What's in a Place? On Platformization of Traditional Agricultural Marketplaces

Anubha Singh
School of Information
University of Michigan
Ann Arbor, Michigan, USA
anubha@umich.edu

Patricia Garcia
School of Information
University of Michigan
Ann Arbor, Michigan, USA
garciapg@umich.edu

Priyank Chandra
Faculty of Information
University of Toronto
Toronto, Ontario, Canada
priyank.chandra@utoronto.ca

Abstract

In this paper, we pay ethnographic attention to the failed attempts at platformization of agricultural trade in one of Asia's largest onion markets, located in rural western Maharashtra. We focus on e-NAM, or the electronic National Agricultural Market, a state-sponsored digital trading platform intended to create a transparent, efficient, and frictionless online national agricultural market by collapsing geographical barriers of traditional marketplaces, commonly known as mandis. We found that despite e-NAM's intended benefits, mandis continue to be the preferred mode of transaction for trading agricultural commodities. We demonstrate that these two agricultural marketplaces foster different meanings of information transparency, efficiency, and participation among stakeholders. In agrarian societies dominated by smallholder farmers, such as India, social collectives and non-economic relationships are crucial for providing safety and risk mitigation when dealing with perishable commodities like onions. We argue that e-NAM fails because its digital intermediation prioritizes an ahistorical and depoliticized free-market approach, which treats farmers (and traders) as independent units driven solely by the economic logic of demand and supply, disconnecting them from their historical and political agrarian social class.

CCS Concepts

• **Applied computing** → **Agriculture**; • **Human-centered computing** → **Empirical studies in HCI**.

Keywords

Agricultural Marketplaces, Platforms, Auctions, Digital Agriculture

ACM Reference Format:
Anubha Singh, Patricia Garcia, and Priyank Chandra. 2025. What's in a Place? On Platformization of Traditional Agricultural Marketplaces. In *CHI Conference on Human Factors in Computing Systems (CHI '25), April 26–May 01, 2025, Yokohama, Japan.* ACM, New York, NY, USA, 16 pages. https://doi.org/10.1145/3706598.3714250

1 Introduction

".. e-NAM is a turning point for Indian Agriculture"

On April 14, 2016, Prime Minister Narendra Modi launched the electronic National Agricultural Market, or e-NAM, calling it a "turning point" for Indian agriculture. Inaugurating the digital platform at Vigyan Bhawan (Science Building) in New Delhi, the Prime Minister framed e-NAM as a pan-Indian electronic trading portal for agricultural commodities that would reform the inefficiencies and irregularities of traditional wholesale agricultural markets, colloquially known as *mandi*. The ethos of the reform was also reflected in the following e-NAM vision statement:

> *"To promote uniformity in agriculture marketing by streamlining of procedures across the integrated markets, removing information asymmetry between buyers and sellers and promoting real time price discovery based on actual demand and supply."*

The vision statement presents e-NAM as a strategic initiative to overcome the challenges of traditional agricultural marketplaces. For decades, discussions about mandis in academia, policy organizations, and the mainstream media have been dominated by narratives of crisis, political control, exploitation of farmers, information asymmetry between sellers and buyers, and pervasive corruption [15, 16, 66]. In response, e-NAM promises to mitigate market disparities through two main strategies: a) collapsing place-based geographical limitations and b) expanding market participation.

e-NAM aims to create a unified, frictionless online national agricultural market by collapsing geographical barriers primarily through a dematerialization of agricultural trade. By reducing dependency on physical mandis, e-NAM bypasses local politics, caste and class-based social dynamics, cultural specificities, and human subjectivity—the sociocultural and political realities often blamed for corrupting mandis. Furthermore, collapsing geographical barriers to expand competitive trading would, in theory, attract traders from outside the geographical regions who are willing to pay fair prices for good quality agricultural commodities. In essence, e-NAM seeks to foster an environment of perfect competition, free from "social factors" [32] and governed solely by the free market economic logic of supply and demand.

However, six and a half years since the inception of e-NAM and despite considerable state investment, we found the use of e-NAM to be conspicuously absent from the daily transactions occurring in western Maharashtra's onion markets—two of the largest in Asia. In fact, the two main stakeholders who were supposed to benefit the most from e-NAM—farmers and traders—actively refused to participate in e-auctions on the platform. In this paper, we refer to primary producers of agricultural commodities as farmers and upper-caste intermediaries/wholesale buyers in the agricultural supply chain as traders. We draw our findings from a 17-month-long



This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
CHI '25, Yokohama, Japan
© 2025 Copyright held by the owner/author(s).
ACM ISBN 979-8-4007-1394-1/25/04
https://doi.org/10.1145/3706598.3714250

ethnography of the onion supply chain in Western Maharashtra by the first author, pointing to a disconnect between the state's push to digitize agricultural trade and the continued preference of farmers and traders to conduct trade transactions through in-person auctions at mandis. In this paper, we take the refusal of farmers and traders to participate in the e-NAM market platform seriously [31] and critically examine *why, despite the intended benefits of digitally streamlining agricultural transactions, mandis continue to be the preferred mode of transaction for trading agricultural commodities?*

We move beyond simplistic explanations of the digital divide to understand the failure of well-intentioned technological interventions in rural and remote areas of the majority world. We provide in-depth ethnographic accounts of how farmers and traders participate in and interact with two trading processes: the mandi and e-NAM. We demonstrate how each setting cultivates different meanings of information transparency, efficiency, and participation, which are valued differently by different stakeholders. Our analysis indicates that, more than the digitally mediated promises of transparency and fairness, farmers value the security and risk management that mandis offer through established social networks and personal connections. These networks provide critical information, access to credit, and support to farmers. Conversely, by dematerializing mandis, e-NAM emphasizes an ahistorical and depoliticized free-market approach that treats farmers as independent units, disconnecting them from their historical and political agrarian social class. This tendency of platforms to individuate, atomize, and flatten diversities creates friction with existing agrarian realities, as social collectives are an important source of safety and risk mitigation for farmers and traders, especially when dealing with highly perishable commodities like onions.

We begin by situating our work in existing scholarship on ICTs and marketplaces followed by a brief background about the prominence of mandis as primary agricultural markets in India. After describing our methods, we present our findings through a rich ethnographic description of how the onion trade plays out at both a mandi and on e-NAM and highlight critical contrasts between them. Finally, we discuss how sociocultural and political realities shape the adoption of digital interventions in traditional marketplaces and orient our arguments towards expanding the understanding of transparency, participation, and efficiency in the study of digital platforms.

2 Related Work

2.1 The Promise of Agricultural Financialization and Digital Agriculture

The 'financialization' of agriculture—where farmland and crops are viewed as financial commodities—has gained momentum with the rise of financial instruments, deregulation, and trade globalization [8]. Historically considered risky due to the whims of both weather and government regulation, the global agricultural sector has increasingly become controlled by financial actors, capitalist logic, and market dynamics, rather than the production and trade of physical agricultural commodities. As farms and agricultural commodities become more economically valuable data-driven agricultural technologies, or AgTech, that employ data and computer-enabled statistical analysis for precise, predictive, and efficient farm management are simultaneously gaining traction. AgTech is widely seen as a positive development for the profitability and productivity of farmers. HCI researchers have critically analyzed how the financialization of agriculture drives the digitalization of the sector, highlighting AgTech's profit-driven motives [23], its universalizing tendencies [82], and related ethical issues [47, 77]. Prior work has also shown how initiatives globally have faced critiques for prioritizing datafication and metrical governance at the expense of farmer autonomy and representation [13, 30]. We situate our paper within critical studies of digital agriculture that borrow from HCI, ICTD, and STS and focus on the adoption of AgTech for smallholder farmers in remote and rural postcolonial agricultural regions such as India [1, 38].

In India, a major global agricultural producer, AgTech is not only viewed as a key component of financialization but also as a symbol of technological modernity linked with notions of progress and empowerment [71]. In this paper, we examine the adoption (or lack thereof) of e-NAM in traditional onion marketplaces as part of the increased financialization of agricultural trade in India. Electronic trading portals, such as e-NAM, aim to increase competition by reducing information asymmetry, enhancing transparency, and fostering conditions for a "perfect market." As a unified market platform, e-NAM digitally connects dispersed traditional markets into a single national market for agricultural commodities removing physical barriers for participation. Overall, e-NAM represents the platformization of agricultural trading in India and seeks to utilize the advantages of digital intermediation to reduce corruption and ensure fair outcomes for both buyers and sellers [66]. In this context, e-NAM is a technologically driven project intertwined with familiar notions of technological modernity, such as technology driving change and progress, rationality, and purposeful action, thereby promising a better life [26, 51].

2.2 The Realities of Technology Adoption in Real-World Markets

In perfect markets, individuals pursuing their self-interest, inadvertently create positive outcomes for the economy. The "invisible hand" concept [74], or the idea that a free market economy can be self-regulated, has been challenged by economic sociologists. The idea of an absolute and instrumental model of markets driven solely by the economic forces of demand and supply has since been revised to include: 1) understanding the social structuring of networks, 2) the influence of institutions, and 3) the performativity of markets [28, 35, 63, 84]. Even when exhibiting all characteristics of a perfect market, scholars have shown that market actors do not make purely rational profit-maximizing choices, for example, letting go of short-run profits at the cost of maintaining their relationships and a long-run niche status in the market [62]. The complexities of real-world marketplaces challenge economic theories of perfect markets and technological modernity, which offer an idealized vision of markets driven by rational self-interest and efficiency through digital platforms.

Within HCI, there is a well-established but somewhat limited tradition of studying how the complexities of real-world marketplaces impact the adoption of technologies. Research has focused on informal marketplaces or bazaars as socio-economic entities, which

are important sites for studying technology consumption [17]. By highlighting the situated characteristics that sustain informal marketplaces, studies have shown how non-economic practices like the use of intercoms and rumors become integral to these markets in circumventing regulation and managing ambiguity [18, 19]. Conversely, scholarship has also noted how religious values, sentiments, and practices can be obscured in the digitization and platformization of context-specific marketplaces impacting active participation [50].

In ICTD research, there has been a strong focus on studying how ICTs are integrated into socially distributed and regionally specific sectors like rural agricultural markets, which rely on shared knowledge and community collaboration [56, 85]. A common myth, attributed to information determinism, particularly for low-income, rural populations in the Global South, suggests that "market price information" facilitated through ICTs will lead to market efficiency that benefits all [11, 42]. However, Srinivasan and Burrell's [76] formative work analyzing the fish markets of Kerala challenges this econometric generalization of market price information by highlighting many additional (non-economic) conditions that must be fulfilled for this hypothesis to hold true.

