industrial portfolio.

The main practical conclusion is that the bottleneck lies in preparing viable projects, rather than in a shortage of sectoral ideas. Resources, investment and external technologies become productive capital only when infrastructure, skills, standards, suppliers, financing and markets are coordinated around them. Success should therefore be measured by higher productivity and domestic value added, supplier development, reduced dependence on critical imports, greater engineering and technical employment, the adoption of new processes and the emergence of products new to firms and markets.

The proposed architecture of industrial transformation is relevant beyond the Eurasian region. For developing countries, it serves as a navigation tool: it helps align ambitions with the initial production, workforce and infrastructure base; identify activities with verified demand, resources and technological relatedness; establish the necessary preconditions and instruments; build a priority portfolio of viable projects; and scale up or discontinue support based on measurable results. The approach thus helps avoid two extremes: premature commitments to technologically attractive but unprepared projects, and the entrenchment of commodity, assembly or low value-added specialisation through permanent protection and subsidies.

Ultimately, **the proposed framework shows how to create the conditions to attain and sustain high-income status** without autarky or administrative substitution for markets: the industrial base builds human capital; human capital turns imported technology into an acquired capability; technological mastery provides the foundation for innovation. Industrial development complements openness, digitalisation and the environmental transition, connecting them to investment, productivity, quality employment and the commercialisation of knowledge to create an integrated mechanism for sustained growth.

Eurasian Development Bank

RESEARCH DEPARTMENT
EURASIAN DEVELOPMENT BANK

Your comments and suggestions concerning this document are welcome at:
pressa@eabr.org

Eurasian Development Bank

www.eabr.org