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Growing algorithmic governmentality: Interrogating the social construction of trust in precision agriculture

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ABSTRACT

Precision agriculture (PA) is restructuring farmer livelihoods and identities through a panoply of technologies that generate and process big data to influence agricultural practices. In this paper, we ask the question: *How does algorithmic rationality impact farmers' trust in PA?* We focus on the modalities of power wielded by agritech firms through PA that socially construct a form of moralistic trust, the politics of knowledge and knowledgeability, and the internalization of new social identities. This research study utilized a mixed methods approach that included focus groups and follow-up surveys with social actors along the PA value chain. We found that agritech firms have successfully positioned their knowledge products as superior to farmers' experiential knowledge, thereby ensuring farmers' sustained engagement with PA technologies for the purposes of data capture and capital accumulation. Farmers internalize the algorithmic rationality of PA and position themselves along a moral register through governmentalized actions that ostensibly demonstrate moralistic trust in the system. This process has the effect of transforming social identities, interpellating farmers as the architects of their own alienation. Agritech is increasingly adept at digitally abstracting farm knowledge away from farmers. PA is a battleground wherein the politics of agrarian knowledge are contested.

1. Introduction

Precision agriculture (PA) is an approach to farming that utilizes numerous data-driven technologies that generate localized farm data to assist farmers with decision-making in managing their food production system (Bongiovanni and Lowenberg-DeBoer 2004; Rossel and Bouma 2016). The widescale application of PA technologies, such as in-situ sensors, drones and satellite imagery for collecting data and artificial intelligence (AI) and machine learning algorithms for mining them, are providing farmers with recommendations on when to plant, seed, spray and harvest (Gebbers and Adamchuck, 2010). While these tools can enable a more economically productive and environmentally sustainable farming practice, PA engenders social frictions. In this study, we explore these social frictions and theorize why farmers who are negatively impacted by PA technologies continue to use them. We focus on the social construction of trust, the politics of knowledge and transformations in the social identities of users. In the proceeding subsections, we situate PA as an accumulation strategy within the long genealogy of ecological modernization, whereby agritech firms exercise governmental power to articulate new subjectivities of users through the production of 'precise' knowledge.

1.1. Ecological modernization for capital accumulation

PA systems create social exclusion that benefit large scale technologically intensive monoculture farming systems over other systems, such as agroecology (Klerkx and Rose 2020). At the same time, agritech firms (e.g., John Deere, Bayer-Monsanto) and state agencies frame PA as a grand technoscientific project seeking to modernize farming in the context of global environmental change by essentializing and capitalizing off of farmers' ambitions to improve livelihood practices by adopting these digital tools (Kuch et al., 2020; StartupAUS 2016). Proponents of PA in the agricultural technology firms (agritech) seek to frame these technologies as being in the public interest, agricultural innovations that are socially and economically desirable for the public and the environment.

However, such imaginaries are often discursively counterposed against neo-Malthusian tropes that portray non-participating farmers as

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responsible for declining yields that delimit a burgeoning human population (Godfray et al., 2010). For example, 'A bevy of new technologies is now starting to pervade the farm that we believe has a central role in ensuring humanity cheats Malthus again over the next 100 years' (Goldman Sachs, 2016:5). Viewed through this neo-Malthusian logic, so-called 'early adopters' of PA are positioned to 'save the world' whereas so-called 'laggards' are a threat to global food security (Carolan 2020a). Essentially, agritech firms are asking the following question: 'What makes growers confident enough to turn from "Laggards" into "Early Adopters" or "Early Majority"?' (AGCO 2016). The following passage is instructive to how agritech firms discursively articulate farmers along a moral register to promote their technologies: 'Historically, it takes 40 years for a new idea to become fully accepted. In other words, it is a long time from when a Techie first uses a new idea to when a Laggard finally adopts it. And adoption is a process the profitable Early Majority Pragmatists will not take on until the Early Adopter Visionaries do. Likewise, the large Late Majority Conservatives will not until they see that the Pragmatists are successful. However, the pace of adopting new technology is increasing' (Farm Equipment, 2014). Agritech firms are increasingly interested in psychologically persuading farmers to ensure the firms' capital accumulation.

As a paradigm in agricultural production, PA systems represent the latest iteration of capital-intensive ecological modernization of farming. Goldman Sachs' advice on PA to investors is revealing: 'In a gold rush, sell shovels' (Goldman Sachs, 2016:10). Previous technological transformations in agriculture, such as the Green and biotechnological revolutions, were framed by agribusiness and governments as a 'a story of radical and progressive technological change that has been embraced by literally millions of farmers' against looming crises of food security (Glover 2015:229). Cioffo et al. (2016) argued that many advocates of a new Green Revolution for Africa place the burden of low crop productivity on to farmers' unwillingness to use modern agricultural inputs. Most development programs, in their cost-benefit analyses, narrowly focus on economic benefits of smart-technologies to farmers while ignore its negative impacts on agrarian labor (Kansanga et al., 2019). PA presents a similar narrative of 'success' and 'transformation' through harvesting the power of high-performance computing, automation, and big data. 'From the introduction of the steel plow and reaper over 200 years ago to modern advances like large scale planters and genetically modified seeds, man continues to find new ways to feed the world's growing population. As we near the limits of available arable land, a confluence of technologies is driving a new leg of productivity in Precision Farming to enable growers to meet the demand challenge from existing land' (Goldman Sachs, 2016: 4).

We know from previous technology-driven agricultural paradigms, such as the Green Revolution and biotechnology, that these innovations not only bring economic benefits but also produce social and cultural risks (Bronson 2015). For example, the legal system through patents that protects innovations by large agribusiness corporations on seeds of genetically modified organisms (GMOs) has brought benefits to some farmers from improvements to crop yields but has also expanded power inequities between conventional and organic farmers and bonded stronger dependencies between farmers and powerful agribusinesses (Bronson 2015; Stucke and Grunes 2018). Large agritech corporations, through processes of mergers and acquisitions (e.g. the Bayer-Monsanto merger), are monopolizing the digital agriculture space by consolidating proprietary data and intellectual property from seed and chemical patents and digital platforms to transform farmers from independent business owners to captured users (Bronson 2019; Davidson 2018). PA falls within a genealogy of ecological modernization forged through asymmetrical power relations within a politics of agrarian knowledge.