In addition to the idea that social change is achievable through ICT-mediated market price information, another common theme surrounding ICTs in marketplaces is disintermediation, or the removal of intermediaries such as traders and commission agents. Disintermediation is not just about eliminating mediators but, by extension, the end of distance, politics, and history [9, 52], which are often blamed for creating inefficient and exploitative market economies lacking fairness, efficiency, and transparency. However, studies of rural agricultural markets in India and Myanmar have challenged this belief by highlighting the central role of power and politics in the seemingly "unmediated and free circulation of information using ICTs" [58, p. 354]. These studies demonstrate that the goals of disintermediation through ICTs are rarely achieved in sectors like smallholder rural agricultural markets of Global South, where historical legacies, politics, and socio-cultural norms and relationships play a critical role [57].

By highlighting the non-economic conditions, historical legacies, political realities, and power dynamics that govern rural agricultural markets of postcolonial Global South regions, research in both HCI and ICTD complicate the assumptions about the seemingly neutral, disruptive role of ICTs in these socio-culturally and politically situated sectors.

2.3 Auctions and Perfect Competition

In this paper, we specifically studied the e-NAM platform as as an ICTD technology that, in theory, streamlines auctions and trading transactions by allowing farmers to trade on the platform directly or through a commission agent. Broadly conceptualized, auctions are economic processes for prices formation and commodities allocation via the participatory process of bidding [27]. Auctions play an important function in the movements of commodities across regions and are commonly used across the globe in different agricultural supply chains such as coffee [5], strawberries [32], soybean [45], cattle [22], and fish [6, 76].

Auctions are a popular price discovery tool because they help sellers discover the highest price a bidder is willing to pay, especially when the value of a commodity is difficult to determine beforehand [49, 80]. Furthermore, auctions are perceived as fair because the rules are common knowledge and they can theoretically maximize seller revenue [53]. Under certain conditions, auctions can mimic the outcomes of a perfect market. However, scholars in STS argue that this is not an inherent property of auctions but rather a socially constructed outcome. In studying strawberry auctions, Garcia-Parpet [32] ethnographically tests the four necessary conditions of perfect competition: atomicity of buyers (no economic agent has a significant influence over prices), homogeneity of commodity (the product should not be associated with the buyer's identity), market fluidity (all parties are free to enter or exit the market), and transparency (all parties should have "perfect knowledge" of the quality, quantity, and price of all commodities in the market); to show how a "perfect market" is also socially constructed. Garcia-Parpet argues that the market operates in a particular way not because of economic forces and self-regulation but because of specific social, organizational, and institutional arrangements.

Studies in economic sociology complicate the notion of a fixed 'true' value in auctions by challenging the conditions of perfect markets. In studying different auction markets, Smith [75] studied how value is determined by a complex social process combining the beliefs and actions of the auction participants and the assumptions and practices on the auction floor. By investigating how pricing is determined during auction sales, research has shown that auctions can be understood as a 'distributed object,' [34] meaning that price determination is distributed across a series of events including viewing the auction catalog, comparing sale prices with personal market knowledge, consulting with absentee bidders, and experiencing the theatrics of bidding. Additionally, prior research on art auctions found that price mechanisms constituted a symbolic system [79] and that exchange relations and active participation affect the social definition of what are perceived as high-quality products [83].

Whether at fish markets or art auction houses, these prior studies show that rather than being peripheral to economic activities, socio-cultural and political practices sit at the heart of market transactions. While prior work has offered rich ethnographic descriptions of geographically specific markets, the scale of digital interventions in market transactions have grown beyond localized efforts. As the adoption of the e-NAM platform in India shows, digital interventions have become state-sponsored and nationally-implemented. Yet, despite the large scale nature of national digital interventions, technology adoptions must still occur in highly contextual settings with their own geographic boundaries, cultural practices, political relations, and economic realities. Thus, in this paper, we analyze the adoption of e-NAM in India on two scales–as a large-scale effort that occurs digitally across a national market and as a small-scale effort that plays out locally and contextually in mandis. By analyzing the adoption of e-NAM by farmers at these two scales, we are able to explore our motivating research question: Why do traditional mandis continue to be the preferred method for trading agricultural commodities, as opposed to large digitally mediated platforms like e-NAM? In exploring this question, we examine how state visions of technological modernity play out in the reality of local markets and how these realities surface differing value systems.

3 Methods

3.1 Field site

The findings of this paper emerge from a 17-month-long, multi-sited, and multi-lingual ethnography of the onion supply chain conducted between 2021 and 2023 in the Nashik district of Maharashtra, India. Located about 100 miles from Mumbai, Nashik is a small district nestled in the Sahyadri mountain ranges of the Western Ghats. The district has diverse climate zones and is highly conducive to horticultural production. Nashik is particularly well-known for onion production, as evidenced by the fact that two of the largest wholesale onion markets in Asia are located there. Chandrapur mandi (name changed), which serves as the main field site for this research, is one of these two mandis.

In line with the multi-sited ethnographic tradition, this research followed linkages between different field sites through relationships, circulations, movements, and processes [25, 48]. The fieldwork was conducted across various locations, including onion farms, traders' warehouses, onion storage structures, AgTech startups, technology incubators, and scientific research institutions.

3.2 Data

The data for this paper was mainly drawn from daily descriptive field notes with a thick description that included not only recording daily incidents and human actions, but also the cultural context, meanings, and interpretations of these actions and behaviors [33]. For this, the first author followed people, stories, and objects, which became the primary methods to collect data and understand this highly networked field site [10]. Given the nature of immersive ethnography, obtaining written consent for every interaction was impractical. However, the first author ensured to introduce herself to all new interlocutors and research participants, providing her institutional affiliation and describing the purpose of the study. Data was only collected from participants who consented and allowed the researcher to work with them at their farms, warehouses, or start-up offices. This research was approved for ethical considerations and exemptions by the University of Michigan's Institutional Review Board.

Other modes of data included memos written weekly or bi-weekly summarizing the key findings and analysis from that period [24, 41]. During the fieldwork, the first author also conducted over 80 interviews with different stakeholders in the onion supply chain. A semi-structured interview protocol was employed, which the first author revised as new themes emerged during the fieldwork. Interviews were recorded with permission, and when consent to audio record was not obtained, the first author took detailed handwritten notes, which were later digitized for recordkeeping. The interviews were conducted in a combination of Hindi and Marathi, which the first author later translated and transcribed. For this paper, interview participants included mandi office holders, traders, farmers, and mandi staff– including but not limited to auctioneers, e-NAM analysts, and weighmen. The authors of this paper have collectively decided to use pseudonyms for names and field sites to protect the identities of the research participants. The only exception to this rule is government institutions and officials.

3.3 Data Analysis

To track the main themes and elements from the research site, we used Adele Clarke's Situational Analysis to map *"all the analytically pertinent human and nonhuman, material, symbolic/discursive elements of a particular situation as framed by those in it and by the analyst"* [21, p. 87]. These maps changed throughout the research but were instrumental in identifying the key sociocultural, economic, technological, and organizational elements and actors across the field sites. A systematic analysis through coding [67] of the field notes, memos, vignettes, and interview transcripts led the first author to key themes that center around the state initiative to digitize mandis through e-NAM (e.g., "platformization," "e-NAM," "streamlining supply chain," "information," "refusal," "disruption"); farmers' concerns (e.g., "rising costs," "market inequalities," "Minimum Support Price," "discontent," "risk mitigation," "safety"); and traders' issues ("quality assessment," "trade practices," "complicated e-auction," "lack of trust," "relationships").

It should be noted that because farmers and traders refused to use the e-NAM platform, the e-NAM analyst at the Chandrapur mandi had to create dummy e-auctions to explain the workflow of e-NAM to the primary author. This was necessary since no real trade occurred on e-NAM, and the platform was primarily used for data entry. The primary author found that many traders and farmers were unaware of e-NAM, meaning they couldn't identify the platform by name. Since its launch in 2016, the initiative largely failed at the field site, resulting in low familiarity among farmers and traders. This research, conducted under constrained circumstances, highlighted the finding that e-NAM was either absent from or rarely present in the onion markets in Nashik. This once again underscores the central concern of this paper: *Why do traditional mandis continue to be the preferred method for trading agricultural commodities, as opposed to large digitally mediated platforms like e-NAM?*

3.4 Positionality Statement

The authors of this paper include a graduate student and two faculty members from educational institutions based in the United States and Canada. The first author, who conducted the fieldwork and data analysis, is an upper-caste woman from India. Her cultural background as an Indian national and her fluency in Hindi and basic knowledge of Marathi helped her gain access to various field sites. Although the first author is a cultural insider, she often did not share the same class and caste backgrounds as the participants in this research. Additionally, since agriculture and particularly mandis are predominantly male-dominated sites, the first author had to navigate several safety concerns during the fieldwork. Given the rural and remote nature of these locations, data collection was a challenging task. The second and third authors played crucial roles during the writing stage of this paper. The second author is based in the United States, while the third author is from India. Their work addresses critical race and postcolonial politics in Human-Computer Interaction (HCI), and they have extensive experience conducting collaborative research on these issues.

4 Background: Understanding Mandis

In India, "mandis," or traditional agricultural markets, are multi-commodity, multi-stakeholder markets for trade and commerce of agricultural commodities [44]. Given that India is a country of small and marginal landholding farmers, with 89.4% of farmers owning less than two hectares (approximately five acres) of land [55], mandis are sites of aggregation and play a crucial role in streamlining the agricultural supply chain [45]. Depending on their geographic location—urban centers of distribution or rural markets for aggregation—mandis can serve as both primary and secondary agricultural markets. For this paper, we will focus on mandis as rural, wholesale, primary markets where smallholder farmers sell bulk produce to traders, commission agents, and corporate intermediaries who then distribute the commodities further down the supply chain.

Mandis are not only sites for the aggregation of agricultural commodities from primary sellers like smallholder farmers but also various stakeholders of the agricultural supply chain, including traders, buyers, and commission agents. Commission agents, or *"adhtiyas,"* act as intermediaries between traders (or wholesale buyers) and farmers. For a fixed commission, they facilitate transactions, assist in price negotiations, and often provide financial support to farmers. Traders, or wholesale buyers, purchase agricultural produce in bulk either directly from farmers or through the commission agent. These traders generally have substantial buying power, access to extensive networks and large infrastructures, enabling them to handle large quantities of agricultural commodities and subsequently export or sell them to retailers, processors, or other buyers. Within a mandi, the staff, employed by the elected mandi commission and funded partly by the state and partly through a transaction fee on each deal, coordinate and support operations among various stakeholders who converge at the mandi. The staff responsibilities vary widely, from handling paperwork to managing cash transactions or coordinating the actual trade on the mandi premises. We describe some of these mandi employees and their specific roles in detail in the findings below. Additionally, mandis serve as sites for loading, packaging, and transporting agricultural commodities into the supply chain; consequently, they are also homes to logistics coordinators and service providers. Given these convergences, mandis are important social, political, and economic intermediary institutions that connect local producers to global commodity supply chains. Mandis are geographically specific, agro-ecologically diverse, and culturally situated; they support complex local commodity chains and are dynamic and highly responsive to larger social, political, economic, and infrastructural changes. These defining characteristics of mandis and their geographic specificity contribute to their vast and complex functioning, making it difficult to procure data about their performance, which is highly disorganized, fragmented, incomplete, and intermediated [43].

