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Abstract:

What are the potential consequences when a relatively small number of firms come to dominate markets within the global food system? This article examines the implications of corporate concentration and power in the seeds and agrochemicals industry, a sector that has become more consolidated in recent years. It outlines the pathways via which concentrated firms in this sector have the potential to exert power in the food system – both directly and indirectly – in ways that matter for food system outcomes. Specifically, concentrated firms can shape markets, shape technology and innovation agendas, and shape policy and governance frameworks, with important potential effects on food systems. The article makes the case that a range of measures are needed to ensure that corporate concentration and power do not undermine key goals for food systems, such as food access, sustainability, and broad-based participation in food system governance. These include measures to strengthen competition policies, to bolster public sector support for diverse food systems, and to curb corporate influence in the policy process.

Introduction:

A relatively small number of firms have come to wield significant influence within the global food system. Recent years have seen firms all along agrifood supply chains merge and acquire one another, to form giant ‘mega-companies’ that are central players in what can only be described as a profound reconfiguration of the world food economy. This process is happening in markets for farm inputs, agricultural commodity trading, and food processing and retail [1][2][3]. In parts of the food system where just a few giant firms control a significant share of the marketplace, these firms can influence the types of seeds farmers plant, what crops are grown, what breeds of livestock are raised and in what types of facilities, working conditions for food system workers, and the types and prices of food items that appear on grocery store shelves, to name just a few examples.

There is longstanding concern that powerful firms in concentrated markets are more incentivized to advance the short-term interests of their shareholders rather than the public good [4][5], a concern that extends to the food system. Civil society groups worry that concentrated food system firms might pursue profit maximization strategies in ways that undermine the livelihoods of small-scale producers, push up prices, limit product choices, and damage the environment. As preparations are underway for the 2021 UN Food Systems Summit (UNFSS), which has goals of making food systems more equitable, healthy and sustainable, civil society groups have expressed

concern that the Summit agenda does not sufficiently focus on the implications of corporate power in the food system [6]. This omission is especially puzzling in the context of growing global concern about the potential harm from concentrated markets in other sectors, like Big Tech. Because food systems are so important for multiple reasons – food is a basic need as well as a basic human right, food systems provide livelihoods for nearly a third of humanity, and food systems are intimately connected to ecosystems – it is imperative that we have a better understanding of the potential consequences of corporate concentration and power in the sector.

This article examines the implications of corporate power in one highly concentrated part of the food system – the seeds and agrochemicals industry – which has become more consolidated in recent years [7][8]. The merger of Dow and DuPont in 2015, which spun out a new agricultural input firm, Corteva Agriscience, was one of three major mergers that the agricultural seeds and chemicals industry saw in the 2015-2018 period. ChemChina purchased Syngenta in early 2016, shortly after the Dow-DuPont deal was announced, and within a year Bayer made a move to purchase Monsanto. What was already a highly concentrated industry dominated by what were known as the ‘Big Six’ firms since the early 2000s, is now dominated by just four large firms: Bayer, Corteva, ChemChina-Syngenta, and BASF (which grew by purchasing assets the other firms sold in order to get their merger deals approved by regulators).

Closer examination of this sector reveals that there are multiple ways in which concentrated firms can exert power – both directly and indirectly – that matter for food system outcomes: by shaping markets, by shaping technology and innovation agendas, and by shaping policy and governance frameworks. Without policies in place to keep corporate power in check, there is a risk that concentrated markets can undermine key goals for food systems, such as the provision of equitable livelihoods, sustainability, and broad-based participation in food system governance. Policies to rein in corporate power in the food system will require efforts on multiple fronts, and a focus on these efforts should be prominent on the agenda of the UNFSS.

Shaping market dynamics

When only a few firms dominate within a market, those firms at the top tend to have power to shape how that market functions. The desire to have more power over market dynamics is in fact a big reason why firms engage in mergers and acquisitions in the first place – to expand their market share and deliver higher returns to their shareholders. Economists have long been concerned about ‘market power’ that comes with concentrated sectors because it can stifle competition and potentially lead to higher prices that can harm consumers [9]. For this reason, most regulatory attention is paid to the potential impact of market power, and in particular, its impact on consumer prices.

