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INTERNATIONAL PANEL OF EXPERTS ON SUSTAINABLE FOOD SYSTEMS

TOO BIG TO FEED

Exploring the impacts of mega-mergers, consolidation and concentration of power in the agri-food sector

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Key messages

- A significant horizontal and vertical restructuring is underway across food systems. A spate of mega-mergers is sparking unprecedented consolidation in the seed, agri-chemical, fertilizer, animal genetics and farm machinery industries, while creating ever-bigger players in the processing and retail sectors.
- New data technologies are emerging as a powerful new driver of consolidation. Rampant vertical integration is allowing companies to bring satellite data services, input provision, farm-level genomic information, farm machinery, and market information under one roof, transforming agriculture in the process.
- The high and rapidly increasing levels of concentration in the agri-food sector reinforce the industrial food and farming model, exacerbating its social and environmental fallout and aggravating existing power imbalances.
- Consolidation across the agri-food industry has made farmers ever more reliant on a handful of suppliers and buyers, further squeezing their incomes and eroding their ability to choose what to grow, how to grow it, and for whom.
- The scope of research and innovation has narrowed as dominant firms have bought out the innovators and shifted resources to more defensive modes of investment.
- The merry-go-round of company buyouts, boardroom turnover and product rebranding is eroding commitments to sustainability, dissipating accountability, and opening the door to abuse and fraud.
- The rush to control plant genomics, chemical research, farm machinery and consumer information via Big Data is driving mega-mergers – and stands to exacerbate existing power imbalances, dependencies, and barriers to entry across the agri-food sector.
- Dominant firms have become too big to feed humanity sustainably, too big to operate on equitable terms with other food system actors, and too big to drive the types of innovation we need.
- The wide-ranging impacts of mega-mergers often evade the scrutiny of regulators, but steps to redefine anti-competitive practices and extend the scope of anti-trust rules are starting to turn the tide.
- Steps to build a new anti-trust environment must be accompanied by measures to fundamentally realign incentives in food systems and address the root causes of consolidation.
- A collaborative assessment of agri-food consolidation and a UN Treaty on Competition are required to deliver transnational oversight of mega-mergers.
- A shift towards diversified and decentralized innovation, locally-applicable knowledge and open access technologies – a new 'wide tech' paradigm' – is urgently needed to harness the benefits of Big Data for all.
- Short supply chains, innovative distribution and exchange models – such as 'solidarity economy' initiatives – must continue to circumvent, disrupt, and de-consolidate mainstream supply chains – and must ultimately be supported by integrated food policies.