1.2. Articulation of subjectivities through 'precise' knowledge production

By wielding discursive elements of 'accuracy, prediction, and quantification', PA allows the agritech industry to dominate over existing systems of scientific knowledge (Kuch et al., 2020). 'Today's farmers have access to a wealth of data. So much data, in fact, they often don't know what to do with it' (AgFunder 2017). Consequentially, PA is transforming some farmers' 'knowledgeability', or everyday social practices, including ways of knowing, doing, and being (Carolan 2020a). Likewise, farming practices are becoming intertwined and transformed through interactions with digital artifacts, spaces, and infrastructures (Orlikowski 2006). Through sustained engagement with PA technologies, farmers begin 'acting like algorithms' (Carolan, 2020b). For example, new John Deere's tractors are embedded with 'digital locks' that impedes farmers' ability to repair the machinery themselves (Carolan 2017). Farmers must take their equipment to an authorized John Deere dealer, who is the only 'knowledgeable' authority to conduct repairs. Digital locks allow firms like John Deere to 'effectively retain control over aspects of someone's tractor' (Carolan 2020a:17), while redefining farmers' knowledge of repairing *their* equipment. These proprietary tractors also use numerous environmental sensors that generate data for the entire farming system, including farmers' preferences and actions, which are protected through intellectual property rights that prevent the farmers from accessing, controlling or possessing this information—an act of dispossession (Carolan 2017; Rotz et al., 2019a). The repeated use of these technologies engenders a social dependency of farmers who 'get something in return' for their generation of data (Fraser 2019). Through the production of 'trusted' knowledge and equipment, PA systems increasingly mediate a social order in which farmers are becoming dependent on the information and commercial inputs supplied by these firms (Higgins et al., 2017:197). Effectively, 'trusted' knowledge is mechanistically configured into a 'trusted' PA subject.

Farmers have expressed concerns from opaque data sharing agreements and recommendations made by intelligent decision support systems. A recent survey conducted by the American Farm Bureau Federation showed that almost 70% of farmers are concerned that corporations and the government may unfairly access, use and sell their data or use it for marketing products and services and enforcing regulations for clean soil and water quality (American Farm Bureau 2016). Notwithstanding these concerns, through repeated engagement with PA systems, many farmers internalize the algorithmic rationality of PA technologies (Miles 2019). Farmers begin to 'trust' the data-driven recommendations and accept the 'disciplinary directives offered by algorithmic authority'—subject to a form of 'governance by algorithm' (Carolan, 2020b)—thereby ensuring the cultural hegemony of agritech firms and PA technologies (Lupton, 2015:104). Farmers internalize the new logics of privacy or data sharing and modify their livelihood practices to fulfill the policies and ambitions of the state and agriculture tech providers, becoming subjects of the PA system itself (Cheney-Lippold 2011; Fraser 2019). This process can be conceived of as *governmentality,* exercising technologies of power that seek to govern behaviors and influence social identities through subject-making (Foucault 1991).

Digital representations and algorithms represent an increasingly sophisticated 'technology of government,' modalities of knowledge production wielded for the purposes of population management by both state and non-state actors. Rose-Redwood (2006) identifies geocoding as a necessary prerequisite of constituting 'governable subjects' that could be enumerated for census-taking. Wilson (2011) studies governmental practices of geocoding within a citizen engagement campaign in Seattle which consisted of residents normatively mapping the built environment along a value-laden continuum of 'deficits' to 'assets'. Jefferson (2017) asserts the Chicago Police Department's GIS-based CLEARmap application is a surveillance apparatus that constitutes Black and Latinx populations as racialized subjects for policing and carceral discipline and refracts public perceptions of crime through the prism of geospatial rationality. Effectively, CLEARmap is an example of how "cartographical production of subjects intersects with racialized carceral power" (Jefferson 2017: 9). Absent algorithms and cartography, subjects are also articulated within environmental registers. Indeed, there exists a long history of subjectification to new systems of environmental management through political economy (see Agrawal 2005; Birkenholtz 2009; Cavanagh 2018; Moulton and Popke 2017). For example, Bose et al. (2012) traces a genealogy of the colonial and postcolonial Indian state that created administrative categories of identity for indigenous groups for the purposes of forest management. The Bhil indigenous group strategically internalized state-created categories of ethnic identity to ensure access rights to the forest. The 'forest governmentality' of this case enabled the perpetuation of state control over forest lands and the domination of tribal groups.

Agritech firms wield discursive power to create new social categories of farmers. These categories influence PA farmers and their social identities. Their internalization is accomplished through the social construction of trust. PA's algorithmic rationality that mediates user-technology relations interpellates[1] a PA farmer subject with governmental responses who increasingly performs the role of a technology savvy farmer, an early PA adopter (Carolan 2020a). Hence, PA serves as a moralistic designation of a 'modern' farmer who 'trusts' scientific knowledge and technology to 'improve' farming practices (Kuch et al., 2020; StartupAUS, 2016). In other words, farmers come to perceive and behave towards PA systems through a moralistic form of trust (Uslanar 2008). Farmers in their pursuit of becoming a 'successful' and 'modern' farmer come to see PA to belong to their 'moral community' (Uslaner 2008:4). They consider big data, machine learning algorithms and algorithmic recommendations as an ethical and social practice, not through a careful assessment of their risks and benefits, but through cultural transmission of idealized values of what it means to be a 'good farmer', in this case an early PA adopter (Higgins et al., 2017). The development and use of PA interpellates a farmer subject whose interactions with the technology are socially constructed as 'trust' in the system. Against this background, we ask the question: *How does algorithmic rationality impact farmers' trust in PA?*

This paper contains five additional sections. The next section explores the interrelations between social construction of trust in PA, the politics of knowledge and the reconfiguration of social identities. Afterwards, we discuss the methodological approaches used to conduct this research, as well as the study sites where fieldwork was conducted. Following this, we discuss our research findings on moralistic trust, the politics of knowledge and social identities. This section is followed by a discussion on the implications of PA for food production systems. This paper concludes by asserting the importance of algorithmic governmentality in sustaining digital agriculture.

2. Farmers' moralistic trust in precision agriculture: knowledgeability and social identities

2.1. *Defining trust*

Conceptualization of trust in the social sciences have differed substantially but can be categorized into two broad analytical dimensions: strategic trust (Cook et al., 2005; Hardin 2002; Robbins 2016) and moralistic trust (Dinesan 2011; Uslaner 2002)[2]. Strategic trust relies on the beliefs about others' trustworthiness that are formed through personal experiences and subsequent evaluation of others' competence, goodwill, or benevolence (Coleman, 1990; Hardin 2002). This form of trust 'reflects our expectations about how other people *will* behave' (Uslanar 2008:5, emphasis in the original) and is grounded in social cognition. For instance, farmers may carefully assess their experiences of using AI-based decision support systems, and accordingly guide their judgment about trusting the technology (Yamagishi et al., 1998). Strategic trust is 'knowledge-based trust' and depends on past experiences and accuracy of knowledge or tools shared (Yamigishi and Yamagishi 1994). Moralistic trust, on the other hand, is not contingent on social actors' rational expectations of reciprocity, personal experiences, or perceived trustworthiness of others, but depends on the moral values of their culture (Robbins 2016). Moralistic trust is 'inherited via cultural transmission' (Robbins 2016:973) and becomes a form of 'value-rational action' (Weber, 1922), where actors come to believe 'that most people share their fundamental moral values (Uslaner 2008:4).' Previous studies examining farmers' engagement with PA technologies have mostly conceptualized farmers' trust in PA to be knowledge-based or strategic (Jakku et al., 2019; Wiseman et al., 2019). These studies have framed farmers' trust (or lack thereof) as a barrier to successful farming and being able to 'change with the times' (Carolan 2020a; Wiseman et al., 2019). Problems of trust are often explored through an information deficit model, where the user's skepticism of emerging technologies is assumed to result from a lack of information and poor technical understanding (Sturgis and Allum 2004). Therefore, it is assumed that farmers are agentic actors and can accurately assess the trustworthiness of PA and its recommendations, through conscious and rational expectations about its efficacy. But focusing narrowly on strategic trust ignores the disciplinary power of the algorithmic rationality in establishing farmers' trust in PA. Here, we take a critical turn in the social scientific scholarship on PA and examine how farmers' trust in PA is formed by the social construction of shared values under PA through a moralistic trust, instead of rational and strategic expectations of its trustworthiness.