The recent mergers in the seed and agrochemical sector generated enormous concern about the potential impact of greater corporate concentration on markets [7][10]. Prior to the recent mergers, the share of the market held by the top four firms at the global level for seeds was 54%, and 53% for agrochemicals in 2009, up significantly from 21% and 29%, respectively, in 1994, prior to several rounds of mergers in the sector [11]. This level of concentration was approaching the

threshold of what most economists consider to be a highly concentrated market, where anything over 40% share for the top four firms is considered moderately concentrated, and over 60% is highly concentrated. In 2018, post-mergers, the top four firms controlled even more of the market – around 70% of the global pesticides market [12] and around 60% of the global seed market [13].

Some analysts warn against reading too much into these aggregate global market share figures regarding concentration levels because there are differences in specific crop seed market shares at the domestic level [14]. However, even that data shows that in many domestic markets, just a few firms dominate sales of key staple crop seeds in a wide range of countries, including the United States, the UK, Turkey, Ukraine, Mexico, Italy, Denmark, Brazil and Argentina. In Brazil, for example, the top four firms controlled 97% of the maize seed market by value [10]. Such high levels of concentration usually are red flags for regulators who seek to ensure that markets remain competitive.

Concentration at these levels can impact seed prices through weakened competition, especially in cases where there are significant barriers to entry due to high costs for research and development (R&D), as is the case in the seeds and agrochemicals sector. There are relatively few studies that examine this question empirically in the sector, given difficulties in accessing data that is held behind paywalls by the private sector. The peer-reviewed studies that do exist looked at time-series data for key crop seed markets in the US and found that market concentration is at least one significant factor contributing to higher seed prices [15][16][17]. A recent OECD study [10] that analyzed proprietary cross-country seed price data also found a linkage between concentration and seed prices, but only at elevated levels of market concentration (although this study was limited by the fact that it only looked at data from one year, 2016). The findings of the link between concentration and seed prices in these studies raises concern about the potential implications for equity, making this area worthy of further study. If farmers are paying more than they would otherwise for their inputs due to market concentration, they are mostly absorbing these costs in the form of lower compensation for their work. The reason is that it is difficult for farmers to pass on those higher costs to consumers because they are often selling their products to concentrated buyers who demand lower prices.

Higher prices are not the only way in which concentrated firms can shape market dynamics. Fewer firms controlling a market can also limit choice by making certain products more available than others. In some markets in the US, for example, it is becoming increasingly difficult for farmers to access non-transgenic varieties of seeds, as the big firms with more market share can exert influence over product availability [18] and incentivize distributors to focus on sales of genetically modified versions of seeds that deliver higher profits and sales of other products, such as associated herbicides [19]. Intellectual property protection that transnational seed companies hold over hybrid and genetically modified varieties also limits the ability of farmers to save seeds for replanting [20]. This kind of market control is intensified when there is vertical integration of businesses across different parts of the agrifood value chain [21]. The seeds and agrochemicals businesses were once distinct industries but have now morphed into one because genetically modified seeds are designed to work with specific inputs (such as certain herbicides), in an integrated way.

Giant firms that dominate markets also typically have more bargaining power over working conditions and labor compensation [22][23]. Recent research indicates that labor's share of income in the economy in the US and many other countries drops as firms become more concentrated [24]. Mergers among dominant firms can also mean job losses, especially if the resulting firm seeks to make its operations more 'efficient' by combining key functions. The merger of Dow and Dupont, for example, resulted in 1700 job losses, while Bayer cut 12,000 jobs in the wake of its purchase of Monsanto [25][26].

Shaping technology and innovation pathways

A few concentrated firms dominating a sector can influence technological innovation trends in important ways [27]. Firms pursuing mergers and acquisitions often make the case to regulators that they need to consolidate into larger entities in order to put more funds toward R&D that can result in breakthrough innovations that promise widescale benefits, including the possibility of lowering costs for consumers. But at the same time, corporate markets can also work to impede innovation, especially when it results in higher barriers to entry for other firms [28][29]. A key question for regulators is to tease out which force is likely to prevail, if any. Untangling the implications of these competing dynamics for innovation in the seed and agrochemical sector is not an easy task [14].