4.1 Corrupt Mandi Politics and its Socio-Cultural Implications

In terms of their regulation, mandis in India are a state subject[1] and regulated according to the Agriculture Produce Market Committees (APMC) Model Act of 2003. The APMC Act primarily outlines rules for the regulation and formation of a "market committee," which includes representatives of farmers, traders, labor unions, weighmen, and state board members that govern individual mandis [44]. It is composed of representatives of political parties, powerful traders, and big farmers; it wields significant power in mandi related decision making and is frequently accused of corruption, bribery, and favoring traders and middlemen.

In western Maharashtra, this accusation carries sociocultural implications due to a clear caste and class divide between the local lower-caste Maratha (Kunbi)[2] farmers and Baniya[3] traders. The latter often gatekeep the entry of new non-Baniya traders in mandis, leading to a distinct caste divide and caste-based control of the mandi-based agricultural trade. Similar issues are reported from many parts of the country, where traders, along with the market board, are accused of price manipulation, price collusion, and a lack of transparent price discovery mechanisms [4, 15, 43]. In popular discourse, mandis are often described with a crisis narrative highlighting the resulting exploitation of farmers [7, 54, 60]. However, research has shown that despite the collusion, auctions are still effective means of agricultural trade because a) the presence of sellers (farmers) in the market who can call out wrongdoings, b) fairly open and transparent price discovery for farmers, and c) the establishment of a price benchmark for other mandis and private markets [3, 4]. This price benchmark particularly provides farmers with more options to sell their produce. Furthermore, no matter how problematic, the fact remains that mandis are the only regulated multi-commodity and multi-buyer sites available to smallholder primary producers of agricultural commodities in India [39, 81]. Scholars of agricultural markets in India have further highlighted the many complexities involved in the econometrics of ascending auctions at mandis [3, 4]. These complexities arise from various factors, including the varying quality of produce, competition, policy interventions, political events, mandi infrastructure, transportation, and logistics.

The crisis narrative of corrupt mandis coupled with the lack of uniformity and complex nature of mandi activities creates issues of legibility for their governance and regulation [47, 68]. Centralizing mandis through a common platform emerged as a potential solution to these perceived problems [15, 16], leading to the creation of e-NAM. By relying on technology's promises of transparency, efficiency, and fairness, e-NAM aimed to not just reduce corruption, but also transform the agricultural trade process itself. Through the digital dematerialization and disintermediation of physical mandis, e-NAM sought to improve the agricultural trade process by expanding competition, ensuring uniformity of processes, and removing sociocultural barriers to efficient trade.

It is important to note that we do not condone unethical practices such as buyer collusion. However, a disproportionate focus on these

[1] In India, the term "State Subject" typically refers to subjects or areas of governance and legislation that fall under the exclusive jurisdiction of individual state governments as opposed to the central government.

[2] Maratha-Kunbis are a community in Maharashtra, India, traditionally part of the peasant class engaged in shepherding and agriculture. The term "Kunbi" typically refers to a caste associated with farming and agricultural work. Kunbis are classified under the Other Backward Class (OBC) category in India, a designation for groups that have faced social, economic, and educational disadvantages due to systemic barriers.

[3] Baniya is a generic term used to denote a middle caste community in India and encompasses various sub-castes and communities with different historical and regional distinctions. Baniyas are traditionally associated with trade, commerce, and business, dominating most economic life in India.

malpractices can obscure the structural issues that smallholding farmers face, including the lack of a safety net like the guaranteed minimum support price (MSP) for their crops and effective risk management strategies, such as improved storage structures, better transportation, and logistics to move perishable commodities out of the region and into the supply chain.

5 Findings: A Tale of Two Auctions

In this section, we use ethnographic data to provide a detailed description of how auction processes unfold at a geographically specific site—the Chandrapur mandi—and the web-based e-NAM platform. Although there are regional and commodity-specific variations, we focus on how onions are auctioned, both traditionally through person-to-person transactions at the Chandrapur mandi and via digitally mediated transactions on the e-NAM platform. By offering an in-depth account of how these two onion marketplaces operate, we contribute an ethnographic understanding of how efforts to digitize and platformize trade processes generate different meanings of transparency, efficiency, and participation. These differing interpretations often conflict and slow the adoption of ICTD technologies in traditional agricultural marketplaces.

5.1 "Open Auctions" of Onions at Chandrapur Mandi

Spread over an area of 145 acres, the Agricultural Produce Market Committee (APMC) of Chandrapur[4] (hereafter referred to as Chandrapur mandi) in the Nashik District of western Maharashtra, is reputed to be one of the largest marketplaces for onions in Asia. Situated along the principal commercial corridor of the national highway, NH-3, the mandi benefits from its strategic transportation and logistical advantage, making it a favorable site for agricultural commodity traders who need to quickly push-out perishable commodities into the supply chain. Upon entering the imposing red and yellow entrance of the mandi, one witnesses the bustling 7-acre onion auction yard, filled with neat rows of tractor trolleys and pickup trucks brimming with the season's new red onions (Figure 1). Each tractor-trolley carries approximately 35 quintals[5] and each pickup truck carries around 25 quintals of red onions. As one of the largest onion markets in Asia, Chandrapur mandi receives an average daily arrival of 1,000 vehicles, which triples to about 3,000 vehicles during the peak onion harvest season between March and June. From April 2023 to March 2024, approximately 6,273,674 quintals of onions were traded in Chandrapur mandi, with the highest volume traded in a single day reaching 59,492 quintals on May 8, 2023[6].

Onion auctions in Nashik district are colloquially called "open auctions," where "open"[7] refers to the onions being openly displayed for inspection and sold directly to the trader (Figure 2). In an open auction, farmers perform a rough sorting and grading of freshly harvested onions at their farms and transport the unpacked onions in vehicles directly to the mandis. Once at the auction yard, farmers



Figure 1: Onion auction yard at Chandrapur mandi



Figure 2: Onions on display in 'open' auction

unlatch the safety door at the back of their vehicles, causing the onions to tumble out and form a pile on a plastic sheet laid out beneath. The onions of each vehicle or lot are now on display. This setup is intended to facilitate the quality assessment of onions by the licensed traders, who are both the bidders and buyers of onions.

5.1.1 Quality Assessment. One of the most important aspects of agricultural commodity trade is the quality assessment of commodities, which informs bid and purchase estimates. In the mandis, quality assessment occurs simultaneously with the auction and involves a quick visual inspection. Traders are often seen taking a small sample from the lot, checking various parameters, and then placing bids based on their *subjective* assessment of onions. When asked about their assessment parameters and process, the responses were largely ambiguous: *"experiential knowledge," "embodied experience," "sensory understanding,"* and *"dekh kar hi bata denge"* (we only have to look at the onions to determine quality). Even though it was ambiguous, almost all traders and even the auctioneer were found to employ such experiential knowledge practices to determine the quality of onions. This form of quality inspection was central to the trade of onions in Chandrapur and other onion markets in the region.

5.1.2 "Open Auction" at Chandrapur Mandi. During the hot summer months, onion auctions begin at 8:30 a.m. when the auctioneer, an employee of the mandi, calls out to licensed traders using a

[4]Name changed
[5]1 quintal = 100 kg or 220 lbs
[6]Data procured from Chandrapur mandi records
[7]While open auctions can refer to open-bid auctions in economics literature, 'open,' in this field site, was a reference to the onions being 'openly' displayed for quality inspection



Figure 3: Auction in progress

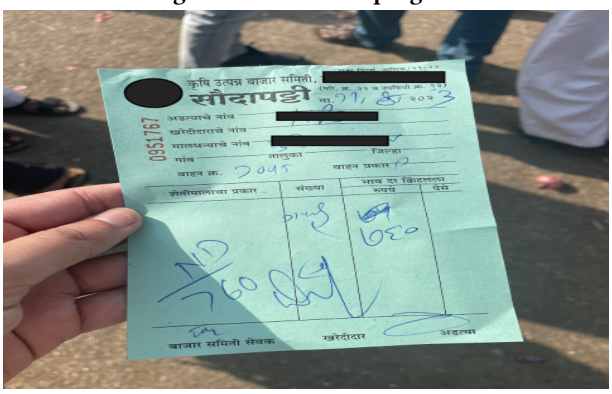


Figure 4: Issuance of *Saudapatti* or Deal Slip post-auction

portable microphone. After a quick visual assessment of the lot's onion quality, the auctioneer announces a *"reserve price,"* or the minimum price, signaling the traders to start bidding in ascending order (Figure 3). Groups of 25 to 30 traders place bids, with prices rising until only one bidder remains, who is then declared the winner. This auction follows an English auction format, also known as an open-outcry ascending-price auction. In this setting, the reserve price plays a crucial role. During discussions with the auctioneer, the first author learned that the reserve price is supposed to be determined by the highest closing price of similar-quality onions from the previous day. However, after several visits, it became apparent that this was not consistently the case, and the process of setting the reserve price was largely obscure.

At Chandrapur Mandi (and other neighboring mandis in Nashik district where an "open auction" format was followed), auctions took place at a dizzying speed, with 5-6 vehicles being auctioned per minute. The auction process was highly chaotic, involving loud conversations alongside the bidding and to an untrained eye, it looked like a group of men moving very slowly along the rows of onion-filled vehicles.

5.1.3 Documentation and post-auction process. Once the auction concludes and a winner is declared, additional mandi staff spring into action. A mandi employee who accompanies the auctioneer continuously records the winning bid along with vehicle details in a record book (Figure 5). This activity is visible to all stakeholders in the mandi. At the end of the auction, another mandi employee issues a green *"sauda-patti,"* or deal slip, to the farmer (Figure 4). This slip contains details of the auction and identifying information for both the winning trader and the farmer's lot, including the farmer's name, vehicle's license plate number, winning trader's company name, and the bid offer. This task is rotated among 4–6 mandi employees to maintain the auction's pace. If the farmer agrees with the offer, they have this deal slip stamped by another mandi employee as confirmation that the auction was finalized at Chandrapur Mandi on the specified date (Figure 6). Otherwise, the farmer can either leave the auction altogether or re-enter the queue for re-auction.



Figure 5: Post-auction recordkeeping in mandi



Figure 6: Stamping of *Saudapatti* or Deal Slip

After the auction, the farmer takes their produce to the weighbridge to determine the exact weight of the onions. This is done by measuring the vehicle both before and after unloading the onions at the traders' warehouse. The entire process is monitored by a mandi employee, and at the end, the weighman notes the difference between the two weights as the actual weight of the onions and issues a bright pink *"kanta patti,"* or weight slip, to the farmer. The farmer takes the weight slip, along with the deal slip, to the mandi committee office, where they receive payment for their produce in cash and are given a white *"hisaab patti,"* or final sale agreement slip. Only after the issuance of the trade slip does the entire trade process conclude.

