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Territory, technosphere and psychosphere: foundations of digital sovereignty

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ABSTRACT

This article analyzes the digitalization of territory as the current phase of the technical-scientific-informational milieu, emphasizing the disputes over the meanings of digital sovereignty in Brazil and the ongoing popular period of history. Based on the categories of technosphere and psychosphere, it argues that sovereignty involves the simultaneous control of technical infrastructures and of the meanings of actions that guide the use of territory as both resource and shelter. It discusses the role of big tech, datafication and platformization in the production and organization of space and in the reproduction of technological dependency, characterized as data colonialism. The analysis of an emerging core of public policies aimed at digitalization reveals tensions between regulation, development, and subordination to international capital. Finally, the article highlights the emergence of popular digital sovereignty as an alternative, grounded in the collective appropriation of technologies and in the construction of public and community digital infrastructures guided by the social function of technology.

KEYWORDS: territory in use; popular period of history; popular digital sovereignty.

Thematic Dossier. WG-1 Space and Economy Colloquium. Financial dominance, platform capitalism, and productive restructuring.

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INTRODUCTION

The accelerated digitalization that began in the mid-2010s has profoundly reconfigured and transformed geographic space. Although the processes and origins of the current "techno-scientific-informational milieu" date back to the post-World War II era, its consolidation occurred in the mid-1970s (Santos, 2023 [1996]) alongside globalization. Composed of techniques, norms, and information organized according to the logics of capital and territorial states, globalization has sought to impose a single rhythm, mindset, and direction upon the world and its places through the singularity of technology and a singular driving force: the logic of the financialization of global surplus value. In the present day, this consolidates the two tyrannies identified by Santos (2000), along with their associated violence and perversities: the tyranny of information and the tyranny of money.

This process accelerated with the global spread of the internet starting in the 1990s, elevating informational infrastructures and digital flows to the status of structural elements of territories worldwide. A decisive factor in this was the process of datafication (Couldry & Mejias, 2019), that is, the transformation of values, perceptions, materialities, and social, economic, and political practices into quantifiable data for the purposes of measurement, accumulation, and speculation. As a key, rising variable within the techno-scientific-informational milieu, datafication began with computerization (1960s/70s), accelerated with the internet (1990s), and became widespread in the 2000s.

Another decisive historical layer in the emergence of the digitization of territory, with the widespread adoption and generalization of smartphones and interactive digital screens beginning in the 2010s (Bertollo, 2019), the "luminous rectangles," which became definitively and dramatically entrenched at the start of the 2020s (Ribeiro, 2024), was the process of platformization (Srnicek, 2017). The rise of major digital platforms, "Big Tech" or "root-platform" companies (Pessanha, 2020), such as the US-based GAFAM (Google, Amazon, Facebook, Apple, and Microsoft) and the Chinese BATX (Baidu, Alibaba, Tencent, and Xiaomi), which underpin a myriad of other platform companies, is characterized not merely by data collection, storage, and processing. It also involves structuring markets, production processes, behaviors, social relations, public policies, governance mechanisms, and forms of work through digital infrastructures that mediate, modulate, and govern these interactions via the algorithmic management and use of territory (Tozi, 2022). It is, therefore, a process of "condominium-ization",

conversion into a condominiums, compartmentalization, or enclosure of the global computer network by large technology corporations and financial funds, with the complicity of territorial states.

The reconfiguration of the links between power, technology, culture, and territory resulting from the digitalization of geographic space has also fostered a renewal of debates, conflicts, and interpretations of the world. Below are a few proposals, for illustrative purposes only, such as the concepts of digital colonialism or data colonialism (Morozov, 2018; Silveira et al., 2021), in which countries of the Global South come to play a subordinate role in the globalized digital economy. While in previous cycles, peripheral integration occurred primarily through the export of resources and raw materials, today it manifests through the extraction and circulation of data and information, now converted into a new strategic raw material of contemporary capitalism. In this regard, as Zuboff (2019) argues, the massive capture of data and its transformation into economic value within surveillance capitalism has established new forms of dependency: data is exported, while technological vulnerability, informational subordination, and a loss of sovereignty are imported. This dynamic aligns with debates on extractivism, neo-extractivism, and the commodification of data (Gago & Mazzadra, 2017; Pessanha, 2020, 2024; Paulani, 2022) by highlighting the conversion of data and information into commodities and strategic assets. In other words, it is a process of intensive capture and appropriation, characterized by a lack of transparency and a tendency toward concentration, marked by minimal processing and value-added activity, significant environmental impact, and a dependent position within the global economy.

This logic operates within the broader framework of platform capitalism, a concept systematized by Srnicek (2017), who identifies digital platforms as the hegemonic organizational form of contemporary capitalism. Within these platforms, the extraction, processing, and monetization of data has become central to capital accumulation, redefining the relationships between territory, labor, consumption, and power. Major digital corporations,"Big Tech", gain control over technical infrastructures, communication flows, and global economic circuits, thereby deepening asymmetries between decision-making centers and peripheral regions. In this process, territory is restructured according to networked and selective logics subordinated to transnational corporate interests; this can be interpreted as a form of "Imperialism 2.0" (Crocetti, 2025), characterized by dominance over digital infrastructures, information, and cognitive systems.

Along these same lines, Han (2017) demonstrates how neoliberal power shifts from classical disciplinary forms to subtler mechanisms of controlling subjectivity. Psychopolitics he proposes acts directly upon the psyche, shaping desires, affects, and behaviors through algorithms, voluntary surveillance, and digital devices of self-exploitation. Unlike external coercion, this power operates under the guise of freedom, inducing subjects toward constant self-management and spontaneous adherence to the logics of performance and the market. Thus, the infrastructural domain articulates with the cognitive domain, especially within a post-truth context (Crocetti, 2025), where information manipulation, algorithmic segmentation, profiling, and consensus-building become central instruments for reproducing new forms of coloniality and dependency.