It is important to consider how the impact of concentration on innovation can change over time, as technological changes emerge and settle, and as markets become more concentrated and potentially shut out new entrants due to high R&D costs. There was a boost in seed innovation that followed mergers among seed and chemical firms in the 1970s-90s period, for example [11], when firms were consolidating in order to invest huge sums into R&D operations for the development of agricultural biotechnology that resulted in new seed varieties. But as the sector became more highly concentrated in the late 1990s and early 2000s, innovation in the agricultural biotechnology sector weakened [29]. And throughout the entire period, the big firms did not commercialize any new herbicides, because the innovation agenda focused exclusively on the relatively less costly strategy of modifying seeds to work with existing herbicides [30][31][32].

Simply focusing on whether firms 'innovate' in general gives an incomplete picture of the power of concentrated firms to shape food systems. We must also pay attention to the kinds of innovation dominant firms promote and whom that innovation serves. In other words, what matters is not whether new seed varieties and herbicides are introduced at all, but rather, what types of seed varieties and other related technologies are being developed (or not developed) and whether end-users were consulted and social and environmental implications were taken into account [33]. In concentrated sectors like seeds and agrochemicals, the firms that hold the most market share have tended to focus on very narrow innovation pathways that privilege high-tech and relatively high-cost proprietary technologies, such as genetically modified seed and agrochemical packages over other less capital-intensive and more accessible innovations, such as agroecology [34]. In other words, firms tend to invest in innovation pathways that are good for their own bottom lines, rather

than developing more accessible and low-cost technologies for the world's farmers, especially small-scale producers in the developing world.

A narrow focus on certain technologies over others can also foster technological 'lock-ins' for users that can have undesirable environmental and social consequences. The technological innovations that came with the agricultural biotechnology revolution, for example, locked farmers growing certain crops into using genetically modified seeds that were designed to work only with certain chemical herbicides. And glyphosate, which was once just one of many non-selective herbicides in the 1970s, rose to become the world's most widely used herbicide due to the fact that most genetically modified seeds were altered to be resistant to it [35]. As we are becoming more aware of the potential risks associated with widespread glyphosate use, including growing weed resistance to the chemical and still-debated health-related concerns, some firms are engineering seeds to be resistant to older, more toxic chemicals that bring their own risks [36].

The high-tech innovation agenda in the seeds and agrochemicals industry has become especially pronounced in recent decades due to the general trend toward privatization of agricultural R&D, where governments have stepped back from their earlier strong role in sponsoring agricultural research [37]. This trend leaves much of the technological agenda-setting in the sector to the largest firms whose primary goal is short-term profit maximization to satisfy shareholders.

The latest round of consolidation in the agrifood sector is already shaping the technological landscape for farming in new ways. The dominant firms are seeking to establish leading positions in emerging digital platforms for agriculture and in computer-assisted genome editing [7][38]. One of the key motivations for Bayer to purchase Monsanto, for example, was to acquire the digital agriculture start-up that the latter had already purchased [39][40]. If the same firms that dominate seed and agrochemical development also dominate digital farming platforms, they can integrate their products in ways that drive additional types of technological lock-in. Such an outcome could result in further constraints to farmer choices and raises questions about farmers' rights over and access to data, including that generated on their own farms [41][42][43].

Shaping the policy agenda

As firms become larger and more dominant within a sector, they are more able to exert political influence, which has important implications for equity and representation in society more broadly [23]. Political scientists have raised concerns about the ways in which growing corporate concentration in the agrifood sector amplifies the voices of the largest firms to influence government policy agendas [44][45]. Large agrifood firms that dominate key markets can exercise power to influence food policy and governance in several ways.

Most directly, large firms have more capacity to engage in lobbying activities to let government policymakers know about their policy preferences. In 2019, for example, Corteva Agriscience and ChemChina each spent nearly US\$1.3 million and BASF spent US\$1.6 million on lobbying activities in the US. Bayer AG spent US\$9 million in the same year – a year after it purchased Monsanto and the same year the US was reviewing whether to re-register glyphosate [46]. US

lobbying disclosure forms reveal that agricultural issues were prominent topics of its lobbying: pesticide registration, labelling of genetically modified organisms, and biotech innovation and regulation, among others [47]. Bayer and BASF each also spent over €3 million lobbying the EU in 2019 in the run up to the expiry of glyphosate's registration in 2022, while Syngenta spent over €1.5 million and Corteva nearly €1 million that same year [48].

