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How data-driven, privately ordered sustainability governance shapes US food supply chains: The case of field to market

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ABSTRACT

Multi-stakeholder initiatives (MSIs) establish metrics and collect farm-level data to measure sustainability in the food system. Rooted in the private sector, MSIs advance goals that were once the responsibility of the state. To make sense of this trend, we distinguish three ideal types of accountability systems in the United States agrifood system: community-based, state-led, and private-ordering systems. We explore the implications of data-driven private-ordering for the distribution of power and accountability along a food supply chain by analyzing Field to Market, a prominent US-based MSI. A central feature of Field to Market are metrics that commodity producers can use to assess their performance and which provide data for food manufacturers and retailers to support sustainability claims. Compared to state-led environmental sustainability efforts from the 1940s until the 1980s, which depended on farmers voluntarily adhering to regulations, metrics rely upon the generation and circulation of data that create a nascent, privately ordered bureaucracy. This change in governance has purported and undeclared consequences for food supply chains. Field to Market's metrics promise continuous improvements in agricultural sustainability and accountability in the food system, but they also help food manufacturers and retailers coordinate their supply chains, facilitate the commodification of farm management data, and reframe the meaning of sustainability.

1. Introduction

Multi-stakeholder initiatives (MSIs) that promote sustainability in US agriculture reflect the convergence of two trends. First, beginning in the 1970s, actors from across the political spectrum criticized governments for their poor record on environmental sustainability (Dryzek, 2013). Second, private organizations increasingly adopted the role as primary driver of sustainability, in particular in the agri-food system (Dauvergne and Lister, 2013; Freidberg, 2017, 2020; Konefal et al., 2019a). Driven by consumer concerns and the negative impacts of environmental degradation on agricultural production, many agri-food corporations, food retailers, and farmer associations proclaim support for sustainability (Dauvergne and Lister, 2013; Friedberg, 2017, 2019; Jaffee and Howard, 2010). Consumer-facing companies in those supply chains are increasingly turning to on-farm data to show that they are meeting their sustainability claims (Carolan, 2000a; Konefal et al., 2019a).

Private actors, corporate and non-profit, develop novel systems of accountability to facilitate non-state governance of agriculture and food supply chains, a trend linked to the rise of neoliberalism (Busch, 2010, 2011; Marsden et al., 2010). However, the specific approaches and regulatory frameworks that private entities develop to facilitate transactions often remain overlooked by structural critiques of neoliberalism. One such approach is private ordering—the operational alignment of private companies through contracts without direct government regulations (Cahoy and Leland, 2009; Quinn, 2009; Schwarcz, 2002; Vandenbergh, 2013). Private ordering emerged in the middle ages (Schwarcz, 2002), but it has become prominent with the deregulations

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that began in the 1980s (Quinn, 2008).[1] Opposition to regulations became so powerful that the US federal government did not pass any environmental policies between 1991 and 2012 (Vandebergh, 2013). Supporters of private ordering assume that self-regulating private firms find more efficient than the state. This perspective is consistent with the belief that governments are cumbersome bureaucracies compared to the private sector (Mazzucato, 2013). Various anti-government and pro-business voices contend that big-government bureaucracies overwhelm the spontaneity and entrepreneurship of the private sector with red tape and paperwork (Fleming, 2020).

Multi-stakeholder initiatives such as Field to Market, the Stewardship Index of Specialty Crops, the National Sustainable Agricultural Standard Initiative, the U.S. Cotton Trust Protocol, and the U.S. Roundtable For Sustainable Beef represent systems of private ordering in the field of sustainable agriculture governance (Konefal et al., 2014, 2019a). Our paper probes the implications of multi-stakeholder sustainability governance for accountability and power relations within food supply chains by examining Field to Market, the largest U.S. agricultural sustainability MSI today. Since Field to Market and other MSIs are constantly evolving, it is impossible to make definite claims about multi-stakeholder governance. But as Field to Market aspires to become a leading platform for sustainability efforts in US agriculture, and already involves some of the most powerful food system actors, it is important to pay attention to an MSI that has the potential to reshape US agriculture. We begin by discussing three ideal types of accountability systems in the US agriculture and food system: community-based, state-led, and private-ordering systems. We then present Field to Market and explain how its metrics-based approach to sustainability relies on aggregating farm-level data. We move on to discuss how the change towards data-driven private ordering affects the accountability and distribution of power within food supply chains. Finally, we contend that sustainability metrics create nascent, privately ordered bureaucracies.

2. Multi-stakeholder initiatives, sustainability governance, and accountability systems

Environmental protection used to be the authority of the state. Now, governments share this responsibility with private actors (Bostrom et al., 2015; Vandenbergh, 2013). MSIs have become the preferred approach of sustainability governance (Ponte, 2014). MSIs vary in how they are constituted and resourced (Bain et al., 2013; Cheyns and Riisgaard, 2011; Konefal et al., 2019a), but they typically convene interested parties from different sectors to address, and often govern, shared issues or problems in place of the state (Tamm Hallstrom and Bostrom, 2010).

MSIs constitute a significant shift in how accountability is established in the agri-food system. From the New Deal until the 1980s, US agriculture was characterized by a state-centric accountability system in which government agents monitor compliance with environmental, labor, and quality regulations—an approach often referred to as "command and control" (Dryzek, 2013: 98; Lin, 2014). A contemporary example is the US Food and Drug Administration oversight over nutrition- and healthfulness-related food label claims (Pomeranz, 2013).