Scholarship on trust differentiates between particular and generalized trust (Robbins 2016). Particular trust is related to specific people or subjects that actors know or whose trustworthiness they can assess (Mayer et al., 1995). Trust can be extended to particular people, such as friends and family, but also generalized to large socio-technical systems, such as PA (Simmel 1978). We conceptualize PA as a socio-technical system in which farmers have a moralistic form of generalized trust, which consists of assemblages of tools and equipment, such as robotics and machine learning algorithms, but also human actors and institutions (e.g. knowledge, user practices, cultural values, markets, policies) and non-human objects, such as crops, weather, and soil (Geels 2005; Pigford et al., 2018). We conceptualize farmers' trust in PA to extend beyond the technology or the agritech company developing the technology and encompass the socio-technical system, in general. Generalized trust enlarges the scope of trust beyond specific people to larger systems or people and institutions in general (Yamagishi and Yamagishi 1994). Importantly, generalized trust provides the foundation for a moralistic trust, as it is 'the perception that most people are part of your moral community' (Uslaner 2008:7) and 'rests on the premise that others will not let us down' (Uslaner 2008:11). Generalized trust provides farmers' the moral license to trust PA, not through personal experiences but from expectations of moral values held by others in the system, a trust socially constructed by the agritech firms. The next section explains the social and political processes through which farmers are conditioned to moralistically trust PA.

2.2. *Trust as farmers' governmental response to shifts in knowledgeability and social identities*

Science and technology studies (STS) scholarship has been critical of the power-laden relationships between science and society and interrogates how science and technology are not only discovered, but are co-produced through specific cultural and political preferences that influence formal and informal knowledge production and the development of particular technologies (Bijker, 1997; Jasanoff 2004). STS scholarship highlights that technologies (and ultimately their impacts) are established through the ways that actors and organizations envision, describe, and use them (Bijker 2012; Jasanoff 2004). Since its introduction in the 1980s, PA has been discursively articulated to address overlapping concerns of food security, agricultural productivity, and climatic change (Wolf and Buttel 1996). Agritech's provision of real value to farmers from PA is premised on assurances that PA algorithms and hardware can target problematic characteristics of the farming system with precise solutions. In aggregate, agritech firms frame PA systems that tackle biophysical or climate-related problems through a meticulous application of inputs and constant monitoring of outputs on individual farming systems as interventions for the 'public good' (Bronson 2015; Jasanoff and Kim 2009).

Through big data, artificial intelligence and machine learning algorithms, agritech challenges the veracity of farmers' knowledge by generating 'precise' farming recommendations that are 'quantifiable, distributable, and searchable.' Farm-level 'knowledge' produced by PA systems, such as integrated decision support systems, are marketed as superior to farmers' tacit knowledge of their own farm systems, and thus more 'trustable' (Lupton, 2015:103). 'Armed with this knowledge, farmers can be more prescriptive in their seed placement' (Goldman Sachs, 2016:23). Yet knowledge production is an inherently political process with asymmetrical power relations (Haraway, 1988). Influential actors and institutions make value judgements as to what forms of knowledge and whose knowledge is deemed authoritative and accurate (Goldman et al., 2011), a process we refer to as the *politics of knowledge*. By establishing the primacy of algorithmic knowledge, agritech companies wield the ability to reconfigure farmers' knowledgeability through PA systems. Effectively, farmers internalize new social identities as PA subjects potentially possessing imprecise, inaccurate or inadequate farming knowledge, interpellated as incomplete to beget governmental responses that sustain engagement with the PA system. Farmers' trust in PA therefore is dependent not only on material artifacts such as drones and sensors performing 'as expected', but is influenced by agritech companies who discursively frame PA and ensuing agronomic recommendations as more reliable, accurate, transparent and fair than previous systems (Wiseman et al., 2019). Thus, agritech socially constructs 'trust' through discursively articulating the algorithmic rationality of PA along a moral register of superior and trustable knowledge.

Despite the potential high risk of AI-driven technologies to cause technological unemployment in agriculture (Ford 2015), agritech promotes PA tools not only as 'supporting and augmenting' farmers' knowledge, but also as an alternative to farm labor itself (Carolan 2020a; Kuch et al., 2020:4). For example, agritech imagines future farmers as 'an algorithmically assisted subject' (Kuch et al., 2020), a reconfiguration of agrarian labor that 'casts farmers as office managers rather than as cultivators' (Tsouvalis et al., 2000:913). PA may be changing the interpretative sense of agriculture through changes in farm work. Land and crops produced are becoming digitalized and farmers' observations, qualitative descriptions of what they see and feel, are now being transformed or 'augmented' into big data consisting of '0s' and '1s'. Some researchers have labeled this transformation of humans as 'digitized humans' or 'data-generating machines' (McFedries 2013). As a result of this socio-technical change, not only are farmers repurposed as data-generating objects, but by virtue of generating commercially viable environmental data via proprietary technologies, farmers may be concurrently interpreted as commodities too (Lupton, 2015). Moreover, farmers are no longer the sole reserve of intelligence, as cognition and decisions have increasingly become distributed between farmers and intelligent technologies (Hayles 1999; Latour 2005; Tucker 2012). PA has the potential to disrupt not only mechanical work, e.g. moving heavy equipment, but also cognitive intelligence (including thinking and feeling tasks) (Huang et al., 2019). AI-based farm machinery can complete 'non-standardized' farming tasks (e.g. scouting for weeds or picking fruits and vegetables using machine vision) that were previously earmarked for human workers (Marinoudi et al., 2019; Vougioukas 2019). Hence, farmers' agency, or performance of actions or capacity, is becoming distributed or extended 'outside' them (Richardson and Bissell, 2017:2). These are governmental acts that benefit agritech and are driven by social identities reconfigured through PA's politics of knowledge.

