*Original research article*

BIG DATA & SOCIETY

Big Data & Society
April–June: 1–18

DOI: 10.1177/20539517261447797
journals.sagepub.com/home/bds
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# The data fix: Smart farming and the sociotechnical politics of datafication and assetization

**Lin Zhang[1] and Tu Lan[2,*]**

**Abstract**

This article brings critical data studies into dialogue with agri-food scholarship to theorize the data fix—the use of data infrastructures to manage economic, social, and ecological contradictions under digital capitalism. Drawing on China's mushroom industry in Gutian, it traces how the data fix operates through the assetization of data, land, and labor. Historically, China's trajectory, from cybernetic socialism to the agriculture digital brain, reveals a distinct mode of state-led assetization, in which data function both as speculative assets and as instruments of governance. Unlike North American corporate financialization, China's collective land ownership and state coordination constrain market speculation while transforming governance itself into a site of value creation. The article situates China's hybrid model within broader debates on data colonialism and Southern data politics, arguing that the data fix provides a comparative framework for understanding how digital infrastructures reconfigure agrarian relations, state power, and capitalist accumulation across uneven but interconnected global contexts.

**Keywords**

Digital agriculture, governance, rural reform, land tenure, platformization, China

This article is a part of special theme on Infrastructure, Labour, & Social Change. To see a full list of all articles in this special theme, please click here: https://journals.sagepub.com/page/bds/collections/infrastructure_labour_social_change?pbEditor=true

## Introduction

In late 2019, Illinois farmer Parker Smith learned that his landlords had been approached by Tillable, a venture-capital-backed startup marketing itself as an "Airbnb for farmland." By auctioning leases and monetizing farm data in collaboration with Climate Corporation, a subsidiary of Bayer, Tillable disrupted the trust-based rental relations that had long underpinned the U.S. Midwestern family farming and raised fear about and resistance against the datafication of farmland by both agricultural startups and incumbent firms (Charles, 2020). Across the Pacific, mushroom growers in Gutian, Fujian Province, were undergoing a parallel yet differently organized transformation. Once the global hub of tremella cultivation, Gutian's smallholders were incorporated into the *Mushroom Digital Brain*—a state-orchestrated platform integrating production monitoring, e-commerce, and finance.

Taken together, these stories show both convergence and divergence. On both sides of the planet, farmers face the prospect of their knowledge, practices, and even land being transformed into data streams and financial assets. In the US, this process is propelled by private platforms and venture capital; in China, it is directed by local governments in

[1]Department of Communication, University of New Hampshire, Durham, NH, USA
[2]Department of Geography, University of New Hampshire, Durham, NH, USA

*Equal first author.

**Corresponding author:**
Tu Lan, Department of Geography, University of New Hampshire, Durham, NH 03824, USA.
Email: tu.lan@unh.edu

collaboration with technology firms. Yet in both contexts, farmers find themselves caught between technological aspiration and socio-economic reality, illustrating how the politics of agricultural data are reshaping farming globally in uneven but interconnected ways.

This article conceptualizes these transformations through the concept of the data fix—a global but uneven strategy that deploys data infrastructures to manage economic, social, and ecological contradictions under digital capitalism. Focusing on China as our empirical site, we explore the political and economic role of data in agricultural transformation under conditions where land and markets cannot be fully financialized. By analyzing the data fix in the world's largest agricultural producer by total output and an emerging technological superpower, we develop a comparative theoretical framework that elucidates both the general mechanisms of agricultural digitalization and assetization and their regionally and culturally specific configurations.[1]

Extending the technological fix (Nye, 2003; Weinberg, 1967) and Harvey's (2006) spatiotemporal fix, the data fix denotes attempts to stabilize accumulation not by material expansion but by capturing and capitalizing information as asset. In agriculture, such projects promise to solve stagnation and inequality by translating farming into a field of measurement and prediction. Yet, as Bronson (2022) argues, "immaculate" data imaginaries depoliticize these interventions, naturalizing corporate and state power while obscuring extraction and inequality. We focus, specifically, on three prominent dimensions of data fix and agricultural assetization in our analysis, namely, the assetization of agricultural data, the assetization of farmland through datafication, and the transformation of agricultural labor under datafication and assetization.

Over the past decade, scholarship in critical agri-food studies has revealed how digital platforms are reshaping global food systems by reproducing oligopoly and deepening financialization. Hackfort et al. (2024) identify three dominant corporate strategies of agricultural data assetization—lock-ins, price-setting, and product development—through which information is converted into speculative assets and future rent streams. Fairbairn and Reisman (2024) describe an "incumbent advantage" in which legacy agribusinesses permeate startup ecosystems, shaping innovation through dependence on their infrastructures and venture-capital logics. Similarly, Sauvagerd et al. (2024) show how multi-sided platforms reorganize relations among farmers, corporations, and consumers, extending asymmetrical control over data flows. Together, this body of work demonstrates that value extraction in digital agriculture increasingly depends on assetization—the transformation of agricultural knowledge, land, and ecological data into new rent-bearing forms of capital.

In parallel, critical data studies have shown that data infrastructures are not neutral tools of efficiency but political institutions that define ownership, agency, and value (Milan and Treré, 2019). Scholars such as Amrute and Murillo (2020) urge us to "compute from the South," treating the South not merely as a locus of extraction or resistance but as a relational analytic that reveals how computation mediates labor, infrastructure, and sovereignty. Building on this call, Valente and Grohmann (2024) develop a Latin American framework that theorizes *with* rather than *about* the South, foregrounding dependency, liberation, and intersectional oppression as key analytical lenses. Their approach expands critiques of "data colonialism" (Couldry and Mejias, 2019) to include international divisions of datafied labor and alternative imaginaries of data commons. These contributions collectively decenter Euro-American epistemologies of digital capitalism, offering comparative insights into how data governance unfolds in diverse political and economic contexts.

Against this backdrop, China's experience with agricultural datafication resists simple classification within the Global North–South divide. As a semi-peripheral economy with residual socialist institutions and growing technological capacity, China operates simultaneously as a site of both data extraction and infrastructural innovation. Its agricultural transformation—shaped by collective land ownership, state coordination, and platform experimentation—does not mirror the corporate financialization of the North or the donor-driven digitalization of the South. Instead, it reveals a hybrid regime where data serves not only as a speculative asset but also as an instrument of governance and legitimation. This in-between position invites us to rethink global narratives of the data fix and assetization beyond the binary of domination and colonialism or dependency, emphasizing the diverse political economies through which digital capitalism takes root (Birch and Ward, 2024).

While recent research on China has explored distinctive modes of data governance during the COVID-19 pandemic (Liu and Wang, 2022) and regionally situated imaginaries of artificial intelligence (Meng, 2025), much of this work remains urban-centric, overlooking the vast rural population and the agrarian foundations of Chinese modernization. The few exceptions (e.g. Wang, 2023) that address rural datafication often focus on recent pilot programs without tracing the longer genealogy of cybernetic thinking and data-driven governance in agricultural policy. Building on and extending this emerging literature, we historicize China's rural datafication within its broader trajectory of post-socialist reform. We show that the evolution of the data fix in China has been shaped not only by technological change but also by the shifting political economy of land and labor, revealing how the pursuit of digital modernization remains entangled with enduring agrarian constraints and evolving governance structure.

By bringing these strands of literature together, this article bridges critical agri-food and critical data studies to theorize the data fix as both an economic and a governance

strategy that reconfigures relations among humans, nature, and information. Specifically, we ask (1) how do different configurations of state, capital, and land ownership shape the political economy of agricultural datafication? and (2) what does China's hybrid data fix reveal about the uneven global geographies of digital capitalism and the possibilities for alternative, post-neoliberal data governance?

Our ethnographic site centers on Gutian, a county in the southeastern province of Fujian. A national pioneer in smart farming and digital platform development, Gutian's mushroom industry offers a compelling illustration of China's data fix in action. The ongoing construction of the *Mushroom Digital Brain* offers a grounded perspective on the contentious unfolding of the data fix on the ground in rural China as Gutian has answered to the central state's call for agricultural datafication under the *Digital Village Project* from the late 2010s. As one of the country's largest producers and trading posts of edible fungi, Gutian exemplifies how smallholder farming, collective land ownership, and local state support have co-evolved in ways that both enable and constrain assetization and datafication.