Since the 1980s, private ordering has become more prominent as an approach to meeting environmental goals before governments intervene with regulations. In privately ordered accountability systems, non-governmental actors enact environmental policies. To illustrate, as of 2012, more money was spent on private environmental inspections in the United States than by the Environmental Protection Agency's enforcement office (Vandenbergh, 2013). In food and agriculture, the most common form of private accountability is third-party certification (Hatanaka et al., 2005). In this approach, independent organizations verify compliance by businesses and farms through standards instead of regulations. Typically, this process involves documentation reviews and occasional site audits. Accountability systems within supply chains have also proliferated (Tannis et al., 2018). In these approaches, downstream actors (e.g. processors and retailers) hold suppliers accountable through supply chain metrics, standards, and/or performance reports.

State-led regulatory processes do not exclude private actors and privately ordered approaches sometimes include government. For instance, organic certification relies on private businesses as certifiers, but it is a government-led program. By contrast, General Mills initiated an agreement between the Ecosystems Services Market Consortium and the Kansas Department of Health and Environment to promote regenerative agriculture (Noltemeyer, 2020). Although both are hybrid accountability systems, organic certification is led by government while General Mills' regenerative agriculture initiative is driven by a private firm. In the case of Field to Market, public organizations sit at the table, but do not exercise regulatory authority.

MSIs establish diverse governance instruments, including standards, certification protocols, and metrics (Ponte, 2014). The latter are becoming more prominent. MSIs often develop metrics along the supply chain that food retailers can use to verify their marketing claims (Konefal et al., 2019b). For example, in 2013, General Mills announced that ten of its priority ingredients would be sustainably sourced (General Mills, 2013). Similarly, Unilever claimed in 2015 that it was sustainably sourcing 60% of its agricultural raw materials and that it would reach 100% by 2020 (Unilever, 2015). The Kellogg Company has also promised to "responsibly source" its "10 priority ingredients," and Nestlé claims it will "responsibly" source 70% of its ingredients. Other companies make similar claims (Scott, 2018). These firms are members of Field to Market and have sought to use the MSI's Fieldprint® platform to support some of their claims.[2] As firms anticipate consumers to increasingly request evidence of sustainability, food retailers and manufacturers have turned to non-government entities to develop that evidence (Freidberg, 2017; Konefal et al., 2019a).

The shift from government to private accountability systems has the potential to change the power dynamics between actors along the agri-food supply chain. Research on global supply chains in the textile and automobile industries describes how consumer-facing companies have become "inspector firms" (Heritier et al., 2009: 1). These firms either audit their suppliers and subcontractors themselves, or they engage third-party certifiers to do the inspection. Heritier et al. (2009) contend that, even though this process can be more costly for the inspector firm than government regulations, the firms pursue this strategy to meet consumer expectations in high-end markets. This suggests that the companies expect to recover the added costs by marketing their products as exceeding government regulations on environmental and labor criteria. A hierarchy of authority emerges when one firm in the supply chain makes claims and then audits other firms to validate them. Although there is considerable diversity among the supply chains of different types of commodities (Dallas et al., 2019), the example from the textile industry shows that the transition from government to private accountability systems is not politically neutral. Research is needed on the effects of such transitions on agri-food supply chains.

In command-and-control approaches, governments have a near

[1] Governments tend to be marginally involved in private-ordering paradigms by setting framework legislation and urging companies and farmers to adopt environmentally friendly practices to dissuade new regulations. Governments are also involved to the extent that courts tends to mediate disputes that arise when private rights and contracts are disputed. However, private ordering is different from government regulation to the extent that governance is initiated by private firms (Schwarcz 2002).

[2] These firms sometimes develop programs outside of the Field to Market framework to get their suppliers to grow commodities in ways that meet their sustainability claims. For example, a firm might incentivize their farm suppliers to plant buffer strips to reduce soil erosion. This would enable that firm to claim sustainable practices without using the Fieldprint® platform.

monopoly on regulatory power. By comparison, in a privately ordered approach, power is more plural, shared, and dispersed (Freidberg, 2017; Loconto, 2015; Rosin et al., 2017; Wolf and Ghosh 2019). Lead companies play a central role in setting and implementing sustainability metrics in their supply chains (Bartley 2018), but they cannot do this alone (Friedberg 2017; Konefal et al., 2019b). Accountability in sustainability governance entails collaboration. Although the stakeholders participate in MSIs as equals in theory, some actors are likely to have more power than others (Cheyns and Riisgaard, 2014). Private governance has tended to shift power along the food chain from producers and processors to food retailers and supermarkets (Busch and Bain, 2004), just as the consumer-facing firms have taken on greater authority in the textile and automobile industries (Heritier et al., 2009). There is reason to believe that a similar shift may also occur within MSIs.

Although we present state-led and privately ordered accountability systems as opposites, both approach accountability through generalized relationships in which non-farming entities act as intermediates between food producers and consumers. This contrasts with community-based accountability systems which exist alongside these two approaches. Local food systems are embedded in spatially bounded communities of consumers and producers that share more than market relationships (Lyson and Green, 1999; Feenstra, 1997; Kloppenburg et al., 1996). In such systems, it is assumed that common investments in a healthy community and the proximity of consumers and producers foster social control that holds farmers accountable to sustainable practices. In addition, local networks among farmers often facilitate such practices (Baumgartz-Getz et al., 2011; Prokopy et al., 2008). Such community-based accountability systems are the hallmark of local, alternative agriculture, but are still relevant among farmers who take part in the dominant industrial agricultural system (Strube, 2019). From the perspectives of community-based food systems, the shift from state-led to privately ordered accountability is only marginally relevant, because these systems are directed at creating autonomy from external interference, whether from the state or private firms (Van der Ploeg, 2012).

Building on these insights, we explore whether metrics in privately ordered accountability systems affect the governance of industrial agri-food supply chains beyond aspects related to sustainability. We use a case study approach to analyze the competing perspectives on the gathering and circulation of farm-level sustainability performance data in one prominent MSI: Field to Market.