PA technologies are probing and challenging farmers' given modes of meaning, knowing, and doing agriculture, in turn affecting their social identities (Gardezi and Bronson 2020; Higgins et al., 2017). Burton (2004:210) writes that farming systems are 'highly symbolic environments where the social value of production must be considered on par with economic value'. Certain farming practices and technologies can produce social and cultural rewards for the farmer if these practices are correlated with being a 'good farmer'. Indeed, PA systems interpellate farmers as moral subjects whose sustained 'trust' and engagement with the system demonstrates the 'good farming' practices of a 'good farmer' (Higgins et al., 2017). For example, Higgins et al. (2017) show that automation in the dairy industry has modified temporality of business cycles and changes the description of milk production activity as 'commodified economic activity' with subsequent shifts in farmer self-conceptions regarding what represents a 'good farmer' (Higgins et al., 2017; see also Carolan 2017). Moreover, early technology adopters are 'routinely celebrated in the media for having new 'tech--savvy skill sets'' (Carolan 2020a: 16). Del Marmol et al. (2018) and Gardezi and Bronson (2020) describe the relationship between technology and social identity formation, where a farmer's adoption of new agricultural technologies can 'transform the entire social fabric,' including the social identities of farmers. Effectively, farmers internalize the algorithmic rationalities of PA. Agritech firms discursively interpellate farmers into moralistic subjects of PA which is framed as trust in the system, and farmers demonstrate governmental responses by modifying their farming behaviors in accordance with the data-driven recommendations of the PA technologies. This socio-technical power relation between agritech and farmers, mediated by PA, often alters the farmers' perceived sense of self and community.

Technology adoption shapes a farmers' social identity and also contributes to the formation of a generalized moralistic trust in these technologies. Social identity theory is premised on the view that social actors evaluate themselves in terms of social categories, such as 'farmer', 'businessperson', 'environmentalist' (Robbins 2017). As a consequence, social actors tend to distinguish themselves from other groups, or social categories (Robbins 2017). Identification with a nominal social category, such as 'PA users', makes farmers more prepared to act as a member of that group and on behalf of that group. Such collective identities implies that cooperation will be inclined toward in-group members (Simpson and Macy 2004) and that farmers' trust in PA will form along salient nominal categories created by agritech firms like 'early adopters' or 'laggards' (Robbins 2017). Thus, farmers' who use the technologies come to think of PA as belonging to their moral community, in which there are codified sets of values and norms of behavior. This new identity as Jasanoff (2004:39) writes, is also a way of 'restoring sense out of disorder' … 'When the world one knows is in disarray, redefining identities is a way of putting things back into familiar places.' These collective identities are shaped and sustained through the increasing governmentality and farmer dependence. Thus, technologies and their production play an important role in shaping and sustaining these social roles or in giving them power and meaning (Jasanoff 2004). Therefore, trust (albeit socially constructed by agritech) can be thought of as a way for farmers to engage with a PA system that does not require a conscious calculated assessment of the competence or efficacy of the PA tools (Frederiksen 2014). From the farmers' viewpoint, trust is a form of 'virtue signaling' a moral identity in the context of ecological modernization. Doing so requires an internalization of PA's algorithmic rationality, simulating 'trust' through the ostensible creation of new social identities.

Our literature review highlights that farmers moralistically trust PA systems to help them overcome the uncertainty associated with changing knowledgeability and social identities produced by agritech through the socio-technical system of PA. Trust is an essential component of sustaining farmers' use of PA technologies. Yet 'trust' is a social construction of human deference to data-driven algorithmic functions and vital to interpellating PA subjects (who have internalized their PA subjectivity as a moral identity) with governmental farming responses that induces adoption and use of these capital-intensive technologies, thereby sustaining capital accumulation and maintaining agritech's hegemony over food production systems.

3. Methods

Fieldwork for this research was carried out in South Dakota (SD) and Vermont (VT) between October and December 2019. The research used a mixed methods approach that included six focus group discussions (FGDs) and a follow-up survey with 52 FGD participants. The participants included represented different sections of the PA space, including 1) software and hardware developers, 2) state and county extension specialists, 3) non-profit and government agencies and 4) crop, livestock, and dairy farmers. With the help of subject matter experts known to us, we identified the key stakeholders in the PA innovation, governance, and user ecosystem. We also employed a snowball sampling approach to invite actors so that people with disparate interests, priorities, and agendas could participate in the discussions. Participants at the focus group discussions deliberated risks and benefits of PA tools, such as AI, big data, and machine learning algorithms for agronomic and financial decision-making in crop, livestock and dairy production systems. They discussed the effectiveness of existing PA education and ways in which traditional and non-traditional education can prepare farmers and technical support personnel for careers in PA. Participants also examined how PA will impact rural communities and farms of different sizes. From these discussions, participants' perspectives on the social construction of trust were parceled out. This allowed us to gauge trust that participants had of other people in the agricultural systems, and farmers and advisors' loyalty to PA products and tools.

The geographic spaces of SD and VT are widely different in terms of social, political, and environmental aspects of agriculture. Participants from these locations reflect this heterogeneity. By conducting FGDs and surveys in two states, we were able to have participants represent different types of agriculture (corn/soybean versus diversified small crops and dairy), small open-access and large scale technology developers, and non-farm non-profits that espoused unique socio-political values. The two states provide an interesting comparison of the heterogenous socio-demographic and biophysical conditions that provide useful context into diverse food, fuel, and fiber production systems. For instance, SD contains a majority of medium and large-scale farms, whereas VT has a majority of small and medium scale farms. The average acreage in SD is 1459 acres compared to 176 acres in VT (United States Department of Agriculture, 2019). Further, SD has mostly industrial scale and conventional monocropping farming systems, while VT farms tend to be family owned, organic, mixed cropping/grazing-based. In 2017, with a total of 719 certified organic farms, VT had more organic farms than any other state per capita (Northeast Organic Farming Association, n.d.). Sampling of workforce, industries, workers and non-profit organizations from both SD and VT provides a diverse sample that can capture the spectrum of farm types and scales across the US. Despite the scale and typing differences, both SD and VT farmers have initiated investments in PA technologies.

This research used a broadly qualitative interpretivist approach to animate concepts described in the literature reviewed above on social construction of trust, politics of knowledge, and social identities. This approach guided us in determining what codes might be relevant, which were then reshaped by what was actually found in the data. Specifically, we conducted qualitative thematic coding of all FGD transcriptions for preliminary keywords and then organized keywords into broader themes (e.g., politics of knowledge, social construction of trust, social identities). Results from the focus groups were complemented with a follow up survey that included questions to elicit respondents' attitudes, beliefs, and perceived risks and benefits of PA technologies. Survey data was coded and then analyzed using statistical software using standard techniques of quantitative analysis. The FGDs were audio and video recorded and later transcribed along with unique codes for speaker name, affiliation and location of the workshop.

In the results section that follows we traverse key themes that emerged in the focus group discussions from participants' views on the risks and benefits of PA. We also share some findings from the survey questionnaire that are relevant to participants' moralistic trust in PA. In the discussion, we return to the key theoretical perspectives (social construction of trust, politics of knowledge, and social identities), to draw key insights offered by these complementary viewpoints.

4. Results

In this section, we explore power relations and subjectivities within PA between agritech firms and research participants. Specifically, we focus on modalities of power wielded by agritech firms that socially construct a form of moralistic trust, the politics of knowledge and knowledgeability, and the internalization of new social identities. In doing so, we hope to illuminate the social and political effects of this current wave of technological innovation in agriculture. In response to our research question, algorithmic rationality has consequential influence over farmers' trust in PA systems. In the next section, we empirically demonstrate farmers' moralistic trust.

