Indian Agritech: Boom or Bust for the Smallholder Farmer

by

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Abstract

Amidst growing concerns over an agricultural crisis, efforts to financially include the rural poor, and a nationwide "Digital India" campaign to embrace digital modernity, a new class of financial technology firms has emerged in Indian agriculture. Indian agritech companies seek to make agriculture more "efficient, inclusive, and resilient" by digitally disrupting agricultural supply chains and providing informational and financial services for agricultural livelihoods. Despite international media coverage and venture funding for these initiatives, few studies have explored the element of 'world-building' by agritech companies that aim to reconfigure networks of informal actors in the Global South. Using an autoethnographic approach, I draw from my experience searching for agritech initiatives in the Green Revolution state of Haryana, interning with one high-ranking agritech company in its Gurugram corporate office, and speaking with its affiliated farmers and shopkeepers in the nearby state of Uttar Pradesh. I present findings related to the broader visions and values underlying agritech initiatives, how these interact with the realities of the affiliated smallholder farmers and shopkeepers, and the influence of historical and geographical factors on the agritech industry in India. I show that company services embed the neoliberal development principles of global risk management and financial and digital inclusion, and argue that they incorporate both small farmers and shopkeepers into a sociotechnical system that enables their exploitation, while simultaneously transforming the social landscapes surrounding agriculture in favor of their operations.

Chapter 1 Introduction

On a humid, summer day in a village near Barabanki, India, I am near the end of my interview with a farmer. We sit on two perpendicular *charpais* under the awning outside of his house. Krishna looks at me expectantly, as I jot down my notes. When I am done, I ask him my final question: "What do you hope for your children? Do you hope for them to become farmers too?"

Krishna's eyes light up as he responds:

> Every person wants his child to become a white-collared professional. But this depends on fate, right? On hard work. The person who does farming does not want his children to do farming. We would want that our children also go and study in America. Anything wrong with that? But now, where they are going to reach, what they are going to do… Like this child we are taking to school – we are hoping he would leave this business and get ahead, become a white-collared professional. Right?
>
> – Krishna, agritech company-affiliated farmer

Indian agriculture has long been known to jump from crisis to crisis (Gupta, 2005). Climate variability and environmental degradation resulting from the unsustainable agricultural practices of the Green Revolution compound the uncertainty of reaping a good harvest (Shiva, 1991). In tandem, farmers face a volatile market, and other factors that reduce profit, including high costs of production and long output supply chains (Deshpande, 2017).

U.S. President John F. Kennedy once said: "...the farmer is the only man in our economy who has to buy everything he buys at retail - sell everything he sells at wholesale - and pay the freight both ways." (The American Presidency Project, 1999). This statement captures the weight of being a cultivator, be it in the U.S. or India. Despite 60% of the nation's population depending on agriculture for their livelihoods, government subsidies in the sector have diminished, normalized with respect to agricultural output (Salunkhe and Deshmush, 2012). The 1990s witnessed a sharp decline in government support as structural adjustment programs led to economic liberalization within the sector (Ghosh, 2005).

In conjunction with the Green Revolution model of commercial cultivation, liberalization heightened the financial burden on already precarious farmers. The following decades saw an upsurge in agrarian distress and farmer suicides (Kannuri and Jadhav, 2021). Significantly, these suicides were not the result of unmediated economic hardship, but rather the specific ways in which economic conditions interacted with the sociocultural dynamics of rural life; largely the effect of an increasingly individualized agricultural sector experienced most poignantly by socially disadvantaged households (Mohanty, 2005; Vasavi, 2009). Despite extensive academic scholarship on the economic burdens faced by Indian farmers, and a smaller but growing body of work examining the social and psychological experiences constituting agrarian distress, the government's approach to agriculture has continued to take a neoliberal turn.

In 2020, the Indian Parliament passed three bills to deregulate the Indian agricultural sector by promoting the interests of private actors in agricultural supply chains and marketplaces. These became the Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, the Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act,

and the Essential Commodities (Amendment) Act (Ministry of Agriculture & Farmers Welfare, 2020).

The acts, though eventually repealed in 2021, encouraged private agribusinesses to replace state-level regulatory bodies that facilitate transactions among farmers, the public, and private actors (Drèze, 2022). The decision led to a strong backlash; farmers from the agriculturally rich states of Punjab and Haryana marched to New Delhi in protest and were joined in solidarity by others from all over the country, risking their lives to demand an end to this proposed legislation. In particular, the lack of mention of a government support price led farmers to fear being vulnerable to the whims of private agribusinesses.

Although these reforms were not inscribed in policy, the past decade has seen the growth of an entire industry dedicated to disrupting Indian agriculture in the name of making it more 'efficient,' 'inclusive,' and 'resilient' (Ganeshkumar and Khan, 2021: 160). The Indian agritech industry is a fast-growing conglomeration of startups developing a variety of tech-enabled solutions to the quagmire of Indian agriculture. As lack of access to formal credit is widely understood as a problem facing farmers, many firms offer financial services, making them fintech, or agrifintech companies at their core.

Company models range from downstream, end-to-end, precision, midstream, and biotech (McKinsey and Company, 2023), each with different implications for the sector. Some firms seek to eliminate agricultural intermediaries or 'middlemen,' digitally connecting farmers directly to customers and shopkeepers. Other firms try to digitally connect middlemen with the best markets. Still others offer online marketplaces where farmers can purchase inputs. A handful of firms aim to integrate all these and other services under a single platform.

Fundamentally, most companies aim to disrupt traditional agricultural networks and create newer, more 'efficient' ones, digitally and financially.

Agritech representation by media within the consulting and finance realms is highly optimistic (Bhardwaj, 2022; Dobhal and Pathak, 2023), with reports predicting that such solutions can boost farmer incomes by 25-35% due to greater efficiencies in the sector (McKinsey and Company, 2023). Indian startups are also attracting significant venture funding from all over the world, with highly ranked firms receiving hundreds of millions of dollars in venture capital.

Although agritech firms receive rave reviews for offering 'farmer centric' solutions, few (if any) popular articles discuss farmer perspectives on, and reception of, these firms, whose interventions would theoretically transform farmers' lived realities. Nor has academic scholarship yet given voice to farmer perspectives on these initiatives, despite their resemblance to the government's visions in the proposed farm bills, which 700 farmers gave their lives to protest (Nielsen and Nielsen, 2022).

According to reputed consulting firm, McKinsey: "It's a system that builds: the more agtechs know the farmer, the better products they can develop" (2023). Given the history of failed efforts to financially include the poor and the myriad unintended consequences associated with digital technology, there is something ominous about capital-rich startups "knowing" farmers, to supply them with digitally enabled financial products and services.

Due to the industry's relative nascency, academic scholarship is somewhat restricted to the sphere of 'digital agriculture,' with much of this literature based on studies in the Global North. Limited attention has been given to exploring the element of world-building by agritech

firms, particularly as they aim to reconfigure networks of informal actors in the South. These questions are especially salient within Science and Technology Studies (STS), which aims to demonstrate that scientific knowledge and developments in technology simultaneously embed and are embedded in society's institutions, identities, norms, and values (Jasanoff and Kim, 2015). It follows that disruptive innovations such as those proposed by agritech firms are likely to have sociocultural implications in addition to economic ones.

Brooks (2021) and Mann and Iazzolino (2021) lay the foundation for these discussions in the context of digital agricultural platforms. They highlight the creation of new subjectivities shaped by all-encompassing digital platforms and affiliated agricultural extension systems. Yet more scholarship is needed with respect to understanding the broader implications of agritech initiatives. Firms receive good press for farmer-centric solutions, yet what are the visions and values behind agritech endeavors that aim to reshape agricultural ecosystems? Beyond individual services, what kinds of worlds do they strive to shape? Correspondingly how do these visions interact with the realities of recipients of their solutions? And how are these informed by local histories and geographical contexts?

Given the apparent discrepancies between the message expressed loud and clear by Indian farmers in the 2020-2021 farm bill demonstrations, the media hype surrounding the Indian agritech industry, and the dearth of farmer perspectives on agritech represented in the media, this research aims to investigate some fundamental aspects of the Indian agritech boom for smallholder farmers, using the following research questions:

1. How do Indian agritech companies conceive of their business and operating models?
2. How do smallholder farmers and shopkeepers working with such companies experience these partnerships?
3. How do historical and geographical contexts influence agritech penetration in India?

I address these questions using a combination of semi-structured interviews, casual conversations, and participant observation at three research sites: two rural settings, and one high-ranking agritech firm's corporate office (henceforth referred to as the Company for this thesis). Of the rural settings, one is without the presence of agritech initiatives, while the other has a network of farmers and shopkeepers affiliated with the Company.

Findings related to Research Question 1 are based on interviews with Company executives and employees. Findings related to Research Question 2 are based on conversations with farmers and shopkeepers in the Company network, and observations of interactions between farmers, shopkeepers, and company employees. Findings related to Research Question 3 are based on a comparison of conversations and observations of farmers across both rural settings, supported by external literature.

I report my findings in autoethnography, a methodological choice that originated from the unique, nonlinear trajectory of my fieldwork, but which I later found to be the most effective at vibrantly communicating the different social worlds I inhabited while in the field, and their relationships to the agritech industry. A full description of autoethnography is included in 'Methods.'

Chapter 2 offers a literature review including the Indian Green Revolution and scholarship on informality, digital and financial inclusion, and their application in agriculture. Chapter 3 discusses my methods and explains autoethnography. Chapter 4 contains findings based on an autoethnographic approach and integrates discussions referencing the existing literature. Chapter 5 ties these together in a conclusion.

Chapter 2 Literature Review

2.1 The Green Revolution and Agrarian Distress

In the years following independence from Great Britain,[1] the Indian government sought to decrease its reliance on international imports,[2] and focused on strategies to boost food production within the nation (Tripathi et al. 2012). The 1950s witnessed a push toward adopting hybrid seed varieties and corresponding synthetic agrochemicals, a new mode of agriculture shaped by American involvement in Indian agricultural research (Abrol, 1983).

The northern states of Punjab and Haryana were chosen to pioneer the practices, based on their demonstration of initiative in agricultural matters. Farmers from these states were trained in the new methods and incentivized to produce large yields by a Minimum Support Price (MSP) policy which set a price floor for crops and guaranteed government procurement of marketable surplus (Das, 2020). Ramping up to what is today known as the Indian Green Revolution of the 1960s, the era marked a historic change in agricultural practice. India overcame its food shortage and became a net exporter of grains; the Green Revolution was heralded as a national victory, a symbol of self-sufficiency following a hard-fought battle for Independence (Cabral et al., 2021).

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[1] India gained Independence in 1947.

[2] For example, subsidized wheat from the United States under PL-480.

Although the combined efforts of the government, scientists, and farmers to feed the nation resulted in increased net food production, the Green Revolution did not reduce the number of hungry people in India (Patel, 2013), and associated policies and practices had long-term social and environmental repercussions. Among them were the exacerbation of regional inequalities due to regressive government policies (Subbarao, 1985; Krishnaji, 1990; Chand, 2003; Tripathi et al., 2012; Ali et al., 2013; Das, 2020); environmental degradation due to monocropping and agrochemical use (Abrol, 1983; Shiva, 1991; Singh, 2000); and agrarian distress associated with subscription to the Green Revolution model of commercial cultivation, particularly among socioeconomically disadvantaged households (Shiva and Jaffri 1998; Vasavi 2009; Kannuri and Jadhav 2021).

2.1.1 State Policies and Regional Disparity

While regional economic disparities formed during the colonial era, state policies associated with the Green Revolution exacerbated these by concentrating price supports, input subsidies, and subsidized institutional credit in five to six 'advanced' states that already had water, power, and fertilizer (Subbarao, 1985).

2.1.1.1 Price Supports

As government involvement in agricultural development intensified, agricultural price policy became part of a larger policy package to promote growth, particularly in irrigation-endowed regions (Krishnaji, 1990). In 1965, the Agriculture Price Commission (APC) introduced the Minimum Support Price (MSP), a policy that set price floors for essential crops based on the costs of production; should the market price rule below the MSP, the government would procure the marketable surplus at the MSP as part of its Public Distribution System (Ali et

al., 2013).[3] The policy aimed to protect producers from market fluctuations, while incentivizing them to adopt the high-yielding methods and technologies of the Green Revolution.

Despite its efficacy in certain areas, MSP has been criticized for favoring certain regions and crops over others, thereby worsening inter- and intra-regional inequalities (Chand 2003; Tripathi et al., 2012; Ali et al., 2013; Aditya et al., 2017; Das, 2020). While the policy theoretically applies across the entire country, its efficacy is limited to those regions where the government has procurement systems, including Public Procurement Agencies (PPAs) (Tripathi et al., 2012). In places without such systems, the policy is effectively nominal.

Punjab and Haryana, the first states to adopt Green Revolution technologies and henceforth known to produce large amounts of marketable surplus, benefit from a concentration of government procurement systems (Chand, 2003). States without an aggregate surplus are not prioritized, with the rationale that higher demand than supply should result in market prices above MSP. Reports show, however, that pockets of surplus in such states result in market prices below MSP, leading to financial loss and distress among farmers (Chand, 2003).

At an individual level, landholding size, institutional facilities, and ability to negotiate determine a farmer's odds of selling to a PPA at MSP; consequently, smallholders and socioeconomically disadvantaged farmers are least likely to do so (Das, 2002). Thus, due to inequitable enforcement, the policy has resulted in both region- and class-based inequalities.

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[3] The Public Distribution System was developed to manage food scarcity by distributing food at affordable prices, and operates under the joint purview of the central and state governments. The central government handles the procurement, storage, transportation, and allocation of food grains to the state governments, which in turn allocate these within the state (Department of Food and Public Distribution, 2024).

2.1.1.2 Subsidies and Credit for Agricultural Inputs

Input subsidies included fertilizer, irrigation, and power; in terms of subsidy per unit of food produced, output was most heavily subsidized in Tamil Nadu, Gujarat, Andhra Pradesh, Karnataka, Haryana, Punjab, Uttar Pradesh, and Rajasthan, and least heavily subsidized in the poor eastern states (Subbarao, 1985).

Subsidized institutional credit enabled farmers to purchase modern inputs; Tamil Nadu, Kerala, Haryana, Punjab, Gujarat, and Karnataka experienced the highest increase in total institutional credit during the Green Revolution (Subbarao, 1985).

Both represent forms of government support to a select set of states (many of which overlap), demonstrating the uneven distribution of resources during the Green Revolution. This has implications for the trajectory of agrarian development and resulting sociocultural landscapes in states at the forefront of the Indian Green Revolution, versus those that were not.