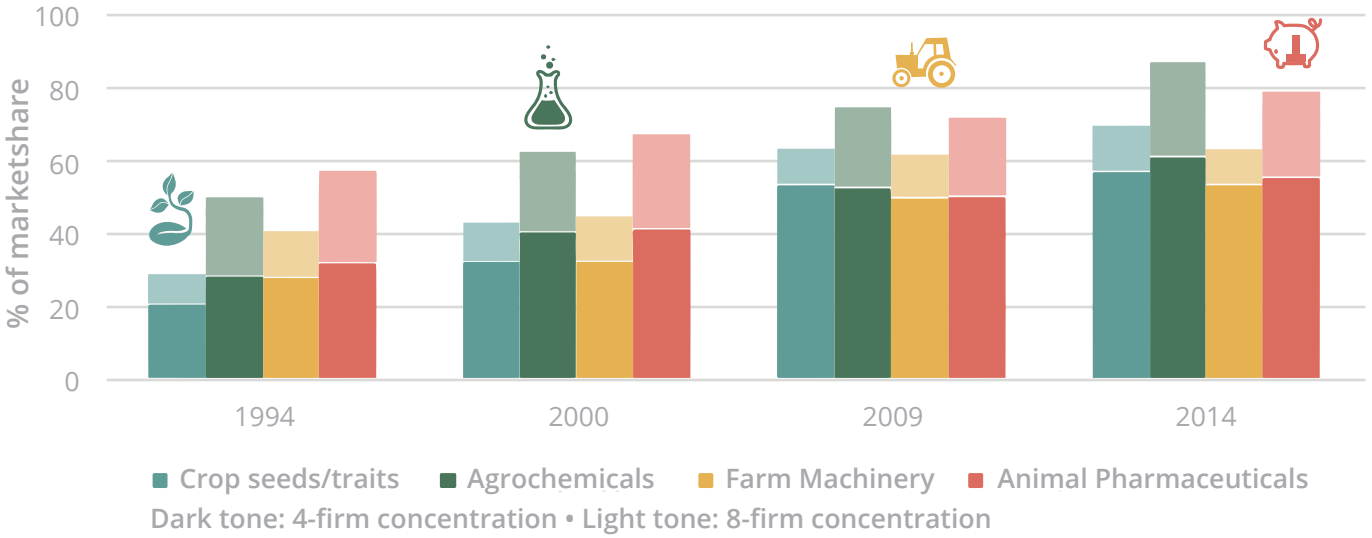
Executive Summary

Mega-mergers are sparking unprecedented consolidation across food systems, and new data technologies represent a powerful new driver. For decades, firms in the agri-food sector have pursued mergers and acquisitions (M&A) and other forms of consolidation as part of their growth strategies. However, the recent spate of mega-mergers takes this logic to a new scale. Since 2015, the "biggest year ever for mergers and acquisitions", a number of high-profile deals have come onto the table in a range of agri-food sectors - often with a view to linking different nodes in the chain. These include the $130 billion merger between US agro-chemical giants, Dow and DuPont, Bayer's $66 billion buyout of Monsanto, ChemChina's acquisition of Syngenta for $43 billion and its planned merger with Sinochem in 2018. These deals alone will place as much as 70% of the agrochemical industry in the hands of only three merged companies. Meanwhile, the merger between leading Canadian fertilizer companies Potash Corp. and Agrium, Kraft-Heinz's bid for processing giant Unilever, and online retailer Amazon's acquisition of Whole Foods Market are proof that mega-deals are sweeping through all nodes of the chain. Financialization – i.e. the increasingly powerful role of financial actors, motives and trends in shaping global economic activity – has become a major driver of corporate consolidation across various sectors as investors demand higher and shorter-term payouts. However, beyond the physical (e.g. drones) and scientific (e.g. gene editing) technologies behind agri-food sector consolidation, information technology comes out as the newest and most powerful driver. Big Data connects inputs—seeds, fertilizers, and chemicals—to farm equipment and retailers to consumers in unprecedented ways.

A significant horizontal and vertical restructuring is underway across food systems. Rampant vertical integration is allowing companies to bring satellite data services, input provision, farm machinery and market information under one roof, transforming agriculture in the process. Mega-mergers come in the context of an already highly-consolidated agri-food industry, and are ushering in a series of structural shifts in food systems. Agrochemical companies are acquiring seed companies, paving the way for unprecedented consolidation of crop development pathways, and bringing control of farming inputs into fewer hands. The mineral-dependent and already highly concentrated fertilizer industry is seeking further integration on the back of industry overcapacity and a drop in prices; fertilizer firms are also moving to diversify and integrate their activities via hostile takeovers, joint ventures, and the buying and selling off of regional assets–with mixed results. Meanwhile, livestock and fish breeders, and animal pharmaceutical firms, are pursuing deeper integration with each other, and are fast becoming a one-stop-shop for increasingly concentrated industrial livestock industry. Leading farm machinery companies – already possessing huge market shares – are looking to consolidate up- and down-stream, and are moving towards ownership of Big Data and artificial intelligence, furthering their control of farm-level genomic information and trending market data accessed through satellite imagery and robotics. Agricultural commodity trade remains dominated by a handful of actors – including new players from emerging markets – with trading, shipping, and processing increasingly rolled together into highly-integrated operations straddling different commodity sectors and regions, and independent grain traders finding it ever more difficult to compete. Food processors and retailers, the biggest players in the system, are seeking international expansion and capturing new segments of

4- AND 8- FIRM CONCENTRATION IN AGRICULTURE INPUT INDUSTRIES

(Data source: ETC, 2015)