In this context, the debate over sovereignty emerges as a decisive arena for geopolitical, cultural, economic, and territorial disputes (Tozi, 2018; Silveira, 2021). However, regarding the techno-operational domain of artificial intelligence (AI), data flows, the extraction of rare earths and critical strategic minerals, and the spatial distribution of data centers, satellites, undersea cables, fiber optics, base stations, sensors, cameras, and antennas, what is at stake are the uses of territory and the very conception of sovereignty in the information age, particularly in the current debate and contestation surrounding so-called digital sovereignty (Couture & Toupin, 2017; Pohle & Thiel, 2021).

Governments, corporations, and multilateral bodies frequently employ the concept of sovereignty, transforming it into a narrative that serves neoliberal and oligopolistic projects. Certain initiatives (policies, programs, regulations, and bills) reveal an attempt to reconfigure the digital layer of Brazilian geographic space in line with the interests of global finance capital, consolidating a model of digitalization that is subordinate and geared toward the private valorization of information infrastructures. Thus, far from fostering digital sovereignty, whether public or popular, anchored in the public interest, social participation, and the socially and territorially grounded use of technology, these measures deepen Brazil's dependency. We examine this issue in the next section of the article through a brief analysis of an emerging cluster of Brazilian state public policies regarding digital infrastructures.

Drawing inspiration from the analytical triad regarding globalization, or the techno-scientific-informational milieu, proposed by Milton Santos (2000), we critically analyze the construction of and contestation over digital sover-

eignty in Brazil. We view globalization not only as a myth and a perversity but also as a possibility for other worlds. The intensification of contradictions within the techno-scientific-informational milieu gives rise to the conditions and pathways for the "popular period of history". We explore this issue in the third section and the conclusions, aiming to contribute, from a geographical standpoint, to an understanding of digital sovereignty through a spatial lens: one that is simultaneously a technosphere and a psychosphere, constituting an inseparable system of materialities and actions.

For Santos (2023[1996]), the technosphere refers to the material set of objects and infrastructures that constitute geographic space, such as networks, artifacts, materialities, machines, and information systems, which enable the production, circulation, and organization of life. The psychosphere, in turn, refers to the set of ideas, values, beliefs, and worldviews that guide the actions of subjects, constituting the immaterial and symbolic dimension of space; this dimension is strongly mediated by social memory, culture, forms of sociability, media, and information. These are, therefore, inseparable dimensions of the techno-scientific-informational milieu: the technosphere expresses its technical materiality, while the psychosphere reveals its ideological and cultural dimension, the meanings and perspectives underlying action.

This essay-style article is grounded in ongoing research using a qualitative approach. It relies on a review of literature and documents and a critical analysis of territorial dynamics, linking theory, public policies, agents, the meanings of action, and contemporary processes of territorial digitalization, all situated within the broader context of the digitalization of geographic space. Our central aim is to problematize sovereignty, without seeking to exhaust the topic or present an exhaustive review of the vast body of work and debate surrounding it, with a particular focus on digital sovereignty. We proceed from the understanding that sovereignty is not restricted to state and corporate actors but also encompasses the Latin American tradition of popular forces and resistance. In this regard, we seek to understand two major lines and meanings of digital sovereignty, the public-state and the popular, as well as the risks of this concept being captured by big capital. We take as our reference points geographic space, understood as "banal space", that is, the territory used by everyone (Santos, 2023 [1996]), and sovereignty as the effective use of territory (an inextricable blend of technosphere and psychosphere), which unfolds in specific places as mediated by the Brazilian socio-spatial formation (Santos, 1977).

PROBLEMATIZING THE EMERGING CORE OF PUBLIC POLICIES FOR DIGITAL INFRASTRUCTURE IN BRAZIL

This section aims to define and characterize a specific core of public policies within the broader range of government programs and actions focused on digitalization, platformization, and datafication. The goal is to problematize digital sovereignty from the perspective of the Brazilian State and Digital Public Infrastructures (DPIs). To this end, we analyze five initiatives and, at the end of the section, engage with the study by Schiavi et al. (2025), which examines four other national policies.

The focus here is on the challenges posed by the dynamics of Brazil's integration into the political economy of digital colonialism (Silveira, 2021), a process marked by the annual transfer of billions of reais in public funds to services provided by Big Tech companies (approximately R$ 23 billion between 2014 and 2025, according to Silva et al., 2025). This stands in stark contrast to the chronic underfunding of domestic Information and Communication Technology (ICT) industries, Digital Public Infrastructures, Research and Development (R&D), scientific and educational training, and free software ecosystems.

The five initiatives analyzed are: the Brazilian Artificial Intelligence Plan (BAIP, 2024); the National Data Center Policy (NDCP, 2025); Bill No. 3.018/2024, regarding the regulation of artificial intelligence (AI) data centers; Bill No. 1.680/2025, which establishes the National Policy for Digital Processing and Storage and proposes the creation of ZEPADs (Special Zones for Digital Processing and Storage); and Bill No. 2.080/2025, which establishes the National Policy on Energy Efficiency and Socio-environmental Sustainability for data centers.

The recent legislative progress of these bills, programs, and regulations reveals the formation of an emerging core of public policies aimed at organizing a strategic digital sector. Although distinct in their immediate objectives, Bills No. 3.018/2024 (addressing AI data centers), 1.680/2025 (ZEPADs), and 2.080/2025 (energy efficiency and sustainability for data centers), when analyzed together, reflect three fundamental dimensions of state action: strategic regulation, industrial policy, and socio-environmental governance.