2.1.2 Environmental Degradation

In the decades following the Green Revolution, evidence of environmental degradation became clear, inviting an onslaught of scholarly criticism surrounding the origins, practices, and values of the era (Stephan, 2022). In a foundational text, Abrol (1983) argues that American involvement in Indian agricultural research leading into the Green Revolution had a long-term "disorienting" effect on the national research agenda. American-led research promoted high-yielding varieties (HYVs) over native seeds and individual crop productivity over farming systems; it simultaneously dismissed traditional agricultural waste recycling and neglected soil and water sustainability (Abrol, 1983).

In a case study of Haryana, Singh (2000) describes the damage to soil, water, and vegetation resources due to Green Revolution practices; intensive use of chemical inputs lowered organic matter in soil while contaminating the groundwater table, and the "use of monocultures, mechanization, and excessive reliance on chemical plant protection…reduced crop, plant, and animal diversity" (Singh, 2000). The promotion of HYVs also opened India as a market to the multinational corporations that sold the newly required inputs: synthetic fertilizers, pesticides, and herbicides that resulted in negative environmental impacts and greater expenses for farmers (Thomas & De Tavernier, 2017; Gruere & Sengupta, 2011).

Renowned scholar activist Vandana Shiva (1991) condemned the Green Revolution for giving rise to an agricultural sector that prioritizes yield and commercial productivity above environmental health and social equity. Compounded by a changing climate, environmental damage caused by Green Revolution practices increased the uncertainty of a good harvest and the precarity of agriculture as a livelihood, contributing to agrarian distress (Behere and Bhise, 2009; Mishra, 2006; Revathi, 1998).

2.1.3 Agrarian Distress and Farmer Suicides

In addition to environmental damage, scholars connect subscription to the Green Revolution model of commercial cultivation with high levels of agrarian distress and farmer suicide (Shiva, 2006; Vasavi, 2009). As suicide rates escalated in the 90s and 2000s, the micro- and macroeconomic conditions surrounding agriculturalists gained academic attention (Ghosh, 2005; Vasavi, 2009; Kannuri and Jadhav, 2021). Scholars attributed suicides to financial strain due to the increasing production costs, decreasing revenues, and the dearth of available credit associated with globalization and liberalization trends in the 1990s (Shiva and Jaffri, 1998;

Ghosh, 2005). Others argued that it was insufficient to say farmers committed suicide because of indebtedness or financial strain; rather, it was the ways in which wider political and economic forces (such as those involved in commercial cultivation) interacted with the sociocultural dynamics of rural life that created the conditions for suicide.

A handful of scholars seek to understand farmer suicides from a sociological perspective, in which they account for the effects of caste and class in the experiences of farmers also struggling with cultivation using the Green Revolution model. Mohanty (2005) examines suicides in Western Maharashtra through the lens of Durkheim: suicide is "an effect of individualization, a process of socio-economic estrangement" that many farmers experienced while grappling with the unfamiliar challenges associated with commercial cultivation post-economic liberalization.

In particular, lower- and middle-caste victims, encouraged by land reform and other distributive measures to pursue a better life, met with the neoliberal realities of commercial agriculture amidst upper-caste hostility, and feelings of shame, failure, and isolation (Mohanty, 2005). Vasavi (2009) draws on studies of farmer suicide in Andhra Pradesh, Karnataka, Kerala, Maharashtra, and Punjab where most suicides occurred between 1998 and 2006. She notes that victims were largely marginal cultivators (owning less than one-hectare plots) entering into Green Revolution commercial agriculture for the first time. Facing a new set of financial risks, social stigma on indebtedness, confusion about agricultural knowledge, and increasing individualization, many entered a state of advanced marginality (Vasavi, 2009).

Shah (2012) argues that a purely economic explanation ignores how political and economic forces interact with sociocultural relations in rural society. She identifies social and

cultural imaginaries pertaining to a fear of pauperization, contending that: “For the suicides, therefore, whether scarcity actually exists is less relevant than how the idea of scarcity is articulated in affective responses. Thus, the relationship between real scarcity and suicides is not reciprocally straightforward, but highly intricate” (Shah, pp. 1175, 2012).

Kannuri and Jadhav (2021) connect farmer suicides to wider social, cultural, political and economic forces. Noting that most suicides between 1995 and 2018 were committed by farmers from ‘backward’ castes, they conducted an ethnographic study on Dalit cotton farmers, using narratives from surviving family members. They find humiliation to be a common experience among victims as reported by their families and point to the literal and metaphorical toxicity in agricultural landscapes, as created through political and economic marginalization and caste structures.

From these studies, it becomes clear that agrarian distress, while affecting all farmers, is particularly severe among lower caste and socioeconomically disadvantaged households. Many of these viewed the Green Revolution model of commercial cultivation as an opportunity to transcend their socioeconomic disadvantages. However, most did not have the financial and experiential wherewithal to effectively manage the risks they were undertaking (Vasavi, 2009). Furthermore, they faced hostility and isolation from their upper-caste counterparts (Shiva and Jaffri, 1998). Ultimately, the Green Revolution benefited those farmers who had enough financial security and experience to manage the risks associated with Green Revolution commercial cultivation.

Thus, while technologies, policies, and practices associated with the Green Revolution helped India become self-sufficient in food production, their execution resulted in long-term

regional disparities, environmental damage, and agrarian distress, particularly among lower caste and socioeconomically disadvantaged households. They promoted a standardized form of agriculture that required synthetic inputs manufactured by multinational corporations, thus increasing the cost of production for farmers. Green Revolution agriculture attracted both privileged and disadvantaged farmers aspiring for a better life. In the context of economic liberalization, the latter were left to fend for themselves.

Beyond the literal decades during which it took place, scholars have analyzed the Green Revolution more broadly to provide context to current trends in agricultural development, including agritech. Although the Green Revolution is commonly considered to have occurred between the 1940s and 1970s, Patel utilizes a historical lens to trace a "Long Green Revolution" that spans the 19th and 20th centuries, arguing that "...it is centrally a set of actions to control the process of accumulation" (Patel, 2012: 51). Patel points to how the program, motivated by the threat of communism, resulted in accumulation for the dominant hegemonic block within recipient countries at the expense of the rural poor (2012).

Brooks (2021) builds Patel's analysis, arguing that digital agricultural platforms (one of several agritech models) function to incorporate small farmers "into value chains and wider circuits of capital and data," representing, to some degree, a continuation of the Long Green Revolution (Brooks, 2021: 374). Specifically, it is the drive to modernize global south agriculture, to financially 'include' and digitally 'connect' the rural poor, and lastly to employ behavioral economics to "steer beneficiaries towards correct choices" that constitute the creation of 'good market subjects' through digital platforms (Brooks, 2021: 376).

Academic attention to the nascent agritech industry is relatively recent, and the debate around digital agriculture does not address the broader visions and values behind agritech models, nor how these interact with the realities of recipients of agritech solutions. Scholars call for more attention to the concentration of markets and increasing inequality, the impact on farmer-farmer, farmer-consumer, and other relationships, and farmer culture and identity (Ingram et al., 2022).

Central to these themes are questions of democracy and power relations that are especially relevant to politically marginalized Indian smallholders interacting with capital-rich agrifintech startups. My research examines one such agritech company offering a digital platform.

The next section reviews the academic literature on economic informality, efforts to financially and digitally 'include' the rural poor, and their application in agriculture.

2.2 Informality, Inclusion, and Agriculture

Like the term, *technology*, *agritech* has many applications. More than physical machinery, however, high-ranking agritech firms use digital technology and artificial intelligence to 'disrupt,' 'optimize,' or 'add value' to existing agricultural ecosystems. Examples include digital disruption of agricultural supply chains, digital marketplaces for farm inputs, and digital provision of farm advisory services using satellite data and precision agriculture. Solutions are deployed through smartphone apps for farmers, middlemen, and shopkeepers, and through private agricultural extension services, resulting in the creation of new socio-technical systems.

Within these models, companies implicitly or explicitly allude to processes of *formalization* and the digital and financial *inclusion* of agricultural livelihoods. They promise to 'formalize' the informal, and 'include' the rural marginalized. In this section, I review the scholarly literature on informality, inclusion, and their application in agriculture. I focus on digital agricultural platforms, as pertain to my findings.

2.2.1 Informality

Agritech platforms frame themselves in various ways. Their purveyors talk about the benefits they will bring through their digital technology platforms: digital transactions and accounting, and integration into the formal economy. Recipients of agritech solutions are typically actors in the informal economy. It is therefore important to address what is meant by formal and informal.

Scholars have long theorized definitions of and explanations for informality. Despite its heterogeneity, many agree that the informal economy can be understood as "income generation…unregulated by the institutions of society in a legal and social environment in which

similar activities are regulated" (Castells and Ports, 1989: 12). In informal economies, the production and distribution of goods are unregulated, and workers lack social protections. Chen (2005) argues that the informal economy is a foundational "feature of modern capitalist development," arising from "jobless growth, economic crises, global competition, corporate business strategies, changes in investment patterns, lack of unemployment insurance and safety nets, cutbacks in social spending, increased costs of living, retrenchment of formal workers and privatization of public enterprises" (Chen, 2005: 23).

2.2.2 Inclusion

Concerns over social unrest due to rising inequality and the precariousness of the informal workforce (brought out by the COVID-19 pandemic) have led development experts towards discourses on economic inclusion (Meagher, 2021). Ideas of inclusion range from expanding the poor's access to financial services to holistic community development, involving quality education, housing, and healthcare. However, scholars point out that inclusion is not so straightforward.

Du Toit (2004) argues that we must move beyond the inclusion-exclusion binary to consider existing power relations that shape the terms of inclusion, and their role in adversely incorporating the poor into economic systems in which they remain at a disadvantage. He later demonstrates how the terms of incorporation of South African smallholder farmers into commercial agro-food commodity chains and export-oriented labor markets affect the outcomes of their integration (du Toit, 2009). Others discuss a spectrum of "labor unfreedom," including many forms of voluntary labor, and the co-optation of informal labor in the interest of capitalism (Barrientos et al., 2013; Meacher and Lindell, 2013).

However, scholars also point to the danger of creating a new binary: that of inclusion vs. adverse incorporation, in which connections between formal and informal sectors are either upheld as empowering or denounced as neoliberal (Du Toit, 2009; Elyacher 2010).

Observing that the inclusion discourse invokes far-left principles of labor rights and social protection, while simultaneously incorporating bottom-of-the-pyramid[4] ideology from the far-right, Meagher (2021) uses an infrastructural lens to re-politicize inclusion, parsing its rhetorical ambiguity by examining what it does, rather than what it is:

> Infrastructures of inclusion are defined here as structured arrangements of actors, institutions, technologies, and power relations that link precarious populations into formal economic systems and circuits of capital (Meagher, 2021: 731).

These socio-technical connections make informal economies legible to state and private actors and facilitate their regulatory restructure. Meagher questions whether the "new social contract" proposed by advocates of inclusion – and in particular, digital inclusion, through which social and financial services may become accessible to informal actors – would serve to transform informality or further facilitate its exploitation. Hernandez et al. (2023) compare the integration of street vendors into informal-to-formal and informal-to-informal trading links, finding that the two compete in terms of poverty alleviation potential, with the latter also diminishing exploitation opportunities and providing higher incomes.

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[4] Popularized by C. K. Prahalad in 2004, Bottom of the Pyramid literature argues that private corporations can and should target consumer goods to the world's poor, historically excluded from consumer markets; such an arrangement is suggested to offer win-win opportunities for both corporations and the poor (Brueckner, 2013).

To further explore the impacts of inclusion, it is important to consider its different elements. These include financial inclusion, digital inclusion, and the creation of market subjects.

2.2.2.1 Financial Inclusion

At the heart of the inclusion discourse is access to financial services. Efforts to achieve financial inclusion have undergone several iterations in the recent past. Microfinance reached peak acclaim in 2006, when Grameen Bank founder Mohammad Yunus received the Nobel Peace Prize, but gave way to the broader strategy of financial inclusion after criticism that recipients' socioeconomic positions either stagnated or worsened (Bernards, 2022). Financial inclusion encompasses a wider range of financial services than microfinance,[5] but has had slow and uneven progress, resulting in a newfound faith in digital technology to disseminate this access, in the form of FinTech (Bernards, 2022). This will be explored in the next section.

Despite persistent calls by development organizations[6] for improved access to credit, savings, and insurance (AFI, 2010; Ozili, 2021; UNCDF, 2022), scholars point to the failures of such efforts to improve poverty and inequality, and in many cases, their propensity to worsen it through exploitative arrangements (Soederberg, 2013; Mader 2018).

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[5] Including credit, savings, and insurance.

[6] The U.N. Capital Development Fund, World Bank, International Monetary Fund, Asian Development Bank, African Development Bank, and Alliance for Financial Inclusion.

Some situate financial inclusion within the broader 'financialization of daily life' (Aitken, 2013; Roy 2010; Maden, 2018), in which everyday activities increasingly adhere to pervading financial logics (Martin, 2002). Aitken (2017) examines alternative credit scoring methods used on the 'unbanked'[7] finding that these perform problematic social sorting and segmentation in pursuit of new, formerly invisible sources of financial value.

Alternatively, Bernards argues that finance has been "coaxed" into serving development ends since capital is most interested in higher-end markets and "cannot change the underlying structures of power and exploitation that create poverty" (2022; 5). He traces the origins of poverty finance[8] to colonial times, during which colonial activity resulted in poverty and inequality which colonizers then answered with calls for access to financial services. Iterations of this neoliberal project – microfinance, financial inclusion, and most recently, fintech – continue to disregard the idea that the precarity of poor livelihoods is itself the reason commercially provisioned financial services fail (Bernards, 2022).

Scholars examine the agrarian experience resulting from financial inclusion efforts in the global south. Green (2022) argues that credit-debt relations in global south agrarian households exist within the social structures of rural life, but are increasingly influenced by newfound connections to global financial markets. Isakson (2015) critically evaluates the recent financial

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[7] Those without access to financial services.

[8] Bernards borrows this term from Rankin (2013), who refers to 'the business of extending financial services to those traditionally excluded from the mainstream financial system' (547), and thus relevant to our discussion.

derivative, index-based agricultural insurance (IBAI), developed in the name of insuring small farmers against climatic risk. He argues that while farmers could benefit from a form of insurance, IBAI stipulations may increase overall farmer vulnerability by exposing them to basis risk,[9] raising the probability of crop failure through the promotion of less resilient agricultural inputs and methods, increasing economic risk, and interfering with the traditional moral economy through which farmers collectively manage risks (Isakson, 2015).

Such financial measures have been shown to increase distress among farmers. Meerendonk (2020) uses an ethnographic approach to show how farmer experiences of agricultural insurance contribute to broader feelings of tension associated with the agricultural crisis in Maharashtra, raising questions among farmers about who is morally entitled to claim insurance.

Notwithstanding the above, advocates of financial inclusion frame it as a win-win solution. Kish and Fairburn argue that all financial markets are "imbued with particular ethics" and "moral claims-making" that make up "the standards by which investors are deemed "good" economic subjects (2017; 570).