Methodologically, this study employs a mixed-methods approach, integrating longitudinal policy analysis from 1979 to the present with qualitative fieldwork. Following preliminary research in 2023, we selected Gutian County's tremella industry as our primary case study due to its national significance, informant accessibility, and its role as a "Digital Village" model for smallholder systems. Between December 2024 and January 2025, we conducted 40 in-depth interviews with state actors ($n = 8$), entrepreneurs ($n = 16$) including platform developers, farmers ($n = 5$), and academic experts ($n = 2$). Some interviewees were interviewed more than once. Tailored interview protocols focused on policy design for officials, personal and business histories for farmers and firms, and technological trajectories for mycologists. These were triangulated through participant observation at industry conferences and corporate data collection field trips to capture the lived realities of datafication. All names were anonymized.

The article proceeds as follows. The next section develops the conceptual framework of agricultural assetization and the data fix, situating China's experience within comparative debates on digital agriculture. We then trace the historical evolution of China's data fix—from cybernetic socialism to algorithmic statecraft—and examine the Gutian case as an empirical instantiation. We conclude by reflecting on the broader implications for critical data and agri-food scholarship.

## Data fix and agricultural assetization beyond the north–south dichotomy

Two key concepts here are those of agricultural assetization and the data fix. An asset, according to Birch and Ward (2024), is "both a resource, which generates income streams, and property, whose value is determined by capitalizing its future income streams and their relationship to broader political-economic trends" (p. 9). Agricultural assetization then refers to the process of transforming agricultural resources and activities into financial assets to generate rental income and future speculative value.

Situated at the intersection of datafication and assetization, the data fix extends earlier concepts of the technological fix and the spatiotemporal fix. Like the technological fix, which treats social contradictions as solvable through technical means (Bronson, 2022; Johnston, 2018; Nye, 2003; Weinberg, 1967), the data fix reframes crises of overaccumulation, legitimacy, and governance as problems to be managed through the capture, circulation, and capitalization of data. Building on yet diverging from Harvey's (2006) spatiotemporal fix, it highlights how contemporary capitalism absorbs over-accumulated capital not primarily by investing in physical infrastructures but by turning information itself into an asset. In this sense, the data fix exemplifies what Birch and Ward (2024) call the spatiotemporal specificity of assetization in a low-growth economy, where accumulation increasingly depends on new forms of rent extraction from data. Data infrastructures thus function as speculative enclosures that stabilize value through the continuous capitalization of information flows rather than through territorial expansion alone.

To understand agricultural assetization more fully, the notion of the data fix must address not only the economic but also the social, ecological, and political dimensions of crisis management under capitalism. Building on feminist and critical political economy perspectives (Fraser, 2022), the data fix can be seen as a multi-dimensional strategy through which digital infrastructures mediate and temporarily stabilize systemic contradictions. Datafication does not simply absorb surplus capital through new sites of accumulation; it reorganizes the social and ecological relations that underpin production itself. By translating land, labor, and living systems into quantifiable and exchangeable information, the data fix extends assetization into the very processes of political negotiation, social reproduction, and environmental maintenance that sustain agriculture. In this sense, it functions not only as an economic resolution to overaccumulation but as a broader political and ecological project—one that renders life, care, and ecology governable through data and capital alike.

China's agricultural data fix is best understood in this expanded sense, not in isolation but in relation to other regional trajectories. Positioned as both a semi-periphery in the global economy and a semi-neoliberal state system, China negotiates between foreign technological dependence, indigenous innovation, and enduring socialist institutions such as collective land ownership (Yan and Sautman, 2023). This hybrid position produces a developmental logic distinct from the Global North, East, and South.

At the foundation of Chinese agriculture are hundreds of thousands of family-based small farms and micro-scale service providers, whose workers are predominantly self-employed and aging (Huang, 2014; Yan et al., 2021; Zhang, 2023). Over decades of modernization and limited land consolidation, a new stratum of larger, specialized agribusinesses has emerged. Often founded by younger and more educated entrepreneurs, these agricultural dragonhead companies serve as intermediaries linking smallholders with urban food retailers and logistics networks. This hybrid structure—combining smallholders, locally rooted agribusinesses, and state mediation—defined Chinese agriculture until the mid-2010s (Yan et al., 2021). County and provincial governments, operating under central directives, managed relationships between farmers and enterprises through bureaucratic coordination and systems of credit and subsidy.

Yet since the late 2010s, this landscape has been profoundly reshaped by the entry of digital platforms and new capital. Big Tech firms, venture-backed agri-tech startups, and national state-owned champions such as the Syngenta Group[2] have introduced fresh technological, social, and political-economic dynamics (Xu and Chen, 2025). Family farming has not disappeared but has gradually been woven into complex assemblages of data, finance, and platform governance. Unlike the North American and Western European model dominated by agribusiness giants such as Bayer, Corteva, John Deere, and BASF (Bronson, 2022; Fairbairn and Reisman, 2024; Hackfort et al., 2024; Sauvagerd et al., 2024), China's agricultural transformation remains characterized by state coordination, multi-scalar experimentation, and uneven integration.

China's agricultural data fix is less financialized than the North American model, where platforms like Climate Corporation or Tillable convert farmland data into securitized assets and speculative markets. In China, collective land ownership and "red line" policies channel datafication toward governance goals like food security and administrative accountability instead. Compared to the "Global East" (Japan and South Korea), China shares a smallholder base and strong state direction but lacks the value-redistributing cooperative institutions of its neighbors. Finally, unlike the donor-driven data regimes of the Global South, China's strong state apparatus enables large-scale mobilization and symbolic assetization through digital platforms and industrial parks. Consequently, China represents a hybrid formation that uses the financial rhetoric of the North and the statist ambition of the East to navigate the structural fragmentation of the South.

Taken together, these comparisons highlight China's data fix as a hybrid formation: borrowing the digital and financial rhetoric of the North, sharing the statist ambition of the East, and confronting the structural fragmentation of the South. Yet its distinct institutional configuration—collective land ownership, central–local experimentation, and state-coordinated platformization—produces a specific socio-technical trajectory of agricultural datafication and assetization, where data operates *both* as a speculative asset *and* as a political and administrative instrument for stabilizing rural governance and signaling modernization. This distinct trajectory complicates any singular narrative of "digital agriculture," reminding us that the politics of data are always conditioned by governance, land regimes, and agrarian histories.

## From cybernetics to agricultural digital brain: tracing the data fix in rural China

The historical trajectory of agricultural datafication and assetization in China is inseparable from the evolution of its post-socialist developmental state. What distinguishes China's data fix from the American trajectory of datafication and financialization is that it emerges not from market-led neoliberalism but from a long lineage of technocratic socialism, administrative subcontracting, and state-centered assetization. Across the past four decades, Chinese policymakers and intellectuals have repeatedly turned to information, systems, and data to stabilize crises of governance and accumulation—translating the socialist aspiration for collective coordination into the idiom of digital control. Tracing this genealogy—from the cybernetic reforms of the 1980s to the agricultural digital brain (ADB) initiatives[3] of the 2020s—reveals that the contemporary data turn is both a continuation and a mutation of China's post-socialist political economy: an attempt to manage contradictions between growth and redistribution, decentralization and control, through information infrastructures that promise efficiency and harmony.

The conceptual roots of China's data-driven governance stretch back to the late Mao and early reform eras, when reform-minded scientists and economists rediscovered cybernetics and systems theory as politically neutral languages for reimagining socialist planning (Wu, 2022). Emerging from the disarray of the Cultural Revolution, these ideas offered an alternative to class struggle and ideological mobilization. Through the notion of feedback, reformers could frame decentralization and experimentation as means of optimizing production without repudiating socialism. The Rural Development Research Group, established in 1981, epitomized this turn (Fang, 2024). Its members, many of them "sent-down youth" who had lived through the rural collectives, drew on cybernetic metaphors of input, output, and information flow to justify giving households greater autonomy within collective land ownership. In their model, the state remained the ultimate regulator, but its coordination relied on flows of data rather than commands of ideology. This early appropriation of cybernetics forged what would become the epistemic core of China's technocratic governance: a belief that complex social systems could be stabilized through information feedback, hierarchical supervision, and self-regulation.