In the next subsection, we similarly describe e-NAM's workflow.

5.2 Onion Trade on e-NAM

e-NAM is a web-based platform available at all participating APMC mandis across the country. e-NAM is a quasi-physical platform ie., it does not seek to replace mandis. Rather, its aim is to digitize the in-person auctions in mandis into online electronic auctions (e-auctions) [20]. e-NAM's main objective is to expand the geographical scope of trade by allowing traders from other regions to participate virtually. Along with the e-NAM software, participating APMC mandis receive financial grant assistance for internet access and the establishment of quality assaying labs for commodities.

5.2.1 Gate Entry and Lot ID Allocation. e-NAM's online trading processes mirror those of traditional mandis. Farmers bring their roughly sorted and graded produce in tractor trolleys or pick-up trucks to the Chandrapur mandi. At the mandi entrance, each incoming vehicle receives a "gate entry" slip (Figure 8). This slip is the most important document in the e-NAM trading process, as it contains the farmer's identifying details, such as their name, address, and e-NAM registration number, along with information like the vehicle number, commodity type, and approximate quantity of the commodity.[8] Using this information, a unique lot number, or Lot ID, is generated and assigned to the vehicle. This Lot ID serves as a unique identifier in all subsequent e-NAM procedures.

5.2.2 Quality Assessment. Similar to the traditional mandi setup, upon entering, the vehicle is parked in the mandi's auction yard. Here, an assaying lab technician, typically the e-NAM analyst, collects a sample of onions from a lot for quality testing. The e-NAM analyst is the main person responsible for managing all e-NAM-related activities in participating APMC mandis, including the quality assessment of onions. To be able to assess the quality of agricultural produce, e-NAM analysts from a region are required to attend training sessions at the regional AGMARK Lab to learn about AGMARK standards[9] of quality and grading for different crops and produce. The AGMARK standards are the basis for centrally agreed upon grade categories. In an ideal scenario, the quality of agricultural commodities would be standardized and categorized into central categories. However, due to the nature of diverse smallholder farming and the sensitive makeup of onions—which exhibit trait variations in response to minor input changes such as weather conditions, irrigation methods, and nutritional inputs—no standardized qualities of onions exist in the region. For this reason, the quality that aggregates in the mandi is highly diverse.

On e-NAM, a small sample collected from a lot (or vehicle) is taken to the assaying lab inside the mandi office building for quality assessment. This location is inside the mandi office, separate from where the farmers remain in the auction yard. In the assaying lab, the e-NAM analyst evaluates the quality of the onions. However, the details of this assessment are unclear, as no "scientific" device currently exists to measure or grade the quality of onions. The quality determination relies on the training of the e-NAM analyst in determining AGMARK standards and their subsequent subjective assessment of the onion sample. Following this quality assessment, the e-NAM analyst assigns a grade or quality rating to the onions: Grade 1 (premium), Grade 2 (average), or Grade 3 (below average). On e-NAM, these grades are centrally agreed upon beforehand, are pre-loaded on the software and, as we explain below, do not reflect the varied qualities of onions that arrive at the mandi. However, it is unclear how these pre-loaded central grades of onions are finalized. According to the e-NAM analyst at the Chandrapur mandi, these grades closely reflected the AGMARK standards of quality and grades.



Figure 7: e-NAM analyst's office



Figure 8: Gate entry on e-NAM and Lot ID generation

5.2.3 e-Auction on e-NAM. After determining the appropriate category for the quality of onions, the e-NAM analyst generates an e-bid on the e-NAM platform from a designated computer, usually in their office away from the farmers and the auction yard (Figure 7). The platform includes a feature called "assured price," where the analyst sets a minimum and maximum bid amount for a lot. A maximum bid is established to cap the highest amount for a lot, ensuring that costs remain fair and aligned with the market and

[8]The usual practice for estimating the quantity of a commodity involves counting the number of bags it is packed in. However, this method does not apply to the "open auction" of onions in the Nashik district, where onions are presented for sale in an unpacked state. Consequently, an approximate number of bags and an estimate of weight are mentioned to provide an estimate.

[9]AGMARK is a certification mark used on agricultural products in India, ensuring they meet standards approved by the Directorate of Marketing and Inspection (DMI) of the Department of Agriculture, Ministry of Agriculture and Farmers Welfare, Government of India. The term "AGMARK" combines "agriculture" and "mark." In India, AGMARK is legally enforced by the Agricultural Produce (Grading and Marking) Act of 1937, which was amended in 1986. The mark certifies that the products meet specific quality standards, providing confidence in the safety and quality of agricultural products and aiding in the sale and export of these products by assuring consumers of their quality.

to prevent overpayment. Similar to the English auction in traditional mandis, bid generation on the platform involves establishing a *reserve price* and setting a maximum time for bids during which traders can place their offers. The e-NAM analyst has control over setting the appropriate time for bidding which depends on factors like commodity, number of bidders, total number of lots to be e-auctioned. At Chandrapur mandi, an e-auction was usually open for 15 minutes. Additionally, e-bidding is also governed by several stringent rules, such as a buyer required to bid at least three times to remain eligible in the online auction. In the e-NAM system, the designated analyst effectively replaces the auctioneer's role from traditional mandis and is responsible for monitoring the bidding process. Important to note is that e-bidding is an anonymous process, meaning that while the bidders/traders will be able to see the highest bid amount they would not know who the corresponding bidder is.

Large markets like Chandrapur also provide a trading room equipped with several computers for local traders to place their bids online. During the e-bidding, the bids and offers corresponding to a Lot ID should be displayed on a large screen at a common accessible place in the mandi for transparency. However, the first author could not locate any such screen or infrastructure at Chandrapur mandi or any other mandi in Nashik district.

5.2.4 Post-Bidding Process. After the bidding period concludes on the e-NAM platform, the e-NAM analyst announces the top bid along with the corresponding bidder. The bid specifics are then communicated to the farmer through a text message. If the farmer accepts the bid price, the e-auction concludes successfully. However, if the farmer rejects the offer, they may choose to re-list their produce for a subsequent auction on e-NAM or proceed with a traditional auction in the mandi. The rest of the trade process is similar to that of a traditional mandi auction except for documentation. After the e-auction, the vehicle carrying the produce proceeds to the weighbridge for weighing. Following this, a final *sale agreement* is drafted, detailing all pertinent aspects of the transaction, such as the farmer's and buyer's information, the weight and quality of the produce, e-auction specifics, and the agreed price. The issuance of this contract obliges the buyer to transfer payment directly into the farmer's bank account. Finally, an exit pass is issued to the farmer, signifying the completion of the transaction and permitting the farmer's departure from the mandi premises.

In the next section we highlight the contrasts between the traditional mandis and e-NAM and their affordances when it comes to transparency, efficiency, and participation in agricultural trade processes.

6 Contrasting Mandis and e-NAM

In the subsections, we discuss essential contrasts between the mandi and e-NAM. We demonstrate how similar trade processes foster entirely different interpretations of values such as transparency, efficiency, and participation among farmers and traders. In the conclusion we argue that these differing values are why farmers and traders prefer mandis over e-NAM.

6.1 Transparency: *Visibility* of Processes

In this subsection, we contrast how a crucial aspect of agricultural commodity trade—quality assessment—played out in traditional mandis and on e-NAM. We illustrate how the two agricultural marketplaces, one physical and the other digital, foster visibility of processes and information differently. We demonstrate how these differences shape what transparency means in the two contexts. We found that, rather than being a fixed technical value aimed at reducing information asymmetry, transparency was context-dependent.

6.1.1 Visual Quality Inspection: Exactitude vs 'Overall Quality'. A key difference between the mandi and e-NAM is the method of quality assessment for onions on the two platforms. As noted in the previous section, in a mandi, traders use a visual inspection method to assess onion quality. This method may not be immediately apparent to an amateur observer, but it is highly logical and aligns with both trade practices and the specific biological and material characteristics of onions. Below, we explain why a visible inspection of the entire lot and, therefore, physical presence is crucial for determining onion quality.

Assessing onion qualities is a reverse process that begins not from the onions themselves but from a loose categorization of grades based on common export demands. For example, it is widely recognized among traders and farmers that light pink onion bulbs smaller than 45mm are preferred in the Bangladeshi market, a common export destination, whereas bright red bulbs larger than 55mm are favored in Dubai and Gulf markets, another frequent destination for exports. Given these specific requirements, traders create *loose categories* for grading onions during auctions.

During fieldwork, the first author found that different traders had various grade specifications. While not very specific, these specifications could be grouped into broad categories. In this paper, we refer to these general trader-determined loose/shifting grades that are socially constructed and actively created [2, 12] as "general trade categories." These categories primarily serve as guidelines for traders when there is good availability (in terms of quality and quantity) of onions in the market. Traders purchase onions of different qualities based on the prices offered and the grades demanded by their buyers further down the supply chain.

Several attributes serve as indicators of the onion's quality and grade, guiding buyers in their decision-making throughout the auction process. These include onion's outer protective skin, color, and size. A greater number of dry outer skins indicates better post-harvest treatment or curing, which results in a longer shelf life. The other two factors—color and size—are mostly cosmetic features but nonetheless important. Sometimes, traders would assess onions for firmness and other identifying characteristics. Higher-grade onions fetch higher prices, while lower grades result in reduced prices. Table 1 provides an overview of general trade categories of red onions in onion mandis of Nashik district.

Since onions are a root vegetable visible only once harvested, onions from a single lot (vehicle) can vary widely in size. During the open auction, traders place bids on a lot that best matches their requirements. To do this, they quickly assess the overall quality of onions in a lot through various sensory practices, such as checking the onions for color, firmness, outer skin count, and inspecting for

General Trade Categories of Red Onions (in Nashik District)		
Grades and Colloquial References	**External Parameters**	**Size**
Grade A ("Super")	Triple skin, bright red color	>70+mm
Grade B ("Average Super")	Double skin, bright red color	50-75mm
Grade C ("Average")	Single skin, lighter red-pink color	30-50mm
Grade D ("Damage")	Skinless, damaged	-

Table 1: Qualities and Grades of Red Onions

any visible diseases or irregularities like smut, doubling, and bolting. The traders' approach during auctions is not one of precision but rather involves quickly gaining an *overall sense* of a vehicle's lot. As Mr. Jain, a prominent and influential onion trader at Chandrapur mandi, put it:

> *"Onions are a unique crop... non-essential but ubiquitous! Their value lies in their volume..."*

In stating that the value of onions lies in their volume, Mr. Jain reiterated the trade fact that, when it comes to onions, the *overall quality* of the lot is far more important than the quality of individual onions. Therefore gaining an *overall sense* of the lot made onion procurement a *subjective* process that depended on multiple trade and non-trade factors and therefore was largely sensorial.