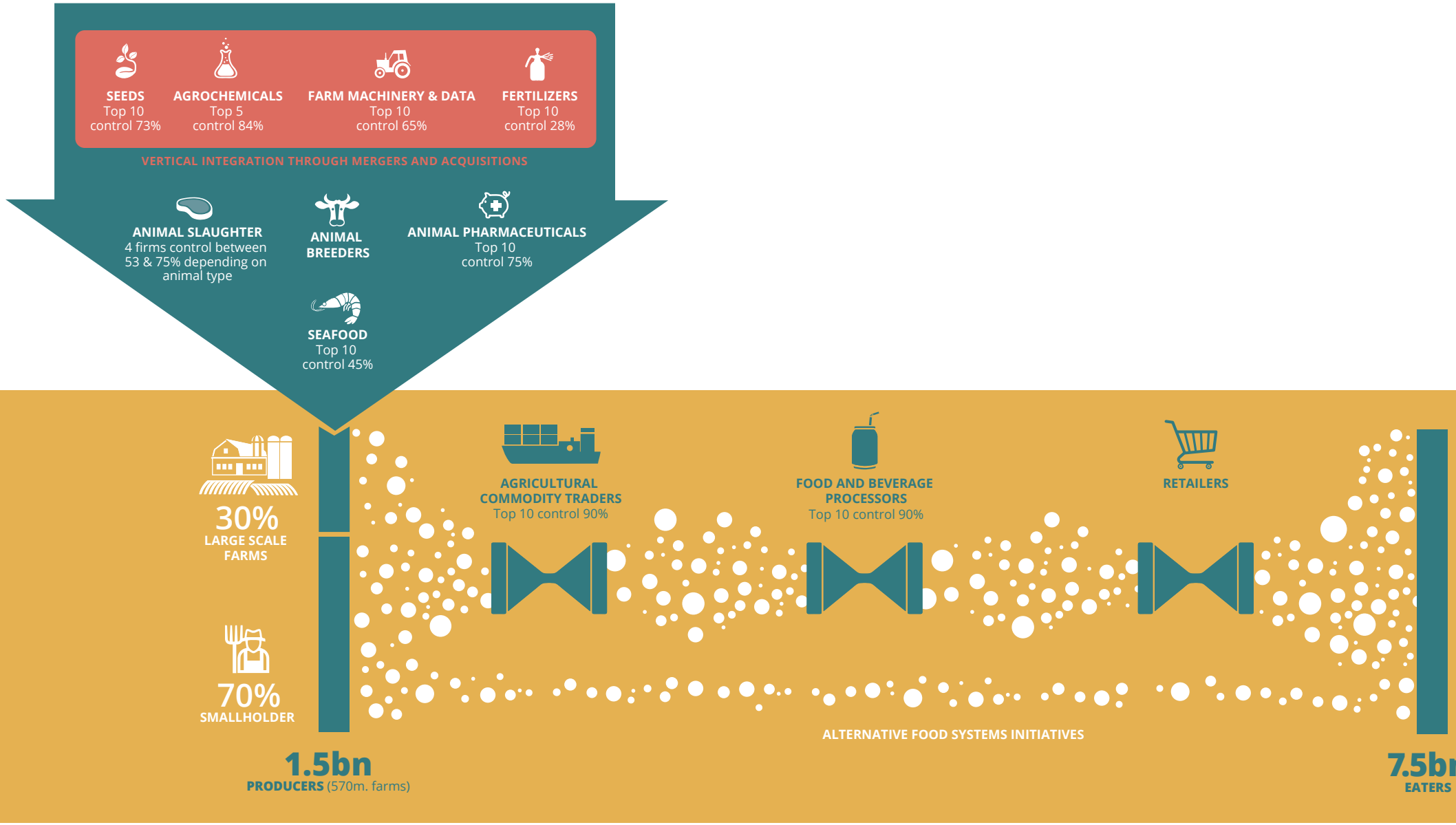


the market to meet changing consumer demands. Many leading processors already control the digital data for raw material sourcing, processing, marketing, and delivery. They are moving upstream to better oversee their supply chains and meet quality requirements; to address changing consumer demands, they are reconstructing their images through the acquisition and creation of seemingly healthier and more sustainable brands. Retailers are moving to consolidate their position in the major markets while expanding into growth markets through further M&A activity. New actors such as Amazon are vying to harness Big Data possibilities in order to track and analyze consumer shopping habits to strengthen both in-store and online delivery systems.