3. The case: field to market

We approach our inquiry through a case study of Field to Market, the most prominent MSI in US agriculture. Field to Market was founded in 2006 by twelve agri-food corporations and non-governmental organizations to improve sustainability in US row-crop production. It has since grown to comprise 137 stakeholders and ten full-time employees. The MSI has enrolled 3,700,000 acres in its program as of 2019 (Field to Market, 2020). One of Field to Market's main innovations have been eight metrics of key aspects of agricultural (environmental) sustainability: biodiversity, energy use, greenhouse gas emissions, irrigation water use, land use, soil carbon, soil conservation, and water quality (Field to Market, 2019). Farmers report data on their operation and practices in these areas through Field to Market's Fieldprint® platform. This software aggregates data from farms within a certain geographic area organized as Fieldprint® projects. Farmers input their data directly into the free Fieldprint® calculator, or they use one of several third-party farm management softwares that communicate with the Fieldprint® platform through an application programming interface (API). The farmers can then benchmark their own performance against the average of their peers. Downstream project participants can use the aggregate information to develop programs to support farmers in becoming more sustainable and to generate data that might later be used to make claims about the sustainability of their sourcing. Fieldprint® projects are usually coordinated by midstream commodity chain actors with close relationships to growers, for example food processing companies, extension services, or grower's organizations. For example, if a company sets out to source a commodity sustainably, it can partner with such a midstream organization to recruit farmers to supply the commodity and farm-level data.[3]

4. Data gathering and analysis

We gathered data as part of a four-year, USDA-funded project to evaluate the capacity of MSIs to promote sustainable innovation among farmers. Although we engaged three MSIs, we focus on Field to Market in this paper because it is the most established one with a comparably larger number of enrolled farms. We gathered publications, reports, and press releases from Field to Market and its stakeholders. We conducted participant observations at three Field to Market stakeholder meetings. We interviewed Field to Market staff, senior sustainability managers, project-level coordinators of 21 corporate and non-profit stakeholder organizations, and 11 farmers who participate in Fieldprint® projects. In total, we conducted 44 qualitative interviews between 2018 and 2020.

We faced difficulties recruiting interview participants in the private sector. This is likely because private firms consider conversations about marketing strategies to be proprietary information (Glenna et al., 2007). To recruit farmers, we depended on project coordinators. These coordinators were often protective gatekeepers, and not all of them shared grower contact information. When we did get contact information, each farmer we approached agreed to be interviewed.

We used NVivo to code the data in a two-pronged procedure. Initially, we created a coding tree based on our initial questions that emerged from the literature. However, we adapted the tree as needed to fit unexpected insights. To analyze our findings, we created what Miles and Huberman (1994) call data displays, which present a range of opinions and views on questions related to this paper. Some arguments emerged repeatedly during our analysis of the dataset, which we present as themes in the empirical section of this paper below. We highlight quotations from the interviews to illustrate these themes.

5. Intended and unintended effects of data-driven, privately ordered sustainability governance

We explore five consequences of Field to Market's data-driven sustainability governance. First, we document the stated goal of sustainability metrics to continuously improve agricultural production. Second, we examine how metrics coordinate supply chains and shift decision-making power from farmers to off-farm actors who make the marketing claims. Third, we discuss whether sustainability metrics facilitate the commodification of farm-level data, and whether this might lead to farmers being paid for the data. Fourth, we analyze how sustainability metrics reframe the meaning of sustainability. Fifth, we explore how data circulation enables food manufacturing and retail firms to verify their sustainability claims.

5.1. The promise and its reality: continued improvement through science-based measurement

A key motivation for adopting sustainability metrics is the notion of continuous improvement. Rooted in the management literature, continuous improvement means evolutionary improvement via collaborative processes and incremental innovation (Singh and Singh, 2012). By aiming to improve metric scores, each farm can theoretically improve its performance year after year, regardless of how sustainable it was when first entering a metrics program. Small, incremental changes on

[3] For a more in-depth profile of Field to Market, see Konefal et al. (2014, 2019a, 2019b) and Freidberg (2020).

thousands of farms, then, reduce the liabilities of the industry at large. From this perspective, transitioning to a sustainable food system does not require systemic change, but a series of ongoing small improvements in current practices. Field to Market's theory of change focuses on this idea, both in terms of how their metrics are to be improved and how farmers adopt more sustainable practices. A Field to Market representative shared:

> [O]ur emphasis is on what we refer to as continuous improvement. Can we move the whole system forward through you-can't-manage-what-you-don't-measure, through the measure-to-manage approach, can you actually over time move the whole system forward?

This measure-to-manage approach to continuous improvement is enabled through innovations in precision agriculture and agronomic modeling. In precision farming, sensors generate precise, narrowly focused, and standardized field-level data that farmers can analyze using specialized decision-support software to optimize farm management (Carolan, 2000a, 2000b; Fountas, 2015). Metrics rely on such data to measure a farm's sustainability performance, but they also go beyond previous applications of precision agriculture in that they do not just inform farm managers, but are also being used to optimize supply chains. Metrics can also generate scores based on agronomic models that use field characteristics and specific practices as inputs in the absence of empirical measurement. Those who promote the use of metrics in agriculture expect that precise data and performance benchmarks make farmers aware of inefficiencies and encourage them to implement more effective practices. To illustrate, a low score on the Fieldprint® irrigation water use metric indicates to growers that they could use water more efficiently, and in so doing could save both a natural resource and money. One farmer notes:

> *There's a part in there at the end, it shows you … it's not a graph but it's a visual picture of where you're at […]. And the thing that I didn't think about is, when I'm hauling grain, I can take a load here, go to [the elevator], pick up a load of grain at a bin site, go to [the city], kind of make a circle out of it versus just running grain back and forth to [the elevator], if I can make it work. And I can save some miles. So, I kind of realized that through the* Fieldprint® *calculator.*

Such stories are the successes that Field to Market and its proponents highlight. Thus, in theory, the Fieldprint® metrics encourage farmers to think about measurable aspects of sustainability. In reality, however, such epiphanies remain rare. A board member of Field to Market and senior sustainability manager of a major food company states:

> I've got a lot of one-off stories of, hey, because of doing Field to Market calculator and realized how many miles I was driving to the bins to … We bought new bins and put them up in different places, so it cuts my greenhouse gas in, you know, reduced energy. I've got those stories one-off from different ones, but we weren't seeing an overall [trend].