Visible inspection to determine quality by someone familiar with current trade requirements was integral to onion trade. e-NAM, due to its digital intermediation, was unable to replicate this subjective quality assessment that gave an 'overall sense' of the entire lot– a task traditionally performed by traders. Instead, e-NAM tasked the analyst with collecting a sample from each lot and assessing it using non-existent 'scientific measures.' This approach presented several issues: a) in the absence of any scientific tools or methods for assessing the quality of onions, it forced traders to rely on and trust the quality assessment by an e-NAM analyst, often a "stranger"; b) given that a lot can contain onions of varying sizes, assessing a small sample does not provide a comprehensive evaluation. It is important to note that the e-NAM analyst, unlike other mandi staff such as the auctioneer, weighman, and auction yard staff, stayed mostly inside the mandi premises working on their computer. Given the nature of their work responsibilities, they had limited interactions with farmers and traders. Furthermore, the analysts were computer science graduates who had limited experiential knowledge and understanding of the onion trade. Compared to other on-the-ground mandi staff, the e-NAM analyst was often considered a "stranger" by the farmers and traders.

Given this reality, traders' inability to conduct a visual inspection on e-NAM made the quality assessment process unclear and opaque for them. Due to these issues, e-NAM failed to provide the adequate and appropriate information necessary for successful onion trade. We found a mismatch between what transparency means to traders (and farmers) and what e-NAM claims as transparency through digital intermediation.

6.2 Participation: Familiarity, Accountability, and Agency

While visibility—or the ability to observe processes—was a crucial factor in defining transparency in agricultural trade, we also found *participation* to be another important value for farmers, who preferred using mandis over e-NAM. In the subsections below, we move away from auctions to other peripheral activities, such as documentation, and discuss how these activities were equally as important in determining why farmers preferred using mandis over e-NAM. We show how activities such as documentation not only streamlined the trade process but also fostered a sense of confidence and accountability among farmers and traders—something that e-NAM could not replicate.

6.2.1 Documentation. Apart from the quality assessment of onions, another crucial difference between the two agricultural markets is in their documentation and payment processes. As described above, in a traditional mandi, documentation occurs at all critical stages of the agricultural process: auction, weighing, and final payment. In contrast, on e-NAM, aside from the gate entry slip, the only documentation the farmer receives is the sale agreement document at the end of the transaction. We found that these two methods of documentation have different implications for transparency especially for farmers.

During a conversation, Mr. Shinde, a senior mandi staff member at Chandrapur, explained how the traditional "open" auction at the mandis instilled confidence in farmers, while e-NAM, on the other hand, induced anxiety:

> *"[On e-NAM] farmers don't know what is going on inside the mandi office... I remember entering information about a lot on my tablet when a farmer created a scene and demanded to see what was being entered as he did not understand what was going on... He was not wrong..."*

Mr Shinde pointed out how the farmers did not trust the system because they could not participate or see the 'background activities' of e-NAM. Unlike e-auctions, there were no background activities in the mandis, and successful trade at mandis required active participation by both farmers and traders in all crucial stages of the trade, such as auction, weighing, transportation, and cash payments. There was also clear documentation of each step of the trade in the mandis in the form of the deal slip, the weight slip, and the sale agreement slip signaling the completion of a trade process. As one farmer explained, these trade slips were familiar tangible documents that they could hold onto and that exuded trust in the process as - *"we witness every single process" ("sab aankh ke saamne hota hai").*

In contrast, e-auctions are organized, managed, and declared by the e-NAM analyst from their desktop, far removed from the farmers and traders. In discussions, farmers told the first author

that they found e-auctions to be complex, opaque, and unfamiliar because they had no sense of participation or control over the platform. Farmers, by design, had little to no role in selling their commodities on e-NAM. It was evident that their ability to participate, observe, and engage in mandi trade was what instilled trust and confidence among them in traditional marketplaces.

6.2.2 Accountability and Agency. In addition to fostering a sense of familiarity among the farmers, we found that participation in day-to-day mandi activities also encouraged accountability in agricultural trade. Given that markets are often accused of corruption and inefficient trade operations are frequently blamed for the exploitation of smallholder farmers, this is a significant finding. We discovered that accountability—in this case, the ability to hold the mandi responsible for its actions and events—stemmed from the familiarity and confidence in the system that we discussed in the previous subsection. Participation in mandi activities and knowing where or to whom to allocate responsibility in the system gave farmers the agency to negotiate, complain, and protest. In this subsection, we demonstrate how accountability and agency operated in the mandis, encouraging participation from farmers and traders, and how their absence in e-NAM discouraged participation from these groups.

At Chandrapur mandi, while it seems that farmers have limited control over the auction process, we found that they are not completely excluded from it. Since all onions are auctioned in the same yard, farmers stay informed about the prevailing rates for various onion qualities. Within the auction yard—and outside it—farmers operated as a collective. In one instance, after an auction, a farmer complained that trader collusion had unfairly lowered the price of his high-quality onions. He claimed that his onions were deliberately sold for much less than another lot of comparable quality. This dispute escalated into a heated argument, quickly drawing a large crowd of supportive farmers voicing their own concerns. The unexpected crowd significantly altered the dynamics of the auction yard, leading to a suspension of the auctions for 15 to 20 minutes. It required the intervention of the auctioneer, a senior market staff member, and a prominent local trader to negotiate with the farmers and resume the auctions. Although the matter was not entirely resolved, the suspension disrupted the day's trading schedule, resulting in considerable financial losses for traders, other farmers, and the market as a whole.

We do not suggest that there is no malpractice by traders or that farmers always receive fair prices for their produce in the mandi. Rather, our findings complicate this understanding, indicating that the reality of trading agricultural commodities is not straightforward and complicated by many non-economic factors that we have highlighted in this paper. If anything, the farmers voicing their disagreements and the occurrence of disputes during mandi auctions indicate farmers' agency and a space for negotiation to address disagreements, even if through loud complaints and protests.

Given the nature of agricultural trade, which requires coordination among multiple stakeholders and the handling of delicate, perishable commodities, things often went awry both accidentally and deliberately. The ability to address grievances or flag issues is integral to these processes. As we described above, the mandis facilitated this through active participation and familiarity with the processes and the people involved. In contrast, we found that while e-NAM claimed to offer information transparency and efficiency, the platform lacked active participation by stakeholders and, consequently, lacked accountability.

During a conversation about e-NAM, Shivam, a Niphad-based [10] smallholder farmer, summed up this reasoning succinctly through a hypothetical scenario that the first author could find no response for:

> *"What if they enter the wrong information [on e-NAM], or press the wrong button... where will we complain then?... Is there a guarantee it will be solved?... We have no control over the system..."*

Shivam pointed out the lack of clarity and familiarity with the organizational structure of e-NAM, which affected accountability. He was well aware that platforms and digital systems are prone to human error. For him, it was difficult to determine accountability for errors and oversights on e-NAM, and he understood that he had limited influence to resolve issues in what would likely be a time-consuming bureaucratic process. For a smallholder farmer dependent on mandi income, this translates into a significant loss. In contrast, robust documentation at mandis provided farmers and traders with agency, offering mechanisms for accountability and grievance redressal on the spot. Smallholder farmers understood that in the larger scheme of things—within a high-volume perishable commodity trade on a tight schedule—their issues could get buried in the digital system. Instead, farmers preferred trading in the mandis over e-NAM, where they felt a sense of control, could actively participate, and closely monitor the trade process both individually and collectively.

6.3 Efficiency: Human Expertise and Historical Legacies

In this section, we examine e-NAM's claim of being more efficient than traditional mandis. We highlight the mismatch between what efficiency means on the platform and what efficiency is for farmers and traders. Specifically, through the case of smallholder farmers' preference for receiving cash payments, we demonstrate that efficiency is not solely about streamlining processes and increasing information symmetry. Instead, we emphasize the significant role that human expertise and historical legacies play in determining efficiency.

6.3.1 Time Consuming and Linear e-Auctions. As one of Asia's largest onion markets, Chandrapur is a bustling trade hub and a popular destination for farmers from distant districts to sell onions and other agricultural commodities. During the peak harvest season, approximately 3,000 vehicles arrive at the market each day. To keep up with this high volume, the market operates with exceptional efficiency and at a rapid pace, auctioning 5-6 vehicles per minute, or roughly 7-10 seconds per auction. Given this tempo, the market processes function like a well-oiled machine, where each participant is an expert who understands their tasks, responsibilities, and actions. In such a system, the traders' quick, experience-based visual quality assessments are essential for the efficient and timely auctioning

[10] Niphad is a taluka in Nashik district. In India, a taluka is an administrative unit below a district. Taluka are also known as tehsil in North India

of the day's arrivals. Daily market activities, especially during the harvest season, rely heavily on the expertise and coordination of all participants, who benefit from their involvement in and familiarity with market processes. This level of efficiency is crucial for swiftly moving high-volume, perishable commodities like onions out of the region—given the limited storage capacity—and into the networks of the global supply chain.

In contrast, e-NAM's digital processes were linear, focusing on information asymmetry. Rather than having expertise divided among the stakeholders, most trade responsibilities—such as quality assessment, setting up e-auctions, monitoring auctions, and declaring results—were managed by the e-NAM analyst. It was indicated that on e-NAM, no more than four to five vehicles could be auctioned in an hour.

In July 2023, during a field visit to the Chandrapur mandi, the e-NAM analyst and the first author stood on the roof of the mandi office to get an aerial view and a sense of the vast premises. The seven-acre onion yard and the two reserve yards across the road were packed with colorful tractors loaded with shiny red onions, all waiting their turn to be auctioned in the unforgiving summer heat. Noticing the first author's surprise at the large number of vehicles in the mandi, the e-NAM analyst spoke about e-NAM's efficiency and remarked:

> *"[on e-NAM]...it would take us a month to auction all the vehicles that are auctioned in the mandi in one day alone..."*

This comment was significant in highlighting the necessity for the trade to operate with exceptional efficiency and speed. Neither farmers, traders, nor perishable commodities like onions can afford prolonged delays in the trade process. In fact, it is human expertise, informality, space for negotiation, and daily coordination at the mandi that fed global supply chains and kept them afloat.

6.3.2 Cash Payments. We found that one of the main reasons farmers preferred mandis over e-NAM was their preference for immediate cash payments rather than online bank transfers. This preference was due to several factors: a) cash payments allowed farmers traveling from remote areas to purchase essentials like groceries, household items, fertilizers, and other necessities on their way home; b) the rural banking infrastructure, while still developing, remained inconvenient and time-consuming to access; and c) farmers had a deep-seated mistrust of the state.