The high and rapidly increasing levels of concentration in the agri-food sector reinforce the industrial food and farming model, exacerbating its social and environmental fallout and aggravating existing power imbalances. Rather than putting food systems on a path to sustainability, consolidation reinforces the logic of the industrial food and farming model – and its widespread social, environmental, and economic fallout. Consolidation also allows firms to pool economic and political capital in ways that reinforce their ability to influence decision-making on the national and international levels – and to defend the status quo.

Consolidation across the agri-food industry has made farmers ever more reliant on a handful of suppliers and buyers, further squeezing their incomes and eroding their ability to choose what to grow, how to grow it, and for whom. The emergence of increasingly dominant retail and processing firms has driven concentration along the chain in order to provide the requisite scale and volume, enforcing a de facto consolidation of agriculture. Meanwhile, upstream consolidation has left farmers hostage to a handful of suppliers and mounting commercial input costs. These trends have exacerbated existing power imbalances, allowing costs to be shifted onto farmers, squeezing their incomes, eroding their autonomy, and leaving them vulnerable to unilateral sourcing shifts. Despite the supposed efficiencies of a highly-consolidated agri-food industry, consumer food prices have not been systematically reduced – and tend to rise in highly concentrated markets.

CONCENTRATION IN THE AGRI-FOOD SUPPLY CHAIN



The scope of research and innovation has narrowed as dominant firms have bought out the innovators and shifted resources to more defensive modes of investment. Increasing market concentration has reinforced a focus on input traits and major crops promising greater returns on investment. Companies have shifted R&D resources to the least risky modes of investment, e.g. focused on protecting patented innovations and creating barriers to entry. Meanwhile an explosion of new product lines is providing an illusion of innovation in processing and retail – but often amounts to little more than the repackaging of existing products. Genuine innovation is emerging from start-ups, but tends to be diluted as smaller brands and companies are bought out by mega-firms.

The merry-go-round of company buyouts, boardroom turnover, and product rebranding is eroding commitments to sustainability, dissipating accountability, and opening the door to abuse and fraud. Commitments to sustainability tend to be lost as progressive CEOs are replaced and products are rebranded following mergers and buyouts. Proliferating M&A activity in food systems is also bringing financial players, e-retailers, and logistics firms to centre-stage in defining the trajectory of food systems – raising further questions about the prospects for building greater sustainability and accountability. Furthermore, horizontal and vertical integration is driving a reduction in seed and livestock genetic diversity, while increasing the risks of foodborne and livestock disease proliferation in increasingly centralized and homogenized systems.

The rush to control plant genomics, chemical research, farm machinery and consumer information via Big Data is driving mega-mergers – and stands to exacerbate existing power imbalances, dependencies and barriers to entry across the agri-food sector. Big Data promises major innovation and major disruption: new genomics and consumer surveillance tools could pave the way for eliminating entire links in the food chain. Access to and ownership of data often remains unclear. In this context, the data revolution could exacerbate some of the most pressing problems in food systems, including restrictions on farmers' choices and the difficulty for innovative start-ups to access data.

Dominant firms have become too big to feed humanity sustainably, too big to operate on equitable terms with other food system actors, and too big to deliver the types of innovation we need. Like the banks that by 2007 had become 'too big to fail', the emerging mega-firms have made themselves a central cog in food systems, and a major amplifier of risks – acting to reduce their own private risk at the expense of society's and the environment's long-term sustainability. The agri-food giants may not be 'too big to fail', but are becoming too big to feed humanity sustainably. Consolidation is not fundamentally driven by concerns for food security, sustainability or even increased innovation - and is not delivering these outcomes. Instead, consolidation has followed a cyclical logic, with one major merger triggering increased M&A among competitors. It has come in response to the market uncertainties which increasingly concentrated and highly financialized food systems help to drive. Finally, consolidation has been pursued to capture new technologies or control technology 'network effects' within and between sectors, as well as to maintain a system of capital accumulation and low-cost commodity supply. Consolidation may therefore succeed in these objectives, while undermining the sustainability of food systems on multiple fronts.