Bill No. 3.018/2024 falls within the realm of regulation and digital sovereignty by treating data centers, particularly those linked to artificial intelligence, as critical infrastructure. Its focus lies on control, security, and governance, signaling an attempt to reposition the state as a regulatory agent in the face of the growing concentration of power among major technology corporations. In this sense, the bill engages directly with the debate

on technological autonomy and data control, seeking to reduce reliance on foreign digital infrastructure.

The measures currently under discussion by the state include, for instance, tax incentives such as exemptions from the Tax on Industrialized Products (IPI), the Social Integration Program and Contribution for the Financing of Social Security (PIS/Cofins), and import duties on equipment for a five-year period. The proposal also mandates that data centers be located in Export Processing Zones (EPZs) and utilize exclusively renewable energy (Brazil, 2025). According to estimates by the Ministry of Finance, this regulatory framework has the potential to attract up to R$ 2 trillion in foreign investment over the coming decade (CNN, 2025).

Meanwhile, Bill No. 1.680/2025, by proposing the creation of ZEPADs, embodies an industrial strategy and policy aimed at the country's competitive integration into the global digital economy. Inspired by models such as free trade zones and technology hubs, the project relies on granting incentives and attracting investment to foster digital production chains. This development approach prioritizes economic expansion and the creation of a domestic digital infrastructure sector; however, it could reinforce external dependency if such investments are dominated by large transnational corporations. Thus, ZEPADs are based on establishing specific locations for the implementation of these and other policies, creating areas of functional specialization within the territory that allow not only for the concentration of investment but also for coordination with synergistic and complementary policies. This may result in forms of territorial compartmentalization in Brazil, with direct implications for the nature and totality of the socio-spatial formation (Santos, 1977).

Meanwhile, Bill No. 2,080/2025 introduces a sustainability dimension by establishing guidelines for energy efficiency and socio-environmental responsibility for data center companies. The bill acknowledges that these infrastructures entail high consumption of energy and natural resources, such as water, resulting in significant territorial impacts. Thus, it seeks to align digital expansion with environmental limits, incorporating concerns regarding resource use, energy transition, and socio-spatial inequalities.

Viewed together, these three bills demonstrate that a policy for digital infrastructure is beginning to take shape in Brazil, anchored in three interdependent axes: who controls it (regulation and sovereignty), who invests and produces (industrial policy), and under what conditions (sustainability). However, this articulation reveals significant tensions and contradictions be-

tween: economic growth and environmental limits; the pursuit of sovereignty and dependence on foreign capital; and the strengthening of state regulation versus the market's centrality as a driver of development. This set of initiatives signals a shift in the national debate on digitalization: the focus is moving from discussions about data and platforms to the materiality of infrastructures, encompassing territory, energy, investment, and power. In this sense, digital infrastructure is coming to be understood as a central element in the production of space and the use of territory, opening up a strategic arena for political, economic, and socio-environmental contestation regarding the future trajectory of Brazil's socio-spatial formation.

Such measures and actions tend to deepen structural dependency by reproducing three main dynamics: (i) the attraction of investments concentrated in hyperscalers, which serve a few global corporations without fostering technology transfer; (ii) the intensive and predatory use of national resources (such as energy, water, and pre-existing technical networks) for infrastructures that generate few jobs and entail high socio-environmental costs; and (iii) the expansion of tax breaks without effective reciprocal commitments to strengthen local innovation. In this context, while the government negotiates with Big Tech companies to mitigate costs and fees, the prevailing model tends to consolidate a form of digital colonization of the territory, wherein sovereignty is reduced to merely authorizing the hosting of the physical infrastructure that drives this dependency.

Within the framework of the emerging core of public policies proposed here, the 2024 Brazilian Artificial Intelligence Plan (BAIP) and the 2025 National Data Center Policy (NDCP) play a strategic role by deepening and systematizing the guidelines outlined in the analyzed bills. Both function as instruments of state planning and coordination; while they represent advances in recognizing the centrality of digital infrastructure, they also perpetuate structural dilemmas and ambiguities regarding technological sovereignty.

By establishing guidelines for the development and adoption of artificial intelligence systems in the country, the PBIA emphasizes the need to expand national capabilities in research, innovation, and human capital development. However, its overall orientation remains firmly rooted in fostering an innovation-friendly environment driven by market logic, prioritizing public-private partnerships and integration into global productive spatial circuits. Consequently, even while acknowledging the importance of technological autonomy, the plan tends to favor the diffusion and application of technolo-

gies developed by major corporations, predominantly foreign ones, thereby limiting its potential to foster genuine digital sovereignty based on national control over data, algorithms, and infrastructure.

The NDCP, by specifically focusing on the expansion of and investment attraction for data centers, highlights the material dimension of the digital economy. The policy recognizes Brazil as a prime location for establishing such infrastructure, owing to comparative advantages such as the availability of renewable energy and water resources, integrated technical systems for circulation and communication, vast territorial extent, and a large consumer market. However, by relying on tax incentives, regulatory streamlining, and the attraction of foreign capital, the NDCP reinforces the country's subordinate position within the international division of labor, wherein the national territory is utilized primarily as a platform for data storage and processing controlled by external actors.

Taken together, the BAIP (2024) and the NDCP (2025) help consolidate a state strategy that links technological innovation with infrastructure expansion, aiming to foster the progressive internalization of strategic stages within digital productive spatial circuits and to accelerate the development of national capabilities in sectors deemed essential for the country's technological sovereignty. Although Brazil currently lacks expertise in several critical segments, and developing such capabilities would require years or even decades, these policies seek to fast-track stages of national development by expanding data processing and storage infrastructure, cultivating human capital, stimulating research and innovation, and attracting investment. Yet, the lack of more robust mechanisms for internalizing material capabilities and ensuring sovereign control means that these initiatives perpetuate significant ties of external dependency. Thus, while expanding the state's role in planning the digitalization of the territory, these policies also reveal the limitations of an approach that, by prioritizing competitiveness and investment attraction, may reinforce and perpetuate patterns of dependency, thereby deepening Brazil's peripheral status within the international division of digital labor.