In a conversation with Umesh, a licensed trader at Chandrapur mandi, the issues of inconvenience and mistrust in the state emerged during a routine discussion:

> *"Farmers will not accept online payment... they don't have the time for repeated visits to the bank (chakkar kaatna)... they also fear that taxes and cess will be deducted from their bank accounts because they had previously taken subsidies from the government... Farmers don't want to keep their money with the government [in the bank]..."*

When probed further about cash payments, Umesh provided historical context and explained that in rural areas, due to limited banking infrastructure, farmers typically had to wait 2-3 hours *"to get their own money out of the bank."* He added that although the banking system is comparatively more efficient now, farmers still prefer avoiding the *"bureaucratic process" (sarkari taam-jhaam)* when the option of instant cash payments was available at the mandi.

Discussions with several farmers revealed that the memory of the rural banking infrastructure failing during the COVID-19 global pandemic was fairly recent. During the pandemic, all mandi payments were made online through RTGS[11] fund transfers. Given the high volume of trade, numerous errors in entering bank account details occurred, causing significant hassle for the farmers. Additionally, since transferring money required manual cross-checking of each transaction, it took mandis 4-5 days to transfer the money to farmers' accounts. Consequently, farmers from remote regions who depended on trips to the Chandrapur mandi to stock up on essentials were stranded. Some even had to make a second trip to Chandrapur to access their bank accounts, as there were no bank branches in their villages.

The state was also not of much support during the pandemic and the farmers felt betrayed (*"saath nahi diya"*). In multiple conversations, farmers revealed having a mistrust in the state and feared that the authorities would deduct previous subsidies awarded to them from their accounts. The source of this fear was unclear and when asked for clarification Umesh shrugged his shoulders and responded– *"perhaps demonetization*[12]*..?!?! It will take farmers at least another decade to fully embrace online banking..."*

The lack of clarity in why farmers mistrusted the state was indicative of longer historical legacies that perhaps went further back in time to indicate current peasant struggle both locally and nationally. The state brutality against farmers during the 2020-2021 farmers' protest in north India was fresh in everyone's memories. Additionally, cash payments provided farmers with a sense of completion in the trade process. This method allowed them to actively participate, feel free from anxiety and doubts, and experience transparency. It was one less step to worry about for the farmers in the already time-consuming trade process. Efficiency therefore was not just a function of information availability but was shaped by historical and political legacies and experiences.

7 Discussion

In this paper, we advocate for an expanded understanding of values such as transparency, efficiency, and participation as mediated by digital platforms. By comparing a traditional agricultural marketplace (mandi) in rural western Maharashtra with e-NAM, a national trading portal for agricultural commodities, we demonstrate how these two sites cultivate different meanings for these seemingly fixed values. As platforms and their technological governance expand to new sites like smallholder agriculture in non-Western contexts, we argue against the generalizability of these platforms. Instead, we advocate for attentiveness to the sociocultural, political, and historical organization of rural agrarian society.

Our work builds on existing literature in ICTD and HCI that has studied rural markets in India and reached similar conclusions [76, 85]. This literature emphasizes the importance of digital technologies, such as mobile phones, as tools for accessing agricultural

[11] Real Time Gross Settlement

[12] The demonetization of 2016 in India refers to the Indian government's sudden and controversial decision to invalidate the 500-rupee and 1,000-rupee banknotes as legal tender.

market information and highlights non-economic factors beyond market prices that influence decision-making processes in traditional marketplaces. However, this paper diverges from previous literature and makes significant contributions by examining the growing role of the state in reshaping these markets, as demonstrated by eNAM, a state-sponsored platform aimed at transforming mandis for welfare and governance of smallholder farmers. As the state increasingly uses datafication to govern various public sectors, such as agriculture, education, health, and transportation [40], our work critically examines how this governance unfolds in practice. In doing so, we not only highlight the state's data-driven model of governance but also emphasize the agentic role that users play in these otherwise top-down sociotechnical systems. This focus is particularly significant in Indian agriculture given recent political events where Indian farmers have actively taken on state policies in what they perceive is being left at the mercy of laissez-faire market policies [37].

In the subsections, we emphasize the need to expand our understanding of transparency, participation, and efficiency when studying how platform logics translate to newer sites and contexts. We conclude by arguing that platforms are political sites of engagement and play a significant role in expanding or limiting people's capacity for action through their affordances of agency and accountability.

7.1 Expanding the Scope of Transparency, Participation, and Efficiency

Economic literature on auction theory links the efficiency of auctions to transparency or "openness" regarding the availability of accurate and relevant information about commodities to all market participants, particularly the bidders [49]. Theoretically, "informed" bidding leads to efficient outcomes for all stakeholders because bidders do not overestimate the value of goods, sellers increase their revenue as a result of competitive bidding, and commodities go to the bidders who value them the most. As a digital trading platform, e-NAM aims to bring transparency and efficiency to agricultural trade by reducing information asymmetry and uncertainty for bidders and traders. The platform tries to achieve this by providing information about available lots, including details on the quality and grade of commodities. On e-NAM, transparency is closely tied to the fairness of trade outcomes, as the anonymity of bidders on the platform makes it more difficult for them to manipulate the auction.

In our paper, we have demonstrated that transparency does not have a fixed meaning that automatically equates "more information" with more transparency. Instead, we have illustrated how transparency is context-dependent and closely linked to non-economic conditions such as local sociocultural networks, agrarian realities, familiarity of interactions, sense of control, and historical legacies. For instance, quality assessments have historically relied on subjective, relational processes, such as visual inspections conducted by market actors. In contrast, e-NAM systematizes these processes in ways that overlook their embeddedness in local networks. While standardization aims to enhance fairness and consistency, it risks erasing productive negotiation spaces that have long been central to building trust and fostering accountability in agricultural markets.

Reducing "transparency" to a technical issue of increasing information access and decreasing information asymmetry is a simplistic way of understanding how transparency operates in real-world auctions and marketplaces. In traditional mandis, negotiation spaces are embedded in the socio-political fabric of the markets, and act as important sites for resolving disputes, building trust, and fostering accountability. For both farmers and traders, the two main target groups of e-NAM, transparency was closely tied to active participation in the trade process. Witnessing and participating in the market process were important prerequisites for transparent, efficient, and fair agricultural trade, as they allowed farmers to gather real-time information about prices and gauge the current mandi dynamics. Such participation creates a knowledge economy rooted in familiarity stemming from local sociocultural dynamics and agrarian politics, experiential knowledge and repeated interactions. While not all participation or knowledge was positive, it made the highly unpredictable and volatile price-determination process more approachable and understandable, allowing farmers some sense of control.

Digital platforms like e-NAM, with their emphasis on efficiency and anonymity, risk designing out these spaces of negotiation, and consequently eroding the relational trust integral to market stability. The premise of e-NAM's free-market logic, that renders non-economic relationships to a peripheral status, was at odds with the existing reality of agricultural trade. e-NAM promoted an ethic of anonymity and impartial mediation through a third-party digital platform. It encouraged farmers and traders to place their trust in newly appointed experts, such as the e-NAM analyst, who typically did not belong to the same agrarian class and had lower stakes in the process. This approach reflects broader trends in digital platform design, where friction is often seen as a problem to be eliminated rather than a productive element to be preserved [29, 70]. The result is a system that not only disrupts established socio-political dynamics but also induces mistrust and anxiety among stakeholders unfamiliar with its operational logic.

By doing so, e-NAM uprooted both farmers and traders from their socio-political agrarian networks, increased the distance between stakeholders, and altered the meaning of participation in agricultural marketplaces, thereby inducing a sense of anxiety, suspicion, and mistrust toward the unfamiliar system. Such mistrust was not baseless or merely a fear of the unknown. Instead, it was rooted in farmers' historical experiences, where they felt neglected and betrayed by the state. The Indian state's recent push to digitize *all* sectors of the economy has also been criticized for depoliticizing and flattening differences of caste, class, gender, religion, and ethnicity, which produces more harm for structurally marginalized groups [71]. Given this reality, farmers' and traders' refusal to participate in e-NAM is a political act [31], whereby they act as members of an agrarian social class with its own social ties, cultural contexts, shared understanding, and sources of risk mitigation and safety.

It is worth repeating that we do not condone or romanticize unethical or corrupt practices, such as buyer collusion. However, an overemphasis on these malpractices has resulted in design decisions that overlook local socio-cultural practices and structural issues, favoring systems that fixate on addressing corruption. This overemphasis on corruption detracts from farmers' demands for a

guaranteed Minimum Support Price (MSP) for their crops and effective risk management strategies, like improved storage facilities and better transportation and logistics to quickly move perishable commodities into the supply chain. Overemphasizing malpractices results in market platforms designed to be anonymous and depersonalized. Such designs do not increase transparency or efficiency; rather, they render shared social contexts and socially constructed trust obsolete. These design practices, which isolate and individualize, result in more harm for marginalized communities, such as smallholder farmers from lower caste and class backgrounds in this case. These isolating design practices of market platforms eliminate farmers' social safety net (association with an agrarian class), which is crucial for risk mitigation, especially when dealing with highly perishable commodities during a climate crisis.

We acknowledge that this tension between "corruption" and "community" is not new and has long complicated our understanding of "informal" spaces [46, 59, 65] and how to design for them [17]. The legitimacy of market institutions is tied to market actors' historical experiences with those institutions. As scholarship on informal economies has shown, if the state is perceived as a distant or unreliable actor, then individuals will resist formal mechanisms of transparency and accountability [14, 64]. We argue that designing "fair" market platforms requires retaining these informal negotiation practices rather than erasing them. By grounding digital interventions in local norms and practices, designers can create systems that are both accountable and contextually legitimate and predictable, fostering trust and long-term adoption. This involves re-imagining alternate platforms not as mechanisms for seamless transactions but as spaces where social, political, and economic practices can coexist productively, guided by friction [61] rather than its erasure.

7.2 Platforms and Politics: Of Agency and Accountability

We have argued that e-NAM's focus on enhancing information symmetry overly prioritized economic principles of supply and demand. This overemphasis resulted in a market platform that signified the end of intermediation, distance, politics, and history [9, 52], thereby mystifying technology-mediated information symmetry [76] and implying economic and technological progress. By discouraging non-economic or socio-cultural influences from affecting transactions, e-NAM treated each stakeholder as an independent business entity. This approach deliberately separated farmers and traders from their agrarian social class, limiting their collective action, agency, and safety.

HCI literature on platform capitalism has shown how urban, on-demand service platforms reduce workers to minimal and quantifiable data points to manage their labor [69]. This technological governance operates through individuation and isolation as a labor management strategy, extracting workers' compliance and preventing work disruption by containing protests [72]. Workers often report a lack of agency and participation in the platform's labor management strategies during crises [73] and the platform's failure to address their grievances, which leads to overwork, exhaustion, speedups, and injury [72]. We argue that, as a market platform, e-NAM similarly individuates farmers and traders and limits their agency by identifying them in the system only as data points. By reducing farmers to Lot IDs and traders to independent business units acting solely out of economic 'self-interest,' e-NAM advances a limiting understanding of transparency, fairness, and efficiency.