Sometimes those who lobby on behalf of large agribusiness firms end up working in government and then cycle back into industry jobs, in what analysts refer to as a 'revolving door' between industry and government. While the specialized knowledge held by industry veterans can sometimes be useful in the policymaking process, the practice also raises important concerns about potential conflicts of interest that may result in regulatory decisions that are biased in industry's favour. This concern is especially relevant when the period between roles is minimal and when former industry or government representatives do not recuse themselves from decision-making on matters relating to their former or prospective employers [49][50].

The dominant firms in the seeds and agrochemicals sector also spend enormous amounts on public relations (PR) activities on a regular basis to shape public discourse and narratives about their image and their products as a more indirect means of influencing the policy landscape. Such strategies include framing issues in ways that portray their products in a positive light [40][43]. These activities are often part of everyday information dissemination in the form of advertisements in farming publications, pamphlets, websites, and engagement in media strategies. Concentrated firms in the agrifood sector also often sponsor university-based research on topics that relate to their interests and in so doing can shape not only the types of research questions that get asked but also how that research informs broader policy debates [51][52][53].

Firms that dominate markets also have deeper, and in many cases less visible kinds policy influence, often referred to by political scientists as 'structural power' whereby firms can influence the regulatory context without even having to spend money on lobbyists, PR campaigns, or research sponsorship [44][54]. Because large firms in concentrated markets are often big employers, governments may be reluctant to take policy and regulatory measures that could encourage those firms to leave and take jobs with them [55]. Structural power is often hard to document, but in the case of the seeds and chemicals giants, we got a glimpse in early 2017 when the CEOs of Bayer and Monsanto met privately with then US President-elect Donald Trump to promise that the firm would create 3000 new jobs in the US if the merger was to be approved [56]. But in the end, as noted above, some 12,000 jobs were cut in the wake of the deal [26].

Strategies to rein in corporate power in the food system

The case of seeds and agrochemicals illustrates that corporate concentration and power can shape food systems in profound ways, with enormous implications for equity, working conditions, sustainability, health, and democratic participation. The power at the disposal of concentrated firms, and the strategies they pursue to influence the market, technology, and policy contexts, overlap and reinforce each other in complex ways. Similar dynamics are taking place in other parts of food systems that are also dominated by just a handful of players, including among Big Food

companies that dominate the processed food sector [57][58], commodity trading [59][60], and food retail [1][2].

Given the extent to which corporate concentration and power can affect food systems, the scant attention directed to it in the UN Food Systems Summit agenda leaves a curious gap. The initial “discussion starter” documents for the UN Food Systems Summit’s five Action Tracks, for example did not mention the problems and risks associated with corporate concentration in the food system [61]. It is encouraging that one more recent papers of the Summit’s Scientific Group acknowledges some of the problems associated with market concentration, albeit in a limited way [62]. It is imperative that international policy and governance mechanisms that promote food system sustainability – including those that will be in place well beyond the Summit – pay more focused attention to this pressing issue, not just in the seeds and agrochemicals sector, but across the entire food system.

Fostering a more equitable distribution of power in the food system will require efforts on multiple fronts. Simply relying on firms that dominate in highly concentrated sectors to undertake voluntary accountability measures is not sufficient, nor is relying on pressure from investors via ‘sustainable investment’ initiatives. Regarding the former, several decades of research shows the disappointing results from this approach due to structural flaws in voluntary sustainability reporting and certification mechanisms and the power of corporations to influence their implementation on the ground [22][63]. With respect to the latter, efforts to pressure firms via ratings on their environmental, social and governance (ESG) performance have been hampered by unreliable and inconsistent data as well as a weak conceptualization of human rights within those standards [64].