4.1. Moralistic trust

In recent years, the topic of users' trust in new and emerging technologies (e.g. autonomous vehicles) has garnered immense interest by social, economic, and political actors and organizations. Several large transnational corporations and governments around the world have engaged national, regional and international commissions to develop ethical guidelines for enhancing trust of users in AI and AI-based decision support systems. With regards to food security and sovereignty, for example, the 'Montréal Declaration for a Responsible Development of Artificial Intelligence (2018)' (Université de Montréal, 2018) and participatory technology development initiatives, such as *Farm OS*, highlight the need for democratized access to farm-level environmental data and sensing technologies so that small-scale farming managers have access to high quality, high resolution data and machine learning algorithm code at a low cost. Recent social science scholarship has described ethical development and use of AI in PA as antecedent to enhance farmers' trust in big data and machine learning algorithms, all the while questioning the accumulation strategies of agritech firms (Fraser 2019; Rotz et al., 2019b), which 'serves to reinforce the concentration and dependence on these conglomerates' (Cooper 2011; Kuch et al., 2020:13). Yet most social science scholarship stops short of exploring the mechanisms by which agritech firms influence farmers' knowledgeability and social identities, essential precursors to sustaining engagement and trust with the technologies, a power relation in PA to which this paper will return.

Overall, participant farmers exhibit a moralistic form of trust based upon perceived moral values constructed and circulated by agritech firms. A farmer in South Dakota reflected upon his experiences with PA: 'Take a company, such as Climate [The Climate Corporation] or whoever, that's collecting all this farm data and then they can use that data to market things or manage things. You got to trust that Climate will help me with the massive amounts of data that I'm giving them, with the massive amounts of data that everybody is giving them. It's a moment of trust, I guess.' Moralistic trust is culturally transmitted through what is considered by most social actors as a legitimate form of exchange between firms and farmers. For example, agritech firms establish the expectation among farmers that they will receive something from the agritech firm in return in the future, namely precise recommendations and new product offers. Farmers assess the expected value of exchanging or not exchanging data and information with the firms through a prism of moralistic trust. A University Extension worker in South Dakota remarked how often they find farmers trusting these technologies without questioning its trustworthiness, a symbolic feature of moralistic trust: 'You know, farmers spend money on this stuff–big money at some co-ops and some retailers. And again, it comes back to trust, I guess. It just comes back to the trust because if I'm going to be spending this money, I want to review my yield maps before they're spread. I mean, I would say that five percent of the farmers that I worked with reviewed their maps before the fertilizer was spread. And I find that kind of shocking sometimes, but I guess maybe people have more trust than I do in this technology [PA].' As this extension worker insinuated, a farmers' moralistic trust in the technology may supersede concerns over efficacy. Another extension worker lamented that the trust some farmers have in agritech dealers was surprisingly strong following recommendations that are made by PA systems: 'I get really frustrated when they've told me they got this fertilizer recommendation from XYZ co-op whoever, and it's ridiculous. 'They told me to, so I'm just going to do it.' They might not even know what it means in some cases. They will trust that person; they will trust businesses, but a lot of precision agriculture businesses in South Dakota make recommendations on products that they sell, and it's like that doesn't quite compute with a lot of farmers that I work with. Yes, this company gave you this recommendation, but they also sell this product, so you should review it, right?' Many farmers have internalized the algorithmic rationality of the technologies and the superiority of data-driven farming knowledge provided, performing their PA subjectivities in ways that may contradict their own crop production and financial interests.

However, establishing an unquestioned moralistic trust in the technologies does not result in an immediate reduction in farmers' agency or expertise, instead follows a 'principle of gradualness' over sustained interactions with PA (Luhmann, 1979: 41). In its abstract form, trust could exacerbate asymmetrical power relations between farmers and agritech. For example, uncritical engagement could deepen PA subjects' dependence on the 'expert' without consciously assessing the competence of the expert or the trust situation (Frederiksen 2014). A representative from the government in South Dakota described the discursive elements behind algorithmic governmentality applied by agritech firms that are centered around selling 'ideas' for profit-making: 'Do you trust an organization that you think is trying to sell you something even if maybe it is in your best interest, but how do you feel about if the purpose is trying to sell you something? So, not to pick on any one company, but I mean, we have known companies who are very good at selling producers an idea. And behind the scenes, it's all about profit, right?' The penetration of PA tools deemed important by agritech firms is creating an atmosphere that engenders greater adoption of these tools by manufacturing trust without a serious strategic evaluation of its efficacy by farmers. This results in governmental responses by farmers which sustain capital accumulation for firms who exercise cultural hegemony over industrial agriculture.

4.2. Politics of knowledge

With precision accuracy, agritech firms wield discursive power to reshape behaviors and identities of farmers. Agritech firms frame PA as an all-encompassing social and environmental benefit to farmers. A South Dakotan agritech representative's summation of PA is a perfect example: 'So, I'm going to give one short, sweet one: using technologies for better agriculture production.' Against these idealized values of PA held by its proponents, farmers are becoming subjects of PA's algorithmic rationality. Farmers acknowledge that PA has its shortcomings but decide to use it because this knowledge is superior, more accurate, and trustworthy, even if it doesn't work perfectly every time. A South Dakota farmer highlighted this notion of moralistic trust in the knowledge produced by PA and agritech: 'You could make an argument that you can be like, my yield map isn't right, my soil sample was not taken correctly, my remote sensing all has to be true. Like, there's a reason the lack confidence, but at the same time, all those are very valuable if they're done correctly.' Sensors attached to farm equipment, such as tractors and aerial drones, can collect multispectral information about crop and animals. However, the analysis of these large environmental datasets is a complex endeavor that requires advanced computational skill-sets, especially for many farmers and agronomists who are not trained as data scientists. An academic from Vermont highlighted how this new form of knowledge was both 'sophisticated' and at the same time 'inaccessible' to farmers: 'As that new information comes their way, how do you make sense of that? The concern I have is the data become so sophisticated and encrypted and inaccessible that even if they gave it to the farmer, he or she wouldn't know what to do with it or how to use it.' While the veracity and relevance of farmers' knowledge and expertise are called into question and new knowledgeability is arranged through PA, there is a widespread concern that farmers may not know what to do with the data that the agritech collects using their farm equipment. There is a prevailing sense of uncertainty about this relationship with data and knowledge. Under conditions of uncertainty and imperfect knowledge, farmers tend to look to trusted institutions for guidance (Dietz et al., 2007). This remains true even for participants who are critical of PA technologies. A non-profit worker from South Dakota described how moralistic trust was driving their optimism regarding automation in agriculture and its impact on farmers' knowledgability: 'I would hope that automation makes us more efficient with our natural resources so that we never get the gully in our fields, right, so that we figure out how to manage our fields and keep it healthy, and preserve our carbon and things like that. But I am concerned where a human doesn't unlearn something once they've learned it, so technology could just run wild.' Without mechanisms for agritech accountability, legal protections nor access to data, farmers' PA adoption is often dependent upon faith alone.