As Schmalzer (2021) shows, systems theory allowed reform intellectuals to recast Maoist notions of harmony between humans and nature into a technoscientific project of optimization. In doing so, it carried forward the socialist promise of integration between politics and production but stripped it of class struggle. Meng (2025) later terms this tendency a "post-socialist imaginary"—a residual utopian belief that technoscientific coordination could reconcile equality and efficiency. It was within this imaginary that data first entered Chinese governance as both a symbol and a tool of rational modernity. By the mid-1980s, this cybernetic ethos had been institutionalized in national programs such as the four-tier agricultural science network and the rural credit cooperative system (Lan, 1999; Yuan, 2015). These early infrastructures created vertical channels of data collection and reporting that prefigured the architecture of today's digital governance. Information, at this stage, functioned less as a commodity than as an instrument of post-socialist rationalization—a way to render the national economy legible to central planners while allowing limited flexibility at the local level.

During the 1990s and 2000s, this technocratic rationality converged with China's gradual marketization and integration into global capitalism. Informatization emerged as a policy keyword that promised to rejuvenate state capacity through digital means. Projects such as the Ministry of Agriculture's "Golden Agriculture" initiative sought to network local administrative and production data into national systems. Yet, unlike the liberal rhetoric of "open markets" and "transparency" in the West, informatization in China was understood as a process of strengthening administrative coordination. Wu (2024) reminds us that the Chinese term *pingtai*—commonly translated as "platform"—never carried the neoliberal connotations of neutrality and equal access. Instead, it evolved within the context of state informatization and e-government to denote an actant of governance: a technical and moral apparatus to rationalize administration and improve public service.

By the late 2000s, this statist logic of platformization intersected with the expansion of private tech firms into rural China. Under the "Internet Plus Agriculture" policy, companies like Alibaba and JD partnered with local governments to promote rural e-commerce, bringing digital infrastructures and data governance into the countryside. This partnership between local states and platforms extended the reach of informatization into rural markets, but primarily on the circulation and consumption side rather than agricultural production (Zhang, 2023).

At the same time, China's reform era witnessed the rise of another powerful mechanism of accumulation: land-based financialization. The privatization of housing in the 1990s and the institutionalization of local land finance created what urban scholars describe as an asset-based regime of accumulation (Wu et al., 2020). Local governments leased long-term land-use rights to developers, using the proceeds to fund infrastructure and welfare. This model constituted a unique Chinese form of assetization anchored in state control rather than in market speculation (Wu et al., 2020).

Yet this growth model also sowed the seeds of instability: ballooning local debt, speculative housing markets, and widening inequality. By the late 2010s, the profit-driven, e-commerce-centered expansion of rural informatization had entered a period of crisis. Xi Jinping's 2017 declaration that "housing is for living, not for speculation" (Xi, 2017: 34) marked the state's growing unease with financialized accumulation and the exhaustion of the land and real-estate-based growth paradigm. The abrupt suspension of Ant Group's record-breaking IPO in 2020 further underscored this policy shift, signaling Beijing's determination to curb platform financialization and reassert political control over data and capital. Together, these turning points revealed the limits of earlier developmental fixes and foreshadowed the state's search for a new data-driven, production-oriented fix in sectors such as agriculture.

Amid these shifts, data came to function as both a new asset frontier and a renewed technology of governance. Beginning in the mid-2010s, the central government codified data as a "productive factor" through policies such as the Big Data Development Strategy (2015), the Internet Plus initiative (2015), and the Digital Village Development Outline (2019). As captured by Figure 1, these programs reframed rural areas as laboratories for digital transformation, where information about agriculture, logistics, and governance could be aggregated into national databases. The creation of the Ministry of Agriculture and Rural Affairs' Big Data Development Center in 2021 institutionalized this logic.

The ADB project, modeled after *City Brains*, epitomizes this evolution: a techno-administrative system designed to visualize, forecast, and optimize the rural economy. An operationalization of the *Digital Village Project*, the ADB encompasses eight major dimensions—from infrastructure and smart agriculture to digital governance, cultural revitalization, and environmental sustainability— to build a real-time datafied control and feedback system that integrates state administration, economic planning, and everyday life in the countryside (See Figure 1). Through the ADB, localities translate social and ecological complexity into quantifiable variables—soil moisture, yield rates, population flow—that can be fed upward into national dashboards. This transformation extends the cybernetic fantasy of harmonious control to the entire agrarian domain.

At the same time, the acceleration of China's data turn was also deeply intertwined with the escalation of geopolitical competition with the United States in trade, technology, and science. Since the mid-2010s, a series of export controls, sanctions, and restrictions on Chinese tech firms have reinforced the central state's conviction that data constitute not only an economic resource but also a matter of national

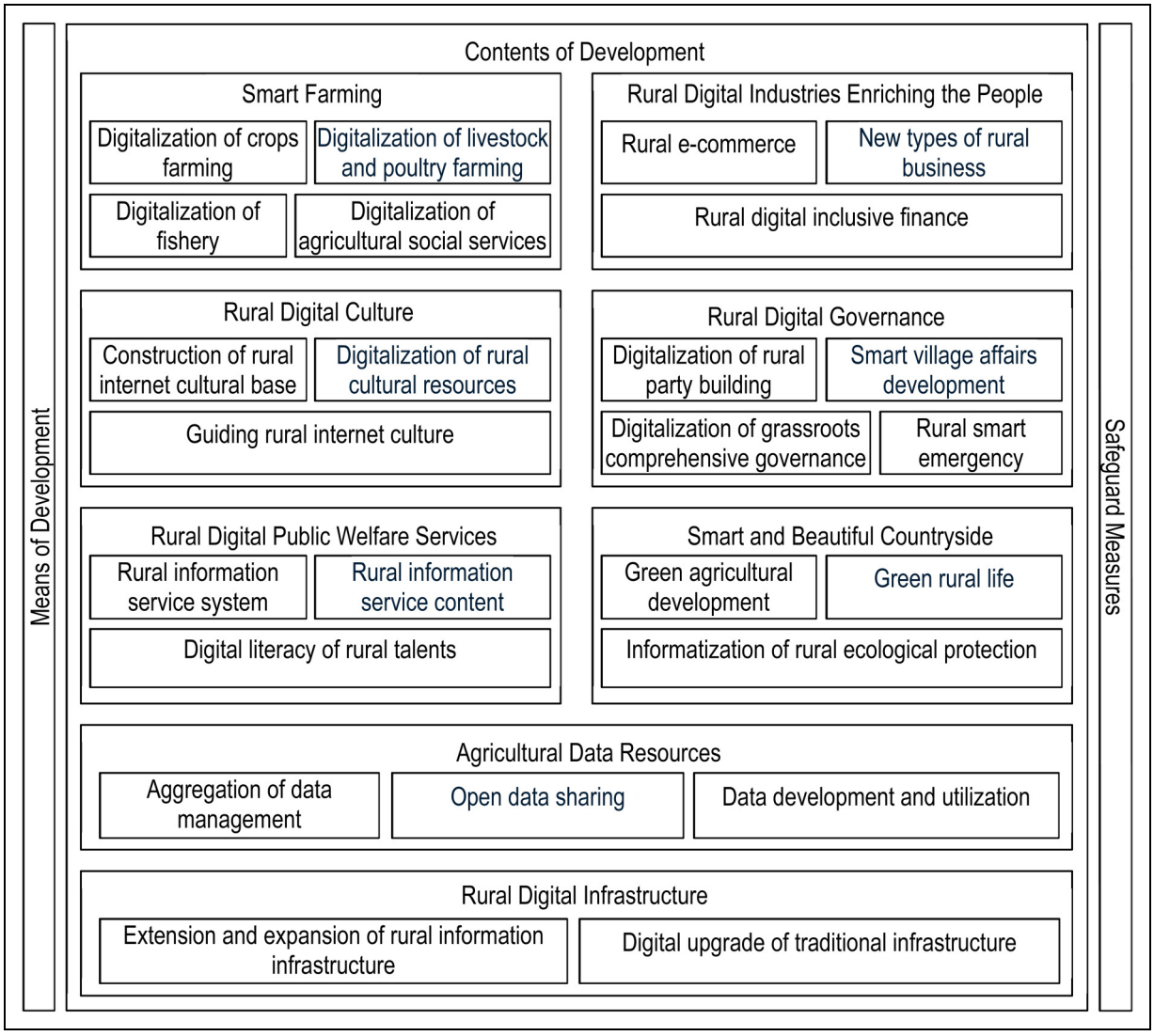


**Figure 1.** The digital village development framework.
Source: Adapted from the Digital Village Development Outline 2.0 (CCAC and MARA, 2024).

and food security (Zhang, 2023). Ensuring "data sovereignty" thus became an extension of securing territorial and technological sovereignty. In agriculture, this imperative was particularly acute: digital infrastructures for monitoring soil, weather, seed, and supply chains were reframed as strategic assets vital to food self-sufficiency and resilience against global market volatility. Within this shifting geopolitical terrain, the data fix emerged as both an economic and security response—a means of insulating domestic accumulation from external shocks while reinforcing the state's capacity to govern through informational control.

