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AI SUPERCLUSTER IN THE SYSTEM OF THE NEW SPATIAL ORGANIZATION OF THE DIGITAL ECONOMY

The current stage of the digital transformation of the world economy is increasingly determined not only by the development of artificial intelligence algorithms, but also by the formation of a new infrastructure architecture, within which computing power, energy resources, network connections, data arrays, and mechanisms for controlling access to them are concentrated. In these conditions, the key source of competitive advantage is not simply the possession of technology as such, but the ability to scale it through access to super-large infrastructure complexes for artificial intelligence. That is why a new type of infrastructure concentration is emerging in the modern digital economy, represented by the AI supercluster, which is gradually becoming one of the main mechanisms of structural dominance in the global digital space [1].

A change in the very logic of the spatial organization of economic activity accompanies the transformation of the digital economy. If the classical industrial economy was built around territorially localized production centers, transport corridors, ports, industrial clusters, and energy hubs, then the modern digital economy is increasingly organized around infrastructure systems that ensure the concentration and scaling of computing capacity. In this context, the territory does not lose its importance, but it ceases to be the only basis of economic control. Instead, a new type of functional spatiality is being formed, within which computing density, network connectivity, access to energy resources, and modes of use of digital systems' infrastructure acquire strategic importance [2].

That is why it is appropriate to interpret the AI supercluster not as a localized technical complex or a separate data center, but as a transnationally integrated infrastructure-computing complex of a very large scale, which ensures the concentration, coordination, and continuous use of computing power, energy resources, data, network connections and software environments for the creation, training, scaling, and deployment of artificial intelligence systems. Its specificity lies in the fact that

territorially dispersed infrastructure elements function as a single architecture of digital production, forming new configurations of dependence, access, control, and infrastructure power. This means that the modern digital economy is increasingly defined not by individual technologies, but by the infrastructure architecture of their scaling [3].

An AI supercluster is best viewed as a multi-level infrastructure system that combines physical, computing, energy, network, data, software, and institutional components, functioning as a single architecture for manufacturing, scaling, and deploying AI systems. Unlike traditional digital platforms or localized data centers, an AI supercluster is a functionally integrated, ultra-large-scale system that ensures the continuous operation of frontier AI models by coordinating many interdependent infrastructure elements. The material basis of an AI supercluster is the physical infrastructure layer, which includes data centers, server complexes, cooling systems, land infrastructure, water resources, high-voltage power grids, and backup power supply systems. It is at this level that the modern digital economy, despite its virtualized nature, remains deeply materialized and dependent on spatially localized resources and capital-intensive infrastructure. The core of the AI supercluster is the computing layer, comprising GPU clusters, TPUs, AI accelerators, high-performance server systems, and parallel computing architectures. It is this layer that enables training, retraining, and scaling large artificial intelligence models. At the same time, the effectiveness of modern AI systems is determined not only by the amount of computing power but also by their ability to be integrated into a functionally unified, high-performance computing environment.

This integration is provided by the AI supercluster network layer, which includes high-speed interconnects, low-latency data channels, intra-cluster networks, and distributed model training synchronization systems. It is this layer that turns thousands of individual chips and servers into a single computing architecture capable of functioning as a holistic infrastructure organism. The energy layer of the AI supercluster is critical, as scaling modern artificial intelligence models requires extremely large amounts of electricity and stable access to energy infrastructure. As a result, AI companies are increasingly competing not only for chips or data, but also for access to megawatts of capacity, energy backup systems, and cooling infrastructure. This means that the digital economy is increasingly integrated with the energy economy, creating new forms of energy and infrastructure dependence [4].

The functioning of the AI supercluster as a single system is ensured by the software orchestration layer, which includes MLOps systems, an orchestration stack, load-balancing tools, model scaling architectures, and inference-serving mechanisms. It is this layer that provides coordination of computing resources and turns the AI infrastructure into a continuous production mechanism for creating, updating, and operating artificial intelligence models. At the same time, the AI supercluster does not function outside the platform-cloud architecture of the digital economy. The platform-cloud layer includes hyperscale cloud, GPU cloud, AI cloud platforms, and other environments for leased compute access. It is here that a new type of cloud dependency emerges, in which a limited number of global cloud providers controls access to critical infrastructure. As a result, even those actors who formally gain access to AI technologies remain dependent on external platform ecosystems [5]. The institutional and regulatory level of the AI supercluster, which defines chip access regimes, rules for cross-border data movement, export controls, sanctions, cybersecurity standards, and model licensing mechanisms, is particularly important. It is at this level that the AI infrastructure becomes an object of political economy and geo-economic rivalry.

As a result, a new type of dependence is emerging, which is conveniently defined as "compute dependency". Its essence lies in the structural dependence of states, universities, companies, and innovation ecosystems on access to computing power controlled by a limited circle of global actors. In the modern digital economy, innovative capacity is increasingly determined not only by knowledge and algorithms, but also by access to infrastructure that enables the scaling of artificial intelligence. That is why computational dependence is gradually turning into a new form of technological and geo-economic asymmetry [6].

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