PA's algorithmic rationality induces a process of governmentality which discursively adjudicates 'legitimate' forms of knowledge and forecloses other forms. For example, farmers are becoming estranged from practices previously known to them. An academic from Vermont questioned the intent behind automation in agriculture: 'What are we replacing in terms of actual connection? Hands in the dirt versus just being dashboard where you're clicking buttons and stuff is happening out there.' Another extension worker in South Dakota described how a farmers' experiential knowledge is important for improving farming outcomes: 'And I think the autonomous farming will further lead to a degradation of our natural resources. I think that human factor has to be there making those decisions on how we're going to do this, and just pushing buttons and letting drones go will lead to a further degradation of our natural resources. And it's a relationship to owning a physical asset, the earth, and realizing what that natural system is providing in that process; whereas, when we go autonomously, we're starting to ignore that, and it's the black box that makes the decision on what we're going to do.' In addition to the importance of farmers' experiential knowledge, their expertise is necessary to accurately interpret data and make farming recommendations. An extension worker in Vermont compared big data analytics in agriculture to other sectors (i.e. online consumer sales) to assert that farmers and agronomists possess vital knowledge to interpreting the data-driven recommendations of PA: 'In other sectors, it's really clean data, you know, when you're processing mouse clicks and page loads, that's really easy to deal with. But in agriculture, you need a lot of domain expertise to deal with what goes on a farm.'

Yet farmers' domain knowledge is being challenged by the fast-moving speed of technological innovation in PA. Fig. 1 illustrates the degree to which research participants considered the task of maintaining knowledgeability of PA technologies to be difficult. Notably, more than two-thirds of agritech industry participants agreed or strongly agreed with the statement that 'keeping up with precision agriculture technologies for farmers is like a never-ending treadmill.' Agritech is increasingly adept at digitally abstracting farm knowledge away from farmers. PA is a battleground wherein the politics of agrarian knowledge are contested.

4.3. Social identities

PA technologies are restructuring farmer livelihoods and influencing their behaviors by framing certain actions and identities as possessing

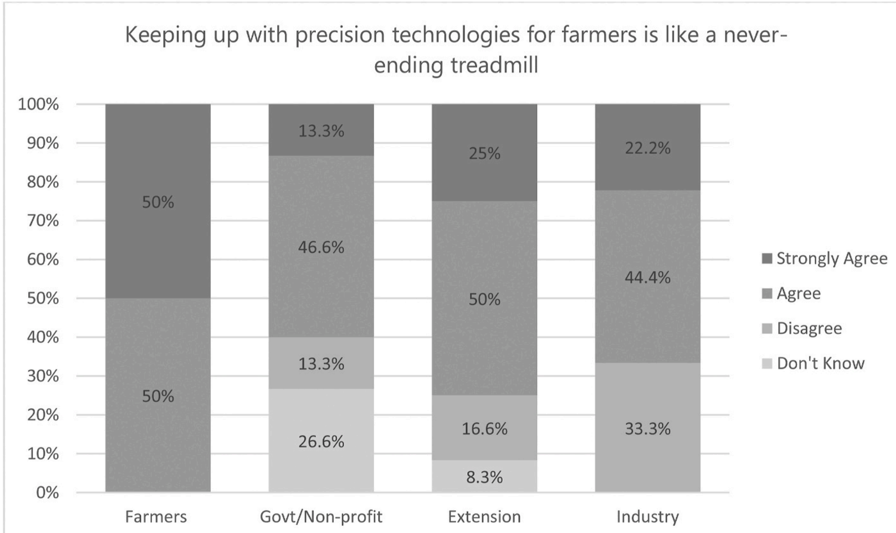

Fig. 1. This figure illustrates data from the survey question disaggregated into four sections of the food system ranging from farmers to the industry. Y-axis shows the percentage of responses for each category of the survey question (e.g., Don't know, Strongly Agree, etc.). The numbers marked within the bars are the percentage of respondents observed in the survey question.

superior value and veracity, interpellating farmers as willing PA subjects. Farmers internalize the algorithmic rationality of the technologies and position themselves along a moral register through governmentalized actions that ostensibly demonstrate moralistic trust in the system. This process has the effect of influencing farmers' social identity. For example, a University Extension worker in Vermont perceived skilled farmers as those who embrace algorithmic governmentality: 'The best farmers are observational data collectors, every single minute of every single day. They may not perceive themselves as data scientists, but information collectors.' An agritech worker in Vermont described how previous agricultural technologies have historically influenced the skills and identities of farmers: 'Before tractors existed, farmers weren't mechanics, right? But I think one thing we need to recognize in that is that probably where the most inertia comes in is a cultural and identity and emotional issue in terms of switching jobs, acquiring new skills, whatever. You know, there's certain cachet and identity of being a farmer. You don't think of yourself as a data scientist, that and I think there's more of an identity barrier to making that transition than there is a technical barrier, especially as the data science tools, as you know, so much easier and easier to apply and data gets easier to collect.' Indeed, technological innovations in agriculture continue to influence farmer identities, circumnavigating sociocultural barriers to adoption, through subtle modalities of discursive power that assert the superiority of PA's algorithmic rationality and knowledge.

Participants in Vermont and South Dakota were asked to identify the characteristics of a 'good farmer' by indicating their agreement with the following statement: 'A good farmer is one who has the most up-to-date equipment'. Table 1 shows that some social identities of a 'good farmer' were more important for the participant than others. For instance, 30 percent of respondents considered it important or somewhat important for a good farmer to have the most up-to-date equipment. Similarly, almost half of the survey respondents perceived a good farmer as someone who used the latest seed and chemical technology and were an early adopter of these technologies. Both of these results highlight that for a variety of food system actors participating in the survey, an important attribute of a good farmer is one who adopts technology first, displaying an unshakable moralistic trust in the technologies. The idealized view of a good farmer under PA is coming to be associated with social identities that describe them as new technology adopters.

Agritech is framing PA to solve not only concerns about crop productivity, but also environmental stewardship. PA technologies, through the specific application of chemical fertilizers and pesticides via drones or tractors, allows 'win-wins' in agriculture, as farmers can now be both environmental stewards and profitable at the same time or 'sustainable productivist' (Bronson 2020). For instance, Table 1 shows that all 56 participants or 100 percent perceived it to be either somewhat important, important, or very important for a good farmer to be one who manages for both profitability and minimization of environmental impact. Social identities formed under PA are supplementing farmers' traditional identities, such as those that define a good farmer to be a 'productivist' and profit-maximizing subject, with 'conservationist' identities that concurrently describe them as stewards of the environment (Gardezi and Bronson 2020). A farmer in South Dakota described this in the focus group conversation: 'When you really look at precision agriculture, it's profitable to be a good environmental steward. When you precisely apply the herbicide you need, and don't have overlap, you've saved money, and done good things for the environment. When you properly manage your watershed, your expensive fertilizer does not

Table 1
Survey question results used for measuring social identities.