Yet the assetization of data in China also differs fundamentally from market-oriented financialization in the United States. This dynamic should be situated in the context of what Zhang (2025) described as China's "market in the fragmented state," where the central government mobilizes private platforms like Alibaba while keeping them within a hierarchically segmented bureaucracy. Unlike the American model of oligarchic platform capitalism, China's hybrid arrangement subcontracts developmental functions to private firms without relinquishing state control. Alibaba's "One Thousand Counties and Ten Thousand Villages" program, for example, extended logistics and training networks into the countryside, effectively performing state work. Yet, as Zhang's fieldwork shows, such collaborations also reproduced familiar problems—speculative "Taobao Cities," wasteful real-estate projects, and bureaucratic clientelism. The socialist rhetoric of "serving the people" endures, but its practice remains enmeshed in local economies of visibility and performance.

This contradictory logic defines China's broader agricultural data regime. The state promotes datafication as a tool

for ecological civilization, national and food security, rural revitalization, and common prosperity, but it also uses it to recentralize oversight and manage fiscal crises. The post-2020 antitrust campaigns and data security laws illustrate this balancing act. In this new context, data becomes a new type of collateral in the bureaucracy: measurable indicators of governance capacity that can be exchanged for subsidies, loans, or legitimacy.

If land finance once served as China's spatial fix and housing its asset fix, the ADB represents its data fix: a new attempt to stabilize accumulation through big data infrastructures. Yet this fix operates under conditions of residual socialist, ecological, and political constraints—collective land ownership, smallholder farming, and fragmented central–local relations—that limit full-scale financialization. Data thus provides an alternative medium of capitalization that does not require full-scale privatization. They allow the state to valorize governance itself, converting information into fiscal and political value while maintaining state and collective ownership. In this sense, the data fix is both pragmatic and ideological: it enables the party-state to pursue accumulation without openly abandoning socialism, and to promise control and transparency as substitutes for redistribution. The Chinese logic of data assetization therefore departs sharply from the neoliberal imaginary of "data as the new oil." Rather than producing speculative wealth through markets, data in China underpin bureaucratic accountability and central coordination.

Yet this transformation also exposes the limits of technocratic governance. As local governments struggle under mounting debt and digital mandates, they increasingly rely on semi-public enterprises and precarious data labor, reproducing the uneven geographies of China's earlier modernization drives. Farmers, recast as data producers, contribute information that sustains bureaucratic metrics but in exchange for humble government subsidies. What was once the collective labor of production becomes the dispersed labor of digitization and folded into the calculus of governance.

Ultimately, the ADB encapsulates the long arc of China's technopolitical imagination: from cybernetic socialism to algorithmic statecraft, or the statist governance of population and economy via data. It reactivates the utopian promise that information can reconcile productivity with equality, nature with development, and the local with the central. But it also embodies the contradictions of post-socialist modernity, where governance is increasingly mediated by data.

As we will show through the case of Gutian, these national dynamics manifest locally through a complex interplay of bureaucratic ambition, corporate participation, and grassroots ambivalence. Gutian's experiment with an ADB illustrates how local governments translate central directives into infrastructural projects that simultaneously pursue governance visibility and fiscal viability. It is here, in the everyday practices of data production and circulation, that the Chinese logic of assetization is made concrete—transforming data from a technical resource into an instrument of political economy.

## Constructing a digital brain for Gutian's mushroom industry

A mountainous county with a population of approximately 334,000, Gutian plays a pivotal role in China's mushroom industry, its development mirroring the broader trajectory of national rural reforms (see Figure 2). In 1958, as part of China's inaugural 5-year plan, Gutian was designated as the site for a new dam, intended to generate electricity and supply fresh water to the nearby provincial capital, Fuzhou. This undertaking resulted in the submergence of the entire old town and the majority of arable land beneath the reservoir, compelling local peasants to pursue alternative livelihoods. By the mid-1960s, with technical assistance from local universities and research institutes, peasants began experimenting with the domestication of tremella, a wild fungus highly prized in traditional Chinese medicine and cuisine. Concurrently, various forms of the Household Responsibility System clandestinely emerged and persisted throughout the Cultural Revolution, incentivizing rural families to cultivate tremella for supplemental income.

These bottom-up social and technical experiments proved remarkably successful in the 1970s and 1980s. Local farmers progressively enhanced tremella yields, establishing Gutian as the world's largest tremella-growing center and a celebrated national exemplar of rural reform (Lin, 2024). Thanks to its extensive native-place associations both domestically and overseas, Gutian's tremella industry, characterized by a multitude of small and medium-sized family farms, continued its growth until the 2010s.

Competition intensified in the late 2010s, challenging Gutian's long-standing dominance in tremella production. A county-commissioned report identified several pressures (Gutian CPCCC, 2022). First, new production clusters emerged in northern and western China, supported by central poverty-alleviation subsidies and technical assistance from Gutian entrepreneurs. Second, advances in automation and microbiology enabled these regions to build vertically integrated factories that achieved economies of scale beyond Gutian's predominantly smallholder farms. The report also highlighted increasing financialization in the mushroom sector: by 2022, China had 15 publicly listed mushroom companies, none located in Gutian, with greater financial leverage and stronger control over value chains—dynamics described as "completely crashing" smaller producers. At the same time, demographic decline intensified labor shortages as younger workers pursued urban employment. Under these pressures, Gutian's share of the national tremella market fell from 79.49% in 2011 to 63.69% in 2020.