Many of the farmers shared that the metrics do not help them become more sustainable because they already have adopted the best practices. One farmer states: "we had all the information already, and we have all of our … All our planters are run with a monitor, and GPS has all the information and then all of our sprayers are … Farmers know what's going on." Another farmer states: "I already felt like for fertilizer and for a lot of different things, I was already doing things and I'd spend my time and effort in those areas to be more efficient there. And so, the Fieldprint® calculator is kind of more of a reporting tool." Fieldprint® project coordinators confirm these assertions. Farmers who are using precision technologies are likely to have already adopted practices to maximize efficiency.

In summary, the idea of continuous improvement through data generation and management assumes farmers use the data to improve their operation. However, social institutions, market structures, and financial incentives also affect these outcomes (Lee et al., 2020). Field to Market recognizes this and has recently facilitated dialogues across its members to explore social, cultural, and economic barriers to adoption of more sustainable farming practices (Field to Market, 2021).

5.2. Coordinating supply chain management

Field to Market's metrics accelerate the trend of coordinating supply chain management by enabling downstream actors to influence farming decision at the field level. Asked about who is driving the development of sustainability metrics, a representative from an agricultural input company responded:

> I don't know that we know right now where the power lies. It feels like we in the ag sector are responding to food companies right now just to be able to operate. I mean, there are certain things that we're needing to do just for a license to operate that are becoming more and more evident to us.

Although this company representative hesitated to say that there had been a long-term shift in influence, the representative stated that consumer-facing companies now have more influence over the establishment of sustainability goals and tools to measure them.

Coordination of supply chains refers to the centralization of management of the different operative stages. Currently, only Fieldprint® project coordinators access farm- and field-level data. Other stakeholders only have access to aggregated data. This provides project coordinators with detailed information about farm management practices and resources, including the size and soil types of their fields, the inputs used, and the yields. Although not all projects coordinators weigh in on farm management, this information enables them to make such recommendations. Coordinators may, and often do, suggest practices that farmers can adopt to improve their scores. They may also require certain practices as a condition for access to a premium price or some other benefit, as is commonly the case in contract farming. In addition, a purchaser might identify underperforming producers and request that they improve their scores, leaving it to the farmer to decide how to do it. Through this process, the Fieldprint® platform enables coordinators to affect farm production and conservation practices.

Project coordinators are walking a fine line between making recommendations, demanding specific changes, and respecting the autonomy of their producers. Farmers are well known for valuing their independence and for resisting being told how to farm (Mooney, 1988). Project coordinators thus tread carefully. Explicitly telling farmers what to do could push farmers away. One purchaser who is part of a Fieldprint® project warns:

> While I'm qualified to go out and discuss agronomy with all my farmers, that's not really in the scope of my job. So, I think we have to be careful to make sure we're staying in our lane, if you will. I don't know that a lot of our growers look … While they look to me to be a non-biased opinion a lot of times towards agronomic questions, I wasn't necessarily, and our program isn't necessarily built around being able to go to the farm gate and tell them how to farm in a more sustainable matter. That's a pretty slippery slope, I think from our perspective.

Likewise, the sustainability director of a large milling company states, "We don't ever go on the farm and try and give recommendations on how to farm. We just talk through opportunities that we see and if that spurs anything in their mind and they wanna try it." Depending on the relationship between a farmer and project coordinators, however, "talking through opportunities" can feel like an order. For one project we studied, a project coordinator admitted to planning to suspend non-compliant farmers from their premium program. Farmers who heard about this risk through the grapevine felt pressured to comply, emphasizing that "there was no choice. You either do it or you're out" as one

farmer put it. Ultimately, the ability of off-farm actors (such as food companies or project coordinators) to steer on-farm decisions through sustainability metrics and recommendations depends on their incentives and sanctions. But at least in places where producers have few alternatives to sell their product, which is quite common in much of US agriculture (Howard, 2016), the mere threat of losing access to a market or program, expressed or not, can induce growers to comply. Already, agriculture and food firms influence on-farm decisions by demanding cheaper commodities that can only be achieved by expanding production and implementing more efficient practices (Howard, 2016). As a result, farmers likely experience the push towards sustainable farming practices from buyers as a new stage in that process. Farmers and politicians once complained that government bureaucrats micromanaged farmers (Glenna, 1999). Now, farmers are asked to conform to management practices requested by private food manufacturers and retailers.

The coordination of farm management between growers and project implementers can also extend down the supply chain. Fieldprint® projects are often initiated by large national and transnational firms that do not directly and regularly interact with farmers. These groups rely on midstream organizations to implement Fieldprint® projects. In line with Field to Market's data privacy guidelines, end-users of the metrics only receive aggregated sustainability data. Consequently, they cannot specify changes in on-farm management to growers. However, they can work with their upstream partners to do so. For example, one prominent food processing company collaborates with a growers' association to implement cover crops in their supply chain to raise several Fieldprint® scores.

In the past, politicians celebrated farmers as best positioned to manage their operation sustainably, but agronomic advisors, educated in agricultural colleges, have long complemented the expertise of farmers (Eanes et al., 2019). With detailed data leaving the farm gate through sustainability metrics, off-farm actors now also possess the on-the-ground information necessary to guide farmers as to how they can improve their sustainability, even though such a coordinated system remains nascent. This supports Comi's (2019, 173) observation of a "distributive, agentic set of relations" forged through precision agriculture. As one Field to Market employee stated: *"The more data capture that's happening and the more big data becomes the norm on North American farms, the easier it's going to be to be able to capture and sort of turn this information into something actionable for growers, as well as for the supply chain."* Over twenty years ago, Wolf and Wood (1997:196) anticipated that "*precision farming is a mechanism through which local and industrial agribusinesses will gain access to, and a greater degree of control over, farm and field-level activities.*" Field to Market's Fieldprint® platform and other, similar metrics, now provide interfaces through which agribusinesses can more readily access such data and influence farm management.