2.2.2.2 Digital Inclusion

The acceleration of digital technology in the past decade has resulted in its recasting as a development tool for pro-poor empowerment through economic and governance participation,

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[9] "Basis risk is the probability that an individual farmer's experience could differ from that estimated by the index, and upon which indemnity payments are based…the policyholder might not receive a payment [upon weather-related crop damage] because the index's 'strike threshold' was not met" (Isakson, 2015).

known as digital inclusion (Chakravarty and Patra, 2019). Development organizations and national governments in the Global South have encouraged digital technology adoption to promote inclusive growth, create a skilled workforce, enhance productivity, and provide more job opportunities (World Bank, 2019). Digital India is a prime example of a national campaign to achieve digital inclusion and a geopolitical status of modernity (Chakravarty and Patra, 2019; Bal and Sharan, 2022).

Ghosh (2021) notes that the core tenets of Digital India – digital infrastructure as a core utility to every citizen, governance, and services on demand, and digital empowerment of citizens – are in part an effort to move the nation towards a cashless economy. However, given India's lack of experience with data privacy regulation, he argues that such an effort risks the "commercialization of bias," in which markets dictate the collection, analysis, and use of data to reinforce differentials in privilege along socioeconomic, racial, caste, educational, and geographic lines (Ghosh, 2021).

Athique (2019) argues that a move towards a cashless, digital economy would benefit governments, law enforcement agencies, banks, and tech companies at the expense of the poor, for whom cash is the primary form of payment and offers independence, anonymity, convenience, and avoiding concerns over internet connectivity and electricity access. Women, 80% of whom had no personal bank accounts, were compelled to find a way to bank hidden personal stores of cash post-demonetization (Athique, 2019).

Aspirations such as cashlessness have engendered a multitude of FinTech applications, with advocates in both state and private sectors. Such applications try but fail to overcome the uneven infrastructures of financial inclusion (Bernards, 2019). Still, the faith in credit as a

panacea for poverty persists, and digital psychometrics and alternative credit data are "aimed at rendering subjectivities legible to financial capital" (Bernards, 2019: 819).

With greater digital development, organizations use digital platforms to set operating models. Examples include rideshare companies like Uber and Lyft, and food delivery companies like Doordash and Postmates. Heeks introduces adverse digital incorporation, in which digital platforms "enable a more-advantaged group to extract disproportionate value from a less-advantaged group," by making it legible and setting the terms for its incorporation into a mainstream market model (2022: 691). The digital platform, designed by the more-advantaged party, sets the terms for incorporation and limits the negotiating power of the less-advantaged party.

2.2.3 Agritech and Platform Agriculture

The above patterns of financial inclusion and digital disruption have salience for agriculture. Across the world, agritech companies have proliferated, searching for new ways to make the agricultural sector more "efficient, inclusive, and resilient" (Ganeshkumar and Khan, 2021: 160). Lakshmikumaran and Sridharan (2021) identify seven key themes in their conversations with venture capitalists, companies, and scientific institutions in the agritech space: (1) precision farming, (2) farmer platforms, (3) credit and financing, (4) agri-biotech, (5) food processing, (6) quality and traceability, and (7) agri-infrastructure (including storage and logistics). Firms focusing on farmer platforms lean heavily on digital technologies, offering a

wide range of services[10] as they strive to optimize upstream (input) and downstream (output) agricultural supply chains (Lakshmikumaran and Sridharan, 2021).

Despite company claims that they can guarantee farmers quality inputs and better prices on their outputs, platform agriculture models have drawn criticism from scholars. Brooks (2021) argues that platforms "bund[ling] together agricultural products, and informational and financial services" employ behavioral economics tools to steer farmers towards becoming good market subjects, creating a new subjectivity: the Digital Farmer. At the same time, these trends risk agricultural deskilling and increasing farmer dependency on market inclusion at the expense of "traditional relations of informality and mutuality" (Brooks, 2021: 390).

Through such platforms, farmers may receive customized notifications with recommendations for agrochemical use, severe weather, pest attacks, and market prices (Fabregas, Kremer, and Schilbach 2019). Malik argues that despite the freedom to ignore such recommendations, farmers "enter a scenario where their failure to adhere to these prescriptions renders them particularly susceptible to individualized blame and could subject them to further interventions that diminish their autonomy and decision-making" (2023: 2199).

Carolin (2016) shows that digital agricultural platforms replace rather than eliminate supply chain intermediaries, holding power through their ability to determine the share of profits split between farmers and the company, and the price of input supplies or output produce. Faxon complicates these critiques by questioning "assumptions about the totalizing power of digital

[10] Service offerings include farm machinery, advisory, finance, satellite data, and farmer-retailer connections (Lakshimukaran and Sridharan, 2021).

technologies," identifying farmer agency in Myanmar's smallholder 'appropriation' of Facebook as an agritech platform, while other, explicitly agritech apps go unadopted (2023: 1). She calls for a rethinking of how agritech is defined, who designs it, and how we measure its effects.

Kumari and Vineeth (2023) identify farmer age, education level, economic status, and landholding size as important factors in determining farmer adoption of agritech startup services in Karnataka's rural Bangalore district. Beyond these discussions lies the question of how historical and geographical contexts affect the penetration of agritech companies. My research explores these questions through a comparison of the sociocultural landscapes in two rural locations, one with and one without the presence of agritech solutions.

Chapter 3 Methods

3.1 Study Sites

During my fieldwork, I gathered information from three study sites. Two were rural locations in the neighboring states of Haryana and Uttar Pradesh, and one was an agritech startup corporate office in the metropolitan area of Gurugram, Haryana. Below, I detail the rationale behind the choice of each study site and (where relevant) the agricultural context of the location.

3.1.1 Kanwari Village, near Hisar, Haryana

An internet search on agritech startup websites yielded few concrete details as to the company's on-the-ground operations, let alone specific locations of activity. Given this lack of information and response to my virtual inquiries, I considered other factors that might lead me to company-affiliated farmers.

Initially, conducting fieldwork in the state of Haryana made sense due to several factors. Haryana had been at the forefront of the Green Revolution alongside Punjab and was thus considered agriculturally advanced. Hisar, Haryana, was known for farmers utilizing advanced machine technology, and the presence of two agriculturally-focused institutions – Hisar Agricultural University, and Guru Jambheshwar University of Science and Technology – added to the possibility that farmers in the region may be able to adopt digital technologies.

Working in Haryana would give me an opportunity to investigate the apparent contradiction between farmer concerns about working directly with private companies (as

evident in the 2020-2021 farmer demonstrations led by Punjabi and Haryanvi farmers) and media coverage of agritech solutions as a revolutionary pan-India phenomenon. Lastly, Haryana offered me some logistical support. My paternal grandparents live in Gurugram, Haryana, just a 3-hour drive from Hisar. My host institution, Jawaharlal Nehru University, where I had faculty contacts supporting my research, was also in nearby New Delhi.

3.1.2 The Company Office, Gurugram, Haryana

Upon returning from Hisar with little evidence of agritech solutions in place, I attempted once again to contact companies to organize virtual interviews, or at minimum determine company operational locations. Given the lack of response to my inquiries, I identified a handful of agritech companies of interest that had corporate offices in Gurugram, my base. I took the approach of simply walking into their offices with my grandfather and requesting to speak with a member of the upper management. In the case of the Company, we were directed to HR, who informed me that I would have the best chance of speaking with company executives were I interning with the company. I accepted a three-week internship with the Company, making its corporate office in Gurugram my second study site.

3.1.3 Multiple Villages around Barabanki, Uttar Pradesh

As part of my internship with the Company, I requested the chance to visit company-affiliated farmers. I was informed that the Company had 'nodes' of operation in several Uttar Pradesh locations, including the city of Barabanki, where it had made significant inroads with farmers. Barabanki, the birthplace of my father and the town of origin of my paternal grandmother, offered me the logistical convenience of arranging a visit there on short notice. Importantly, since Uttar Pradesh falls within the Hindi-speaking belt of India, I would not need

to arrange for a translator, which would be difficult under the time constraint. Since the purpose of my visit was to observe and learn about the company's on-the-ground operations (as opposed to investigating company criteria for choosing its geographies of operation, which I had already done at the corporate office), Barabanki appeared to be as good of a location as any.

3.2 Methods

My methods for this research combine semi-structured interviews and surveys with participant observation. This combination of methods arose from the unique trajectory of my fieldwork because of unexpected findings and changes in direction. Due to finite time in the field and unanticipated pivoting, my interviews are limited, and I seek depth and context. I divide my fieldwork into three legs. First, I spent two weeks in Kanwari village near Hisar, Haryana. Next, I spent two weeks in the Company Office in Gurugram, Haryana. Finally, I spent one week visiting villages outside of Barabanki, Uttar Pradesh. I summarize my research methods for each location below:

3.2.1 Kanwari Village, near Hisar, Haryana

In this location, we gathered information from farmers using semi-structured interviews, with the assistance of a translator. Interview participants were selected using the snowball method, beginning with contacts of the Haryana Vigyan Manch (HVM), the non-governmental organization that facilitated my research in the village. We aimed to interview farmers from both upper- and lower-caste segments, to gain a comprehensive perspective about social relations, values and beliefs, and digital technology use across social stratifications. We conducted 12 upper-/middle-caste interviews and 7 lower-/middle-caste interviews. We were unable to gain equal representation between men and women farmers. Although their spouses often participated in the conversations with us, men farmers were the primary respondents in 17 of the 19 interviews.

3.2.2 The Company Office, Gurugram, Haryana

Next, I conducted a three-week internship at the corporate office of a leading Indian agritech firm. The first two weeks were spent in-office, while the last week was spent visiting affiliated farmers and shopkeepers. In the office, I conducted four unique, semi-structured interviews with company executives, to learn about the company's values and operations under each. Participants were selected based on the recommendation of the main executive I was in contact with; executives interviewed were those directly overseeing services for affiliated farmers and shopkeepers. While in the office, I also relied on participant observation and casual conversations with company employees to inform my understanding of company operations.

3.2.3 Multiple Villages around Barabanki, Uttar Pradesh

In this location, I relied heavily on participant observation to enhance my understanding of company operations 'on the ground'; specifically, I observed the dynamics and interactions between on-the-ground company employees and the farmers and shopkeepers they were working with. Although I had also designed a questionnaire, this primarily served to facilitate a basic understanding of farmer attitudes towards the company's presence and services being offered. Participants were selected by the company extension employee and conversations were conducted in his presence. Although this arrangement undoubtedly impacted my findings, it also provided an opportunity for me to observe candid interactions between the two parties.

3.3 Autoethnography

Given the unique combination of experiences and methodological variation that nonetheless paint a larger picture about the implications of Indian agritech for smallholder farmers, I chose to report my findings in autoethnography, drawing heavily from my fieldnotes and participant observation in addition to data derived from my questionnaires.

Autoethnography is summed up by Adams, Holman Jones, and Ellis as "stories of/about the self told through the lens of culture" (2014). It may include sharing emotional experiences with a wider audience or performing theoretical analyses on social issues and often involves a combination of evocative and analytic components (Kaufmann, 2020). Data that informs autoethnography ranges in abstraction. Kaufman (2020) observes the challenges of writing autoethnography in a neoliberal research paradigm that favors positivistic methods and scientifically based research, resulting in the devaluation of such an approach.

While it is not highly structured, the inclusion of procedural details that help the reader understand how the researcher arrived at the story is important to ensuring reliability, validity, and generalizability in the context of the method (Cooper and Lilyea (2022). Quality in autoethnography is measured by its ability to "[contribute] to knowledge, [value] the personal and experiential, [demonstrate] the power of storytelling, and [take] a relational and responsible approach to research and representation" (Adams et al., 2014).

Autoethnography can be a powerful tool to change the way people understand the world around them. It simultaneously gives voice to a wider range of research perspectives stemming from differences in race, gender, sexuality, age, ability, education, or religion, while also being more accessible than canonical research writing because of its engaging and reflexive narrative

style which functions through “thick description” of personal and interpersonal experience (Ellis et al. (2011). Ellis et al. (2011) highlight autoethnography’s ability to “acknowledge and accommodate subjectivity, emotionality, and the researcher’s influence on research, rather than hiding from these matters or assuming they don’t exist.” Ultimately autoethnographies are stories of hope, in which the author is a survivor of their story (Ellis, 2013).

Chapter 4 Findings and Discussion

This chapter presents my findings as they relate to Research Questions 1-3. To process these findings, it is important to understand the operating contexts in each subsection. In 4.1, I communicate the Company's business model as illustrated by Company chief executives. In 4.2, I describe my interactions with Company-affiliated farmers and micro-entrepreneurs. In 4.3, I take a comparative approach to my experiences in rural villages to support my conclusions. In 4.1-2, I provide my discussion after presenting my descriptive results. In 4.3 the discussion is integrated with the results.

4.1 Agritech Business and Operating Models

In this section, I report key findings from four executive interviews during my brief internship with the Company to show how it conceives of its own business and operating model. I then discuss these in the context of critical literature on global risk management (GRM) and platform agriculture to illustrate the potential implications of such models for their recipients.

4.1.1 Company Services: Farmers, Micro-Entrepreneurs, and Institutional Buyers

An HR orientation introduces the company's mission, services, and organizational structure: The Company was founded by IIT and IIM alumni in 2012, 'with a vision to leverage technology to raise the income of farmers.' To do this, the company offers farmer services that span the entire cultivation cycle. These include soil testing, agricultural advisory, agri-input sales, financial services including credit and insurance, harvest procurement, and market access.

Every affiliated farmer is connected to a Company Center, a local retail outlet that offers products, services, and agricultural knowledge to farmers. Farmers can visit the Center in person, connect through the Company's Farmer App, or call using the Company's Farmer Hotline.

Company Centers are managed by micro-entrepreneurs and local shopkeepers whom the Company has approached to facilitate its farmer services. Micro-Entrepreneur benefits include easy procurement of products from a single digital platform via the Micro-Entrepreneur App, access to financial credit, and digital tools that record product sales to develop analytics.

Besides services for farmers and micro-entrepreneurs, the Company also caters to institutional buyers seeking fresh produce which the Company procures directly from farmers.

The company has a diverse organizational structure to perform this range of activities. Major departments include agri-input, agri-output, agri-extension, finance, agri-tech, network expansion, new initiatives, tele-advisory, and management information systems. The agri-input department, involving the sale of agricultural products to farmers, is most mature, enabled by the company's expertise in setting up sourcing partnerships with global input manufacturers.

4.1.2 The Bigger Picture: Solving Information Asymmetry

An interview with Company Executive A reveals a broader vision behind the Company's 'Seed to Market' digital platform model: solving information asymmetry between local and global agricultural markets. Executive A draws a diagram (Figure 1) to illustrate information asymmetry between local and global actors in the agricultural sector, and how the Company model seeks to reduce it, thereby providing benefit to all involved actors.