Finally, we engage with and concur with the study by Schiavi et al. (2025), who conducted a document analysis of four national policies along these same lines: the Brazilian Strategy for Digital Transformation (E-Digital, 2018); the National Internet of Things Plan (National IoT Plan, 2019); the Brazilian Charter for Smart Cities (2020); and the Brazilian Artificial Intelligence Strategy (BAIS, 2021). The authors demonstrate that, although Brazil's technolog-

ical dependence is acknowledged, these initiatives also prioritize the country's integration into the global data economy based on market logic, without establishing effective mechanisms for sovereignty. Consequently, Brazil tends to occupy the position of a massive data producer and supplier, while processing, control, and value capture remain concentrated in large foreign corporations. Furthermore, the policies analyzed rely heavily on public-private partnerships, show low levels of social participation, and lack strategies aimed at building autonomous infrastructure, thereby reinforcing dynamics of dependency and the reproduction of socio-spatial inequalities.

CONTESTING THE MEANINGS OF DIGITAL SOVEREIGNTY AS A PSYCHOSPHERE AND TECHNOSPHERE IN THE TECHNICAL-SCIENTIFIC-INFORMATIONAL PERIOD

So-called digital sovereignty cannot be reduced to the physical presence of equipment or the existence of protective legislation. Although the Brazilian Civil Rights Framework for Internet (Brazil, 2014) and the General Data Protection Law (Brazil, 2018) successfully and commendably sought to establish a normative framework for internet usage and personal data protection, the material reality of the territory points in a different direction. The expansion of platform capitalism (Srnicek, 2017) and surveillance capitalism (Zuboff, 2019), coupled with the appropriation of digital information and communication technologies by hegemonic economic groups and state sectors aligned with neoliberal interests, has shaped territory and modulated its uses to serve private value accumulation and the reproduction of financial capital.

In this context, asymmetries manifest within the political economy of digital colonialism, where trade sanctions, such as recent U.S. threats and the imposition of tariffs, act as intersecting mechanisms of coercion designed to preserve structures of dependency. Such measures aim to curb autonomous regulatory initiatives by nations (for instance, the Brazilian Supreme Federal Court's move to hold Big Tech accountable) and to consolidate the extraction of data as a commodity (Gago & Mazzadra, 2017; Paulani, 2022; Pessanha, 2024), thereby replicating and updating historical patterns of technological dependency and subordination.

This process, however, does not imply a hollowing out of state action. Quite the contrary: it reveals how the nation-state itself acts as an active agent in enabling this dependency by building the infrastructure that supports the presence of major technology companies, establishing the legal

frameworks for their operations, and guaranteeing the general conditions of production for these corporations. The sovereignty ceded, therefore, stems not from a lack of state power, but from the way the state chooses to exercise it, subordinating its normative and material strength to the interests of international capital (Santos, 2000) rather than articulating its own project for technological and digital development.

This submission is not a geopolitical inevitability. As Santos (2000, p. 77) emphasizes, the state remains strong, and "neither transnational companies nor supranational institutions possess the normative power to unilaterally impose their will within a given territory." Indeed, requirements regarding establishment in Export Processing Zones (EPZs) and Special Zones for Digital and Advanced Production (SZDAPs), as well as the use of "green" energy, demonstrate that transnational agents rely on local regulations to operate. Such measures, therefore, reveal a political choice: prioritizing global financial flows involving the datafication of territory and life at the expense of sovereign control and autonomy for the Brazilian people.

Recent news that the Brazilian government met with Big Tech companies, aiming to strengthen its negotiating position and avert a massive tariff hike on strategic Brazilian sectors (G1, 2025), highlights a set of fundamental contradictions inherent in the construction and assertion of digital sovereignty in the country. As reported, Brazil has softened its stance regarding the defunct ReData plan (Special Taxation Regime for Data Center Services)[1], previously used as a bargaining chip in negotiations, and has increasingly opened the rare-earth sector to private and foreign exploitation. A prime example is the recent acquisition of the Brazilian rare-earth mining *Serra Verde* Group, originally established over 15 years ago with foreign capital and operator of the *Pela Ema* mine in Goiás since 2024, by the US-based company USA Rare Earth[2]. This reflects the pressure exerted by global geopolitical interests and Brazil's structural dependence on transnational capital, particularly given the risk of international trade sanctions and economic retaliation (G1,

1 Established by Provisional Measure No. 1,318/2025, it provided for a five-year suspension of federal taxes for companies installing data centers in Brazil. The measure lapsed in February 2026 after the Senate failed to consider Bill No. 278/2026, which would have turned the regime into permanent law. Other measures are currently being studied and designed to ensure the continuation of the policy's provisions.

2 In this regard, it is necessary to distinguish between mining concessions, exploration authorizations, and projects under development. Although consolidated statistics are lacking, it is observed that while Brazilian companies hold various titles and projects, the most advanced ventures are predominantly controlled by foreign groups, particularly Australian, as well as Canadian, US, and Chinese (AEPET, 2026; Perry and Garfinkel, 2026).

2025). Such a stance demonstrates that digital sovereignty is not merely a technical or regulatory issue but an arena of complex disputes involving the political, economic, and territorial power of the actors vying for control over digital flows and information infrastructures, in other words, a contest over the technosphere and the psychosphere (Santos, 2023).