5.3. Commodification of performance data

Researchers have long noticed that precision agriculture creates a market for agricultural data from which agri-food businesses and technology companies are more likely to benefit than the farmers who generate the data (Wolf and Wood, 1997; Fraser 2019; Carolan 2020b). The Fieldprint® platform facilitates this development by circulating farm management data along the supply chain. The platform is designed for data-sharing, not trading. However, as customer-facing firms strive to use that data to verify their sustainability claims, the line between management tool and commodity is blurring. For example, some farmers expect compensation for sharing their data. One grower stated:

> I do think that data is very valuable to companies. But I think that farmers as a whole got started in collecting data and they don't realize the value of what they have sitting there. And so, they just give it to people. And I think other people make money on it. And that actually has happened. And I've been very cautious not to have that happen because if they're going to make some money, then I want to make something.

Another farmer stated, "[I]f the company is gaining benefit from myself, I'm bringing value to them, why aren't they then reimbursing me with value?" Still another farmer said, "they said our data is there, our data has value, and why are we giving it away … […] it's kind of getting toward almost another … it's like another entity on the farm, which is the data."

One farmer went further when he said, "any data that's harvested off my fields or that I provide somebody is mine, and so I should be compensated for that somehow." The word "harvest" suggests that he regards his data as a farm product comparable to plants and livestock. At present, growers seem uneasy to identify as data farmers. One farmer distinguishes between commodity crops and an unnamed other category, which includes his data: "So my data has value, and so I need to be paid for my data. It's not a commodity. It's not soybeans that I'm bringing to them, but it has value there." This distinction implies that there is a conceptual difference between crops and data, but he does not explicitly reject data as a source of income. In contrast, another farmer resents the commodification of his data:

> I don't know, I never thought of [selling my data]. I really just want to farm. [chuckles] […] It's kind of getting toward almost another … it's like another entity on the farm, which is the data. That's kind of weird. […] I've never thought about or cared about it until those guys [a company who approached this farmer to collect and sell farm management data for him] stopped in that day and were wanting to do that.

These comments suggest that farmers recognize their data has value and that some desire compensation. A Field to Market representative supported this view:

> [Y]ou do have agro-businesses starting up projects on their own with the idea that, because they want, their customers want that. So, they want the farmers they are sourcing from to have experience with the program, and then they can sell essentially sustainability information along with the grain downstream.

The representative later added that they are aware of informal conversations around paying farmers for their data, but it has not yet surfaced at the MSI level.

> I don't know if growers asked the project administrators directly for payments, we've had a couple projects offer that. […] They said if you participate in our sustainability program and use the Field to Market platform, we'll give you X per bushel premium, and then that works to gather more data. So that's fine. Companies are certainly welcome to do that. I don't know if farmers are asking for that. I don't know that they're asking for money for their data so much as they're concerned is what's going to happen with it and if they don't want others to profit off of it.

Relationships between firms and farmers vary. Among the farmers we interviewed, some were part of a long-standing special commodity program. Many of the growers have sold into the program for decades, and all interviewees regard it as a valuable partnership. Besides an initial incentive of a dollar per acre in the first year, the farmers in the program have not been paid extra for sharing their data. However, they receive a premium for their custom crop. One farmer stated that helping their business partner to be profitable motivates them to share their data: "[T]he […] deal with [this company] for us has been a huge profit center for our farm. So, for us to continue with that, you do things that are asked in order to receive those premiums." Another farmer stated:

> [W]hat I get out of it is that it helps [the company] satisfy concerns and questions that their buyers have. And if it takes care of those

concerns that others have about their product, then I'm completely satisfied. Because I want [them] to stay successful. And again, to be a very viable, again, successful and profitable business. And if they stay that way, they'll keep wanting me to produce for them and I'll stay profitable. So, it's not a personal thing to me. I want [my buyer] to do well. If they do well, I'll do well.

By contrast, farmers who sold into the open market and had a choice of buyers wanted to be compensated for sharing their data. One such farmer said, "I do understand how it's worth something to [the processing companies that use my crop], but they're not paying me. So, why am I interested?" Another stated, "I didn't feel that it's worth my effort when I'm getting paid a dime. And so, if they want better information, they need to up the compensation for that information." These statements show that some farmers don't just want any compensation, but one that corresponds to the labor they invest or the value that others derive from it. These farmers did not consider potential non-monetary benefits of the program an adequate compensation and thus left the program.

Comments from retail companies reveal the emerging tension between them and their supplier farmers. One sustainability manager warns: "[W]e don't want to get in the habit of paying for [sustainability data] on an ongoing basis. We want to get this to … it's so widely accepted in the growing community that it's just part of doing business." A senior sustainability manager in another major food processing company is even more candid when he says, "[We]'ll never be able to fairly compensate farmers for what we're asking them to do. Without their involvement, we don't have anything."

Sustainability metrics and related data sharing platforms such as Fieldprint® facilitate the commodification of farm performance data. But different stakeholders have competing interests regarding such commodification. Food manufacturers and retailers want to avoid having to pay for farm data. However, for growers, selling performance data could constitute an additional potential income stream, even though not all farmers embrace the idea of becomingdata producers. As an organization that convenes these different perspectives, Field to Market may need to facilitate a shared understanding regarding farmer data and its value.