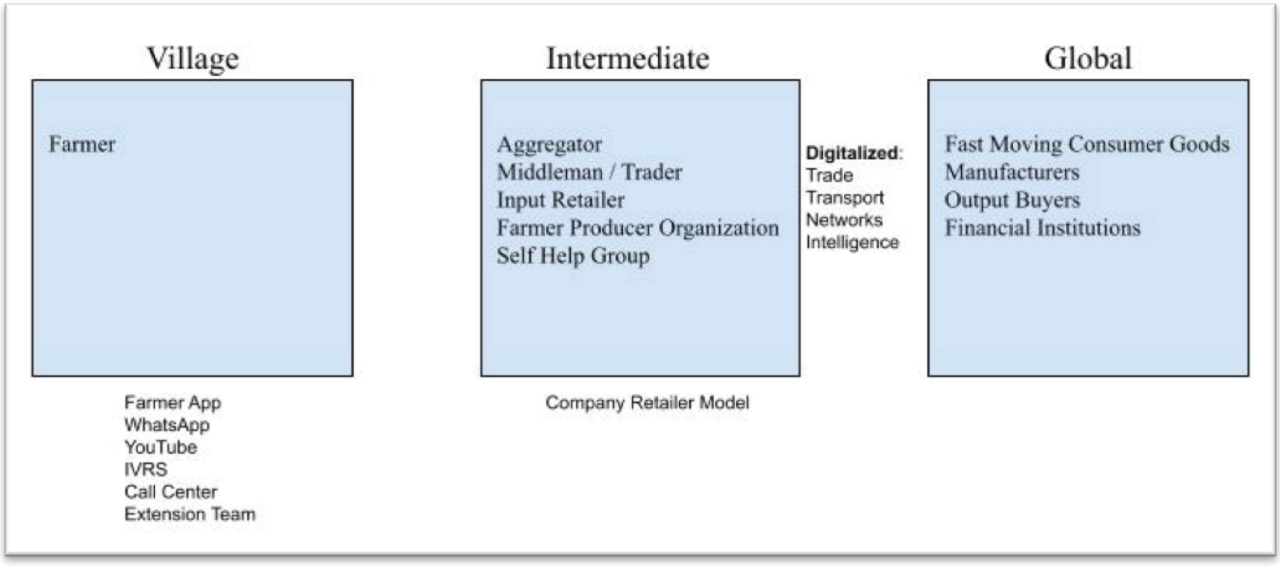

Figure 1. Information Asymmetry in the Indian Agricultural Sector (diagram by Executive A)

The diagram shows three groups of actors. The left-most group includes individual farmers, the right-most group includes global industry participants, and the middle group includes various aggregators and middlemen that connect the right and left sides. Today, the actors in this middle group are informal, Executive A explains. This results in a dearth of information between farmers and global industry participants.

The Company seeks to 'digitally formalize' the middle group through its Micro-Entrepreneur model, thereby streamlining information between farmers, aggregators, and global industry participants. This way, financial institutions will know whom to lend to, insurance companies will understand where risk lies, and agricultural input manufacturers will track farmer demand. Executive A elaborates on the value of information for agricultural companies:

> Agriculture is so variable…There's a pest attack over here? It's a seven-day opportunity for all the agricultural companies in that area. Now, if they don't have any kind of formal party, they'll never get this information unless they devote their resources to the ground, which is not all scalable…there cannot be any company which can put one person in every village.

- Company Executive A

The Company has enacted the process of digital formalization by establishing a Company Center for every group of villages. These are intended as 'one-stop shops' where farmers can purchase inputs,[11] opt into company services, and sell their produce. Micro-entrepreneurs managing these centers are equipped with digital tools and systems developed by the company, enabling them to formally streamline distribution and aggregation between farmers and industry.

To farmers, the Company offers both digital and in-person resources for advisory services around cultivation, input products, financial services, and market features. Digital tools include the Farmer App, WhatsApp, YouTube, IVRS, and hotline. The Company's field extension team serves as a physical touchpoint for farmers.

4.1.2.1 Enablers to Reach the Broader Market

To comprehensively address information asymmetry and connect farmers, aggregators, and global industry, the Company provides methods for 'digitalized trade, networks, transportation, and intelligence' to industry participants. Executive A elaborates on each:

Trade

Trade is enabled through the Company's sale of agricultural products through its digital platform and physical centers. Micro-entrepreneurs stock their shelves by ordering online from

[11] Products sold include seeds and agrochemicals, primarily from multinational input manufactures. A limited selection of products are of the Company's own brand.

the Company, which in turn sources directly from global agricultural input manufacturers.[12] Farmers gain timely access to branded and quality inputs in their local shops.

Networks

Networks developed by the Company are made accessible to global input manufacturers seeking to promote their products. Executive A explains that a product notification can be sent to the Company's network of nearly 2 million farmers within a single click, or IVRS call.

Transportation and Infrastructure

Last-mile transportation and infrastructure are supported by the Company for both pre-harvest and post-harvest supply chains. Examples include the building of district-level warehouses for agricultural input delivery, and the sorting, transporting, and digital invoicing of agricultural output for food industry buyers (which informal traders may be unable to do). The Company has infrastructure in roughly 160 districts or one-third of India.

Intelligence

Business intelligence reflecting agricultural variations due to climate and other factors is offered by the Company to help input manufacturers, post-harvest buyers, and the banking and insurance industry underwrite risk. Intelligence includes crop health and production statuses, and the potential impact of forecasted weather on the farmers' decisions to buy or sell.

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[12] Top global agrochemical companies include Syngenta, Bayer, BASF, Corteva, and UPL, (Huang, 2023).

For example, intelligence of delayed sowing due to floods in a particular region may lead a seed manufacturer to change its distribution strategy. Conversely, farmers working with a shortened cultivation timeline due to flooding would need to shift to short-duration seed varieties. The Company would work with seed manufacturers to provide these to its micro-entrepreneurs serving the impacted areas.

In the same example, actors in the food processing industry would receive intelligence that a region may not supply enough produce, helping them to adjust their procurement, storage, and processing accordingly.

4.1.2.2 Addressing Six Conditions of the Agricultural Sector

Executive A explains that managing information asymmetry will facilitate industry-enabled solutions that address six key agricultural conditions, as viewed from the agritech industry perspective (Table 1). These constitute the 'problem statement,' of the agritech sector; the set of constraints that many firms see themselves working within. He also provides examples of Company solutions to each condition (blue text).

Table 1. Six Conditions of Agriculture from the Agritech Industry Perspective

	Condition	**Description**
1	Owners, Tenants, & Sharecroppers	Around 60% of farming in India is performed by tenants and sharecroppers, not landowners themselves. Company insurance products to landless sharecroppers ensure their livelihoods do not suffer due to climate variability or other crises.
2	Landholding Size	Landholding size per farmer is decreasing, as farmers have divided their land between their multiple children for generations. Company solutions are tailored to smallholders. Inputs are packaged in small quantities, local centers reduce the burden of travel, and advisory services are free of cost.
3	Cropping Patterns	Monocultures or two-crop polycultures are problematic, resulting in lower crop yield and higher water usage, affecting the climate. The company extension team introduces new ideas and training to farmers regarding crop selection. These focus on high returns, marketability, and low water use, to benefit farmers and raise India's image as a globally competitive nation through its expertise in market qualities and export compliances.
4	Digital Adoption	Digital adoption is low, given the higher average age of the Indian farmer (42-43), and less youth interested in agriculture. This results in missed opportunities for credit and insurance through neobanks. Company investment in digital tools for farmers and micro-entrepreneurs has resulted in the latter now conducting 95% of payments digitally.
5	Climate Risk	Given climate change, 56% of the Indian landscape is at high risk of droughts and floods. Company inputs are bundled with parametric weather insurance, thus becoming a convenient partner for insurance companies.
6	Market Linkage	Smallholders have low yields and less power to negotiate transportation costs. Thus, they depend on middlemen or the government. Pre-harvest, Company seeds and agrochemicals cover roughly 1.8 million hectares of India. Post-harvest, the Company procures 4,000 metric tons of produce daily across 32 commodities from smallholders.

Of these six conditions, Executive A places primary emphasis on digital adoption, which he says will enable farmers to use neobanks, compare financial offerings online, and address urgent agricultural needs. Through neobanks, farmers can avail of digital Know Your Customer (KYC) documents that will verify them in the eyes of banks and insurance companies. This would allow farmers without prior financial experience to participate in credit and insurance programs. Farmers can also compare these financial offerings online to make informed decisions. Lastly, digital adoption can help farmers address urgent needs, such as claiming insurance for a pest attack, and knowing which agro-chemicals to apply. In Executive A's perspective, farmers who are neither financially nor digitally resourceful experience the most losses.

4.1.3 Company Visions and Values

Conversations with executives in charge of the agricultural extension, farmer services, and financial services departments further illustrate the operational vision and values surrounding the Company's work with farmers and micro-entrepreneurs. Executives speak to gaining farmers' trust and expanding their services and financial offerings.

Agricultural Extension

Executive B oversees the dissemination of agricultural and company product/service information to farmers through the agricultural extension. An advocate for private over state extension bodies, he believes that the private sector has a far higher stake in farmer adoption of products and techniques than the state service, which receives a salary regardless of farmer adoption. Nonetheless, the Company never forces agri-input sales on farmers, nor compels farmers to join, he explains. Farmers are free to join if they see value in doing so, and the Company positions itself as more than just a seller to overcome farmer distrust:

> Gaining a farmer's trust is not easy. There are many agri-input companies. Their representatives [approach] farmers with their products, but farmers are often confused. All companies [say] that their products are the best. It is hard to gain the trust of farmers if I go as a seller. The Company is not purely an agri-input company. Agri-inputs are the last thing a Company representative will [mention to a farmer]. If he's meeting a farmer for thirty minutes, the last two minutes will be spent talking about agri-inputs.
>
> - Company Executive B

Executive B further explains that for farmers to trust the Company the way they trust traditional middlemen, the Company must work with the farmer throughout the entire cultivation cycle. Middlemen are like farmers' personal bankers. Only by enacting a similar holistic approach can the Company procure directly from farmers.

Interestingly Executive B denies any relationship between farmer caste and access to extension services, as shown by Krishna et al. (2019). He states that the only factor affecting a farmer's access to Company services is the farmer's ability to pay for the service.

Farmer Services

Executive C oversees all company initiatives pertaining directly to farmers. He explains that his department strives to design a 'journey' for participating farmers, 'in which the use of one company service leads to the next.' Currently, it is developing an agri-input delivery service that would bring products to a farmer's doorstep for an extra fee. He elaborates on his vision for farmer adoption of the Farmer App concerning planned and unplanned purchases, and home delivery:

> The core idea is not [just] to push users to use apps. Company Centers are [still] available for them. The purpose of the application is to capture unplanned purchases – the purchases that happen in emergencies under travel or time constraints. The farmer would theoretically use the app to get something delivered to his home if he couldn't leave the house due to

> water-logging, had a time constraint, or another emergency…The farmer has to pay for the extra convenience of home delivery.
>
> - Company Executive C

Financial Services

Executive D oversees the development of all financial services for affiliated farmers and micro-entrepreneurs. “There is a lot of potential to create financial services for the entire ecosystem,” he explains.

Currently, the Company provides three financial services: embedded insurance for farmers, financing for micro-entrepreneurs, and financing for farmers. Embedded insurance for farmers bundles parametric weather insurance with agri-input sales, intended to cover economic loss associated with extreme weather. Financing for micro-entrepreneurs provides them with a rotating credit line so they can stock their shelves via the Company and sell products to their customer network. The Company partners with financial institutions that facilitate the credit line for micro-entrepreneurs, who in turn pay off the loan over time. Financing for farmers provides them with closed-loop credit so they can purchase products available at Company Centers. ‘Closed loop’ means that farmers cannot use this credit for any other purpose. This credit line is extended to farmers through micro-entrepreneurs, who bear interest on any unpaid loans and are thus incentivized to select ‘credit-worthy’ farmers.

4.1.4 Discussion

In the following section, I discuss my findings from the Company considering critical scholarship in Global Risk Management (GRM), and digital agricultural platforms. The GRM framework provides context for the Company’s financial offerings to farmers and shopkeepers.

A critical analysis of GRM reveals that it functions as a neoliberal mode of governance that normalizes the structural violence inherent to financial capitalism, thereby exposing vulnerable populations to greater risk of market discipline (Soederberg, 2016). Scholarship on digital agricultural platforms draws attention to how platforms enact performativity, thereby attempting to steer users towards behavior that aligns with their economic models in which individuals function as rational, self-serving decision-makers (Brooks, 2021; Mann and Iazzolino, 2021). Together these offer a theoretical basis for analyzing Company perspectives and operations.

I conclude that although Company employees may personally desire to help farmers, the company model embodies a neoliberal capitalist paradigm that puts farmers and shopkeepers at greater risk of structural violence through market discipline (and therefore higher levels of precarity) while serving global agribusinesses, financial institutions, and actors in the food processing industry.

4.1.4.1 Global Risk Management: A Neoliberal Development Paradigm

The executive interviews reveal that digitally enabled financial services are central to the Company model, giving rise to questions about their efficacy and legitimacy as solutions to aid precarious populations.

Individual financial protections such as credit, savings, and insurance, have been promoted as ways of managing economic risk by development organizations like the World Bank, World Economic Forum, and UN Habitat since the mid-2000s. They are part of a larger risk-management framework known as Global Risk Management (GRM) that addresses societal risks pertaining to social, environmental, public health, and financial crises. Critical scholarship,

however, draws our attention to how GRM functions as a neoliberal mode of governance that normalizes the structural violence of financial capitalism (Soederberg, 2016).

GRM performs neoliberal governance by reducing risk to economic calculations to be managed through individualized, market-based strategies. At the level of individuals and households, GRM assumes that given 'good governance' and the right financial tools, even the poor can turn livelihood risks into opportunities. Soederberg explains that part of GRM's aim is to incentivize the most precarious populations to embrace risks in ways that turn them into value-creating opportunities, namely through the use of credit, savings, and insurance:

> Good governance will allow individuals, including households, to make decisions in a way that will reduce risk exposure. The primary means by which risk reduction occurs is through individualized means: the market, particularly financial markets. The latter are purported to provide important features whereby the poor can forge new freedoms by engaging in constructive risk-taking through key instruments such as credit, savings, and insurance (Soederberg, 2016: 10).

Risk, therefore, is no longer about harm befalling precarious individuals, but about opportunities waiting to be forged with human beings' entrepreneurial spirit. Further, Soederberg argues that GRM normalizes structural violence in two ways. First, "GRM projects that those made vulnerable by financial capitalism seek protection through highly individualized and privatized means thereby *voluntarily* exposing themselves to market discipline in the form of interest rates, making regular credit payments by engaging in any type of work for the requisite length of time, and so forth" (Soederberg, 2016: 12). Second, GRM erases the relationship between financial capitalism and increasing inequality, instead blaming weak governance, yet without the latter's historical context.