The threat of massive US tariff hikes, often highlighted as a key instrument of geopolitical pressure, is reinterpreted here as a symptom of a deeper asymmetry. Events of this nature expose the structural and systemic coercion that shapes public policy: trade sanctions targeting strategic sectors (such as agribusiness) are weaponized to halt sovereign regulatory initiatives, while tax breaks subsidize the profits of transnational corporations without fostering local innovation. This logic perpetuates Brazil's dilemma, even within coalitions like BRICS (the group comprising Brazil, Russia, India, China, and South Africa)[3]: although partnerships with China (in semiconductors) and Russia (in cybersecurity) offer some room for maneuver, the majority of national data continues to be stored and processed in foreign cloud environments, thereby reinforcing strategic vulnerabilities. Clouds that, in turn, are territorially anchored (Simões, 2023).

The narrative regarding the immateriality and "lightness" of the digital realm, a myth propagated by the construction of the "cloud" concept, masks an extremely dense infrastructure that is essential to the digital environment (Simões, 2023). The cloud, being simultaneously virtual and physical, consists of systems that require and heavily depend on specific materialities and geographical conditions. Therefore, the digitalization of territory does not eliminate the centrality of space; rather, it reconfigures hierarchies and deepens territorial selectivities. Thus, the cloud does not hover homogeneously; it anchors itself in privileged locations within territories that provide the material and immaterial foundations for its operation (Simões, 2023). This anchoring is selective, as evidenced by Loback and Ribeiro (2025) in their analysis of the installation of antennas and base stations for fifth-generation (5G) mobile internet access: the greater the technical density, the greater the technical systemic integration, and consequently, the greater the socio-spatial selectivity.

The territorial materiality of this dependency manifests in acute contradictions. The "renewable energy" requirement aimed at "energy transition", another

3 As of 2024, it also included Egypt, the United Arab Emirates, Saudi Arabia, Ethiopia, and Iran, with Indonesia joining the group in 2025.

myth, for the installation and operation of data centers, for instance, functions as greenwashing by omitting water and energy costs as well as local impacts, in short, perverse outcomes. Greenwashing is a practice whereby companies, governments, or organizations seek to construct an image of environmental responsibility that is exaggerated, misleading, or disproportionate to their actual practices. In other words, it involves using sustainability rhetoric to legitimize activities that continue to generate significant socio-environmental impacts and energy-intensive uses of territory, placing high demands on energy, labor, data, and information, as is the case with platforms and data centers.

Each data center consumes millions of liters of water daily for cooling, intensifying social conflicts in Brazil and Latin America over access to both water and electricity. This model constitutes a form of digital territorial leasing, wherein economically privileged zones (such as EPZs and SZDAPs) host foreign infrastructure without generating endogenous development, thereby reproducing colonial patterns of extractivism (Gago & Mazzadra, 2017; Paulani, 2022; Pessanha, 2024) and the extroversion of the territory. In this light, it is evident that the issue transcends a mere fiscal dispute; rather, it is embedded in a geopolitical logic where territorial incentives and control over digital technologies and data serve as a central vector for the reproduction of global informational capitalism, a system in which countries of the Global South, such as Brazil, play secondary and subordinate roles.

This situation illustrates what Santos (2020) termed "perverse globalization", that is, the global dynamic that produces structural inequalities and imposes severe limitations on the autonomy of countries on the periphery of global capitalism, insofar as their public policies are conditioned and often rendered unfeasible by external interests. Meanwhile, the production of a discourse grounded in myths such as "digital clouds," "energy transition," and "digital transformation" generates a powerful, expansive psychosphere that drives actions and fosters, often uncritical, unreflective, and sometimes fatalistic, acceptance of the digitalization of life and territory, as well as of "techno-solutionism" (Morozov, 2018), all steered by corporate interests and agents.

SOVEREIGNTY, MATERIALITIES, AND THE MEANINGS OF ACTION: PRODUCTION AND APPROPRIATION OF PUBLIC AND COMMUNITY DIGITAL INFRASTRUCTURES

At the heart of this dispute lies the concept of digital sovereignty. In the tradition of modern political theory, the concept of sovereignty was con-

ceived as absolute, independent, and unconditional power (Bicalho, 2024). In the formulations of Jean Bodin (1530–1596) and, subsequently, Thomas Hobbes (1588–1679), sovereignty emerges as an organizing principle of political authority, inseparable from the centralization of power and the territorial delimitation required to exercise that authority (Bobbio, 1988), thereby constituting the foundation upon which the organization of the modern-colonial territorial state is built and asserted. In the current techno-scientific-informational period, this landscape becomes structurally more complex: technology and information become constitutive elements of the production and control of space, and digital infrastructures come to play a decisive role in organizing social relations, redefining the material bases upon which power struggles and territorial uses are structured. Inseparable from the technosphere is a corresponding production of a psychosphere within this technical environment: algorithms that seek to shape behaviors and capture attention to serve interests driven by profit and accumulation, while digital surveillance and biometric capture subject bodies to data extraction and control processes, turning them into objects of territorialization and the exercise of power.

It is within this context that the notion of digital sovereignty emerges and creates tension, a concept initially systematized by authors such as Couture and Toupin (2017) and Pohle and Thiel (2021) based on the recognition of geopolitical asymmetries in the control of digital infrastructures, a tension brought to public attention, for instance, by Edward Snowden's 2013 revelations (Tozi, 2018). In the Brazilian context, Silveira et al. (2021) highlight, for example, the political implications of this technological dependency, evident in agreements involving approximately 80% of public higher education institutions with corporations like Google and Microsoft (Barrera; Devechi, 2023), and in the absence, or chronic insufficiency, of Public Digital Infrastructures capable of countering the corporate concentration of digital flows.

This asymmetric nature of the political economy of data converges with the notion of data colonialism (Couldry & Mejias, 2019): the massive extraction carried out by large corporations constitutes a new form of appropriation of life, in which human experiences, interactions, and behaviors are converted into raw material for capitalist accumulation, reconfiguring, on new terms, historical relations of dependency and hierarchy. In this process, the state acts as an active mediator of these interests, directing its regulatory capacity toward sustaining the hegemony of big capital, while the very concept of digi-

tal sovereignty is increasingly captured by corporate actors, thereby stripping it of its critical potential and capacity for autonomy.