The wide-ranging impacts of mega-mergers often evade the scrutiny of regulators, but steps to redefine anti-competitive practices and extend the scope of anti-trust rules are starting to turn the tide. The narrow focus of existing anti-trust regimes on 'consumer welfare' allows mega-mergers to be waved through on the basis of delivering low prices and a diversity of products to consumers. But low prices come at a high social cost, and the supposed diversity is largely illusory. Most importantly, the scrutiny of regulators typically ignores the impacts on farmers, the knock-on effects on governance (e.g. increased lobbying power), and broader implications for sustainability. In the US, of the 15,000 M&A deals between 2005-2014, only about 3 % were scrutinized by antitrust regulators. According to the OECD, M&A activity in the agri-food sector faces less obstacles than ever - and may be detrimental to those already disadvantaged by agri-food industry consolidation. The tide may now be turning. Steps are being taken in a variety of jurisdictions and sectors to crack down on unfair trading practices in supply chains; to reframe the scope of anti-trust rules (e.g. by lowering the threshold of what constitutes a 'dominant market share', or by collectively addressing the 'creeping concentration' of multiple M&As); and to address cross-cutting incentives and drivers of consolidation (e.g. by cracking down on firms relocating to and declaring profits in low-tax locations – 'tax inversions' – and taking technology firms to task). Key entry points for addressing food system consolidation are therefore emerging, and further movement in this direction is crucial.

Steps to build a new anti-trust environment must be accompanied by measures to fundamentally realign incentives in food systems and address the root causes of consolidation. More robust anti-trust measures will not alone suffice, in the face of unprecedented M&A activity, already extensive consolidation across agri-food sectors – and major power imbalances that lock the

status quo in place. The incentives in food systems must be fundamentally realigned so that consolidation is no longer the prerequisite for firms to survive and thrive, so that start-ups are not automatically subsumed into mega-firms, so that food security is not contingent on a handful of firms and their proprietary data, and so that farmers and small-scale manufacturers have viable options other than to accept the terms set by multinationals in global supply chains. Steps to address the risks of industry consolidation are therefore essential steps to build sustainable food systems – and must be taken regardless of whether current peaks of M&A activity are sustained.

A collaborative assessment of agri-food consolidation and a UN Treaty on Competition are required to deliver transnational oversight of mega-mergers. Various intergovernmental bodies should monitor the impacts of increased concentration at various levels – on farmers' rights to decent livelihoods, on labour conditions on farms, on the direction of technological innovation. To facilitate these assessments, sophisticated indicators of concentration need to be established, taking account of the risks of consolidated power and political influence, recognizing that food is not a commodity like any other, and capturing the risks arising from specific forms of vertical integration. This could pave the way for measures to prohibit companies from marketing seeds whose viability and/or productivity depends on the application of a companion chemical licensed to or controlled by that company. A subsequent and more ambitious step could see the development of a UN Treaty on Competition that directly addresses the differing needs and concerns of all States, building on UNCTAD's (UN Conference on Trade and Development) Model Law on Competition Policy and the Set of Multilaterally Agreed Equitable Control of Restrictive Business Practices. Given the explosion in global M&A activity, the scale of the merged entities, and the many social, environmental, and economic risks it generates, the lack of an international covenant to address corporate concentration represents a major deficit.

A shift towards diversified and decentralized innovation, locally-applicable knowledge and open access technologies – a new 'wide tech' paradigm' – is urgently needed to harness the benefits of Big Data for all. High-tech data-driven innovations can be extremely beneficial for a range of food system actors – whether to understand the spread of pests, to monitor changes in climatic conditions, or to develop new farming practices. However, as M&As increase the consolidation of data among a limited number of actors, urgent steps are required to safeguard against the excesses of highly concentrated information, and to forge more equitable conditions of access, usage, and ownership. In contrast to the current 'high-tech' approach that governs knowledge and innovation, a 'wide-tech' paradigm would shift the focus to diversified and decentralized innovation, locally-applicable knowledge, and open access. While the innovation strategy is wide or 'macro', its impact is 'micro' and attuned to the sustainability of the immediate environment. The general embrace of high-tech approaches has meant that these other modes of innovation and exchange have received insufficient attention – and have often faced obstacles in order to endure alongside the dominant knowledge and innovation paradigms. Steps should be taken to ensure coexistence and complementarity between high-tech and wide-tech approaches. For example, some new IT companies are driving a promising shift towards crowdsourced non-proprietary exchanges of information and research between small producers and processors facing similar challenges around the world. In supporting this shift, it is crucial to ensure that farmers are able to shape the context in which their knowledge is collected and disseminated, and to avoid biases toward the farmers and farming systems (e.g. for export commodities) that can afford top-tier machinery and sensors.

