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INFRASTRUCTURE AS A FACTOR OF PRODUCTION AND THE «INVISIBLE TAX» OF DEVELOPMENT

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In modern development strategies, the infrastructure factor takes on an additional dimension in the context of technoglobalism, as digital networks, the platformization of the economy, and unequal access to technologies create new structural asymmetries in productivity. Digital inequality and the risks of information and digital neo-protectionism turn digital infrastructure into an independent channel of transaction costs, dependencies and regulatory fragmentation. In this sense, infrastructure as a factor of production and an "invisible tax" of development is manifested not only through the physical wear and tear of transport, energy, and water systems, but also through digital constraints that affect the competitiveness, resilience and geo-economic position of states in global value chains [1–5].

Infrastructure in modern development strategies has become one of the key categories of the political economy of the 21st century, since its role extends far beyond the traditional idea of an auxiliary sector of public services [6]. In the classical logic of the production function, labor, capital, and technology dominated; however, structural transformations of the global economy demonstrate that infrastructure capacity increasingly determines the limits of the effective use of all other resources. Infrastructure ceases to be a "background" of economic activity and appears as an active production factor that shapes productivity, competitiveness, investment incentives and macroeconomic stability.

In the strategic dimension, infrastructure plays the role of the material framework of the economy, without which neither the spatial deployment of production, nor the functioning of supply chains, nor the integration of the national economy into global markets is possible. Transport corridors, energy networks, water supply systems, digital communications, and logistics hubs form infrastructure capital, which determines the speed, reliability, and cost of economic transactions. That is why infrastructure is a general-purpose productive asset that ensures the reproduction of the economic system and shapes its long-term development opportunities.

The fundamental insight is that infrastructure creates the basic condition for the realization of labor and capital productivity. Even high-tech production

systems cannot maintain efficiency without a stable energy supply, fast logistics, access to water resources, and reliable transport systems. In this sense, infrastructure serves as a complementary factor that enhances returns on investment in human capital, technological innovation, and production capacity. The absence or degradation of infrastructure means that even with modern technologies, the economy operates under structural constraints on productivity.

One of the central categories of modern political economy of development is infrastructure as a macroeconomic “implicit infrastructure tax”. In traditional discussions, economic losses are associated with formal state decisions to extract resources through the budget. However, in the real dynamics of the 21st century, hidden mechanisms of economic extraction that are not formalized as a tax but function similarly are becoming increasingly important. Infrastructure deficits lead to a steady increase in transaction and operating costs, systematically reducing production efficiency and weakening the state's competitive position.

The economic nature of this effect is that infrastructure is the material environment for the realization of productivity. It provides the conditions for the movement of goods, energy, water, information, and labor. When these systems work reliably, their contribution to growth often remains unnoticed. However, when infrastructure degrades or is underinvested, the economy faces a constant increase in costs, which acts as a chronic drain on productive resources for businesses and households.

Infrastructure deficits function as a hidden tax burden. Businesses are forced to spend more on transportation, equipment repairs, insurance against delays, backup energy sources, or alternative production processes. Households incur additional travel time and costs, face higher tariffs, and indirectly increase the cost of goods through infrastructure costs built into prices. Thus, infrastructure degradation creates a mechanism for “leakage” of income and profits that does not pass through the budget, but has a macroeconomic effect similar to an increase in the tax burden.

It is particularly important that this “invisible tax” is not only costly but also structurally anti-innovative. Increased infrastructure spending means a reallocation of resources from modernization, technological renewal, and R&D to covering basic operational needs. Accordingly, the infrastructure deficit reduces not only current efficiency but also the economy's investment capacity to generate future growth, forming a long-term trap of delayed technological dynamics.

The key channel of this «invisible tax» is the decline in productivity. Productivity is determined not only by technology and human capital, but also by the efficiency of the environment in which they are applied. Congested transport systems, port delays, unreliable power grids, or outdated water systems make the production process less efficient even at the same level of

technology. Total factor productivity decreases not due to internal firm inefficiency, but due to the structural deterioration of the infrastructure environment.

A feature of the infrastructure "invisible tax" is its opacity in the political process. Formal taxes generate public debate and political accountability. In contrast, infrastructure deficits accumulate gradually, and economic losses manifest themselves as "natural" increases in costs or deterioration of competitive positions. This means that society is faced with an economic extraction of resources without a clearly defined entity of responsibility. An additional feature is the socially asymmetric nature of this extraction. Infrastructure deficits shift costs through prices, tariffs, and time losses in a regressive way. Lower-income households and small businesses bear a disproportionately higher burden, as they have fewer opportunities to offset losses with alternatives. Thus, the infrastructure "invisible tax" is not only a factor of lower productivity, but also a channel for the reproduction of internal socio-economic inequality.

Infrastructure deficits are cumulative and accumulate in a long-term trajectory of lower potential GDP. Postponing investment in modernization means that future repair costs become significantly larger than timely maintenance costs. The economy falls into a trap of deferred depreciation, where each year of underinvestment increases the future repair costs and the scale of productivity losses. The macroeconomic cascade of infrastructure deficits manifests itself through interrelated effects. Rising business costs reduce investment profitability and limit production expansion. This weakens labor demand, restrains wage growth, and reduces real household incomes. At the same time, rising transport and energy costs undermine export competitiveness, reducing the country's ability to integrate into global value chains. Infrastructure deficits generate both supply and demand shocks, making them particularly dangerous for development strategies [6].

An important aspect is the cross-sector complementarity of infrastructure. Economic systems function through networked interdependencies of transport, energy, water, and digital components. The simultaneous degradation of several infrastructures creates an effect greater than the sum of their individual losses. Infrastructure losses do not add up arithmetically; rather, they are mutually reinforcing, forming an integrated productivity barrier. This allows us to view infrastructure deficits as a nonlinear, systemic constraint on development rather than a local technical problem.

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