The concept of digital sovereignty emerged in the European context as an attempted response to growing technological dependency and the lag relative to major corporations and external powers, notably the United States and China (Evangelista and Avelino, 2026). European digital sovereignty can be understood as the capacity to control data, infrastructures, technologies, and standards in accordance with one's own interests and democratic values. Broadly speaking, it presupposes: (i) technological autonomy with reduced dependency on Big Tech; (ii) data protection and privacy underpinned by a strong regulatory framework; (iii) control over critical infrastructures (cloud services, data centers, fiber-optic cables, networks, semiconductors); (iv) interoperability and open standards; and (v) alignment with European values (transparency, fundamental rights, and democracy).

Initially formulated as "digital strategic autonomy", the term came to designate the capacity of states and institutions to control data, infrastructures, software, and networks, thereby ensuring economic and political independence, security, and alignment with democratic values. This debate and the initial regulatory foundations gained momentum starting in the 2010s, driven by the intensification of the digitalization and datafication of territory, scandals and revelations regarding global surveillance, and the need to regulate digital platforms and networks. Thus, in Europe, digital sovereignty takes on a normative character, embodied in policies and regulations that seek to combine data protection, technological innovation, and political autonomy, with many of these actions inspired by Chinese models and regulations, even if not explicitly acknowledged as such.

From 2016 onwards, the discussion regarding data regulation and the need for it gained prominence within the European Union, culminating in the 2018 approval of the General Data Protection Regulation (GDPR). This was a decisive milestone that elevated data to the status of a strategic resource, a means of exercising power, and an object of sovereignty. However, it was in 2020 that the term "digital sovereignty" became firmly established in European discourse, gaining geopolitical centrality; it became linked to the concept of "strategic autonomy" and the European Union's attempt to project itself as a global regulatory model and power.

As the concept of digital sovereignty became established in Europe, it expanded in scope; while references to technical control over infrastruc-

ture remained, the concept increasingly incorporated other dimensions, primarily legal, economic, and geopolitical. This appears to represent a repositioning of the European Union within the international division of labor and an effort to secure its role as a key link and actor among global powers during the digitalization process, particularly in the face of an actual loss, or widening gap, regarding productive capacity and control over the material aspects and infrastructures of information.

According to Evangelista and Avelino (2026), digital sovereignty has come to signify not merely the possession of technology, but also the ability to define rules, govern data flows, and vie for power within this space. It is, therefore, a multifaceted concept that interlinks security, regulatory autonomy, and productive capacity, highlighting the tensions between digital globalization and national sovereignty. This transformation reflects the recognition that control over data and digital systems is strategic for both development and democracy itself, thereby making digital sovereignty a central pillar of contemporary policy.

In Brazil, the concept of digital sovereignty was also adopted starting in the 2010s, in dialogue with the international agenda and driven by events that exposed national and social vulnerabilities in the digital realm. This notion began to shape debates on regulation (such as the 2014 Civil Rights Framework for the Internet and the 2019 General Data Protection Law), infrastructure (cloud computing, 5G, semiconductors), and data governance. In the Brazilian context, digital sovereignty takes on a strong strategic and political dimension, understood as the state's capacity to exercise control over its digital space, protect data, and reduce external dependencies. At the same time, it faces structural challenges, such as the global concentration of technology production and digital infrastructure, as well as the hegemony of Big Tech, which reinforces its status as a contested and evolving concept within the country.

However, a key distinction in the Brazilian case is that the formulation and contestation of the digital sovereignty concept, beginning in the 2010s, initially emerged from and was driven by hacktivist organizations, social movements, collectives, and free software communities. Subsequently, over the last three years, the debate and the term itself have been co-opted by the political agendas of major corporations and large-scale capital. This has occurred through corporate lobbying and digital media outlets linked to think tanks, serving to legitimize their programs and actions while pressuring the state to provide the public resources and capital needed to implement digital infrastructure,

infrastructure that functions as a general condition for production and circulation, yet remains tied to and serves the interests of large-scale capital. This reflects a growing social interdependence in production and circulation (spanning infrastructure, collective services, urbanization, and technical networks), making these processes increasingly collective, while simultaneously maintaining private appropriation of the resulting wealth, which is produced both socially and territorially. This involves, therefore, capitalist socialization (Lojkine, 1981[1977]; Santos, 2009[1994]) driven by major hegemonic agents. These agents universalize norms, techniques, and information, unifying the territory, albeit unevenly, and reinforcing the alienated territorial division of labor, territorial fragmentation, and socio-spatial disparities.

This process has intensified the contestation surrounding the concept of digital sovereignty, and heightened its valuation, diffusion, and visibility, in the current informational period. Within the realm of popular forces in Brazil and Latin America, this concept is increasingly defined and championed as "popular digital sovereignty" (Schiavi et al., 2025; Grohmann et al., 2025; Seto, 2025), a counterpoint to corporate notions and practices of sovereignty, for which territory matters far more as a resource than as a place of habitation.