5.4. Competing frames of sustainability

A specific understanding of sustainability undergirds Field to Market's metrics. The Fieldprint® platform operationalizes sustainability as eight measurable, performance-based metrics—biodiversity, energy use, greenhouse gas emissions, irrigation water use, land use, soil carbon, soil conservation, and water quality (Field to Market 2019). Although Field to Market states that sustainability includes sustainable livelihoods, the current Fieldprint® platform focuses exclusively on environmental sustainability and does not contain any social or economic indicators.

Farmers in our interviews portrayed sustainability differently. One farmer stated that "[s]ustainability and profitability go hand in hand." For some farmers, profitability is a condition for environmentally friendly practices. Asked about his definition of sustainability, one farmer pulls out a slip of paper that reads "the economics of social and environmental sustainability." He adds: "And the first in that list is economically viable. Because if we can't be that then the rest of it goes out the window." By contrast, another farmer viewed environmental sustainability as a condition for long-term economic viability:

> *We look at being sustainable as being economic positive. So, if you're not trying to become sustainable, then you're going backwards as far as long term on your farm. So, that's our number one concern is that we are doing things that are profitable as well as going to continue to make the farm better. Anything that is helping to do a better job of that we'll be all for.*

Many farmers did not differentiate economic, environmental, and social aspects when describing sustainability. When asked about his definition, a corn and soy farmer from the Midwest responded:

> *I see sustainability as myself, my family, and everybody that works with and for us, farming in a way that allows my kids, and my kids' kids, and whoever else farms the ground to be able to continue on. That we're not damaging the environment, or the soil, or ourselves, or anything else. That it's just good for everybody and everything that's involved in it. […] I think most farmers do that anyway because they want their sons and daughters to come back and help farm and they want to continue on.*

Like the previous example, many farmers invoke intergenerational economic viability as the guiding principle of sustainability. One farmer stated: "*Basically, how our practices, what we're doing now are going to go into the future. Will we still be able to farm? And will the generations after us be able to?"* Another said:

> I've been farming since '96 with my dad. He's been farming since 1968, somewhere in there and he is the third generation of … some of our ground has been in the family for four generation now. So, to me that's the epitome of sustainability is we've done it for four generations now. And I don't know how you can define sustainability any better than that.

Some Field to Market stakeholders and project coordinators recognize the Fieldprint® metrics only cover the environmental dimension of sustainability. For example, a Fieldprint® project coordinator states:

> I think we've got a lot of great stories within our own program to tell that aren't really able to be documented with a Fieldprint® calculator. Like, seventh generation farming the same way. [One of our farms is] celebrating their 52nd crop with [us]. Those are sustainable metrics as well, but really hard to jam that into a Fieldprint® calculator […]

One farmer doubted that the Fieldprint® calculator promotes environmental improvements when he referred to certain practices as being "Field to Market friendly." His quip implies that practices that satisfy Field to Market's demands are not necessarily the same as environmentally friendly or sustainable. Similarly, another farmer points towards the difference in how Field to Market and growers define sustainability:

> And so, I look at the Fieldprint® calculator thing and I think it's pretty good for documenting what they're wanting to get at and their sustainability goals. But it's not very good at documenting my sustainability. Like my parameters are different than their parameters.

These comments show that various participants along the supply chain operate on different definitions of sustainability. Currently, Field to Market prioritizes the environmental dimension of sustainability and has not incorporated economic or social sustainability metrics into its calculator. Different conceptualizations of sustainability among various stakeholders can create challenges for advancing sustainability (Glenna, 1999). Whether such differences can be reconciled may affect the extent to which Field to Market metrics are implemented. With Field to Market, a conflict seems to have emerged among the various actors over how to define sustainability, just as they disagreed about the value of farm data.

5.5. Evidence-based sustainability claims

Just as decision-making about sustainability goal setting has shifted from farmers towards food processing and retail firms, accountability is also changing under privately ordered governance. A key claim of MSIs is that they are working to make farming more transparent. Although Field to Market's members have long hesitated to implement a robust claims-and-verification framework, the newly developed Continuous Improvement Accelerator program and the Fieldprint® platform now allow downstream actors to make evidence-based claims about the environmental sustainability of their supply chain. For example, General

Mill uses Field to Market to show that their wheat, sugar beets, and corn sourcing in the US has become more sustainable (General Mills, 2019).

With the Continuous Improvement Accelerator, project partners choose a level of assurance (first-, second-, or third-party verification) to support their claims. The Continuous Improvement Accelerator allows companies to make claims that range from simple participation (stating that a stakeholder has registered a certain number of growers and acres with Field to Market) to complex impact claims which require third-party verification. Although claims can go beyond data collected in the Fieldprint® platform, the metrics are central to the more advanced claims. Companies made claims about their participation in Field to Market before the Continuous Improvement Accelerator, but this platform provides a more robust and unified framework that makes such claims more credible. Companies can use such information to create a market for consumer expectations about how their food is being produced and, thus, give companies that provide this information a competitive advantage.[4] The flexibility of Field to Market's claims framework allows stakeholders to substantiate their specific messages and internal assessments but may also confuse consumers who struggle to distinguish between a self-assessed participation claim and a third-party verified claim or standard, such as organic. Questions also remain about the degree to which Field to Market metrics are driving improvements in sustainability. As critical voices among stakeholders working with Field to Market suggest, it remains unclear whether sustainability metrics will empower farmers to recognize their inefficiencies and respond accordingly (c.f. Section 5.1.). Consumer and industry confidence in metrics-based sustainability claims is yet to be seen, but they promise a level of transparency that may come to look like Green Business Certification Inc. (GBCI) or LEED certification programs in the construction industry. These are globally recognized programs that provide a set of standards that builders must achieve in order to receive the GBCI or LEED label. Creating a similar certification program through an MSI may then enable food manufacturing and retail firms to manage accountability between farmers and consumers transparently.