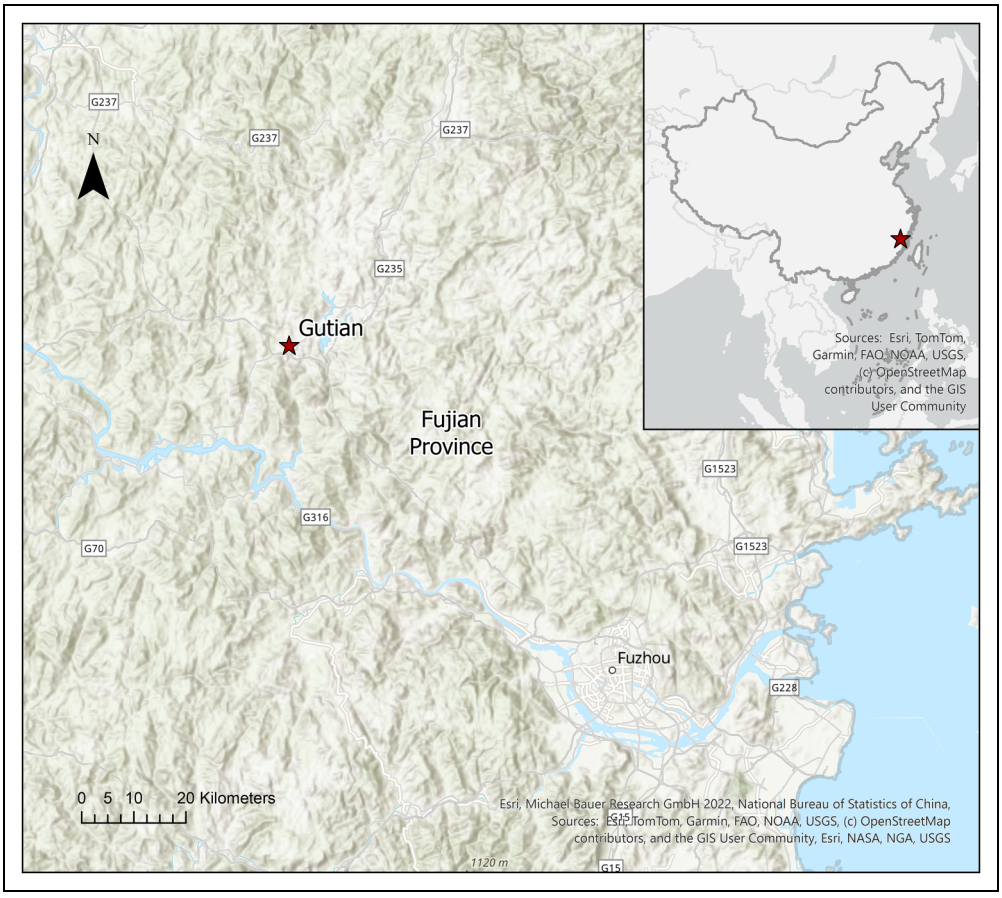


**Figure 2.** Study area: Gutian County, Fujian Province.
Source: Map by author. Data from ESRI.

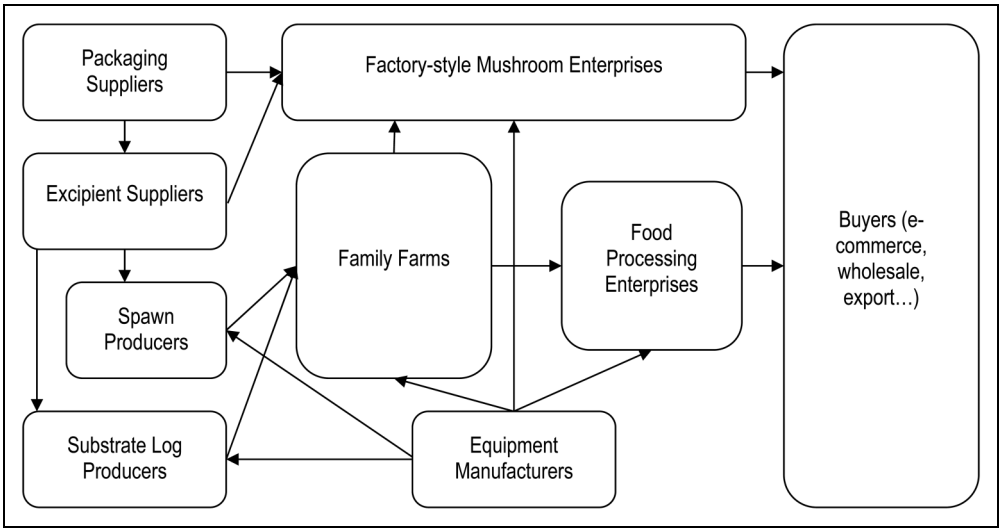


**Figure 3.** Mushroom production networks in Gutian.
Source: Adapted from a chart published by the Bureau of Mushroom Industry Management of the Gutian County and supplemented with the authors' interview data.
Note: According to a latest industry report issued in 2022, the county was home to five dragon-head companies (with annual revenue of 100 Million Yuan, or 14 Million USD and above), 7000 family mushroom farms, and 1282 industry services and supplies providers. Together, they operate over 100,000 mushroom sheds and 11 factory-style farming enterprises.


**Figure 4.** The Gutian mushroom digital brain dashboard.
Source: Photo by author (12/6/2024).

In response to these multifaceted challenges, the county government initiated a selective and strategic participation in the national *Digital Village Project*. Central to the local government's strategy was the Gutian Mushroom Digital Brain (hereafter, "the Brain"), a data platform launched in 2021 to coordinate and digitalize the complete value chains within the mushroom industry. The structure of the industry is visualized below in Figure 3.

The Brain, designed and implemented on the ground by a third-party software firm Boss based in the provincial capital city of Fuzhou, comprises three integrated components: a production monitoring platform designed to enhance yields, an e-commerce platform facilitating transactions, and a financial platform linking farms with banking services. All these functionalities are centrally managed by a geographical-information-system-enabled dashboard (see Figure 4).

The Brain represents a spatiotemporally specific response to polycrisis facing Gutian's tremella industry at the current conjuncture. However, the "actually existing" Brain is far more complex than a mere technical toolkit for datafication, which is illustrative of the geographically uneven and rapidly changing national agricultural sector elsewhere and akin to data fix programs in other counties in China. As we will see, it has been leveraged by multiple stakeholders to justify diverse objectives, leading to notable discrepancies between its stated aims and its actual outcomes on the ground.

## *Divergent stakes in the assetization of agricultural data*

The first layer of assetization occurs through data collection technologies. Farmers are encouraged to adopt production monitoring systems, sensors, and cameras inside their production and farming sheds. These tools record environmental variables such as temperature and humidity, as well as yields. Complementing these systems is Fugubao, a mobile application that aggregates production, transaction, and financial information from farmers and services and supplies providers while serving as a two-sided market platform for both. Another important function of the platform is to collect data from small family farms to evaluate risks for agri-insurance and loans and in return offer them access to these financial services. Together, these tools intend to create a dense layer of digital documentation that converts the messy world of mushroom farming into standardized, extractable datasets.

Yet as the data infrastructure took shape, the data fix exposed competing logics: the local government promoted the Brain as a tool for modernization and inclusion, the platform company viewed it as an entry into future data markets, local dragon-head firms participated out of policy compliance and government relation building, while family farms engaged because of pragmatic need for credit, insurance, and government support rather than enthusiasm for digitalization.

In alignment with central initiatives, the *local government* pursued two primary objectives through this data fix. On the one hand, the Brain was designed to enhance mushroom farm yields and expand market reach. The local government-subsidized farms of all scales to install sensors and mandated the real-time streaming of sensor-generated data onto the platform. The Brain's algorithms were intended to optimize farming practices based on this collected data. Furthermore, the Brain shared real-time camera feeds with prospective buyers, fostering transparency across the value chains and bolstering consumer confidence, especially as Gutian's reputation had previously suffered from several food safety scandals.

On the other hand, the local government sought to leverage the Brain to equalize the competitive landscape for smaller family farms. It disseminated the latest market prices for mushrooms and supplies through the Brain's mobile application and offered that by conducting business on the platform, farmers could bypass intermediaries and secure more favorable deals with both sellers and buyers along the value chain. The government further encouraged family farms to share as much information as possible with the platform, believing this would improve their credit scores and secure discounted interest rates when borrowing from the platform's partner banks.

The platform also scored as a major political accomplishment for the county government, particularly for its party secretary in office between 2021 and 2025. As the central state reoriented its priorities toward national (food) security and social equity, local officials presented the Brain as a key achievement in meeting these new criteria. Visitors from other regions or higher level governments were frequently guided to a showroom to observe the Brain's dashboard. This dashboard prominently displayed the latest transactions made on the platform, along with newly issued loans and insurance policies to farmers. The presenter, typically an employee of the platform company, would also enthusiastically showcase real-time videos of tidy tremella sheds equipped with information-transmitting sensors and roof-mounted solar panels that powered the sheds. All these visual representations of the data fix were strategically deployed to justify the annual one-million yuan paid by the county government for the platform's operation.

For the *platform developer*, however, the incentives driving the data fix diverged considerably. To build the platform, the county government contracted Fujian Boss Software, a publicly listed company best known for developing office automation systems for local governments across China. This was a politically safe choice: by the early 2020s, many local administrations had shifted away from partnerships with Big Tech firms like Alibaba, aligning instead with smaller local IT companies to comply with the Party's antitrust directives. At the same time, China's fragmented agrarian landscape—dominated by smallholder farms—made data collection and smart farming projects both costly and logistically complex, discouraging Big Tech's deeper entry into agricultural production and leaving space for regionally rooted firms like Boss Software to take the lead.

Initially, Boss Software was reluctant to venture into a new business line within agriculture. As aforementioned, collective land ownership in rural China precludes the widespread assetization of farmland. Witnessing the failures of Alibaba and other national platforms, they harbored suspicions regarding the profitability of the agricultural business. Nevertheless, they accepted the contract not for immediate profit but for the possible future of data assetization.

As a publicly listed company, Boss Software sought to craft a compelling narrative of the data fix for its investors, even though the one-million-yuan contract with the local government barely covered operational costs. As the designer of the software and the manager of data collection, Boss's assetization pathway mirrors global trends. In the United States, companies like Climate Corporation have attempted to transform field-level data into proprietary assets for sale to seed, fertilizer, or insurance firms (Hackfort et al., 2024). Similarly, Boss anticipates that the mushroom datasets it currently maintains—though not yet profitable—will accrue value over time. These datasets might eventually be sold to agri-machinery firms, leveraged to develop AI models, or used to sustain speculative narratives in capital markets.