Such a depoliticized understanding of real-world situations mystifies technologies and renders people and relationships invisible, thereby removing agency from people and accountability from systems. Our capacity for action is always relational in character [78], and relationships and cultures are not static but are actively constructed through identity, place, power, and resistance [36]. We have demonstrated the central role that familiarity and interactions play for farmers in voicing concerns and grievances and in their capacity for action. In mandis, farmers' agency materially translates to actions that demand accountability from the 'system.' On e-NAM, however, this agentic relationship to accountability is erased. And this erasure of agency and accountability on e-NAM is well recognized by farmers and traders who then refuse to use the trading platform.

While not perfect, we have shown that mandis, through participation, negotiations, and negations, afford agency to both farmers and traders by allowing them to function as members of an agrarian class bound by shared interests and history. In contrast, e-NAM, as a generalized and centralized trading platform, is relatively disembedded and removed from the socio-cultural realities of local agrarian class politics. These findings raise important concerns about the design practices of these systems, and we emphasize the need to move beyond a purely economic view of markets as neutral spaces. We argue that the design of alternative market platforms must sustain and enhance the practices, relationships, and trust essential for the stability and fairness of markets. Designers can address this by balancing efficiency with the relational and contextual richness that make these markets meaningful and functional for stakeholders. We offer the following recommendations. First, rather than overhauling the entire market system, platforms should incorporate mechanisms for collective negotiation and dispute resolution that align with the existing practices of local agrarian communities. Second, as large-scale platforms seek to expand, they should consider rural infrastructural realities, such as the lack of robust banking systems and unreliable internet services, especially concerning timely payments and tangible accountability mechanisms like receipts and documentation. These measures help strengthen users' sense of control over the process. Finally, market platforms should support both individual agency and relational accountability by embedding mechanisms that allow users to voice concerns, demand accountability, and negotiate collectively.

In our paper, we emphasize that traditional marketplaces, such as mandis, function not only as sites of economic exchange but also as socially, culturally, and politically embedded institutions [44]. Moving beyond the "digital divide" argument to explain why technologies fail to integrate into rural, remote, non-Western contexts, our paper demonstrates the central role of place, culture, politics, and history in explaining why farmers and traders refuse to use e-NAM for agricultural trade. In the face of asymmetrical power relations that exist both within and beyond the market, such as caste hierarchies, markets can serve as vital spaces for intervention.

Market platforms, rather than 'disrupting' existing social and traditional practices, should enable participants to influence market outcomes through collective agency and accountability.

Acknowledgments

We thank our many interlocutors and the staff at Chandrapur Mandi for sharing their invaluable insights and time with us. We also extend our gratitude to the anonymous reviewers for their invaluable feedback and insightful comments, which helped strengthen the arguments of this paper. The first author is especially grateful to Dr. Silvia Lindtner for her intellectual support during the fieldwork for this research.

References

[1] Jenny C Aker, Ishita Ghosh, and Jenna Burrell. 2016. The promise (and pitfalls) of ICT for agriculture initiatives. *Agricultural Economics* 47, S1 (2016), 35–48.
[2] Arjun Appadurai. 1988. *The Social Life of Things: Commodities in Cultural Perspective.* Cambridge University Press.
[3] A Banerji, Neha Gupta, and J V Meenakshi. 2012. Auctions in Grain Markets and Farmer Welfare. *Economic and Political Weekly* 47, 52 (2012), 64–71. http://www.jstor.org/stable/41720552
[4] A. Banerji and J. V. Meenakshi. 2004. Buyer Collusion and Efficiency of Government Intervention in Wheat Markets in Northern India: An Asymmetric Structural Auctions Analysis. *American Journal of Agricultural Economics* 86, 1 (2004), 236–253. http://www.jstor.org/stable/3697887
[5] Rajiv D Banker and Sabyasachi Mitra. 2007. Procurement Models in the Agricultural Supply Chain: A Case Study of Online Coffee Auctions in India. *Electronic Commerce Research and Applications* 6, 3 (2007), 309–321.
[6] Theodore C Bestor. 2004. *Tsukiji: The Fish Market at the Center of the World.* Vol. 11. Univ of California Press.
[7] Partha Sarathi Biswas. 2016. Agriculture Reform: Breaking the Trader Cartel. https://indianexpress.com/article/india/india-news-india/agriculture-reform-breaking-the-trader-cartel-2855435/. [Accessed 04-09-2024].
[8] Hilde Bjørkhaug, André Magnan, and Geoffrey Lawrence. 2018. *The Financialization of Agri-food Systems: Contested Transformations.* Oxon: Routledge.
[9] John Seely Brown and Paul Duguid. 2017. *The Social Life of Information.* Harvard Business Review Press.
[10] Jenna Burrell. 2009. The Field Site as a Network: A Strategy for Locating Ethnographic Research. *Field methods* 21, 2 (2009), 181–199.
[11] Jenna Burrell and Elisa Oreglia. 2015. The Myth of Market Price Information: Mobile Phones and the Application of Economic Knowledge in ICTD. *Economy and Society* 44, 2 (2015), 271–292.
[12] Michel Callon, Cécile Méadel, and Vololona Rabeharisoa. 2002. The Economy of Qualities. *Economy and society* 31, 2 (2002), 194–217.
[13] Michael Carolan. 2018. 'Smart' Farming Techniques as Political Ontology: Access, Sovereignty and the Performance of Neoliberal and Not-So-Neoliberal Worlds. *Sociologia Ruralis* 58, 4 (2018), 745–764.
[14] Miguel Angel Centeno and Alejandro Portes. 2006. The Informal Economy in the Shadow of the State. *Out of the Shadows: Political Action and the Informal Economy in Latin America* 2006 (2006), 23–48.
[15] Ramesh Chand. 2012. Development Policies and Agricultural Markets. *Economic and Political Weekly* (2012), 53–63.
[16] Ramesh Chand. 2016. e-Platform for National Agricultural Market. *Economic and Political Weekly* (2016), 15–18.
[17] Priyank Chandra. 2017. Informality and Invisibility: Traditional Technologies as Tools for Collaboration in an Informal Market. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, Colorado, USA) *(CHI '17)*. Association for Computing Machinery, New York, NY, USA, 4765–4775. https://doi.org/10.1145/3025453.3025643
[18] Priyank Chandra, Syed Ishtiaque Ahmed, and Joyojeet Pal. 2017. Market Practices and the Bazaar: Technology Consumption in ICT Markets in the Global South. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, Colorado, USA) *(CHI '17)*. Association for Computing Machinery, New York, NY, USA, 4741–4752. https://doi.org/10.1145/3025453.3025970
[19] Priyank Chandra and Joyojeet Pal. 2019. Rumors and Collective Sensemaking: Managing Ambiguity in an Informal Marketplace. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland Uk) *(CHI '19)*. Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3290605.3300563
[20] Shoumitro Chatterjee and Mekhala Krishnamurthy. 2020. Understanding and Misunderstanding e-NAM. https://www.india-seminar.com/2020/725/725_shoumitro_and_mekhala.htm#top
[21] Adele E Clarke, Carrie Friese, and Rachel S Washburn. 2017. *Situational Analysis: Grounded Theory After the Interpretive Turn.* Sage publications.
[22] John M. Crespi and Richard J. Sexton. 2004. Bidding for Cattle in the Texas Panhandle. *American Journal of Agricultural Economics* 86, 3 (2004), 660–674.
[23] Olivia Doggett, Kelly Bronson, and Robert Soden. 2023. HCI Research on Agriculture: Competing Sociotechnical Imaginaries, Definitions, and Opportunities. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 236, 24 pages. https://doi.org/10.1145/3544548.3581081
[24] Robert M Emerson, Rachel I Fretz, and Linda L Shaw. 2011. *Writing Ethnographic Fieldnotes.* University of Chicago press.
[25] Mark-Anthony Falzon. 2016. *Multi-sited Ethnography: Theory, Praxis and Locality in Contemporary Research.* Routledge.
[26] Andrew Feenberg. 2010. *Between Reason and Experience: Essays in Technology and Modernity.* Mit Press.
[27] Leslie Fine. 2021. Auctions. https://www.econlib.org/library/Enc/Auctions.html
[28] Neil Fligstein and Luke Dauter. 2007. The Sociology of Markets. *Annual Review of Sociology* 33, 1 (2007), 105–128.
[29] Laura Forlano and Anijo Mathew. 2017. From Design Fiction to Design Friction: Speculative and Participatory Design of Values-Embedded Urban Technology. In *Urban Informatics.* Routledge, 7–24.
[30] Susanne Freidberg. 2020. "Unable to Determine": Limits to Metrical Governance in Agricultural Supply Chains. *Science, Technology, & Human Values* 45, 4 (2020), 738–760.
[31] Patricia Garcia, Tonia Sutherland, Niloufar Salehi, Marika Cifor, and Anubha Singh. 2022. No! Re-imagining Data Practices Through the Lens of Critical Refusal. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW2, Article 315 (nov 2022), 20 pages. https://doi.org/10.1145/3557997
[32] Marie-France Garcia-Parpet. 2008. *Chapter 2. The Social Construction of a Perfect Market: The Strawberry Auction at Fontaines-en-Sologne.* Princeton University Press, Princeton, 20–53. https://doi.org/doi:10.1515/9780691214665-004
[33] Clifford Geertz. 2008. Thick Description: Toward an Interpretive Theory of Culture. In *The Cultural Geography Reader.* Routledge, 41–51.
[34] Haidy Geismar. 2001. What's in a Price? An Ethnography of Tribal Art at Auction. *Journal of material culture* 6, 1 (2001), 25–47.
[35] Mark Granovetter. 2005. The Impact of Social Structure on Economic Outcomes. *Journal of Economic Perspectives* 19, 1 (March 2005), 33–50. https://doi.org/10.1257/0895330053147958
[36] Akhil Gupta and James Ferguson. 1997. *Culture, Power, Place: Explorations in Critical Anthropology.* duke University press.
[37] Paridhi Gupta, Adrian Petterson, Divyani Motla, and Priyank Chandra. 2022. Ladange, Adange, Jeetange: The Farmers' Movement and Its Virtual Spaces. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW2 (2022), 1–34.
[38] Leon Tinashe Gwaka. 2022. Computer Supported Livestock Systems: The Potential of Digital Platforms to Revitalize a Livestock System in Rural Zimbabwe. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW2, Article 360 (Nov. 2022), 28 pages. https://doi.org/10.1145/3555085
[39] Barbara Harriss-White. 1996. *A Political Economy of Agricultural Markets in South India: Masters of the Countryside.* Sage Publications.
[40] Linda Huber, Anubha Singh, Lynn Dombrowski, Shion Guha, Jean Hardy, and Naja Holten Møller. 2024. Datafication Dilemmas: Data Governance in the Public Interest. In *Companion Publication of the 2024 Conference on Computer-Supported Cooperative Work and Social Computing* (San Jose, Costa Rica) *(CSCW Companion '24)*. Association for Computing Machinery, New York, NY, USA, 114–116. https://doi.org/10.1145/3678884.3689137
[41] Jean E. Jackson. 1990. *"I Am a Fieldnote": Fieldnotes as a Symbol of Professional Identity.* Cornell University Press, 3–33. http://www.jstor.org/stable/10.7591/j.ctvv4124m.4
[42] Robert Jensen. 2007. The Digital Provide: Information (technology), Market Performance, and Welfare in the South Indian Fisheries Sector. *The quarterly journal of economics* 122, 3 (2007), 879–924.
[43] Devesh Kapur and Mekhala Krishnamurthy. 2014. Understanding Mandis: Market Towns and the Dynamics of India's Rural and Urban Transformations. *Center For The Advanced Study of India, University of Pennsylvania* (2014).
[44] Mekhala Krishnamurthy. 2020. *Mandi Acts and Market Lore: Regulatory Life in India's Agricultural Markets.* Cambridge University Press, 179–205.
[45] Richa Kumar. 2016. *Rethinking Revolutions: Soyabean, Choupals, and the Changing Countryside in Central India.* Oxford University Press.
[46] Alena Ledeneva. 2017. Where Does Informality Stop and Corruption Begin? Informal Governance and the Public/private Crossover in Mexico, Russia and Tanzania. *Slavonic and East European Review* 95, 1 (2017), 49–75.
[47] Jen Liu and Phoebe Sengers. 2021. Legibility and the Legacy of Racialized Dispossession in Digital Agriculture. *Proc. ACM Hum.-Comput. Interact.* 5, CSCW2, Article 480 (oct 2021), 21 pages. https://doi.org/10.1145/3479867
[48] George E Marcus. 1995. Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography. *Annual review of Anthropology* 24, 1 (1995), 95–117.
[49] Paul R Milgrom and Robert J Weber. 1982. A Theory of Auctions and Competitive Bidding. *Econometrica: Journal of the Econometric Society* (1982), 1089–1122.