A representative of an agricultural input company recognized that consumer-facing companies are seeking industry standards and third-party certification to verify the claims they are making. However, she also raised concerns about the viability of these claims.

> "I think the certification and verification presents some implementation challenges. I don't think I would say that we are not supportive of it. It just adds a layer of complexity sometimes at the farm gate. I think one thing that we're exploring and trying to understand better is that, does the certification tie to that value driver that we talked about before? In other words, if a consumer sees that these bananas have been certified by Fair Trade International, are they willing to, and there are a bunch of social and sustainable benefits along with it, will they pay an additional premium for that? That also changes the receptivity to certification along the value chain, I think, as well."

This representative suggests that certification is likely to emerge if the consumer-facing companies can create a market for it. She is not expecting a certification system to emerge soon, however, her comments indicate that it may be a possibility.

If a certification system were to emerge, it would mark a significant departure from the previous system of state-led regulation. In the past, farmers were asked to file crop management plans with their local USDA office. These farm plans were only voluntary, non-binding, and confidential (Glenna, 1999). On the surface, this nascent privately ordered system is also non-binding. But the more the reporting of agronomic data becomes an operational norm, as Field to Market advocates for, it is likely to exercise a stronger authority over farmers who hope to maintain good relations with their customers.

6. A privately ordered bureaucracy

The Fieldprint ®platform is showing characteristics of an emerging bureaucracy. Max Weber (1978) described bureaucracies as forms of social organization in which particular functions of society and the economy are fulfilled according to permanent, written procedures and rules that prescribe a particular division of labor. In Field to Market, this functional goal is the improvement of agricultural sustainability and accountability. To this end, the Fieldprint® platform exchanges data on sustainability along the supply chain using electronic interfaces, which are equivalent to "files" during Weber's time. In this system, farmers record and enter the data. They often do this with the help of external administrative staff. The data is then automatically compiled and analyzed by an intermediary—the project manager—who also often advises farmers how to improve their score. At the same time, he or she reports aggregate data to a Field to Market stakeholder, which usually provides the funding for the project, including the salary for the project manager. At the stakeholder level, there is usually an employee who analyzes the data for the organization. This employee gives directives to the project manager and delivers information about sustainability to other entities in their organization—such as management and shareholders—and the public. The collective of Field to Market's stakeholders, then, takes on quasi-regulatory responsibilities by defining the procedures according to which Fieldprint® projects are managed. Collectively, the stakeholders also give directives to the executive staff of Field to Market and their contractors, who provide technical support and planning expertise to the MSI and its projects. This generalized division of labor between data farmers, project managers, stakeholders, and the Field to Market executive staff is typical of what Weber described as bureaucracy.

Field to Market's division of labor is characterized by an office hierarchy in which data flows downstream from farmers to stakeholders, and sustainable production expectations largely flow in the opposite direction. The procedures that each actor fulfills are generalized by Field to Market's bylaws, the Fieldprint® platform's application programming interface (API), and policies regarding data protection, privacy, and its claims framework. Some Fieldprint® projects use incentives and sanctions to nudge farmers to report their data and improve their scores, such as by not renewing a contract or excluding farmers from market access. The office hierarchy also implies a "concentration of the material means of management in the hand of the master" (Weber, 1978:980)—in this case, the consumer-facing firms in Fieldprint® projects. Although Field to Market provides its Fieldprint® calculator for free to anyone, the agronomic support to use it effectively is still provided by the stakeholders (whether they carry out this function themselves or delegate it to an intermediary), as are incentives.

Despite the similarities between Field to Market's sustainability metrics and state-led regulatory bureaucracies, there are also differences. Although each Fieldprint® project is led by a single stakeholder, or a collection of stakeholders, as an MSI, there is no top-level organization within Field to Market. Rather, a range of stakeholders share responsibility in developing governance procedures. Weber also identifies a class of salaried, full-time officials as characteristic of bureaucracies, which is missing in the Fieldprint® projects. Although Field to Market creates new administrative roles, the project managers of its Fieldprint® projects, they are usually attached to existing positions, instead of being full-time and independent from other responsibilities. Field to Market also employs ten full-time employees, but their role is defined more broadly to facilitate the stakeholder process and assist projects. They are not directly involved in Fieldprint® projects. In addition, despite Field to Market's range of clearly defined procedures, not everything is spelled out. For instance, with Fieldprint® projects that expect their suppliers to innovate and improve their sustainability, the

[4] Consumers are typically portrayed as demanding more sustainable products, but such expectations are predominantly created by companies and not the consumers themselves (Steger, 2008).

level of such improvements is not usually explicated. This allows a level of discretion for a project manager to reward or penalize farmers that would be atypical for a bureaucracy. Since such expectations are rarely explicit, it is also not a surprise that Field to Market does not have a clearly defined appeals framework, another defining characteristic for a state-led regulatory bureaucracy. Farmers who have been unjustly treated in a project do not have established processes within Field to Market to have their grievances considered. Finally, bureaucracies are characterized by a relatively permanent governance structure. Being still young, Field to Market's governance is in flux. New procedures are being tested and implemented. Projects themselves come and go, although some are designed to exist permanently. Whether Field to Market will eventually evolve into a permanent, fully developed bureaucracy with all the characteristics that Weber (1978) described will depend on a host of factors, including negotiations among various stakeholders, most notably between consumer-facing firms and farmers.