However, the very strategy that could enhance the data's future value—expanding its geographical and temporal scope—also inflates the already high costs of data collection. Given the variability of agricultural production, the datasets Boss currently holds are neither extensive nor standardized enough to realize their anticipated asset potential. For now, its operation in Gutian is legitimized as a political expedient alignment with the state's "rural revitalization" agenda, which frames datafication as a patriotic contribution to national development and social equity. Yet this alignment is precarious: the departure of the county's party secretary, the Brain's chief proponent, in early 2025, coupled with tightening county budgets, has raised concerns that the new leadership may terminate the contract.

While most of Gutian's industry services and supplies providers are presently listed on the Brain, only a select few actively conduct business through it. A lack of compelling incentives explains their reluctance to participate. For smaller firms, a major concern involves the potential leakage of companies' trade secrets. The intense competition within the mushroom industry means that each company operates on very narrow profit margins. Any exposure of proprietary information, whether technical or pricing-related, could profoundly impact their businesses. Despite the local government's assurances regarding data security, most companies interviewed voiced their apprehension.

The few dragon-head companies are most receptive to and financially better positioned to datafication. However, they have already invested substantially in digitalization since the 2010s. All of them had set up fully automated mushroom plants in addition to the traditional practices of collecting produce from small family farms. They have also secured organic certification from the Ministry of Agriculture, rendering the Brain's function of improving transparency redundant. Therefore, unlike local officials and the platform developer, these companies perceive limited utility in the platform. The founder of a dragon-head company selling tremella snacks on TikTok conveyed their frustration (Gutian, 12/20/2025):

> To show respect to the local government, we allowed Boss Software to install all these sensors and cameras in our farm, even though we already had our own system. But they never gave us any useful information beyond what we already knew. We even gave them a shed for their experts to try out their AI. But their yields turned out to be not much different from ours. So, what's the point of this platform?

A significant incentive for family farms to engage with the platform was the agri-insurance program that the local government had previously struggled to promote. When spawns failed, this agri-insurance would compensate for the financial loss of the insured farmers. However, the primary impediment to such insurance used to lay in the prevalent practice of family farms purchasing fungus spawns through informal channels without formal contracts. In the past, tracing the order, verifying the actual loss, and preventing fraud proved challenging for insurance companies. The platform offered a solution: if a farmer purchased QR-coded spawns from a verified supplier on the platform, they would qualify for insurance at a discounted premium.

Insurance and loans exemplify how agricultural data is folded into financial products. By recording production histories and transactions, the Digital Brain supplies metrics that partner banks can use for credit scoring and that insurers can use to evaluate risks. Farmers with more comprehensive data trails are rewarded with better credit terms, lower premiums, or priority access to subsidies. Many appreciate the platform's offerings, particularly the agri-insurance. Five out of 10 interviewed farming families had purchased insurance via the platform, and two of these reported losses and received compensation. However, this arrangement also turns farmers into free data labor for banks and insurance companies: a process that, as we will elaborate on later, is full of frictions and asymmetries. The positive association between the Brain and the agri-insurance, though have benefited the implementation of both on the ground, has been sustained by county government's subsidy. As a result, the long-term viability of these insurance plans is questionable due to the unstable prospects of county government revenue.

As we can see, agricultural data in Gutian is undergoing a slow but visible process of assetization. What begins as digital monitoring to satisfy governance targets or support insurance eligibility is ultimately reimagined as an asset with speculative future value—whether in the form of tradable datasets, algorithmic training resources, or credibility-enhancing stories for capital markets. Boss's strategy, therefore, is not about immediate monetization but about positioning data as latent capital, ready to be activated when the political and financial conditions align.

## *New bottle, old wine: data as a tool for land-based state entrepreneurialism*

While the assetization of data in China follows a trajectory with some parallels to North America, the assetization of land through data reveals more complex and distinctly Chinese contradictions. Unlike in Western agribusiness contexts where farmland can be freely bought and sold, China's agricultural landscape is defined by two structural barriers: collective land ownership and the stringent "red line" policy restricting the conversion of farmland. These constraints make the direct financialization of land—through mortgages, securitization, or large-scale corporate acquisition—legally and politically untenable. In response, local governments like Gutian are pioneering data-driven pathways to indirectly assetize land. This strategy resembles the retooling of land finance observed by urban geographers (Wu et al., 2020). The data fix becomes a "new bottle for the old wine" of local state entrepreneurialism, allowing diverse stakeholders to navigate new central mandates while generating revenue.

The first and most significant barrier of farmland assetization comes from collective land ownership. Straddling between calls for privatization from market advocates and defenses for collectivization from agrarian scholars, the central state, wary of both food security and social stability, has forged a pragmatic middle path (Yan et al., 2021). It encourages moderate land concentration through leasing while steadfastly upholding collective ownership, promoting specialized family farms as vehicles for digital transformation without fueling rural inequality.

The second barrier is the recently reinforced "red line" policy. For years, lax enforcement of this policy allowed local governments to pursue land finance—converting farmland to urban land and then collateralizing and leasing land-use rights to generate revenue—resulting in a significant loss of farmland (Wu et al., 2020). To compensate for the loss of farmland and rapid increase of domestic demand, China imports a great deal of food from abroad, especially from the United States. However, since the late 2010s, the US–China rivalry and rising geopolitical risks have elevated food security to a matter of national security, prompting the central state to tighten enforcement dramatically.

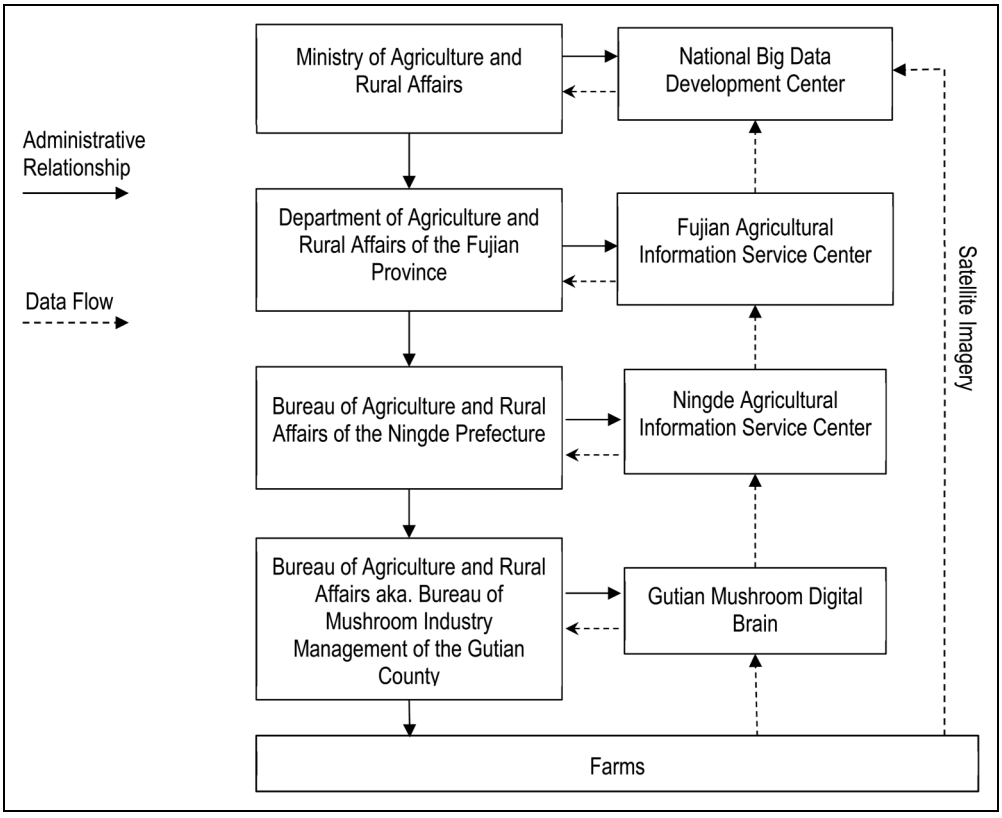


**Figure 5.** The governance structure of agricultural and rural data in China.
Source: Authors' model, based on policy analysis and ethnographic fieldwork.