Among popular forces, which view territory as a resource but, above all, territory as shelter (Santos et al., 2000), the concept of digital sovereignty has been placed on the agenda, contested, and constructed through the appropriation of the material and subjective conditions of data and information production and circulation by collectives and social movements. A notable example in the Brazilian context is the formulation of the concept of popular digital sovereignty originally proposed by the Homeless Workers' Movement (MTST, 2023; Seto, 2025). This concept envisions collective control over digital technologies by communities and workers themselves, aimed at building popular power by ensuring not only access but also autonomy in the production, management, and use of these technologies. Along these same lines, the Technology Collective of the Socialism and Liberty Party (PSOL) in Brazil has proposed the concept of Popular Digital Sovereignty (or popular digital sovereignties) as:

> [...] the construction of socialist and free tools, infrastructures, and platforms, and the creation of the conditions necessary for this, as well as the development of a collective vision, grounded in analyses of current realities, that enables a break from digital and data colonialism. In other words, popular digital sovereignty is rooted in fostering the material and subjective conditions for the popular appropriation of

> the information society, thereby promoting scientific and technological autonomy oriented toward the common good, rather than autonomy that fosters social, political, economic, cultural, and geopolitical domination. In short, popular digital sovereignty entails the creation and adoption of emancipatory technologies, whether digital or otherwise, derived from popular wisdom and citizen science; technologies that facilitate peace, the self-determination of peoples, the promotion of digital equality, and the protection of human rights and the environment, and are, therefore, socialist and free (PSOL, 2023, p. 5, emphasis added).

Furthermore, it is worth noting the "Network for Digital Sovereignty" initiative, launched in 2023 (https://soberania.digital/). This is a nationwide coalition led by civil society, involving movements, communities, universities, labor unions, governmental offices, activists, and social leaders. The network was formally consolidated following the "Sovereignty Now!" (*Soberania Já!*) gathering held in Brasília in July 2025. It advocates for: technological autonomy and national digital infrastructure; democratic control over data, algorithms, and platforms; greater coordination among universities, the state, and society to strengthen science, education, and innovation; the development of artificial intelligence and technologies that incorporate Brazil's specific cultural and social characteristics; national security and sovereignty through the protection of critical infrastructure and strengthened cybersecurity; participatory governance involving the government, academia, experts, and civil society; and overcoming the fragmentation of digital policies across ministries and public agencies by building an integrated national strategy. In addition to the Charter for Digital Sovereignty and national gatherings, the Network has initiated the National Plan for Digital Sovereignty (currently under development). Broadly speaking, this plan proposes state coordination and the localization of productive and material capabilities (hardware, semiconductors, data centers, advanced computing, cloud services, telecommunications equipment, etc.), thereby securing strategic control over the material, technological, scientific, and informational conditions necessary for the production and reproduction of contemporary social life.

Thus, popular digital sovereignty entails the production and appropriation of public and community-owned digital infrastructures, affirming the social function of technology within the state and among social collectives and movements.

While negotiations with Big Tech companies, conducted under the threat of sanctions, expose the corporate capture of the state, other initiatives

demonstrate resistance: *PIX* (as a public digital payment infrastructure), *CadÚnico* (for the formulation, management, and implementation of public policies), and the BRICS submarine cable project all challenge the US monopoly over digital flows. Projects that embody the concept of sovereignty and the possibility of an alternative globalization, by partially reducing dependence on foreign platforms, particularly those from Global North powers, stand in contrast to the current reality. The "flexibilization" of Brazil's stance toward Big Tech reinforces structural dependency, where the physical presence of data centers or the existence of protective legislation does not, in itself, guarantee sovereignty. On the contrary, fundamental gaps regarding infrastructure and data control reveal the extent of the subordination faced by the country and Brazilian society, marked by technological and financial dependence and an inability to break away from digitalization models that prioritize private accumulation over the public interest, the commons, and territorial justice (Lima, 2020).

However, it is necessary to consider that the current geopolitical landscape reveals openings that challenge this scenario. Brazil's engagement within the BRICS group and the intensification of trade and technological ties with China point to the possibility of a reconfiguration, albeit a partial one, of Brazil's position in the international system (CNN, 2025). As a socio-spatial formation characterized by the socialization of the mode of production and the central role of society as a whole in planning, China has developed its own model of digital sovereignty, centered on state control of critical infrastructure, support for domestic companies, and active regulation of the digital ecosystem. In this context, cooperation with Global South nations creates room for Brazil to invest in more autonomous industrial and technological policies, such as the creation of public data centers and national fiber-optic networks, as well as the strengthening of its semiconductor and software production capabilities.

While such possibilities are far from representing a radical break with the logic of dependency, they indicate that the totality of Brazil's spatial formation is permeated by contradictions and emerging dynamics that cannot be ignored. By joining a South-South coalition that seeks to contest the direction of global governance, Brazil finds itself in an ambiguous position where the reproduction of structures of subordination coexists with the opening of paths toward an emancipatory technodiversity (Hui, 2020). Milton Santos's reading of space, as an inseparable set of systems of objects and actions,

technosphere and psychosphere, therefore calls upon us to grasp the fissures within this system and the possibilities for action that emerge from it, thereby technologizing politics and politicizing technology (Ribeiro, 2017).

Brazil's stance regarding Big Tech highlights the need for public policies that promote public digital infrastructure, community networks, free software, citizen-generated data, and other mechanisms enabling an emancipatory model of digitalization, one capable of breaking the conditions and cycle of dependency (Marini, 2013) and the structural vulnerability of Brazilian territory. Geographic space thus reveals itself as a fundamental category for understanding the contradictions and tensions permeating contemporary informational capitalism, as well as the open possibilities for action, projects, and the future (Israel, 2019).

Digital infrastructures and materialities, such as submarine cables, fiber optics, base transceiver stations, data centers, cameras, telecommunication networks, satellites, sensors, smartphones, and platforms, have become central pivots in the production of space and the use of territory, reorganizing productive flows, behaviors, patterns of consumption and labor, imaginaries, and socio-spatial hierarchies. However, the appropriation of these techniques by dominant capital interests imposes a rationality that subordinates the public interest to the demands of capital accumulation, thereby limiting the possibilities for a digital sovereignty that effectively integrates national autonomy, territorial justice, and the use of technology based on solidarity.