Tabulated responses to the survey question: *People have different opinions about what makes a 'good farmer.' Please rate the importance of the following items. (Please circle one number on each line.)*

A good farmer is one who ...	Not important at all	Slightly important	Somewhat important	Important	Very important	Do not know
Has the most up-to-date equipment	34.6%	27%	23.1%	7.7%	0%	7.7%
Uses the latest seed and chemical technology	23.1%	27%	28.8%	11.5%	9.6%	0%
Has the highest profit per acre	1.9%	7.7%	11.5%	48.1%	27%	3.8%
Manages for both profitability and minimization of environmental impact	0%	0%	3.2%	40%	56.8%	0%

end up in the stream, it stays in the field, where you need it.' The 'win-win' ascribed to the use of PA allows farmers to internalize the moralistic social identities of a subject who cares about their profit but also the environment.

Transformation in farmers' social identities is driving farmers' moralistic trust in PA and reinforcing adoption of these technologies. In Fig. 2, we disaggregated one of the dimensions of farmers' identity by respondent type (e.g. farmer, industry). Results shows that while 43% of the agritech respondents describe a good farmer as one who 'has the most up-to-date equipment' as either somewhat important or important, all farmers participating in the survey considered this dimension of farmer identity a less important characteristic. Indeed, we found evidence of conflict within PA's politics of knowledge. Some PA users resisted the narrative espoused by agritech firms. One farmer begrudged their inability to repair their own machines or to access environmental data collected by agritech as a consequence of complex legal agreements signed by them: "If I got to go back to the company that I just spent $300,000 on buying their equipment to get permission to learn about my hogs (from the data they collect), that is like, really? Now who wants to change a strut if I don't have to? But on the other hand, if changing the strut is going to enable me to work my system better, I can be more successful as a farmer." Despite minor resistance to agritech algorithmic rationality, for farmers, PA subjectivity is a moralistic trust in the system's data-driven knowledge than the mere technological innovation of the system. In sum, performing the role of a 'good PA farmer' is more about trust than technology. These results highlight the complexity of algorithmic governmentality, insofar as farmers' social identity as a willing PA subject does not positively determine their assessment of the technological apparatuses that mediate their PA farming tasks nor the outcomes of the technology's performance.

5. Discussion

In order to sustain engagement through a moralistic form of trust in PA technologies, agritech socially constructs their knowledge products as more precise and accurate than farmers' knowledge. Over time, this creates a form of 'knowledge lock-in' that erodes farmers' analogue knowledge (Carolan, 2020b). Effectively, this politics of knowledge produces subjectivities of trust by gradually shifting users' social identities. Users generate data from the food production system that is vital to building and refining the algorithms that animate PA systems, data which informs the precise recommendations generated. In essence, farmers are co-producing PA knowledge with the agritech firms (Jasanoff 2004). Yet their co-production of 'precise' knowledge abstracted from human cognition undermines the veracity of their own experiential knowledge. Supplanting farmer knowledge through the extraction, aggregation, abstraction, monetization and provision of their knowledge and behaviors is an effective capital accumulation strategy predicated on the dispossession of farmers' data. Ironically, PA systems interpellate farmers into governmental subjects that become the architects of their own alienation.

Trust, in such contexts, is often framed by the state and private sector firms as a lack of compliance among farmers of emerging agricultural technologies and as a threat to agritech's profitability as well as a loss to broader social value (Marris 2015; Welsh and Wynne 2013). In this case, trust operates like a Trojan horse, socially constructed to 'open the gates' of cognition and agency by discursively rendering farmers into moral subjects of the grand challenge of ecological modernization. Yet concealed within the equine frame of moralistic trust is an algorithmic governmentality. Farmers trusting robots portends a grim fate for the farmers themselves. Although knowledge dispossession is a worrisome outcome of farmers' engagement with PA, perhaps even more worrisome is the dispossession or restructuring of identities. And yet trusting in the supremacy of PA is internalized along a moral register as indicative of a 'good' farmer, effectively obscuring the rationality of their own redundancy to the algorithmically-driven process of agritech capital accumulation.

There are several important implications of our study findings. First, while we understand that the proponents of PA in agritech and the government would like to achieve higher engagement of farmers through enhanced trust in PA, our findings suggest that social actors in this space must pause and rethink about the inclusionary and exclusionary mechanisms by which some farmers' knowledgeability and social identities are being distorted and modified. Our study highlights how through interpellation, many farmers are transformed into 'subjects' and forced into compliance with data sharing agreements with agritech firms without laws that guarantee their right to privacy and status of data ownership (Jakku et al., 2019). Social actors must reflect on who benefits from farmers' trust in PA. If trust is enhanced for perpetuating the power of large corporations, then it could reproduce historic patterns of inequality between small-scale and large-scale commodity crop farms and large agribusiness. This disparity in power

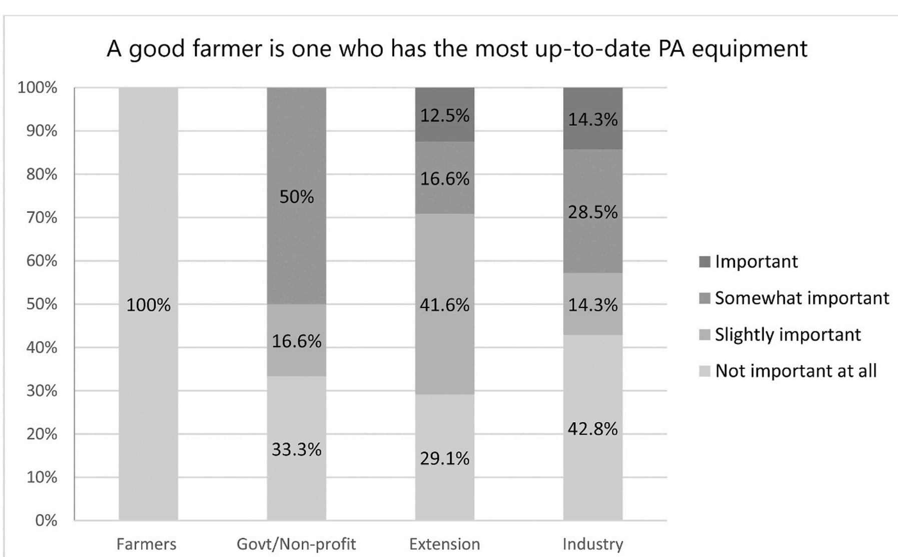

Fig. 2. This figure illustrates data from the survey question disaggregated into four sections of the food system ranging from farmers to the industry. Y-axis shows the percentage of responses for each category of the survey question (e.g., Slightly important, Important). The numbers marked within the bars are percentage of respondents observed in the survey question.

through new digitally mediated spaces have been observed in other sectors of the economy, including social media, where 'media companies and corporations actively seek to monetize content sharing and circulation and to direct this in ways that contribute financially to themselves but not to the creators of the content' (Lupton, 2015). Future research should conceptualize viable political and legal mechanisms to ensure data sovereignty.