The "red line" is now policed by the National Big Data Development Center, which uses real-time satellite imagery to detect unauthorized land-use changes, bypassing local administrative layers. Figure 5 illustrates these bureaucratic layers and maps the data flow. This stringent oversight has created significant frustration on the ground, as expressed by the owner of a cottonseed hulls (a key excipient for mushroom cultivation) market (Gutian, 12/18/2024):

> The government wants us to grow more food while having us handcuffed for growing more food. It's a shame that we couldn't pave our parking lot or build more warehouses because even a tiny change on the ground would be immediately detected by their satellites. If we do it, the next day, officers are knocking on our door.

These restrictions, coupled with new central curbs on urban land finance, have forced local governments to seek creative growth strategies. The "data economy" has emerged as a practical and rhetorical solution. Through the data fix, administrative territory, industrial parks, and even failed real-estate projects are transformed into new assets.

Working with Boss Software, the local state virtually assetizes its territory by promoting Gutian's geographic brand. In 2017, the government launched a geographic indication "Shifangtian," but the brand struggled under the management of a local state-owned enterprise. The Brain thus offered a chance for its revitalization. Local farms are now encouraged to adopt the brand in exchange for sharing their production and transaction data, creating a supposedly mutual benefit: the Brain expands its user base, while the platform's endorsement boosts the products' market price. By packaging the county's mushroom output under a single, data-backed geographical indicator, Gutian transforms its territorial identity into a tradable intangible asset (Birch and Ward, 2024).

Legacy projects from the era of rapid development, such as industrial parks, were also repurposed under the banner of "digital agriculture" and "digital finance." In 2019, echoing the central initiative of promoting indigenous innovation, Gutian rebranded existing industrial parks and started to build new ones, each tailored to a specific vision of the data fix, such as smart farming or big data-enabled financial services. As in the past, the primary goal is not immediate rental income but securing future tax revenues and employment, thereby turning physical infrastructure into an asset valued for its long-term fiscal potential. This strategy demonstrates how datafication, now a central state priority, provides a new and potent rhetoric for local state

**Figure 6.** Repurposed resort villa, Gutian mushroom culture expo center.
Source: Photo by author (12/5/2024).

entrepreneurialism, distinguishing it from the development model of the previous era.

These rebranded industrial parks also create a platform for local dragon-head companies to advance their own assetization imaginaries. King Trellema, a Shenzhen-based trellema processing firm moved its R&D and manufacturing to Gutian in 2023. Beyond enjoying rent-free facilities, the company aims to leverage its alignment with the local government's high-tech agenda to build a narrative of itself as a data-driven, innovative agribusiness—a narrative rumored to be aimed at an eventual stock market listing.

Perhaps the most imaginative example of state-led assetization is the Mushroom Culture Expo Center. Originally an abandoned private resort, the complex was redeveloped with state funds allocated for promoting "modern agriculture" and rural digital culture (Figure 6). The facility now serves as a conference center and museum showcasing Gutian's mushroom industry, with smart farming exhibits

prominently featured alongside quotes from President Xi. In its grand opening in 2024, the center hosted the First Trellema Industry Development Conference, inviting scholars and businesses around the world to celebrate Gutian's advancement in smart farming. This project masterfully weaves together economic development, technological innovation, and political legitimacy, transforming a defunct real-estate venture into a valuable state asset.

These practices exemplify the paradoxical nature of the data-driven, state-led rural land assetization. The central government imposes strict controls to prevent speculative land use, while local governments act as entrepreneurial agents, experimenting with innovative methods to leverage land's value indirectly. The assetization of land through data in Gutian thus represents a hybrid model: a contested process where local governments, agribusinesses, and farmers navigate the terrain between central mandates for land protection and pressing local entrepreneurial imperatives.

## *Transformations in agricultural labor and human–data assemblage*

The third dimension of Gutian's digital transformation concerns labor. Datafication does not simply reorganize flows of capital, it also reconfigures the relationship between humans, machines, and knowledge in agriculture. What emerges is a human–data assemblage marked by uneven burdens, free data labor, and new imaginaries of the future of farm work. Prior to the emergence of the Brain and datafied farming in the 2020s, Gutian's mushroom industry had already experienced multiple rounds of technological transformation. Each round introduced new techniques, machines, and skills in transforming preexisting division of labor, labor relations, and skill-based social differentiation.

Traditionally, family farms constitute the bedrock of Gutian's mushroom industry. Often operated by a couple, sometimes with the assistance of their elderly parents, these farms sold dried fungi directly to external buyers. According to official data, family farms collectively produce approximately 90% of Gutian's annual mushroom output (Gutian CPCCC, 2022). In recent years, mushroom farming in Gutian, in line with national trends, has undergone a process of moderate concentration as many farmers have retired or exited agriculture, leading to an increase in the average size of family farms (Huang, 2014; Yan and Chen, 2015). The average number of sheds managed by each family has risen from five in the 2000s to 20 in the early 2020s. Compared to family farms of the 2000s, those of the 2020s are more specialized and automated. In addition to land allocated by the village, they lease additional land from neighbors, consolidating it into larger farming units.

The division of labor in the industry also complicated with the diversification of mushroom processing techniques and specialization of skills along the supply chains. Initially, a number of services and supplies providers emerged to specialize in sub-industries like the production of spawns, excipient and substrate logs, and product packaging. Unlike family mushroom farms, these companies were frequently founded by individuals possessing specialized skills or access to capital markets, representing the growing disparity within Gutian's mushroom industry. In addition, advancement in food processing techniques and assetization of brands led to a multiplication of product types (freeze dried, canned, fried, sold fresh via cold chain delivery etc.) and new brand-based processing companies. A few of them had evolved into dragon-head companies who became pioneers of digitalization and factory production prior to the arrival of the Brain.

All of these trends have deepened differentiation and inequalities in Gutian where the majority of people depend on the mushroom industry for a living. The introduction of the Brain and the grafting of datafication onto the existing economy build on and complicate these ongoing transformations.

As mentioned previously, many farmers willingly provide free data labor in exchange for agricultural loans and government-subsidized agri-insurances. To make the Brain functional, farmers must continuously upload data, scan QR codes, and cooperate with inspections. The quality and sustainability of free labor turned out to be questionable. Given that many Gutian mushroom farmers are over 50 and did not attend college, learning to use the Brain's mobile application has also proven challenging. Compounding this challenge here is the fact that promoting agri-tech in China is considerably more difficult than that in North American due to the smaller scale of Chinese farms and the fragmentation of rural land. Gutian's mountainous terrain renders digitalization an even more formidable task. To collect in-situ data and instruct farmers on app usage, Boss Software employees spent the majority of their time traversing winding country roads to reach farms in remote areas. They often managed to visit only two to three farms per day, severely escalating costs. One employee offered a sober commentary on big data in agriculture (Gutian, 12/24/2025):

> One day, a local official called us to give them some data which we did not readily have. When we told them it would take us more than a month to collect it, they were mad at us. These people have a false impression that big data is just there for us to retrieve from the database by clicking a mouse. No, they cannot be more wrong. Big data has to be painstakingly collected and cleaned by people like us before entering the database. We are the artificiality (*rengong*) behind the AI (*rengong zhineng*).[4]

The labor of data platform employees who travel into remote villages to install sensors, register users, and provide technical support effectively substitutes for the farmers'


**Figure 7.** Cultivation sheds at a typical tremella family farm.
Source: Photo by author (12/19/2024).

inability or reluctance to self-digitize. This added layer of data labor in rural China makes apparent the irony of artificial intelligence as a labor and cost-saving technology. It turns out to demand more labor and cost, at least at the current stage of (under)development.

Beyond seeking agri-insurance, most farmers report indifference toward the data platform, finding greater utility in their own indigenous technologies. Mushroom farmers in Gutian have developed and perfected indigenous techniques that directly enhance yields or reduce manual labor out of their own backbreaking labor experiences. As temperature and moisture control are absolutely critical for tremella cultivation, all five family farms we visited had installed digital thermometers and moisture sensors with subsidies from the local government (Figure 7). While they could not afford fully automated farms, these farmers improvised with situated and everyday engineering, such as gravity-driven mechanical venting systems, which proved highly effective.

