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DIGITAL INEQUALITY IN THE AGE OF TECHNOLOGICAL RACES

The contemporary dynamics of technological development are interpreted here as manifestations of the growing complexity of technological interaction. We distinguish among technological competition, technological rivalry, and technological races to emphasize the gradual transformation of the mechanisms through which market power is formed, the changing nature of innovation activity, and the deepening of structural forms of digital inequality [1–5]. Unlike conventional approaches, which often use these phenomena synonymously, we differentiate them by identifying distinct regimes of advantage formation, different types of strategic behaviour, and distinct forms in which innovation and digital inequality manifest.

Technological competition can be interpreted as the basic form of market interaction, within which the key source of advantage lies in the ability to create and commercialize innovation. In this logic, economic actors compete on the speed of developing new products, the efficiency of bringing them to market, the flexibility of their business models, and the ability to adapt technologies across different spheres of economic activity. The innovation component here has a clearly product-oriented character, while the digital component functions as an accelerator of market processes by reducing transaction costs, expanding access to consumers, and accelerating the scaling of commercial solutions. Accordingly, inequality at this stage emerges as asymmetry in access to knowledge, research resources, human capital, and entrepreneurial ecosystems.

The transition to technological rivalry signifies a fundamental shift in the logic of interaction. Technologies have become a strategic resource that determines not only the market position of individual firms but also the long-term economic power of states and regions. Within this configuration, the innovation component is no longer limited to the creation of new solutions; it now takes the form of a struggle for control over critical technological capabilities, production nodes, standards, patent regimes, and supply chains. The digital component is transformed from an instrument of market efficiency into an object of strategic control encompassing computing infrastructure, cloud services, data centers, data transmission channels, and regulatory regimes governing access to digital markets. As a result, inequality takes on an institutional and structural character, manifesting as the capacity of some

actors to determine the conditions under which others participate in technological processes.

The further development of technological interaction leads to the emergence of a regime of technological races, within which decisive importance lies not only in the creation or control of technologies, but also in the capacity to accelerate their scaling across multiple domains simultaneously. At this stage, the innovation component shifts in nature, becoming a continuous process of generating, integrating, and commercializing interconnected technological solutions. The digital component, in turn, serves as the infrastructural foundation for the reproduction of advantage, ensuring access to computing power, large-scale data, artificial intelligence models, and platform ecosystems. As a result, inequality takes the form of asymmetry in the capacity for cross-arena scaling, meaning the ability of some actors to transfer accumulated advantages across different technological and market environments.

Within this logic, the phenomenon of omniscalers emerges as a carrier of a new type of market power. Their distinctiveness lies in their ability to integrate financial, innovative, infrastructural, and organizational resources into a unified system applicable across multiple arenas of competition. They do not merely scale individual products or markets; rather, they scale infrastructure capacity, enabling them to operate simultaneously across several technological clusters. This implies that their competitive advantage is formed not at the level of individual industries, but at the intersection of multiple high-dynamic environments.

In this context, arenas of competition should be understood as key structural elements of contemporary economic transformation, combining high growth rates, intense competitive dynamics, investment concentration, and rapid technological renewal. Their defining feature is their interconnectedness, whereby the development of one arena creates preconditions for the growth of others [3-5]. Such systemic interdependence implies that economic power is formed not within isolated sectors, but through their integration.

The central element of this interconnected system is the infrastructural foundation of artificial intelligence, which includes semiconductors, cloud services, and AI software and services. Its significance lies in establishing the basic conditions for the development of a wide range of technological domains, including digitalization, robotics, autonomous transport, biotechnology, and defence systems. Control over this infrastructure implies control over the capacity to scale innovation across multiple arenas simultaneously. Omniscalers play a pivotal role in this configuration, as they can integrate these infrastructural components into a unified system. Their activity is based on the mechanism of resource reuse, whereby computing power, data, algorithms, and engineering capabilities are deployed across different economic spheres. As a result, each new investment not only generates returns but also strengthens the company's position in other segments, thereby reinforcing a cumulative logic that secures a sustainable competitive advantage for omniscalers.

This transformation is directly linked to the new nature of digital inequality. It is no longer confined to disparities in access to digital technologies but takes

the form of inequality in access to scaling infrastructure. This refers to asymmetries in the ownership of computing capacity, data centers, semiconductor resources, artificial intelligence models, as well as in the ability to integrate these elements into effective innovation ecosystems. In such a configuration, digital inequality reflects not only the level of technological development but also the position of actors within the global hierarchy of economic power.

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