Second, our study is paramount at a time when AI is considered as the most disruptive force in the business landscape of the near future (New Vantage Partners, 2017). AI systems, such as IBM Watson, are already playing a key role in fields as diverse as medicine and customer service (Jarrahi 2018). Through machine learning techniques, AI systems can perform complex tasks—such as discerning cancer patterns—that were 'once performed by white-collar workers and were viewed as immune to automation' (Jarrahi 2018:578). Among all sectors of the US economy, agriculture has arguably endured serious transformation under technological progress. For example, the percentage of US workers employed on farms has reduced from 50% of labor force in the early twentieth century down to 2% in 2000 (Ford 2015). This drastic innovation-led labor and environmental transformation necessitates us to preempt some of the social and political effects of PA. One approach to doing this would be to take the moral compass upstream to the agritech firms, and in particular to the designers of PA technologies to interrogate their social and moral values that steer the process of design and innovation (Bronson 2019). This approach comes out of the responsible innovation (RI) framework, which instructs innovators and policy actors to do more than manage an innovation's risks after the fact but advises them to consider the socio-ethical dimensions of technologies in the early stages (upstream) of the innovation process (Owen et al. 2012). This framework can allow exploration of the possible unintended and intended impacts of PA by reflecting on underlying values, purposes, and motivations and using an iterative and inclusive process to steer the direction of innovation (Stilgoe et al., 2013). Future research should examine how guiding principles of RI can enhance not only farmers' trustworthiness of PA, but also how emerging technologies in agriculture affects farmers' knowledge and social identities.

Third, our study emphasizes the importance of understanding the 'varieties of trust' (Uslanar 2008). Most scholarship on trust in agriculture technologies (e.g. biotechnology, GMOs) have defined trust as a strategic intention of farmer to accept some level of risk through positive expectations of the technology and the technologists (Colquitt et al., 2007; Harwood and Garry 2017; Lewis and Weigert 1985). This conceptualization usually highlights the importance of salience or relevance of trustworthy information to farmers' on-farm decisions; the credibility of knowledge, in terms of accuracy; and legitimacy or authority of relevant stakeholders in the innovation ecosystem (e.g. regulators, educators, other farmers, citizens) (Cash et al., 2003). While this is an important conceptualization of trust, it seems misplaced within the social contours in which PA is emerging. Recent guidelines for ethical digital technologies, such as the European Commission's report 'Ethics guidelines for trustworthy AI' propose that secure, reliable and robust AI-systems necessitates users to have control over their own data (Floridi 2019). Such guidelines define trust from a strategic view, where farmers consciously weigh the risks and benefits of using AI-based systems and then decide to adopt accordingly. Contrary to this strategic view of trust, as our results show, farmers trust PA not through a strategic assessment of its risks and benefits to their farming operation but through cultural transmission of moral values upheld as superior by the agritech firms. Existing and new guidelines for ethical digital technologies can greatly benefit by examining trust through its moralistic conceptualization. For example, future research could outline the intended and unintended impacts of PA's algorithmic rationality that create a sense of trust not in the efficacy of PA but in the moral values in the PA 'community'.

Our study neither takes a purely instrumental stance that argues that technology is just a tool that people can use for good or misuse for harm, nor do we take a technological deterministic approach (i.e. technology is so powerful that it molds society and culture) that situates technology at the center of the universe. We take a third perspective (also argued by technology philosopher Peter-Paul Verbeek) that technology is a medium through which we perceive and manipulate our world (Bowles 2018). The advantage of our approach is that it avoids taking fundamental positions that either create an illusion of humans losing all autonomy and autonomous technology having taken over all aspects of agency or humans having the ability to retain complete control over the dominant structures of power in agriculture. By methodologically following the multi-directional flows of knowledge and power through PA systems, we are able to trace the contours of social and political impacts that PA technologies have on food production systems.

6. Conclusion

This paper is animated by an intellectual commitment to explore the social and political effects of PA through participatory, deliberative approaches that include perspectives of multiple and diverse stakeholders across the food system. Precision agriculture is restructuring farmer livelihoods and identities through a panoply of technologies that generate and process big data to influence agricultural practices. However, the sociopolitical effects and farmers' motivations remain unclear. This research study utilized a mixed methods approach that included focus groups and follow-up surveys with a range of people along the PA value chain, including farmers, extension workers, representatives of non-profit organizations and government agencies, and PA developers from agritech firms. Our study found that agritech firms socially construct a form of moralistic trust to ensure farmers' engagement with the system. This social construction is achieved by agritech creating and circulating value-laden identities of farmers, and discursively positioning their data-driven recommendations as a 'superior' form of agricultural knowledge. Desiring to be good stewards of land and resources, as well as to be an esteemed member of their agrarian community, farmers situate their own identity and knowledge vis-à-vis PA's algorithmic rationality. Agritech expertly wields a discursive modality of power that interpellates farmers into willing PA subjects that modify their behaviors in accordance to the profit motives of the firm. Farmers perceive this process of algorithmic governmentality as one of moralistic trust. From their perspective, sustained engagement reflects upon them as tech-savvy and eco-friendly producers. Among research participants, actors along the value chain differently perform and contest PA subjectivities.

Two limitations of this study are worthy of discussion. First, the research was conducted in one country (the U.S.) and did not delve in a cross-national comparison of the role of algorithmic rationality on farmers' trust in PA. Such a cross-national study could improve our understanding of how farmers' trust in PA reorganizes across different cultural and political spaces. Putting our research in conversation with other geographically-informed studies on governmentality and subjectification can strengthen our claim that PA technologies influence social power and (re)produce social differentiation. Second, most of the participants in our sample represented similar constituencies, mainly commercial-oriented farmers or farm advisors. Although, we were able to bring some diversity of opinions into our study sample by selecting two geographically and politically diverse regions in the U.S. (South Dakota is politically conservative and Vermont is politically liberal), we think that future research could benefit by including farmers and farm advisors that represent non-commercial interests too. Notwithstanding the limitations, farmers in our study asserted that trust in PA technology was more important, irrespective of efficacy and outcome. Agritech firms have successfully positioned their knowledge products as superior to farmers' experiential knowledge, thereby ensuring farmers' sustained engagement for the purposes of data capture and capital accumulation. Our study demonstrates the subtle machinations of discursive power in digital agriculture and their potential to shift social identities, essential to the reproduction of agritech capital. The power of algorithmic governmentality in food production systems cannot be understated, evident in how PA farmers increasingly perceive harvesting data as more imperative than harvesting crops. As willing PA subjects, good farmers grow trust.

Notes

1. Althusser explains interpellation thusly: 'We shall go on to suggest that ideology 'acts' or 'functions' in such a way as to 'recruit' subjects among individuals (it recruits them all) or 'transforms' individuals into subjects (it transforms them all) through the very precise operation that we call interpellation or hailing. It can be imagined along the lines of the most commonplace, everyday hailing, by (or not by) the police: 'Hey, you there!'' (Althusser 2014:190).

2. Affective-based trust (Jones 1996; Lewis and Weighart 1985) is another widely recognized type of trust, but is not elaborated in this paper for the sake of maintaining parsimony in the review of extant trust scholarship.

Author statement

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrurstud.2021.03.004.

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