In contrast, local officials and technology firms envision a future where mushroom sheds become fully automated, remotely monitored, and integrated into factory-style production systems. They justify this vision citing not just efficiency imperatives but also demographic realities: rural labor shortages and young people's disinterest in backbreaking farm work. Indeed, there is a strong bottom-up imaginary of automated and immaterial agriculture labor embedded regardless of the state-led and top-down project of the Brain. For example, while the Brain offers attractive rates for agricultural loans, few family farms intend to borrow. Although most farmers grew up in rural Gutian, they often possess sufficient savings and do not envision their family's future in mushroom farming. Due to rapid urbanization and increased urban job opportunities, their children often prefer urban to rural life. A farmer we interviewed lamented that while she and her husband value the independence of rural life, the younger generation avoids the hard work of farming, so they plan to lease out their sheds and move to the city after retirement (Gutian, 12/25/2024).

For younger farmers who remain in the countryside, there is a lot of enthusiasm toward automation, e-commerce, and branding. They see smart farming not only as labor-saving but also as a pathway to climb the value chain and engage in more immaterial forms of labor—such as marketing, livestreaming, or financial management. However, in comparison to the Brain, whose mobile application offers only limited services related to mushroom farming, these young farmers see major monopoly e-commerce platforms like Taobao and PDD as more practical and attractive.

Gutian's experiment with the Brain reveals how datafication reconfigures agricultural labor into a human–data assemblage marked by asymmetry and ambivalence. What is framed as technological empowerment in practice

depends on layers of free and precarious labor—from farmers' routine data entry to technicians' physical maintenance of the system. The rhetoric of automation thus conceals intensified human effort and new forms of dependence on both digital and bureaucratic infrastructures. Rather than democratizing opportunity, the data fix redistributes value upward. Farmers' data sustain institutional systems for credit, insurance, and governance, yet the benefits accrue disproportionately to state and corporate actors. This uneven flow of value underscores the paradox of rural digitalization: data labor is indispensable but marginal, productive yet undervalued or unremunerated.

At the same time, the persistence of collective land ownership and farmers' selective engagement with digital tools temper the extractive potential of assetization. Their pragmatism and reliance on indigenous knowledge and local technical ingenuity reflect not resistance alone but an alternative rationality that values autonomy over optimization. The Brain thus crystallizes the contradictions of China's rural data fix campaign—where technological aspiration confronts socio-economic fragmentation, and the promise of "smart" agriculture remains entangled in enduring inequalities of labor, scale, and power.

## Discussion and conclusion

China's experiment with digital agriculture reveals a distinctive configuration of the data fix—a socio-technical strategy through which information infrastructures absorb rather than resolve the contradictions of growth, redistribution, and control. Unlike the market-driven model of the United States, China's version grows from the post-socialist, developmental state's long tradition of technocratic governance. From cybernetic planning in the 1980s to today's ADB, data have served as instruments for reconciling efficiency and equity, transforming information itself into a means of coordination and legitimation.

In Gutian, this logic takes concrete form. The Mushroom Digital Brain does not simply optimize yields; it converts governance into a field of measurable value. Dashboards and transaction records demonstrate bureaucratic performance, enabling officials to leverage data for subsidies, reputation, and legitimacy. For firms, datasets represent deferred capital—potential inputs for future AI and market speculation—while for farmers they are prerequisites for credit or insurance. Yet, with collective land ownership limiting full-scale financialization, the circulation of data depends less on market demand than on state subsidies and political signaling. The platform thus functions also as a bureaucratic fix: sustaining rural governance amid fiscal constraint and demographic decline.

Collective ownership and the strict "red-line" policy against farmland conversion also reshape how land becomes an asset. Unable to securitize or sell land directly, local governments pursue indirect assetization through digital branding, industrial parks, and cultural expos that repackage territory as data-rich, intangible property. These initiatives revive older forms of land-based state entrepreneurialism but within the boundaries of socialist legality. Datafication, in this sense, supplies a new language for local accumulation and state-led assetization without privatization—a "new bottle for old wine" that turns political space into symbolic capital.

The data fix likewise reorganizes labor. Promises of automation conceal the manual, cognitive, and emotional work required to sustain digital systems. Farmers upload data to maintain eligibility for insurance; platform technicians travel to remote sheds to install sensors and register users. Rather than replacing human effort, datafication multiplies it, transforming farmers and civil servants alike into providers of invisible data labor. Still, farmers engage these technologies selectively, combining subsidies with indigenous techniques and low-cost innovations that preserve autonomy within constraints.

Taken together, these processes show that China's agricultural data fix is not an isolated national project but part of a plural global landscape of datafied asset economy. It neither replicates Northern oligopoly nor follows Southern dependency patterns. Instead, it embodies a hybrid, state-mediated trajectory of datafied assetization where accumulation is tethered to governance priorities—food security, ecological monitoring, and rural revitalization—rather than shareholder profit (Birch and Ward, 2024). This trajectory complicates universal theories of data colonialism (Milan and Treré, 2019) by revealing how distinct land regimes and governance structures generate divergent pathways in a data-centered economy (Valente and Grohmann, 2024).

Our case also underscores the regional disparities and interregional competition of data fix in rural China. Gutian represents a southeastern model characterized by land scarcity and smallholder-based production. In contrast, some western and northern provinces—where land is more abundant but labor shortages more acute—exhibit a different pathway: flatter terrains reduce automation costs, and local authorities are more willing to permit land consolidation by large agri-tech firms. These conditions have supported verticalized farming systems that outperform Gutian's family farms, consequently prompting Gutian's local government to platformize its mushroom industry.

Conceptually, this article advances the data fix as a bridge between critical agri-food studies and critical data studies (Bronson and Knezevic, 2016). It reframes smart farming as a political economy project rather than a technical upgrade: one that redistributes value and power by transforming governance itself into an asset (Bronson, 2022; Fairbairn and Reisman, 2024; Hackfort et al. 2024). In China, digital infrastructures are less about market disruption than about maintaining order—technically, fiscally, and symbolically—under conditions of slower

growth (Liu and Wang, 2022; Meng, 2025; Wu, 2024; Wang, 2023). Recognizing this logic underscores that the politics of agricultural data cannot be reduced to extraction alone; they also involve governing through information.

Returning to the Tillable case clarifies the analytic stakes of the data fix. In the United States, the data fix operates through financial intermediation, where farmland becomes a platform-mediated asset valued via data analytics and venture-capital logics. In China, conversely, the fix is rooted in technocratic governance and infrastructural coordination. Here, data serve as instruments for bureaucratic performance and territorial branding within a system where collective land ownership constrains full financialization. While both models attempt to stabilize agricultural uncertainty through abstraction, they diverge in their political foundations and distributive outcomes. Recognizing these variations frames the data fix not as a singular global model, but as a flexible strategy shaped by specific alignments between states, platforms, and land regimes.

Whether such governance can endure remains uncertain. Fiscal tightening and uneven participation threaten the viability of local digital platforms, even as the broader belief in data-driven modernization persists. Similar tensions appear elsewhere—from Europe's environmental digital farming schemes (MacPherson et al., 2022) to East Asia's cooperative smart agriculture (Li et al., 2023; O'Shaughnessy et al., 2021)—suggesting that multiple data fixes now structure global rural development. Across these contexts, the key question is not whether agriculture will be digital, but who owns the land, who controls the infrastructures, who performs the data labor, and who benefits from the value produced. China's case thus illustrates both the reach and the limits of governing through data: a system capable of unprecedented coordination and visibility, yet perpetually haunted by the contradictions it seeks to contain. Understanding data as both asset and state apparatus enables us to see digital agriculture not as a technological destiny but as an unfolding struggle over value, power, and the future of rural life.

## ORCID iDs

Lin Zhang https://orcid.org/0000-0002-6967-2759
Tu Lan https://orcid.org/0000-0001-8918-3023

## Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

## Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Notes

1. We thank the two anonymous reviewers for helpful suggestions about how to frame and highlight our theoretical contribution.
2. Syngenta Group, a Basel-based agritech conglomerate owned by ChemChina (now under Sinochem Holdings) since 2017, is among the world's largest producers of seeds, pesticides, and agricultural technologies. In China, its Modern Agriculture Platform (MAP) integrates digital farm management, logistics, and finance, using farm-level data to optimize production and manage risk—making Syngenta both a commercial actor and a governance partner in agricultural digitalization.
3. The Agricultural Digital Brain is a state-led data platform system that intends to integrate agricultural production, circulation, finance, and governance into a real-time system of monitoring and coordination, rendering rural life legible, governable, and selectively assetizable through data.
4. The Chinese term *rengong* is a pun, simultaneously referencing artificiality and human labor.

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