Short supply chains, innovative distribution and exchange models – such as 'solidarity economy' initiatives – must continue to circumvent, disrupt and de-consolidate mainstream supply chains – and must ultimately be supported by integrated food policies. Operating at scale and integrating different nodes of the chain have become pre-requisites for sustaining the supply chains that deliver high volumes of food commodities to global markets. To resist further consolidation and counter its effects, mainstream supply chains and food distribution systems may need to be circumvented and progressively replaced by fundamentally different models. While business-led change should be encouraged, changing power dynamics within global food systems requires a diversity of actors to mobilize, new relationships to be forged between food production and consumption, and new networks of distribution and exchange to grow. In almost every sector, new businesses are emerging to meet the 'triple bottom line' of economic, environmental, and social sustainability, building on the principles of social and solidarity economies, food sovereignty, and community empowerment. Some of the most promising initiatives include short food supply chains, direct marketing schemes, cooperative marketing and purchasing structures, and local exchange schemes (e.g. farmers' markets, sustainable local public procurement, community and school gardens, community supported agriculture). In some sectors, new practices are rapidly becoming the norm (e.g. the rise of artisanal craft beer production) and are paving the way for meaningful de-consolidation. Alternative business models are disrupting food systems - if not yet transforming them – and are providing real-life examples of the benefits of a less consolidated food system: reconnecting people with food, rebuilding accountability, cementing trust without imposing homogenizing standards, reinvesting brands and products with meaningful standards, and paving the way towards a more equitable distribution of costs and value. Allowing more diversity and alternative practices to flourish also requires stronger political support. Ultimately, it requires the development of integrated food policies to drive a sequenced shift away from industrial food systems and the highly consolidated companies and supply chains on which they rest.

Introduction

The need to comprehensively assess the impacts of concentration within the agri-food[1] sector has never been more pressing. While concentration is a long-standing feature of the agricultural sector, it has dramatically escalated since the 1980s. Across all economic sectors, the total volume of merger and acquisition (M&A) activity – the most visible consolidation trend – reached a new peak in 2015, the "biggest year ever for mergers and acquisitions" (Farrell, 2015). Since then, a number of high-profile deals have come onto the table in the seed and agrochemical industry, sparking considerable public concern and regulatory scrutiny: the $130 billion merger between US agro-chemical giants Dow and DuPont, Bayer's $66 billion buy-out of Monsanto, ChemChina's acquisition of Syngenta for $44 billion and its planned merger with Sinochem in 2018. These deals alone will place as much as 70 % of the agrochemical industry in the hands of only three merged companies (Dow-DuPont, Bayer-Monsanto and ChemChina-Syngenta). However, mega-deals have not been limited to these sectors. Since 2015, M&A activity has been prolific in every part of the food chain and between different agri-food sectors. The merger between leading Canadian fertilizer companies Potash Corp. and Agrium, Swiss commodity trading giant Glencore's approach for US grain trader Bunge Ltd., US food and beverage processor Kraft-Heinz's bid for Unilever, and online retailer Amazon's acquisition of Whole Foods Market are proof that M&A activity is sweeping through all nodes of the chain. The scale and speed of M&As today are leading global food and agriculture into a new era of uncertainty, with significant implications for food security and sustainability.

In classical economic theory, mergers and acquisitions (M&A) are the expected evolutionary strategy in a firm's development, occurring across all sectors and allowing industry to efficiently pool resources in an increasingly globalized economy (Deans et al., 2002). By pooling the necessary capital to develop technologies, many business leaders further believe M&As provide the means to address the challenges of sustainability, climate change, population growth, and shifting consumer demand (Monsanto, 2016; Dupont, 2016). Others have emphasized the technological change sweeping through the economy as a key driver, with companies vying to gain first-mover advantage[2] over a sea change in the use of Big Data[3] (digital and DNA technologies) that will transform every link in the agri-food chain (Carbonell, 2015; ETC, 2015).