Drawing from the executive interviews, I show that Company operations are based on the GRM framework, thus aiming to provide recipient farmers and shopkeepers with a gamut of individualized, financial services in the name of risk management.

Company executives make several statements to this effect. In discussing the farmer population, Executive A expresses that farmers who are neither financially nor digitally resourceful experience the most losses. Embedded in this statement is the expectation that farmers should manage their livelihood risks through the individualized, privatized means of digital tools and financial infrastructures. In discussing his role as the head of Financial Services, Executive D expresses that he sees potential to develop financial services for the entire ecosystem, reflecting the Company's tendency towards the financialized management of all risk. In another instance, Executive A describes the Company's solution for landless tenant farmers: crop insurance that will ensure that the losses they face will not leave them lower than when they started. Explaining that it has never before been available to them, he frames privatized crop insurance as a solution sought after by landless farmers, thus positioning them as voluntarily exposing themselves to potential market discipline, e.g. an insurance claim not accepted.

Company services speak for themselves concerning adherence to the principles of GRM. Financial services include credit for micro-entrepreneurs and farmers and insurance for farmers. Although these are framed as valuable, sought-after offerings, Soederberg's analysis indicates that recipients may well participate in them for lack of better options. For example, a cash-stripped farmer may utilize the Company's farmer credit out of necessity. A local shopkeeper may accept the position of Company micro-entrepreneur for lack of better options. This does not mean such offerings are individuals' preferred options or the best solutions to help them achieve

livelihood stability. It is indeed individuals' vulnerability created by financial capitalism itself that places them in positions in which financial services are their only options. Ironically these approaches are known to increase vulnerability among precarious populations.

4.1.4.2 Digital Agricultural Platforms: Behavioral Economics as Development

The executive interviews also provide a detailed picture of the Company's model, which operates through both a digital platform and ground extension team to deliver services to farmers and shopkeepers that span the entire cultivation cycle: 'From Seed to Market.' In the context of previous failed attempts to incorporate the poor, this expansive and unprecedented model necessitates inquiry into its true beneficiaries and long-term impacts.

Recent scholarship on digital agricultural platforms calls attention to two primary characteristics of platforms. First, they emphasize how platforms employ lessons from behavioral economics, seeking to turn users into predictable and obedient market subjects amenable to manipulation by global agro-industries. Second, they describe the "locking in" of users to all-encompassing closed loops systems that concentrate market governance away from the state, and into the hands of individual "corporate leviathans" (Brooks, 2021; Mann and Iazzolino, 2021). I divide my analysis of the Company's model broadly by these two characteristics, building upon existing scholarly analysis.

Behavioral Economics in the Company Model

Behavioral economics shares much of its framework with neoclassical economics but varies in its approach to individual market actors. Rather than assuming they are rational, behavioral economists believe that individuals think automatically, socially, and according to

mental models (Brooks 2021). Their goal is to steer individuals towards rational, self-serving, economic decision-making, based on market indicators, thereby enabling the success of neoclassical economic models (Mann and Iazzolino, 2021).

Agritech platforms enact what Mann and Iazzolino coin as "'infrastructural performativity'…the use of infrastructural arrangements to compel human behavior in line with a given theoretical model or paradigm…[capturing] how economic theory does not just describe the economy passively from the outside, but rather helps to 'perform' and constitute it from within" (Mann and Iazollino, 2021: 832).

Agritech platforms seek the alignment of users with their theoretical models of development, thereby constituting their inclusion into a formal economy. Brooks calls it 'the rise of the digital farmer,' a development subject that requires financial and digital inclusion to grow into a (governable) entrepreneur. Ground extension services assist with subject-steering when the neoliberal theories of platform developers fail (Mann and Iazollino, 2021).

Language and statements from the executive interviews demonstrate buy-in to the behavioral economics model. Executive A states that farmers cultivate what is in their comfort zone and are required to be taught to try new approaches. Executive B explains that no farmer is compelled to join the Company, but rather, free to engage if he feels there is value in doing so. Executive B expunges the relationship between caste and access to extension services, stating that access is only a matter of what a farmer can afford. Through these statements, he establishes the farmer as a self-serving decisionmaker and negates any sociological barriers to the success of the neoclassical economic model. Executive B also speaks to the psychology of farmers, explaining that the farmer is confused by and distrustful of the number of companies that

approach him with inputs and that he desires continuity throughout the agricultural cycle. This attention to farmer psychology is part of the Company's enacting of behavior change.

Within the Company, behavior change is often framed in terms of digital adoption, with the expectation that given the widespread uptake of smartphones, farmers will quickly grow into savvy entrepreneurs. Executive A explains that the Company invests in digital tools for this reason. However, as one Company employee alludes to, it is not just general adoption that is sought. It is the adoption of the Company's platform and operating system. Individuals are then expected to refer to the technology as the benchmark and stick to it in the same way that most view themselves as either Apple or PC users. Digital adoption also enables the development of analytics to be sent to the Company, further enhancing its performative power.

Within the Company model, there are many ways in which individuals are 'steered' towards behaving like rational, self-interested consumers. This steering can occur through nudges by the extension service, the design of goods and services (including bundling), and even the threat of market discipline. I elaborate on each of these methods.

The Company's extension service is a powerful mechanism by which farmers can be steered towards becoming 'good market subjects.' Both Brooks (2021) and Mann and Iazzolino (2021) refer to digital agricultural platforms that partner with external agricultural extension services (e.g. government). However, the Company's extension service is internal, enabling even greater alignment with the Company's goals for market subject creation. Nudges from Company extension personnel may lead farmers to invest in seed and agrochemical products promoted by the Company, in addition to participation in financial and other services.

The design of Company goods and services involves a tendency towards 'convenience,' which encourages and compels farmers to invest beyond what they may be able to afford. Examples include small packages of inputs suitable for smallholders, door delivery of inputs for an added cost, and parametric weather insurance bundled into agri-input sales. None of these features are essential for smallholders and can therefore be viewed as convenience features the Company is attempting to promote. Given they are not essential to farmer livelihoods, any compulsion experienced by farmers to partake represents a form of extortion, as the power dynamic between individual farmers and the Company greatly favors the latter. Encouraging farmers to invest in extra conveniences beyond what they can afford further steers farmers towards a culture of living beyond their means, unmistakably not in their best interest.

Lastly, behavior change can occur through the threat of market discipline, also within the design of Company services. Executive D explains that the micro-entrepreneur is incentivized to offer farmers credit because it will bring business to his store, but he is also incentivized to choose the 'correct' farmers to lend to because he will pay the interest on any unpaid farmer loans. He is thus being steered to participate in social sorting that deems farmers 'correct' or 'incorrect,' and incentivized to behave in a purely self-interested manner that will affect his relationships with farmers.

All-Encompassing, Closed Loop System

A second feature characterizes digital agricultural platforms according to scholars:

> …a fully encompassing closed loop system, through which all [farmer] activities, transactions, and relationships are captured. The more complete this picture, the more accurate and authoritative the paradigm's model becomes (Mann and Iazollino, 2021: 833).

The ability of a system to accurately and authoritatively predict these activities and transactions increases its performative power, which in turn enables it to become more accurate and authoritative (Mann and Iazollino, 2021). This cycle of increasing domination and control over farmer livelihoods has grave implications for farmer sovereignty and the impacts of incorporation into circuits of global capital. The Company's all-encompassing closed-loop system is euphemized in the idea of a 'journey' for farmers in which one service leads to the next," as expressed by Executive C.

Farmer sovereignty is affected by reducing a farmer's freedom to make their own livelihood decisions, partially due to nudges and coercion from the Company extension, and partially through the Company's system design. For example, although platforms claim to be farmer-centered, they engage in the bundling of goods and services, thereby improving business for corporate partners like input suppliers, insurance companies, and financial institutions, while reducing farmer maneuverability in the name of incorporating them into value chains (Brooks, 2021).

The Company's closed-loop credit for farmers offers credit that can only be used on agricultural inputs from Company Centers. Many farmers are unable to take out loans or get credit elsewhere. This vulnerability gives the Company greater power to carefully control how it extends credit. Furthermore, this financing is facilitated through the micro-entrepreneur, who pays the interest on any unpaid farmer loans. This system design ensures that the farmer is limited to Company products while distancing the Company from lending risk.

The all-encompassing, closed-loop system also impacts the nature of farmers' incorporation into circuits of global capital, by giving the Company power to connect global

industry to farmers at multiple junctures. Executive A describes four areas in which the Company seeks to bridge the gap between industry and farmers: trade, transport, networks, and intelligence. I highlight some potential implications for farmers in each of these four areas.

Trade

Through the sale of agri-inputs and financial services to farmers, the Company creates trade opportunities for agribusinesses and financial institutions. Executive B explained that agricultural input sales ensure the Company's financial sustainability. Product bundling and the Company's commission as the middleman raise the price of inputs sold to farmers.

Furthermore, there is the question of the Company's contracts with its partners swaying action in favor of industry over farmers. Should the Company promise to secure a given percentage of a supplier's demand, will it push more input sales on farmers? There are few regulations in place to ensure that the Company is not working for the global industry players at the expense of farmers and shopkeepers.

Transport

The Company builds storage and transportation infrastructure (warehouses and last-mile transportation) to deliver inputs and collect harvest to and from its Centers, thus eliminating traditional middlemen. Input delivery is a more mature business model than output procurement, which multiple executives and employees noted is difficult to break into. Still, the Company hopes to begin collecting harvest from farmers shortly.

Unexplored by scholars is the impact of these supply chain disruptions on traditional middlemen and their relationships with farmers. How do these relationships change and what are

the implications for farmers who wish to return to traditional methods of input and output procurement after having worked with the Company?

Networks

The Company makes its farmer network available to industry players seeking to promote their products. Frequent exposure to product advertising, particularly if broadcasted through channels that farmers trust (such as the Company), could result in an overreliance on agrochemicals and products rather than cultivation best practices. Indeed, one scholar notes:

> In the context of increasing commercialization of agriculture, the intensity of competition among agri-business players and the growing distance of State extension services have meant that agricultural practices are increasingly drawn from market-led fads. The result is intense competition among agriculturalists to out-compete others by using new commercial varieties of seeds, fertilizers, and pesticides which has also led to increasing 'agricultural deskilling'" (Vasavi, 2009: 98).

The sharing of farmer networks with agribusinesses thus places additional power in the hands of the latter in terms of accessing and targeting farmer populations with products.

Intelligence

Using app analytics and in some cases, hard copy insurance forms, the Company makes aggregate intelligence available to global industry players, enabling them to track farmer demand and be notified of changes due to weather and/or pest and weed outbreaks. Executive A identifies a pest attack as a "seven-day opportunity for all the agricultural companies in that area," reframing a livelihood risk for farmers as a profit opportunity for agribusinesses. Thus, such intelligence does more than simply matching supply with demand. It enables corporations to gaze upon farmers in distress as a market willing to pay higher prices to manage an emergency.

With added intelligence, industries can target and capitalize on vulnerable populations in times of crisis.

In these four areas, the Company makes Indian smallholders accessible to the global industry, enhancing its power to capitalize on vulnerabilities and disrupt traditional ecosystems. The all-encompassing closed-loop system also has the effect of concentrating power within the Company, by securing a monopoly over a farmer's livelihood. Once a sufficient number of farmers are secured within the system, the Company can make self-serving changes to its pricing and structure. For example, advisory services may be offered at no cost initially but become more costly as farmer dependence on them increases.

Scholars insinuate that put together, platform performativity and closed-loop systems, have dangerous implications for farmers. Of Kenyan agritech platforms, Mann and Iazzolino write:

> Developers hope to lock farmers into closed-loop systems through which they can be disciplined and through which outside investors can be assured of the return on their investments (Mann and Iazzolino, 2021: 830).

While this framing of intent may not be shared by all agritech platform developers, the ultimate effect sought is that users and their activities are more predictable to, and manageable by global industry participants, for whom they constitute markets. Behavioral training and market discipline are inherent to this agritech endeavor.

A final observation related to digital agricultural platforms is their role in facilitating "imaginaries of modernity" engendered by the state (Meagher, 2021: 748). Mann and Iazzolino observe this in Kenyan partnerships between the state and agritech platforms. This also appears

in Company rhetoric. In multiple instances, Executive A alluded to nationalist goals: to make India appear as a nation that is aware of export regulations and can export/reap benefits from the global market. Modernity is also encapsulated by the notion of universal digital adoption, as presented through the Digital India campaign. This angle of nationalism is an unexplored factor in the literature about the motivations of agritech companies but offers the possibility that sociotechnical imaginaries of the Indian state can be observed in the ideals of indigenous agritech corporations, particularly those seeking to facilitate a paradigm shift.

4.2 Agritech-Affiliated Smallholder Farmer and Shopkeeper Experiences

This section presents and discusses findings based on interactions with affiliated farmers and micro-entrepreneurs in the context of literature on sociotechnical imaginaries and accumulation.

It is the first morning of fieldwork in Barabanki, Uttar Pradesh, the town of origin of my paternal grandmother and the birthplace of my father. I am fortunate to have the support of my extended family. My brother and I are staying with my grandmother's niece in Lucknow, and her nephew has arranged a taxi for our excursions into the villages outside of Barabanki.

We set out after breakfast and drive for an hour. Uttar Pradesh is far less dry than Haryana. Instead of shades of brown, it is all shades of green. We finally arrive at the Company Center where we are to meet the company extension manager. He will travel with us in the taxi and guide our visits to company-affiliated farmers and shopkeepers.

Figure 2. Left: Front view of a Company Center near Barabanki. Right: Company offerings to farmers painted on the wall of the center: seed, fertilizer, insecticide, crop insurance, soil testing, agricultural advice, market.

The Center is a small green-and-white painted shop. Inside are shelves neatly stocked with a variety of agricultural products. The outer walls bear posters and text describing the company's offerings for farmers in Hindi, in addition to its farmer hotline number.

The extension manager finally arrives on his bike. He is younger than I expected, perhaps in his mid-twenties. We conduct brief introductions outside, before proceeding into the Center to meet the micro-entrepreneur for the first interview.

Over the course of three days, we interview six farmers and six shopkeepers in various villages within the Barabanki district. All twelve respondents were born and raised in their localities. All have begun their affiliation with the Company within the past year, the period the Company itself has been working in the region. Throughout these interviews, I face the competing pressures of eliciting authentic feedback from my respondents, without offending the extension manager, whom I depend on to travel with us and arrange our conversations.

4.2.1 Farmers

We interact with farmers through home visits and two Company-sponsored farmer group meetings. Our semi-structured interviews center on farmer experiences working with the Company, including the various services they are using, and their rationale for participation.