[50] Nusrat Jahan Mim. 2021. Gospels of Modernity: Digital Cattle Markets, Urban Religiosity, and Secular Computing in the Global South. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI '21)*. Association for Computing Machinery, New York, NY, USA, Article 91, 17 pages. https://doi.org/10.1145/3411764.3445259

[51] Thomas J. Misa. 2002. The Compelling Tangle of Modernity and Technology. In *Modernity and Technology*. The MIT Press. https://doi.org/10.7551/mitpress/4729.003.0003 arXiv:https://direct.mit.edu/book/chapter-pdf/2303993/9780262279932_caa.pdf

[52] Vincent Mosco. 2004. *The Digital Sublime: Myth, Power, and Cyberspace*. The MIT Press. https://doi.org/10.7551/mitpress/2433.001.0001

[53] Roger B Myerson. 1981. Optimal Auction Design. *Mathematics of Operations Research* 6, 1 (1981), 58–73.

[54] Sthanu R Nair and Reddy Sai Shiva Jayanth. 2020. How Farmers View the Existing Mandi System. https://www.newindianexpress.com/opinions/2020/Dec/12/how-farmers-view-the-existing-mandi-system-2235123.html. [Accessed 04-09-2024].

[55] Government of India. September, 2021. *Situation Assesssment of Agricultural Households and Land and Livestock Holdings of Households in Rural India, 2019 (NSS 77th Round)*. Technical Report. Ministry of Statistics and Programme Implementation, Government of India. https://mospi.gov.in/sites/default/files/publication_reports/Report_587m_0.pdf Accessed: 2023-10-05.

[56] Elisa Oreglia. 2013. When Technology Doesn't Fit: Information Sharing Practices Among Farmers in Rural China. In *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers - Volume 1* (Cape Town, South Africa) *(ICTD '13)*. Association for Computing Machinery, New York, NY, USA, 165–176. https://doi.org/10.1145/2516604.2516610

[57] Elisa Oreglia and Janaki Srinivasan. 2016. Intermediaries, Cash Economies, and Technological Change in Myanmar and India. *UC Irvine: Institute for Money, Technology and Financial Inclusion*. (2016).

[58] Elisa Oreglia and Janaki Srinivasan. 2020. Human and Non-human Intermediation in Rural Agricultural Markets. *Journal of Cultural Economy* 13, 4 (2020), 353–367.

[59] John Osburg. 2018. Making Business Personal: Corruption, Anti-corruption, and Elite Networks in Post-Mao China. *Current Anthropology* 59, S18 (2018), S149–S159.

[60] Ila Patnaik and Shubho Roy. 2019. Want to Help Farmers, Remove Middlemen? Scrap the Law Governing Agri Markets. https://theprint.in/opinion/want-to-help-farmers-remove-middlemen-scrap-the-law-governing-agri-markets/196348/. [Accessed 04-09-2024].

[61] James Pierce. 2021. In Tension With Progression: Grasping the Frictional Tendencies of Speculative, Critical, and Other Alternative Designs. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–19.

[62] Stuart Plattner. 1982. Economic Decision Making in a Public Marketplace. *American ethnologist* 9, 2 (1982), 399–420.

[63] Karl Polanyi. 2018. The Economy as Instituted Process. In *The Sociology of Economic Life*. Routledge, 3–21.

[64] Alejandro Portes and William Haller. 2005. *18. The Informal Economy*. Princeton University Press, Princeton, 403–426. https://doi.org/doi:10.1515/9781400835584.403

[65] Johan Rasanayagam. 2011. Informal Economy, Informal State: the Case of Uzbekistan. *International journal of sociology and social policy* 31, 11/12 (2011), 681–696.

[66] A. Amarender Reddy. 2018. Electronic National Agricultural Markets. *Current Science* 115, 5 (2018), 826–837.

[67] Johnny Saldaña. 2021. *The Coding Manual for Qualitative Researchers*. SAGE publications Ltd.

[68] James C. Scott. 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press. http://www.jstor.org/stable/j.ctt1nq3vk

[69] Riyaj Shaikh, Anubha Singh, Barry Brown, and Airi Lampinen. 2024. Not Just A Dot on The Map: Food Delivery Workers as Infrastructure. In *Proceedings of the CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '24)*. Association for Computing Machinery, New York, NY, USA, Article 385, 15 pages. https://doi.org/10.1145/3613904.3641918

[70] Jacob Sheahan, David Chatting, Robert Collins, Jessica Bley, Alexander Eriksson, Nick Taylor, and Marco C. Rozendaal. 2024. Designing with Friction: Inverting Notions of Seamless Technology. In *Adjunct Proceedings of the 2024 Nordic Conference on Human-Computer Interaction* (Uppsala, Sweden) *(NordiCHI '24 Adjunct)*. Association for Computing Machinery, New York, NY, USA, Article 59, 4 pages. https://doi.org/10.1145/3677045.3685504

[71] Anubha Singh. 2021. Whose Country Is Digital India? Unpacking Dominant Power Relations Mediated by the Digital India Campaign. *Asiascape: Digital Asia* 8, 3 (2021), 164 – 189. https://doi.org/10.1163/22142312-bja10020

[72] Anubha Singh, Patricia Garcia, and Silvia Lindtner. 2023. Old Logics, New Technologies: Producing a Managed Workforce on On-Demand Service Platforms. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 160, 15 pages. https://doi.org/10.1145/3544548.3581240

[73] Anubha Singh and Tina Park. 2022. Automating Care: Online Food Delivery Work During the CoVID-19 Crisis in India. In *Proceedings of the 2022 ACM Conference on Fairness, Accountability, and Transparency* (Seoul, Republic of Korea) *(FAccT '22)*. Association for Computing Machinery, New York, NY, USA, 160–172. https://doi.org/10.1145/3531146.3533082

[74] Adam Smith. 2009. *The Wealth of Nations*. AuthorHouse. http://books.google.ch/books?id=rBiqT86BGQEC

[75] Charles Smith. 2002. Auctions: The Social Construction of Value. *Readings in economic sociology* (2002), 112–132.

[76] Janaki Srinivasan and Jenna Burrell. 2013. Revisiting the Fishers of Kerala, India. In *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers - Volume 1* (Cape Town, South Africa) *(ICTD '13)*. Association for Computing Machinery, New York, NY, USA, 56–66. https://doi.org/10.1145/2516604.2516618

[77] Rosemary Steup, Lynn Dombrowski, and Norman Makoto Su. 2019. Feeding the World with Data: Visions of Data-Driven Farming. In *Proceedings of the 2019 on Designing Interactive Systems Conference* (San Diego, CA, USA) *(DIS '19)*. Association for Computing Machinery, New York, NY, USA, 1503–1515. https://doi.org/10.1145/3322276.3322382

[78] Lucy Suchman. 2020. Agencies in Technology Design: Feminist Reconfigurations. In *Machine ethics and robot ethics*. Routledge, 361–375.

[79] Olav Velthuis. 2013. *Talking Prices: Symbolic Meanings of Prices on the Market for Contemporary Art*. Princeton University Press.

[80] William Vickrey. 1961. Counterspeculation, Auctions, and Competitive Sealed Tenders. *The Journal of finance* 16, 1 (1961), 8–37.

[81] PS Vijayshankar and Mekhala Krishnamurthy. 2012. Understanding Agricultural Commodity Markets. *Economic and Political Weekly* (2012), 34–37.

[82] Xiaowei R Wang. 2023. Spicy Red in Shrimp Town: Smart Farming and Settler Colonialism in Guizhou Province. *New Media & Society* 25, 8 (2023), 1888–1912.

[83] Tamar Yogev. 2010. The Social Construction of Quality: Status Dynamics in the Market for Contemporary Art. *Socio-Economic Review* 8, 3 (2010), 511–536.

[84] Viviana A. Zelizer. 1988. Beyond the Polemics on the Market: Establishing a Theoretical and Empirical Agenda. *Sociological Forum* 3, 4 (1988), 614–634. http://www.jstor.org/stable/684548

[85] Matt Ziegler, Lokesh Garg, Shailesh Tiwary, Aditya Vashistha, and Kurtis Heimerl. 2019. Fresh insights: user research towards a market information service for bihari vegetable farmers. In *Proceedings of the Tenth International Conference on Information and Communication Technologies and Development* (Ahmedabad, India) *(ICTD '19)*. Association for Computing Machinery, New York, NY, USA, Article 3, 11 pages. https://doi.org/10.1145/3287098.3287115