However, for others the sudden rash of mergers in the agri-food sector represents a power grab, signaling an attempt to definitively shape the future of food and farming systems (Clapp 2017; Isakson, 2014; Clapp & Fuchs, 2009). From this perspective, consolidation within the agri-food sector can be understood as a means to shape power relations within food systems, requiring attention to the impacts on farm and food chain workers, consumers, and rural communities, and to the political economy of food systems (described below). This report is informed by a political economy approach, and premised on a concern for the highly unequal power relations prevailing in industrial food systems. In their current forms, these systems allow value to accrue to a limited number of actors, reinforcing

1. The agri-food sector includes all economic activity relating to the commercial production of food, e.g. agricultural input production, agricultural production activity, food and beverage processing, wholesale or retail activities.

2. First-mover advantage refers to the perceived competitive edge gained by the first business to bring a product to market. Advantages might include access to resources, strong brand recognition, brand loyalty or the ability to improve a product before other market competitors arise.

3. Big data refers to the techniques and technologies using new forms of integration to extract value from large, diverse, and complex datasets (Hashem et al., 2015, 99). Big Data is primarily cited for its ability to harness information in new ways by the scientific and business communities, as well as government institutions. In the context of market competition, the ability to manage and extract value from Big Data is considered a primary competitive advantage (Cavanillas et al, 2016).

their economic and political dominance, and thus their ability to manage information and influence the policies, incentives and imperatives guiding those systems (IPES-Food, 2016).

As regulators consider the current spate of agri-food sector M&As and those likely to follow, it is therefore crucial to question the logic and benefits of concentration. We must ask why these deals are occurring now[4], why the already-strong imperatives to consolidate are increasing in the agri-food industry, what new forms consolidation is taking, and what are the risks and impacts of further concentration in the food system. This report takes stock of these developments, asking the following three questions:

SECTION 1

What is the current state of concentration in different agri-food sectors?

SECTION 2

What are the impacts of concentration, and why do these pose risks to the development of sustainable food systems?

SECTION 3

How might consolidation be addressed through different leverage points to support fairer, more sustainable food systems?

BOX 1 - MORE RESEARCH ON CONCENTRATION IS NEEDED: DATA GAPS & LIMITATIONS

While evidence about food system concentration and its impacts is growing, it should be noted that data gaps remain high. In order to maximize the information base, the data analysed in this report draws from the (limited) information made publicly available by agri-food companies themselves, academic and peer-reviewed research, anti-trust authorities, as well as the work of civil society organizations and investigative journalists to shed light on agri-food industry concentration and the resulting impacts. The difficulties in accessing often-proprietary market and scientific data will be identified as a major obstacle in addressing concentration of power in the food system in Section 3.

The analysis is also geographically incomplete, relying largely on examples from the United States. This reflects the disproportionate presence and influence of US companies on global markets and emerging technologies, and the corresponding evidence available to understand their domestic and global roles. It also fails to fully reflect the growing influence of leading companies from the Global South (e.g. China, India, Brazil), where historic and real time data is scarce. Together, US and UK-based companies comprise 22of the 40 largest food companies around the world (US = 18; UK = 4) (Howard, 2016b). The analysis is nonetheless global in its reach. Indeed, as described throughout, the dynamics and logics promoted by these leading firms drive and characterize the food systems in place in many industrialized countries, and increasingly taking root in transitional economies. Furthermore, the influence these companies wield over policies and practices means that they will continue to affect the millions of smallholder farmers, pastoralists, and fish harvesters and billions of consumers around the world.

4. Data used in this report was gathered until September 2017.

The analysis takes a political economy and a food systems perspective[5]. Food systems comprise a vast web of interactions between actors, processes, policies and regulatory frameworks and involve the production, processing, distribution, consumption and disposal of foods. Sustainable food systems rely on these interactions to deliver "food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" (HLPE, 2014). Ultimately, the key question asked in this report is how consolidation affects our ability to deliver the types of socio-cultural, political and environmental changes needed to build sustainable food systems.