The interviews reveal that participating farmers have an appreciation for the Company's one-stop-shop model, which provides continuity in support through the entire cultivation cycle. They suggest that this sense of continuity is particularly valuable in the context of limited government/extension support to farmers, and unreliable private companies that sell individual products or services, enabling farmers to develop trust in the Company. Although the extension manager mediates most of our interactions, his presence in the conversations creates the opportunity for me to observe the relationship dynamics between him and various farmers. While he appears on amicable terms with most farmers, his interactions also contain elements of paternalism and coercion concerning farmer participation in Company offerings.

4.2.1.1 Relationship-Building through the One-Stop-Shop Model

Farmer experiences with the Company vary, with two of six interviewees participating in all available Company services, and the rest participating to lesser degrees. Concerning the perceived benefits of working with the company, farmers refer to the company's one-stop-shop model and unique offerings. One farmer explains:

> There is a Company Center, so we are benefitting from that. Before that, we used to have to go here and there to different places. And now the supplies are available there, as well as other things we need. Seeds and advisory, farming-related services.
>
> - Farmer A

Another states that the Company offers unique services and a diverse range of products on a single platform:

> Companies such as X have come here. But those services which the Company offers, no one else is offering. For example, geo-tagging. No company is offering geo-tagging. Other companies offer one thing and leave. For example, they give seeds and leave… Here you get everything in one platform. Other companies only offer their products. This company has all the acquired products, so it's a one-stop shop.
>
> - Farmer B

Aside from his appreciation of the one-stop-shop model, Farmer B contrasts the Company with others that "offer one thing and leave." His language is indicative of an important insight concerning the Company's appeal to farmers: it is not just the Company's wide range of agricultural products and services that engages farmers, but also (and perhaps more importantly) that it remains a permanently accessible resource for farmers. The Company does not leave; it stays. Thus, the Company model offers both temporal continuity as well as continuity of service provision within the cultivation cycle.

This bears significance in the context of farmer distrust of the private sector, which partially originates from negative experiences with private companies who scam farmers or sell them products with no use and then disappear without any method of recourse. Another farmer elaborates on this distrust:

> The companies say that they will do this, they will do that. For example, with the Company's Starter product, they will advise to apply it to the field…Farmers hesitate to do this without having any guaranteed results because the cost of the offered solutions means a lot to them. They would have to do this on pure faith…Companies do tend to say that they have this product, they have that product. They offer solutions for using less material, but they charge for those solutions, so the net cost savings are not as much. Not all companies have the intention to con, they do however overpromise, without being accountable for the results.

- Farmer C

The lack of accountability on the part of private companies is made worse by the fact that farmers do not often know the products. Another farmer explains that farmers depend on companies to help them understand the use of various agricultural products:

> We've taken agrochemicals to boost production. I have not yet bought their seeds. Just the agrochemicals, or phosphorous, or whatever these people provide. We farmers don't know much about what these things are. They tell us what is useful…that if you add this, you will get this benefit, that benefit... So, we add it.

- Farmer D

In the same vein, another farmer states:

> We believe that what we get from the Company is of good quality, but the rest is up to God.

- Farmer A

These responses illuminate the farmer's predicament of not being able to verify the efficacy of the agricultural products they encounter. At the same time, degraded soil conditions and climate variability leave farmers grasping for straws on how to improve their yields. In this context, a company that frames itself as "here to stay" (Executive A's words) has significant appeal because the trust that it builds with farmers underwrites their decisions to purchase Company products and services. The relational component of the Company's model through the continued presence of the on-the-ground extension service increases the Company's reliability.

The Company extension's efforts to "win and influence" farmers are also visible in other spheres, such as the relative success of the Company's Farmer App. One farmer reveals that using the app was not always easy, but the company improved it over time:

> When I first started using it, I felt like this was not useful. There were some flaws, but with improvements, people started using it more. Now the app has become a lot easier to use. The geo-tagging all happens here, I can do it on my phone.
>
> - Farmer B

There is significance to the app gaining traction despite having initial flaws, as many agritech apps have failed to gain users among farmers from their inception (Faxon, 2023). The Company Farmer App's relative success is likely to be the result of relationship-building efforts by the extension managers. Once relationships are built and trust is established, farmers may be more receptive to the extension's continued advocacy for the app.

4.2.1.2 Coercion and Discipline

Through observation, I begin to understand the relationship dynamics between farmers and the extension manager. In two of our six interactions, I observe farmers rely heavily on the extension manager to facilitate their participation with the company. They assume the role of receiving and following his advice. This paternalistic dynamic is accentuated by the differential in technological proficiency and awareness of financial practices between the parties. In other words, it is stronger with the farmers who seem least digitally and financially savvy.

In one such instance, a farmer who purchased the Farmer Package did not realize he needed to submit coupons to receive discounts in the package. Learning this, he is disappointed at his loss. The extension manager, however, uses the opportunity to promote purchasing through the Company's Farmer App which automatically applies the coupons. He attempts to pressure the farmer into purchasing through the app, as shown in the following dialogue:

> **Extension Manager:** That's why I'm saying, you can order online. In that, what can they do? In that, they have already accounted for the

discount. And whoever delivers the order to you, you simply give him the coupons. And pay 50 rupees less! At least, this convenience is there.

Farmer: Getting stuff all together doesn't cost less. Like this pesticide, I got in the bundle. What do I do with it?

Extension Manager: 600 rupees. Apply one coupon and it will become 550. One coupon you could find at home and bring with you [now].

Farmer: No, I can get it from the shop.

Extension Manager: Why the shop? Get it from here.

Farmer: Let it be, brother. That is too fast.

Extension Manager: The company is giving you this convenience.

Farmer: The company is giving it, but forcefully.

When the farmer finally agrees to purchase the product in person at the Company Center, the extension manager tells him that he will not leave until they make the online purchase. This prompts the farmer to ask why he does not trust that he will follow through, to which the extension manager responds that he does.

Nonetheless, it is significant that the onus is on the farmer to earn the extension manager's trust by making the online purchase. This can be interpreted as in line with the doctrine of behavioral economics, and one way in which the farmer must prove he is a good Company subject.

Beyond coercion, I witness the same farmer undergo a form of market discipline when he is denied Company insurance due to late submission of his claim, albeit for legitimate reasons. The sequence of events is narrated as follows:

A nudge from the extension manager led the farmer to invest in Company wheat seeds. He planted 50 kilograms of wheat and received a good harvest of 20 quintals.[13] The next season, the same variety of seeds yielded only 8 quintals, equivalent to a loss of 12 quintals and 22,000 rupees.[14] The wheat production was impacted by the presence of Phalaris Minor, a dominant weed in irrigated wheat, colloquially known as *Gehu ka Mama* or "Wheat's Uncle" (Kaur et al., 2022).

At the point of germination, the farmer could not distinguish whether the plant was wheat or the weed because of their close resemblance to each other. When he later added herbicide to his field, the weed died, leaving only the wheat. However, his wheat's growth had been severely stunted. When he showed the extension manager, he was told he should have brought up the issue earlier. In the farmer's mind, he had no reason to do so; he genuinely believed the crop to be entirely wheat. Neither had he realized that he could submit a complaint.

The farmer's story sparks an argument between him and the extension manager, who asserts that the farmer should have submitted the claim within 21 days of sowing. He acknowledges that he did not communicate that farmers could formally complain, but questions why the farmer did not still utilize any one of the Company's three feedback mechanisms.

Ultimately, the heated discussion turns to the foundation of the farmer's relationship with the extension manager, which goes beyond the farmer's affiliation with the Company as a

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[13] A unit of weight equal to 100 kilograms.

[14] 22,000 INR is the equivalent of approximately 265 USD, and a significant sum for an Indian farmer.

recipient. The farmer organized introductory community meetings for the extension manager when the Company was first establishing itself in the region. The following dialogue illustrates their attempts to reconcile:

> **Farmer:** I have arranged all the meetings. All of them.
>
> **Extension Manager**: Yes, but there was just this small issue. For that, can I ask for forgiveness –
>
> **Farmer:** No! Why do you –
>
> **Extension Manager:** On behalf of the company! I am an employee of the company, not an individual entity.
>
> **Farmer:** You and I have a brotherhood.
>
> **Extension Manager:** We have a brotherhood. You are joined with the company. I am also joined with the company.

The exchange reveals how the farmer and extension manager each approach their relationship. The farmer does not want an apology from the extension manager; his grievances are with the company, from whom he seeks a refund. When the farmer speaks of brotherhood, he refers to a sense of kinship shared by two individuals. The extension manager, however, introduces the company as the institution through which they share their brotherhood. Although both attempt to reconcile, the farmer does so personally, while the extension manager does so institutionally, but only with rhetoric, not a refund.

The farmer tells me about how this experience impacts his trust in the Company:

> Now I'm undecided. It is worthy of trusting, and at the same time, not worthy of trusting. Understand, this is how it is. You tell me…The timeline is in front of you. The issues, the points, those are in front of you. How can one trust this way? Now if you consider the [extension manager's] personal behavior, after the complete discussion, one can still trust something. Isn't it? But in the given circumstances, how can one trust on this basis?

- Farmer E

In his response, the farmer distinguishes between what is and is not worthy of trust. The loss that he incurred as a result of using company seeds erodes his trust in the Company, while the personal relationship he has with the extension manager maintains it. This case study illustrates the Company's strict adherence to financial policies unfamiliar to farmers, resulting in the latter's 'disciplining' through monetary loss.

4.2.2 Micro-Entrepreneurs

In addition to farmers, we make brief visits to six Company micro-entrepreneurs (MEs). Although the Company's partnership with local MEs is recent, all MEs express general approval of the Company and its operations. As with farmers, it appears that the Company's efforts to build relationships with micro-entrepreneurs pay off. One ME reflects:

> The Company – considering the purpose for which they came – their way of working is good. In the Company, the conduct is good. And in the coming time, we people might even get some benefit.

Among the MEs that I visit, I sense that working with the Company engenders a feeling of dignity. Four of the six MEs name high product quality as a key benefit of working with the Company, with two expressing that they like feeling assured of the quality of their products. MEs are also given special introductions at the Company's farmer meetings where farmers learn of the Company and its offerings for the first time. One ME proudly shows me a small payment device supplied by the Company that accepts payments, prints receipts, and records transactions. My observations suggest that working with the Company holds a degree of social significance.

4.2.3 Discussion

In the following section, I discuss findings from visits to Company-affiliated farmers and shopkeepers in light of critical scholarship in digital agricultural platforms, adverse digital incorporation, sociotechnical imaginaries, and modes of accumulation.

Scholarship on digital agricultural platforms speaks to how platforms circumscribe farmer options, reducing the opportunity for collective engagement in agricultural decision-making, and thereby weakening social connections (Brooks, 2021). An analysis of my observations of Company interactions with farmers further suggests that with respect to this model, as egalitarian ties between farmers diminish, paternalistic relationships with Company representatives grow dominant. The literature on adverse digital incorporation addresses the potential for harm when two parties of unequal advantage enter a digitally mediated economic arrangement. This has relevance for company micro-entrepreneurs, who are deliberately chosen by the Company for their status as poor, small, last-mile shopkeepers. The introduction of sociotechnical imaginaries speaks to the construction of a new social order that privileges Company operations. This occurs through relationship-building efforts by the Company's agricultural extension. Lastly, scholarship on accumulation has relevance for the fact that revenue from agri-input sales to poor and marginalized smallholder farmers maintains the Company's financial sustainability. I conclude that the Company capitalizes on farmer vulnerability and isolation, positioning itself as a source of support for farmers, and thereby reorganizing social relationships around its own financial goals.

4.2.3.1 Farmers

By some measures, the farmer conversations occurred under non-ideal circumstances. The presence of the Company representative meant that farmer responses to my questions were, to an extent, mediated and shaped by the representative's voice. However, in exchange, I was able to witness what I believe to be candid interactions between the farmers and the Company representative. Of these, there is a story to be told.

Despite conversational brevity, the farmers I met communicated in a variety of tones about their approaches to and experiences with the Company. Despite these diverse attitudes, all farmers decided to give the Company a chance. They had in common an appreciation for the company's one-stop-shop business model and the emphasis on long-term relationship-building through its extension service. The 'seed to market' model lent itself to the continuous support desired by farmers. The Company offered a comprehensive variety of products and services, and a knowledgeable in-person contact (the extension manager) available for calls and field visits. The extension manager spoke to this when he explained to me that, with farmers, it was always a dialogue and never a monologue. The Company did not "offer one thing and leave," in the words of one farmer. It offered everything and stayed.

Scholars argue that digital agricultural platforms, by circumscribing farmer options, erode the social fabric of cohesion that arises from collective engagement in agricultural decision-making; my experience further reveals that new ties with the Company become dominant, replacing egalitarian relationships with paternalistic ones. Brooks (2021) postulates that such companies contribute to the erosion of "processes of skilling central to agricultural practice while loosening social ties of mutuality and reciprocity in which such processes are embedded…"

(Brooks, 2021: 374). In this sense, they may be seen as moving rural societies towards "econom[ies] independent of social relations." (Bilgrami, 2023). Bilgrami contrasts this with the pre-capitalist, pre-modern view of the economy as an integral, inseparable part of society, traces of which are still pervasive in rural settings.

My experience visiting Company-affiliated farmers, however, reveals that social relationships have not disappeared from the sphere of economic decision-making among these farmers. Rather, they are reorganized around the company and its presence in the area. Primarily, the relationship between farmers and the company extension manager carries significant weight; the latter can influence the farmer to purchase products, partake in services, and even adjust crop patterns. These relationships however carry paternalistic inflections, as the Company extension manager steers farmers towards making 'correct' decisions through behavioral nudges.

A sense of community around the company is cultivated through its farmer meetings, where those interested may gather to learn about company offerings over tea and snacks, with the local shopkeeper at the helm. Those who join are declared "progressive" by the company, a title endowed as though a badge of honor. In these ways, the Company seeks to create its social order in rural agricultural settings.

The interaction between Farmer E and the extension manager revealed a partnership, for which Farmer E had arranged several introductory meetings for the Company. These acts of relationship building, gaining trust, and exchanging favors are evidence that the one limb of the company – the extension service – is itself becoming wrapped up in, and must navigate the principles of pre-capitalist moral economy to achieve its aims. However, the high-level

institutional policy continues to follow principles of market discipline, as we see with the inflexibility of the company's insurance policy for wheat.

Although Farmer E and the extension manager interact as equals, the latter is a Company employee with the authority to enforce company policy, and therefore in a position of power. We might ask whether company strategies will result in distressing situations for farmers as they proceed with relationally underwritten decisions but are later disciplined by unforgiving and inflexible company financial policies. As discussed in the literature on adverse digital incorporation (Heeks, 2022), these risks only increase with digitally mediated transactions, such as the farmer platform and fintech services offered by the Company.