The persistence of a subordinate model thus reinforces the need to build alternatives that transcend the hegemonic system, such as community networks, free software ecosystems, and public or community digital infrastructures. Although still marginal, these initiatives point toward the possibility of "another globalization" (Santos, 2000). This represents an emancipatory technodiversity already manifesting in community networks, free software and applications, platform cooperatives, public software initiatives (such as the Gov.Br portal), and state-run platforms (like the RNP — National Education and Research Network). While still in their early stages, these initiatives reconfigure the territory as a space for action where digital sovereignty signifies self-determination regarding code, data, and infrastructure, that is, autonomy in the production of the technosphere and the psychosphere, whether from a public/state perspective or through community-led efforts by collectives, social movements, and traditional peoples and communities.

CONCLUDING REMARKS TOWARDS TERRITORIAL SOVEREIGNTY IN THE DEMOGRAPHIC AND COMMUNICATIONAL PERIOD OF HISTORY

In this article, we emphasize an analytical shift that rejects viewing digital sovereignty solely as a state prerogative or geopolitical strategy; instead, we seek to conceptualize it as a contested arena shaped by the use of territory and the development of technologies by and for those engaged in social struggles. Thus, popular digital sovereignty, as praxis, is understood as the collective capacity to influence, contest, and control digital infrastructures and flows. It is a sovereignty guided by the right of society, communities, collectives, and movements to determine the terms of their own material and symbolic existence, shifting away from corporate logic and moving beyond state rationalization to the concrete realm of social struggles in specific locales, where territory is actively used and contested.

The analysis presented here highlights that the construction of digital sovereignty in Brazil is deeply marked by structural dynamics of technological and financialized dependency. These dynamics are reinforced by the actions of major global corporations and by the state's limited capacity to implement sovereign, popular, and effective public policies. Current measures demonstrate that, despite stated intentions, serious contradictions and dilemmas persist, keeping the country dependent on and subordinate to international informational-financial capital, with negative impacts on territorial justice, autonomous technological development, and the public interest.

Given this situation, it is essential to formulate and implement strategies that prioritize the construction of public digital infrastructures at the state level, alongside the strengthening of community networks, citizen-led data generation, support for free software ecosystems, and other initiatives by social organizations and movements that promote technodiversity and technological autonomy. Only through an integrated and emancipatory project will it be possible to break the cycle of data colonialism and advance toward a form of digital sovereignty that takes into account the territorial specificities and the social, cultural, and political rights embedded in the country's diverse localities. Geographic space, understood as the inseparability of systems of objects and systems of actions, of technosphere and psychosphere, proves fundamental to understanding these contradictions and identifying pathways (whether existing, currently unfolding, or future) toward an alternative globalization guided by socio-spatial justice and the democratic, socially ground-

ed use of technology. Thus, the challenge at hand is not merely technical or economic but eminently political and cultural, requiring a commitment and broad mobilization in defense of a digitalization model that serves the interests of the majority rather than simply the demands of private capital accumulation and the territory's outward-oriented linkages.

From the theoretical-practical perspective of geography, sovereignty can be understood as the effective capacity of the state and collectives to control, organize, and guide the uses of territory, viewed as an inseparable set of systems of objects and actions. In this light, sovereignty is not reduced to the formal-legal realm; rather, it materializes in concrete conditions of command over the technical networks, flows, and norms that structure geographic space. It is, however, subject to intense tension caused by globalization and the actions of hegemonic agents, such as transnational corporations and financial funds, that fragment and hierarchize the territory. Thus, territorial sovereignty is always relative, varying according to each socio-spatial formation's capacity to impose its own rationalities and projects for territorial use "from below," amidst disputes across different scales of power and the impositions of the technico-scientific-informational period.

In this sense, the social function of technique and "from-below" technologies possess distinct rationalities and political implications that often diverge from corporate, captured state sovereignty. Popular digital sovereignty, especially in Latin America is linked to a tradition of sovereignty associated with the working class, traditional peoples and communities, and struggles against technical dependency (understood in its broad sense). It is, therefore, a technique not limited to a specific rationality or set of technologies, nor to the hegemonic, Western-centric conception that reduces it to "high technology", but rather technique as art and praxis, as communion with the environment, the surroundings, and the setting of life; it constitutes the repertoire and modes through which we enact our humanity and become space.

From a geographic perspective, popular digital sovereignty must be understood as the autonomy and collective capacity to decide on the uses of territory, which is viewed simultaneously as a shelter and as a resource. As a shelter, territory relates to conditions of life, protection, and social reproduction; as a resource, it refers to possibilities for appropriation and productive organization. Thus, sovereignty is not restricted to formal state institutions but is concretely realized through the ways in which different agents participate in and contest the production and organization of space and the uses of territory.

The intensification of contradictions within the technico-scientific-informational milieu, of which the recent dispute over the meaning of digital sovereignty is an expression, has paved the way for the "popular period of history" (already underway and also understood as the "communicational-demographic period"). This period is marked by the expansion of capacities for communication, organization, and collective action among social subjects and forces, driven by concentrations of people and popular technical systems. Digital sovereignty cannot be reduced to data regulation or the pursuit of technological autonomy in a strict sense. Rather, it is a contemporary expression of territorial sovereignty within this popular period of history, inextricably linking control over the technical and infrastructural systems of the technosphere with the psychosphere that animates it, that is, the capacity to shape and imagine its meanings, values, and rationalities. In other words, digital sovereignty concerns the autonomy and simultaneous management of the material and immaterial conditions that produce space and inform territorial uses, articulating necessity and freedom, technique and politics, materiality and meaning. ●

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Luis Henrique Leandro Ribeiro: developed, guided, and supervised the research and its conception, contributing to the conceptual and methodological structuring, manuscript drafting, discussion of the results, critical review of the manuscript, and approval of the final version.
Lucas Cortez Tavares: conducted the research, encompassing its conception, methodological design, interpretative analysis, and manuscript drafting based on the literature review, data organization, analyses, and preparation of the initial draft of the article.

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