Addressing growing concentration and corporate power in the food system will require efforts both specific to the food system, as well as measures at broader levels. Here are some places to start:

Stronger and wider competition policies. At present, most national competition policies focus narrowly on price impacts, with some limited attention to innovation [4][5]. These factors are important, but as the above analysis shows, they are not the only implications of corporate power that result from greater concentration. Stronger and more consistently applied competition policies are needed to ensure that a broader range of potential impacts of concentration are taken into account [5][65]. This means evaluating proposed mergers and acquisitions not just on the grounds of whether they are likely to affect consumer prices and a narrow understanding of innovation, but also with respect to their impact on market structures and how those impacts are likely to affect society more broadly. A focus on market structure impacts, for example, would reveal whether mergers would create undue barriers to entry for smaller and medium-scale enterprises that may offer more opportunities not only for a more diverse base of entrepreneurship but also a wider range of innovation that can reduce inequities, improve productivity, and promote sustainability.

It is also important to ensure that competition policies better articulate with strong public policies in other areas, including environmental, social, labour, and health regulations to prevent large firms from exploiting their access to market power [65]. Strong policies along these lines would also ensure that more robust competition in the food system does not lead to ‘race to the bottom’ dynamics that encourage firms to externalize costs to stay afloat in the market. More international

coordination on competition policy is needed to protect the public interest in all countries to ensure that firms do not simply seek out other jurisdictions to escape those with stronger regulations.

More public sector support for diverse food systems. It is important for governments to commit to broader support for public sector food and agricultural R&D that encourages innovations that are not driven solely by profit. Publicly supported plant-breeding programs as well as support for non-profit initiatives promoting open source seeds, for example, would expand farmers' seed choices [20]. Ideally, public research programs should be inclusive of end-users and focus on production methods that are diverse, sustainable, and widely accessible, such as agroecology. In the US, for example, only a fraction of public sector agricultural spending is currently directed to agroecology initiatives that do not rely on external inputs such as chemical herbicides that are controlled by large corporations [66]. These measures would help to reduce technological lock-ins and expand choices for producers.

Governments can also do more to support production, processing and distribution infrastructure that benefits small and medium sized enterprises within food systems to promote diversity, sustainability, and innovation all along food supply chains [67]. Additionally, support for data collection, as well as programs to ensure public access to that data – such as for seed prices as well as soil and climate data – would go a long way to enabling more transparency and accountability with respect to evaluating the performance of food system actors, including large corporations. Stronger policies to ensure open access to data would also reduce the potential for farmers to be locked into corporate-dominated agricultural data analysis platforms. Such policies would also make digital farming technologies more accessible to small-scale farmers and facilitate the development of responsible models of digital agriculture [42][68].

Measures to curb corporate influence in the policy process. Stronger policies are needed to rein in excessive corporate influence over regulatory policies, scientific research, and public discourse. Although some governments already require public disclosure of lobbying activities, more can be done to ensure that large corporations are not given privileged access or undue influence over the food and agriculture policymaking process. Stricter measures requiring greater transparency in the scientific, policy and regulatory spheres, as well as more strictly enforced waiting period between lobbying and government employment, would help to reduce conflicts of interest.

At the same time, it is essential for governments to foster more equitable and democratic policy and governance spaces that prioritize key goals such as the right to food and food system sustainability rather than corporate profits [28][57]. This means creating dedicated spaces for policymakers to engage in a meaningful way with the voices of food producers and civil society and prioritizing independent science to inform policymaking decisions. It also means establishing and enforcing rights frameworks for farmers and food system workers, as well as upholding the right to food for all citizens [69].

The problem of concentrated corporate power in the food system, and potential measures to address it, should be featured much more prominently in the UN Food Systems Summit deliberations. The measures outlined above should be considered as potential strategies to contribute to Summit's ultimate goals of transforming food systems to better serve both people

and planet. Civil society groups have proposed a sixth Action Track for the Summit focused specifically on the theme of the transformation of corporate food systems as one of the conditions for their participation in the deliberations [5]. No matter one's views on whether corporations do in fact abuse the kinds of power available to them in the food system, it is important to have an open and constructive debate on this topic.

Looking beyond the Food Systems Summit, governments will need to create dedicated spaces to discuss the problem of market concentration and corporate power in food systems, for example through intergovernmental governance forums such as the Committee on World Food Security. There are no quick fixes, but at a minimum more transparency and research are needed to understand the scale of the problem and to develop effective means to address it.

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