That private entities can be as bureaucratic as the government is not a new idea. Weber (1978) observed that the bureaucracy of private enterprises is indeed characteristic of the modern economy. Proponents of a neoliberal agrifood system have long advocated for replacing state-led bureaucracies with more efficient and less-bureaucratic private systems of governance. However, as they have replaced them with regulations that protect free trade and investment, they have created novel, privately ordered bureaucracies and governance structures to coordinate supply chains, including their sustainability (Busch, 2010, 2011). That Field to Market hosts a suite of bureaucratic and potentially disciplinary instruments is thus not entirely unexpected. It is still ironic, however, given that the MSI was specifically founded to be an efficient, flexible, and non-invasive private-ordering answer to industrial agriculture's sustainability and accountability challenges. Mazzucato (2013) contends that it is taken for granted that the private sector is less bureaucratic and more conducive to innovation and flexibility than government regulation. Our analysis suggests that this assumption may not hold up to scrutiny. Our finding is consistent with research by Fleming (2020) and Busch (2010) claiming that privately ordered systems are often as bureaucratic as government regulatory systems.

If Field to Market's bureaucracy is more efficient and involves less paperwork than state regulations, it may be because it lacks some mechanisms that burden government regulatory systems, such as standardized audits to verify the accuracy of what is being reported. If more stakeholders make impact-claims that require third-party certification, however, the bureaucracy needed to verify these claims may soon liken government regulation. In addition, Field to Market may also be more efficient because it has not yet implemented an appeals system through which farmers could claim benefits or avert penalties from a Fieldprint® project, or otherwise file complaints. Furthermore, if Field to Market seeks to increase its credibility via accreditation, as other MSIs have done, this would add another layer of bureaucracy.

Government-led efforts to promote sustainability in agriculture have been called invasive, bureaucratic, and strict. In reality, however, agriculture has exemptions that other sectors of the economy do not, including on child-labor and environmental laws (Ruhl, 2000; Colihan, 2015). Furthermore, in the state-led system, conservation has always been voluntary. In the past, farmers were asked to file crop-management plans with their local USDA office, but these plans were voluntary, non-binding, and confidential (Glenna, 1999). On the surface, the nascent privately ordered system of Field to Market is also non-binding. But the more the reporting of agronomic data becomes an operational norm, as Field to Market advocates for, it is likely to exercise a stronger authority over farmers who hope to maintain good relations with their customers. If MSIs develop robust verification systems, farmers may find that private metrics will be just as, if not more, invasive, bureaucratic, and strict than government oversight.

7. Conclusion

The metrics developed by Field to Market constitute a significant change in the governance of food supply chains and the production of accountability within agriculture. Although our analysis focuses on Field to Market, the most established MSI within US agriculture, our findings are relevant beyond this single case. Many of the aspects that we describe in this paper—the creation of accountability through data, the sharing and accumulation of data through generalized procedures, a bureaucratic division of labor between project partners, the idea of continuous improvement—are inherent to metrics as a governance instrument, although the particularities may vary across different MSIs and metrics.

Although metrics promise to accelerate the adoption of sustainable farming practices and to improve accountability in supply chains, they have yet to prove to be more effective and less invasive in advancing agricultural sustainability than government regulations. Furthermore, we show that the circulation of agricultural data in Field to Market's Fieldprint® platform has consequences beyond improving sustainability and accountability. First, the metrics enable downstream food system actors to make field-level management recommendations and, in some cases, set market expectations. Depending on the relationship between these downstream actors and the farmers, this has the potential of shifting more management decisions from farms to off-farm actors. Second, the Fieldprint® Calculator that aggregates agricultural data for Field to Market's metrics provides a blueprint for platforms that allow trading of such data. We already find that farmers and some stakeholders associated with Field to Market contemplate whether agricultural data are becoming a commodity alongside agricultural crops. Third, Field to Market's metrics as they are currently implemented limit the framing of sustainability to a set of measurable environmental dimensions of sustainability. This contrasts with more holistic understandings of sustainability that many farmers hold, and the widely supported three-pillar model of sustainability (Purvis et al., 2019) which encompasses economic and social aspects besides environmental sustainability. Finally, we suggest that Field to Market's sustainability metrics are creating a new type of privately ordered bureaucracy. This system operates largely outside of government oversight and consists primarily of governance and administration by non-farming private food firms and stakeholders. If fully implemented, this private ordering system may be more invasive to farmers in the US than the previous state-led system of accountability. Without counteracting legislation, private ordering of sustainability and accountability may limit the agency of farmers and further consolidate power in food supply chains in the hands of downstream actors.

Several implications emerge from our findings. Since government regulations in agricultural sustainability have traditionally been voluntary, it is possible that private ordering could nudge farmers to use more sustainable practices. However, if MSIs hope to balance the interests of all members of the supply chain, farmers may need better representation in the implementation of specific project goals and practices. Given the power imbalance between the farmers and large food manufacturers and retailers, diverse farmers should be represented not only in the design but also the delivery of the program. Field to Market ensures representation of growers' associations equal to downstream actors at the stakeholder level, but the representation and rights of individual farmers are not specified within projects. Better farmer representation would presumably foster a broader scope and definition of sustainability to more fully include issues of social and community well-being, as well as economic viability and fairness. To offset the economic power of downstream supply chain actors, farmers would need to gain "data sovereignty" over the data generated on their farms (Fraser, 2019). This would allow farmers to benefit from the surplus value generated from their data (Carolan, 2020b), or otherwise control the usage of their information. These efforts to increase farmer agency in the process could be piloted and evaluated by both independent

researchers and farmer representatives.

As Field to Market and other MSIs are still constantly evolving, and the bulk of US agricultural production is not evaluated by any sustainability metrics, it may be too early to announce a new governance regime in US agriculture that is led by MSIs. Whether MSIs will in fact usher in such a new regime will largely depend on the continued buy-in from its stakeholders and their ability to deliver on their promises. So far, MSIs have struggled to prove that their metrics are in fact improving the sustainability of US agriculture (Freidberg, 2017, 2020). But as long Field to Market continues to grow and its metrics and programs mature, its impact on the governance of commodity crop production is likely to grow. In consequence, our findings anticipate what might happen should multi-stakeholder governance through sustainability metrics become hegemonic.

Author statement

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Declaration of competing interest

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