The Farmer E case is characteristic of how high-level company policy is unsympathetic to the farmer's plight (despite the slogan 'farmer first'), and the relationship between Farmer E and the extension manager has little meaning in terms of truly helping Farmer E. Despite Farmer E's critical role in helping the Company establish itself in the region and the legitimate tardiness of his complaint, the Company still refused him the insurance claim on the wheat seeds. While the extension manager quoted the 21-day policy for claiming the wheat insurance, Farmer E incurred a 60% reduction in his wheat crop and a monetary loss of 22,000 rupees. In this way, the company's actions were not "farmer first," at all.

In addition to refusing him the insurance, the extension manager blamed Farmer E for failing to use one of the Company's three feedback mechanisms and suggests that Farmer E did not sufficiently irrigate his fields as he recommended, resulting in the wheat's stunted growth.

This illustrates the assignment of blame to the farmer for not responding in the timeframe and manner expected by the Company, despite company operations representing a paradigm shift

from the 'informal' methods he is accustomed to. Viewed in this way, the Company's relationship-building is effectively meaningless in terms of helping farmers and serves only to bring them onto its platform, which continues to enact violence through neoliberal markets.

4.2.3.2 Micro-Entrepreneurs

The micro-entrepreneurs generally had positive feedback about working with the Company. A few cited the company's high product quality as a primary benefit of the partnership. Negative feedback consisted of certain products being unpopular among farmers. Despite this seemingly innocuous feedback, a structural examination of the arrangement points to a less equitable scenario.

The role of the Company micro-entrepreneur is diminished in company rhetoric, despite its centrality to the company model. Wording on the company website, the "farmer first," slogan, and the recurring animation of the happy farmer indicate the company's rhetorical focus on farmers as the primary recipients of their solutions. The company does not do business with farmers. The various components of its business model – agri-input sales, financing, and agri-output purchases – are entirely facilitated through affiliated micro-entrepreneurs, keeping the company at a safe distance from potential associated risks.

The concept of adverse incorporation (Du Toit, 2004; Du Toit 2009), and more specifically, adverse *digital* incorporation (Heeks, 2002) finds relevance here. Pre-existing relationships of power and inequality are central to adverse digital incorporation (Heeks, 2022). At the foundation of the Company's relationship with its micro-entrepreneurs is an imbalance of power, by the design of the company. The Company only approaches shopkeepers that make less than or equal to 30,000 rupees per year.

Although the company's choice of these individuals is framed as socially motivated and having reciprocal trust, there are several reasons the arrangement would result in greater benefits for the Company than for the micro-entrepreneurs. This is particularly relevant because of the enormous differentials in power and vulnerability between the two parties, a prerequisite for adverse incorporation (Heeks, 2022). These raise questions about the implications of the arrangement for micro-entrepreneurs in several areas, including profit margins, bearing risk on products, and bearing risk on loans to farmers.

The question of profit margins arises as we consider the relative negotiating power of each party, and their abilities to influence the system. How does the Company's profit margin compare to that of the micro-entrepreneur? The Company negotiates on bulk orders from multinational input suppliers, given that it can secure demand with the help of the micro-entrepreneur's farmer network, and provide the infrastructure to deliver products, capabilities that multinational suppliers would find useful.

Conversely, the micro-entrepreneur does not negotiate the price of products, due to the digital platform nature of the arrangement with the Company. The procurement transaction occurs through a smartphone app with pre-determined, non-negotiable pricing, which evidence suggests is on average higher than market pricing. The micro-entrepreneur is likely to derive slim profit margins from such products.

Despite this financial setback, the micro-entrepreneur is supposed to derive benefit and satisfaction from the convenience of being able to source from one location with a single click. We might ask whether this convenience is a critical factor for the micro-entrepreneur in achieving a sustainable livelihood. Furthermore, how does this change in procurement strategy

affect the micro-entrepreneur's relationships with previous suppliers and his prospects for independent operation should he wish to disconnect from the Company?

Another part of the micro-entrepreneur role is to finance farmers to incentivize their purchases from his Company Center. Partnered with existing financial institutions, the Company finances the micro-entrepreneur so he can procure from the Company and extend closed-loop credit to farmers. However, to ensure that he chooses the "right" farmers, or farmers that are guaranteed to repay the loan, the micro-entrepreneur himself bears the interest on any unpaid loans. In this scenario, while the interest rate is unknown, we can assume that any amount of interest places a financial burden on a shopkeeper earning less than 30,000 rupees per year (the equivalent of 360 USD per year).

This farmer financing component adds additional accountability to the micro-entrepreneur role in that he must ensure the digital repayment of the loan by a deadline. Now he must enforce a temporal deadline for farmer repayments or lose money himself. This may strain his relationship with farmers whom he considers part of his community because the institutions he is accountable to impose a hard and fast deadline, in comparison to the flexible timelines common in the informal sector. This chain of credit, known as financial leverage, can result in a corresponding chain of defaults. This method of financialization contributes to a modus operandi of individualization in Indian agriculture.

4.2.3.3 A New Social World and Modes of Accumulation

Jasanoff (2015) writes that material, moral, and social landscapes have a profound influence on how science and technology manifest, and in turn, shape our social worlds. Termed 'sociotechnical imaginaries,' they are "collectively held, institutionally stabilized, and publicly

performed visions of desirable futures animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff, 2015: 4).

Imaginaries can occur at multiple scales, be spread by a variety of actors, and gain traction through the application of power or sustained coalition-building. They confront important questions about why different moral positionings are attached to new scientific and technological interventions across the world, and the places science and technology hold in different political orders (Jasanoff, 2015).

We may view agritech companies as products of, and producers of sociotechnical imaginaries of sustainable futures and techno-sustainability. For example, 'Digital India' is a national imaginary feeding into the agritech vision of digital disruption of agricultural networks and supply chains. As one of many agritech firms, the Company propagates its own imaginary through its business model and promotion of digital modes of engagement and transaction by farmers and shopkeepers. Embedded in its operations are notions about how farmers ought to behave, through the upholding of those farmers who are quick to adopt new methods and technologies as "progressive," versus those who are not.

In this case, we see how the Company's continued on-the-ground presence facilitates the incorporation of farmers into a new social paradigm that is organized around the priorities of the company. Relationships shaped by the extension service and Farmer and Micro-Entrepreneur apps now privilege the company's operational goals.

Imaginaries in agriculture are situated within the larger contexts of the climate and agrarian crises, through which "influential actors and institutions view the countryside as a

laboratory for technological interventions teleologically elaborated to solve wicked problems…" (Stock and Mardez, 2022: 2). The entrance of capital-intensive technologies into rural areas is often accompanied by acts of dispossession, of which land grabs are a common form (Stock and Mardez, 2022). The collection of farmer data by agritech firms that offer precision agriculture has been called a 'grab' by scholars, thus representing a new form of dispossession (Fraser, 2019), that has consequences for farmer autonomy. Although dispossession is a common form of neoliberal capital accumulation (Harvey, 2003), especially among the rural poor, scholars argue that not all neoliberal accumulation occurs by dispossession (Shrimali, 2016).

Accumulation with respect to the Company is arguably more insidious. By taking advantage of the state's laissez-faire approach to agriculture, which leaves farmers to fend for themselves, agritech companies like the Company seek to establish hegemony over farmer livelihoods by presenting a veneer of support through effective relationship building.

4.3 Historical and Geographical Contexts Affecting Agritech Penetration

In this section, I compare my experiences in the rural districts of Hisar, Haryana, and Barabanki, Uttar Pradesh (UP) in their broader historical and geographical contexts to shed light on how the latter influence agritech penetration.

Concerning their historical contexts, Haryana and UP are neighboring states but have divergent agrarian histories that uniquely impact the culture and character of each location (Jodhka, 2014). Referencing this connection between history and culture, I identify *indications* of cultural difference in three spheres relevant to the agritech world: attitudes towards the government, attitudes towards the private sector, and cohesion among farmers. I suggest that these two locations, uniquely impacted by their respective agrarian histories, present different sociocultural landscapes that in turn affect agritech penetration.

Concerning their geographical contexts, I reference an interview with a Company executive to illustrate how the Company prioritizes districts based on several geographic factors and accounts for politically charged agricultural environments that present challenges to its entry. I draw from both empirical evidence and existing literature to support my conclusions.

4.3.1 Agrarian Histories and Indications of Cultural Difference

4.3.1.1 Attitudes towards the State and Private Sector

> Who people think they are, how they got that way, and what they can do to alter their lives has been profoundly shaped by the institutions, ideology, and practices of development (Gupta, 1998: ix).

This statement by Gupta captures the essence of my observations concerning farmer attitudes towards the government and private sector as development actors in each location. In

Punjab and Haryana, the Green Revolution placed state policy at the center of every village economy (Pattenden and Bansal, 2021). Agriculture in these states benefitted from progressive price policy, input and electricity subsidies, and irrigation infrastructure, resulting in a culture of state-led development that persists even today. This is evident from the 2020-21 Farm Bill demonstrations in which farmers from Punjab and Haryana "approached the state as a moral patriarch and [wanted] it to resume its responsibility of ensuring a just approach to all sections of society, not just the rich and powerful" (Jodhka, 2021: 1359).

Although the Green Revolution also took off in a region of Western UP, the state overall received less government agricultural support than Punjab and Haryana (Bajpai and Volavka, 2005). Barabanki fell outside UP's Green Revolution region and has thus been characterized by a less state-centered trajectory of agrarian development. I contextualize my observations on farmer attitudes towards the state and private sector in these divergent historical contexts.

A Better Livelihood: The Capacities of the State

Farmers in Hisar and Barabanki districts present different attitudes towards the state in its capacity to improve agriculture as a livelihood. Notably, farmers in both locations unanimously express that they do not want their children to enter agriculture. They cite a variety of reasons including its unpredictable nature, manually intensive labor requirement, and primarily that farming is no longer profitable. I follow up on their responses by asking farmers what they believe the state can do to improve agriculture as a livelihood or make it a future they would want for their children. This question elicits different responses in each location.

In Hisar, farmers offer a variety of actions the government can take to improve agriculture. These include some form of crop insurance, provision of/subsidies for agricultural

inputs and machinery, an increase in Minimum Support Price, and better infrastructure for energy and irrigation. Of significance, however, is the fact that every farmer has an idea. As per Gupta's words, this supports the conclusion that farmers view the government as a major actor in positively shaping the trajectory of their livelihoods.

In Barabanki, this question elicits responses that suggest the government does not hold the same positive status in the minds of farmers. For example, one farmer expresses frustration about the lack of government support in the form of MSP and agricultural subsidies:

> They don't offer MSP here. They don't offer it here. And here, they also don't provide money – they don't provide subsidies…They don't give us anything.
>
> - Farmer C

Another farmer responds that the benefits of government agricultural programs do not materialize for most farmers. He adds that this is due to their administrative design:

> No benefit comes down directly in the name of the farmer. The condition of the farmer is such that, wherever they go, they face the biggest brunt cost-wise. This is the situation around here…There is not much respect for the farmer. The farmer has so many problems, but nobody is there to listen.
>
> - Farmer D

The latter part of Farmer D's response resonates with Vasavi's (2009) assertion that Indian farmers are in a state of advanced marginalization concerning the government. Vasavi identifies them as "vulnerable subjects…whose position and rights as citizens are recognized and reckoned with only during elections" (Vasavi, 2009: 102).

Another instance in which farmers express disillusionment with the government occurs after one of the Company's farmer meetings. We are drinking tea with a group of younger

farmers (perhaps in their twenties) when I pose the same question about what the government can do to improve agriculture as a livelihood. In response, several of them laugh and say that the government is "useless." They tell me that a new government ban on the slaughter of freely roaming cattle as holy animals in Hinduism has resulted in the cattle destroying farmer crops. Taken together, these observations and interactions suggest a cultural difference in the way that farmers in each location view the capacity of the state to improve their livelihoods.

Agricultural Advice: The Role of the State and Private Enterprise

Differences in attitudes towards the state as a resource also manifest in farmer preferences for agricultural advice in each location. In Hisar district, I ask farmers about three main sources of agricultural advice: the state extension service, private companies, and local shopkeepers. Most farmers indicate that they utilize the agricultural extension, which offers "good, practical knowledge" in the words of one farmer. On the other hand, there is a clear distrust of private companies, which farmers believe do not have their best interests at heart:

> No companies have come this year. They have visited but people don't trust them. People don't go to the agrifair even though it is free.
>
> I have no relationship with companies. Companies will think of their profit. If I ask for advice from a company, then I would have to go through the company. I avoid it. Although companies do approach me, I have rejected them.
>
> For companies, I listen but do not apply their advice because they do not think of farmers' best interests.

"Private companies will eat us," another farmer explains, after checking to make sure that I do not represent a private company.

Towards shopkeepers, several farmers express similar distrust, this time based on the shopkeeper's motivations and lack of practical expertise:

> I do not take advice from shopkeepers. The shopkeeper will think of his benefits, rather than of the farmer.
>
> I do not take [shopkeeper] advice too seriously because it is theoretically based advice, not empirically based advice.
>
> I do not need to ask the shopkeeper. I discuss it with scientists, social workers, NGOs, and the Haryana Gyan Vigyan Samiti.

A 2017 study evaluating the sources of information accessed by 567 farmers across Haryana confirms their preference for the state agricultural department and agricultural universities over shopkeepers and private companies. The study shows that 40% of farmers reported using the state agricultural department and 35% reported using agricultural universities, while only 22% reported using input dealers and 17% reported using private companies. Farmers in the study reported shopkeepers and private companies did not always provide reliable information. Factors such as age and educational level also influenced how farmers chose their sources of information. Farmers with lower education levels were more likely to approach private companies, while farmers more highly educated gravitated toward agricultural universities for information (Duhan and Singh, 2017).

In Barabanki district, farmers appear more open to working with a private company, as evident in the Company's success in building a farmer network. In further contrast to Hisar, local shopkeepers hold influence over farmers, and play an important role in making them receptive to the possibility of working with the Company, as explained by the extension manager:

> To build a farmer network, the Company first approaches the local shopkeeper who serves farmers in the area. The shopkeeper is more receptive because working with the Company is a business opportunity for

> him. Once the shopkeeper has been brought on board, the Company holds a farmer meeting outside his shop. The villages served by the shopkeeper are notified and invited to the meeting. About a hundred farmers attend. Approaching a farming village without first connecting with the shopkeeper gets you nowhere with the farmers.
>
> - Company Extension Manager

This Company strategy indicates that shopkeepers in the district are well-regarded and have considerable influence over the farming communities they serve. One micro-entrepreneur further testifies to the shopkeeper's influence over farmers, as shown in the following dialogue:

> **Interviewer:** Do you also give advice to farmers?
>
> **Micro-Entrepreneur:** Advice, yes. When the farmers ask [questions], I give them the information I have – that you do this, you do that. Without information, my [business] won't happen. You have to tell the farmer something, only then will he buy something. As in, the farmer mostly depends on the shopkeeper for information. He may well come from his home thinking that he will buy a certain product, but the shopkeeper, if he wants, can influence him in another direction.

This response indicates that farmers in the Barabanki district significantly rely on shopkeepers for advice and information, unlike in Hisar. In totality, this evidence suggests a cultural difference regarding whom farmers believe they can and should depend on for support.

4.3.1.2 Farmer Cohesion

Farmer cohesion emerges as another sphere of possible cultural difference between farmers in Hisar and Barabanki districts. By cohesion, I refer to the extent to which farmers rely on one another for agricultural support, as well as political unity in larger issues.

In Hisar district, most farmers I speak with report exchanging agricultural advice and information frequently. Several describe discussing agricultural updates every day over *hookah*,

every evening over cards, or every weekend in a large group. I interpret this as an indication that these farmers experience a degree of community and solidarity with one another.

Political unity in Haryana can be traced to its role in the Green Revolution, which kindled early farmer unions and peasant movements in the state as economic expectation and aspiration initially took hold across farmers of all castes and classes (Jodhka, 2014; Jodhka, 2021; Gill 1994). In Haryana, the presence of strong political parties also rallied farmer movements (Bhalla, 1999; Singh, 2022a), engendering a sense of political unity. This can be recognized in social movements as recent as the 2020-21 Farm Bill demonstrations, in which farmers maintained a united front against the legislation for over a year (Singh, 2022b; Modi et al. 2022).

One cannot address the notion of farmer cohesion, however, without discussing the impact of caste and gender. My observations and interactions with lower caste farmers in Hisar district reveal that caste affects their access to the state agricultural extension service, and general social capital/safety net in times of crisis. A 2019 study using a nationally representative sample size of 31,185 rural households confirms this conclusion, reporting that farmers from socially marginalized castes had a lower chance of accessing public extension services and "hardly benefitted" from these (Krishna et al., 2019).

In terms of political unity, scholars suggest that across India, marginalized farmers from the lower castes and classes often continue to depend on the political will and power of dominant caste groups to mobilize (Kennedy, 2020; Pattenden, 2005). Caste, class, and gender relations are at the bases of social movements and thus cannot be ignored (Pattenden, 2005). However, these internal contradictions begin to diminish in the face of the increasingly palpable collaboration

between the neoliberal state and transnational agribusiness corporations (Pattenden and Bansal, 2021).

Farmer cohesion does not appear the same in Barabanki district as Hisar, as explained by one Company-affiliated farmer. Interestingly, he responds to the lack of government support for farmers in the district by explaining that farmers here have no political unity:

> Here the biggest point is that there is no unity amongst the farmers. Everyone operates very independently. In Punjab and Haryana, there are big farmers. Land is 500,000-5000 bigha[15] in size. Here, it is at the most 10 to 20 to 50 bigha. A farmer might say, if a 20-bigha plot farmer is sitting quietly on an issue, why should I bother? If you try to tell them to attend a forum where a particular issue can be raised, they deflect it to the 50-bigha plot farmer, saying that they could speak to how it impacts a 50-bigha plot. There is no unity. [In Punjab and Haryana] they raise their voice collectively, likely to be impacted by issues in a common way… They come together to address issues. The farmers here have no unity.
>
> - Farmer D

Taken all together, Hisar district conveys a more cohesive farmer population that looks to the state for progress, while Barabanki gives the impression of more individually operating farmers with greater reliance on local shopkeepers and receptivity to private companies. These diverging sociocultural landscapes have implications for agritech penetration.

[15] An Indian unit of land area, varying between 1/3 and 1 acre.

4.3.2 Geographies of Company Operation: District Prioritization

Concerning geographical contexts affecting agritech penetration, an interview with Company Executive A reveals that the Company has a selection methodology that involves district prioritization based on several geographical factors. This way, it targets regions with economic and environmental assets, and smallholders seeking resources. In addition, he explains that the Company has thus far avoided entering Punjab and Haryana due to factors associated with their Green Revolution histories that present challenges to the Company's entry.

The Company's district prioritization method creates a score based on the following criteria of interest: gross cropped area, landholding size, proximity to farmer producer organizations, proximity to markets, proximity to banks, fertilizer usage, and irrigation and rainfall status. Locations that receive a high aggregate score in the desired criteria make sense to prioritize from a business perspective. For example, regions in which farmers have proximity to markets indicate that farmers will more likely have cash on hand to spend on Company products. Similarly, patterns of fertilizer usage serve as a proxy for how "advanced" farmers are, and therefore how receptive they will be to Company services.

> The goal is to identify regions with maximum [agricultural] output and farmers looking for different options.
>
> - Company Executive A

These are farmers who lack access to inputs, credit, insurance, and advisory, and will therefore derive the maximum value by working with the Company, Executive A explains. For example, the state of Bihar has many smallholders who face high risks of floods and high rates of agricultural input duplication. The Company began its business here.

Besides district prioritization, I ask Executive A about the presence of agritech companies in Punjab and Haryana, explaining that my search for farmers working with agritech companies in Haryana yielded practically no results. Why are companies absent in these states, given their place at the forefront of modern agriculture during the Green Revolution?

According to Executive A, the Company's decision not to enter Punjab and Haryana initially was shaped by reasons associated with the factors of market and land ownership. Pertaining to the market, Executive A explains that generally, these states' Green Revolution histories made them agriculturally prosperous and established a streamlined tradition of output procurement through the APMC Act. The frequent procurement of marketable surplus[16] by the government and deep-rooted business lobby of traditional middlemen results in competition for the Company, which also seeks to procure output for farmers. In this political environment, farmer distrust is also difficult to overcome. In sum, the Company would have to earn farmers' trust while competing against both government and traditional players.

Executive A elaborates that agricultural prosperity in Punjab and Haryana also means that many farmers already have access to the services the Company would offer, such as connections to the market, digital adoption, and financial services:

> A simple story is that the farmers in these areas are more prosperous, more resourceful, and hence the information asymmetry as we talked about is less as compared to other areas. Our business has been running on addressing information asymmetry.

[16] Marketable surplus refers to the total crop produced, minus the amount utilized for household consumption, minus the amount sold to cover the costs of production. This leaves the amount to be sold for profit (Smyth, 2020).

- Company Executive A

The second factor that shaped the Company's decision not to initially enter these states relates to patterns of land ownership. According to Executive A, landowners in these states are often businessmen who hire tenants and sharecroppers to cultivate their farms. He distinguishes between businessmen and farmers in terms of the extent to which their livelihood depends on successful cultivation. Good advisory services, a central feature of the Company's farmer services, is a lower priority for businessmen than for farmers, he concludes.

Executive A makes the disclaimer that these decisions were Company specific, and not an agritech industry rule. Nonetheless, it stands to reason that other firms with similar models and parallel objectives may also strategize this way.

In totality, my empirics, supported by evidence from other studies and viewed in the states' historical contexts, suggest that sociocultural landscapes informed by agrarian histories shape farmer receptivity to agritech solutions, and company decisions to enter these locations. Viewed holistically, the Company's strategy appears to be targeting locations with politically vulnerable, individually operating smallholders seeking support and resources, in proximity to economic and environmental assets. The fulfillment of these criteria theoretically creates the opportunity for greater dependency on, and integration into the Company's platform.

Figure 3. Left: Landscape around Kanwari village, Hisar, Haryana. Right: Landscape around Piprouli village, Barabanki, Uttar Pradesh. These locations differ in rainfall received, one of the Company's criteria in considering which districts to prioritize.

Chapter 5 Conclusion

Prevailing political and macroeconomic conditions favor the expansion of the Indian agritech industry, supported by the government's increasingly neoliberal approach towards agriculture, the embrace of digitalization as a path to modernity, and increased digital adoption in the wake of COVID-19. Yet the proliferation of agritech in many ways represents Indian farmers' greatest fears: a deregulated agricultural sector in which private companies decide the terms of farmer contracts and the price of produce. The precarity of Indian farmers today stems from the economic and environmental aftermath of the Green Revolution, liberalization of the sector, and ongoing efforts to financially 'include' the rural poor.

Agritech companies represent the latest iteration of poverty-finance tech firms within agriculture. They seek to disrupt the sector, creating new digital networks, reconfiguring supply chains, and integrating rural populations digitally and financially into global circuits of capital. Given that the specifics of agritech solutions are not often detailed on their websites, and little has been reported from the perspectives of the recipients, I pose the following investigative research questions: How do Indian agritech companies conceive of their own business and operating models? How do smallholder farmers and shopkeepers working with such companies experience these partnerships? And how do historical and geographical factors influence agritech penetration in India?

My fieldwork consisted of three segments that each offered unique perspectives to my analysis. I began by interviewing farmers in the district of Hisar, Haryana, but found little

evidence of agritech solutions in the district and broader state. I used this opportunity to observe the sociocultural dimensions of agriculture in a place where the industry had not penetrated. Continuing my search for farmers working with agritech companies, I landed a three-week internship at the corporate office of a high-ranking agritech firm in Gurugram, India. I spent two weeks in the office, interviewing executives and employees about the Company's vision and business and operating models. As part of the internship, I negotiated a one-week visit to farmers and shopkeepers working with the company in Barabanki district, Uttar Pradesh. Accompanied by an employee in the Company's extension team, I interviewed affiliated farmers and shopkeepers about their experiences with the company.

Given this unique trajectory and methodological variation, I approach my findings through autoethnography, a research method that centers my experience as the researcher and makes explicit the circumstances under which I collected data. Through the lens of my experience, I present the findings to my research questions, which I contextualize in the literature.

Concerning Research Question 1, I find that the Company has a 'Seed to Market' digital platform model that offers a range of services to farmers and shopkeepers (who facilitate the services on behalf of the Company). The broader goals of the model are to address information asymmetry between the local and global agricultural markets, thereby making it easier for global industry participants to conduct business within farming ecosystems while avoiding economic risk. Interviews with executives reveal that the Company seeks to win farmers' trust and integrate them into a comprehensive system of services and financial offerings.

The Company's vision and operating assumptions align with those embedded in Global Risk Management, a development framework that promotes individual financial protections to create 'win-win' solutions for multiple parties. Critical scholarship argues, however, that GRM represents a form of neoliberal governance that normalizes structural violence on recipients of such financial services (Soederberg, 2016). GRM principles in the Company context place the burden of 'solving' agricultural precarity on farmers themselves, even though their precarity largely originates from financial capitalism in the first place. They are further projected as seeking out these protections, thereby voluntarily exposing themselves to market discipline (as I later observed with a Company-affiliated farmer).

Recent scholarship on digital agricultural platforms draws attention to their application of behavioral economics, and the design of all-encompassing, closed-loop systems through which previously informal users can be disciplined into 'good market subjects' (Brooks, 2021; Mann and Iazzolino, 2021). The Company's extension personnel nudge farmers towards purchasing inputs and partaking in company services, configuring a ready-made market for the Company's global industry partners: agribusinesses, financial institutions, and the food processing industry. The danger of increased legibility of informal agricultural ecosystems is in part that it enables global industries to gaze upon these populations as markets with inelastic demand, and thereby capitalize on agricultural crises. In the words of one Company executive: "A pest attack…[is] a seven-day opportunity for all the agricultural companies in that area." Users 'locked' into the increasingly authoritative closed-loop system are also vulnerable to changes in Company policy regarding pricing and structure.

Concerning Research Question 2, I analyze my interactions with affiliated farmers and micro-entrepreneurs to suggest that the sense of continuity and relationship building associated with the Company model appeals to both groups, enabling them to develop trust in the Company. This seems particularly important for farmers. Rather than "offering one thing and [leaving]" (the words of one farmer), the Company offers the full spectrum of agricultural goods and services and stays.

Despite these relationships, extension employees do not accommodate farmers regarding company policy, should the farmer request flexibility. Farmers that fail to comply, even if for valid reasons, face market discipline. Thus, the question arises that, if not to facilitate the ease of farmers' use of company services, and ultimately benefit therefrom, what purpose do these relationships serve? I conclude that the Company extension essentially works to integrate farmers into its system. Once integrated, farmers are left to fend for themselves concerning disciplining policy. I suggest that farmers may proceed with relationally underwritten decisions pertaining to company offerings, but face distress as they find themselves locked into inflexible, unforgiving Company contracts.

On the social implications of digital agricultural platforms, Brooks (2021) writes that the circumscribing of farmer options by platforms undermines the social cohesion that results from collective engagement in agricultural decision-making. My experience observing interactions between farmers and the Company extension manager led me to conclude that these relationships are at the core of the Company's success with farmers. It does indeed seem that while the egalitarian relationships between farmers diminish, paternalistic relationships with the Company

become dominant. For affiliated farmers, however, the latter is the only institutional support they have.

Shopkeepers or 'micro-entrepreneurs' also form an integral part of the Company model, serving as access points and instruments of penetration into farming communities. Micro-entrepreneurs run the one-stop-shops that provide farmers with the full spectrum of Company services. However, viewed from a structural perspective, the terms of their incorporation are unfavorable. The enormous power differential between the Company and these shopkeepers, and the latter's lack of negotiating power due to the digitally mediated arrangement result in the potential for their exploitation, as discussed in the literature on adverse digital incorporation (Heeks, 2022).

Concerning Research Question 3, I compare my experiences in the districts of Hisar, Haryana, and Barabanki, Uttar Pradesh in the context of their agrarian histories to suggest historically informed cultural differences that affect farmer receptivity to agritech solutions. Cultural difference is indicated in farmer attitudes towards the state and private sectors as development actors and the extent of farmer cohesion. I suggest that these two locations present unique sociocultural landscapes with different degrees of amenability to agritech companies.

Based on a company executive interview, I confirm that Haryana's Green Revolution history has bearings on its present-day socio-cultural landscape and agricultural infrastructures that in turn influenced the Company not to enter the state. I also illustrate how the Company prioritizes locations based on geographic features, ultimately arguing that the Company targets politically vulnerable, individually operating smallholders seeking resources. This creates an opportunity for greater farmer dependency on, and integration into the Company platform.

Drawing from Jasanoff and Kim's (2015) concept of sociotechnical imaginaries, I argue that the Company and others that operate similarly seek to realize their imaginaries, creating social worlds among affiliated farming communities that privilege their operations. Communities of "progressive" company farmers experience a journey of successive services as they progress through the cultivation cycle. Ultimately these aim to establish company hegemony over communities, and the creation of individual 'digital farmers,' who function as 'good market subjects,' as per company sales goals. Arguably this is a form of capital accumulation that occurs not by blatant dispossession but by an insidious method of relationship-building in a neoliberal vacuum of government support.

I hope that future research can build off these findings – within and beyond the Indian context – and further explore the smallholder experience of agritech solutions, their rationales for partaken decisions, and the impact on existing social worlds in rural landscapes.

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