A political economy approach considers food systems' various components (e.g. production, trade, environment, health and nutrition, market structures and prices, research imperatives) to have co-evolved over time so as to become deeply interconnected and mutually reinforcing. This approach allows us to look beyond surface trends (e.g. cyclical rushes of M&A activity) relating to industry consolidation and identify why and how particular practices persist despite a growing call for food system alternatives. It also calls attention to the winners and losers of concentration, and the question of why this trend is insufficiently addressed by policy-makers, despite mounting evidence that it may undermine sustainable food systems. In short, a political economy and a food systems lens enable us to identify the powerful coalitions of interests that underlie existing systems and to identify the leverage points for systemic change.

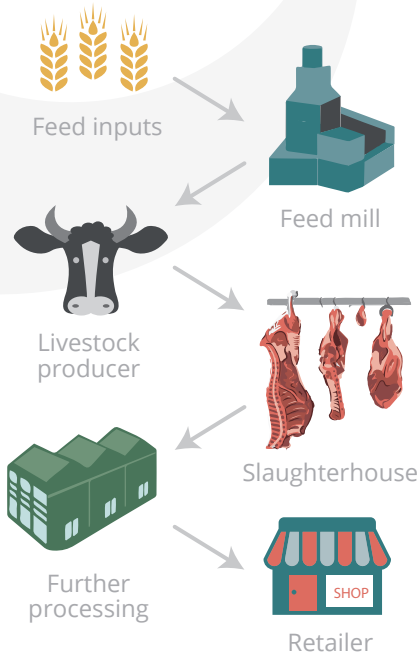
CONCENTRATION: WHAT IS IT AND HOW DOES IT OCCUR?

Concentration traditionally refers to the share of market sales held by the largest firms. The concentration ratio is the main indicator used to assess market competitiveness by evaluating the total market share of a given number of firms relative to the whole market size. While the percentage varies, a market is generally deemed no longer competitive when four firms control more than 40% (Clapp, 2012; Shepherd & Shepherd, 2004; Howard, 2016b). Above these thresholds, concentration is seen to create barriers to entry, i.e. when the most well-established firms have competitive advantages over new entrants due to their dominant positions. While market concentration occurs in a variety of ways, its most visible manifestation is highly-publicized mergers and acquisitions, i.e. when companies opt to merge horizontally or vertically, allowing them to capture larger shares of a market (see figure 1).

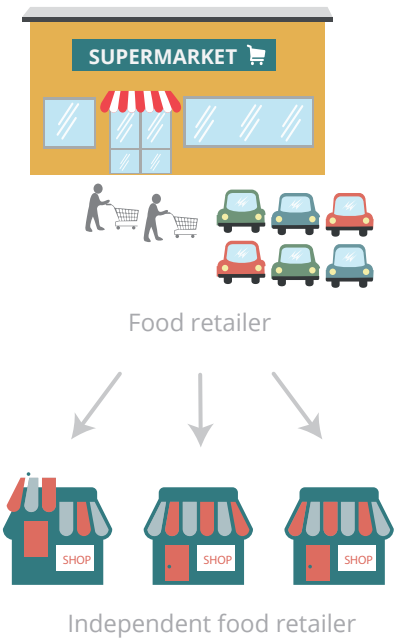
Beyond M&As, there are numerous formal and informal ways concentration can occur. Inter-firm agreements (e.g. strategic alliances, contracting arrangements, joint ventures) are less visible than mergers but just as effective as a means of control (Howard, 2016b; King, 2001). Joint ventures are one type of inter-firm agreement that furthers concentration by strengthening the already dominant positions of large market actors. These (sometimes short-term) undertakings are merger-like in their aim to mutually source materials or share R&D costs. For example, John Deere, the world's leading farm machinery company, has formed alliances with all six of the dominant seed/pesticide companies as well as with other machinery companies to expand its precision farming platform. The goal of these alliances is to increase the command and control of fewer companies over a wider range of agricultural input decisions; these decisions may involve everything

5. A detailed description of the food systems perspective employed by IPES-Food can be found in the panel's first report, 'The New Science of Sustainable Food Systems: Overcoming Barriers to Food Systems Reform' (2015): http://www.ipes-food.org/images/Reports/IPES_report01_1505_web_br_pages.pdf

FIGURE 1 • HORIZONTAL AND VERTICAL INTEGRATION



Company purchases one or several other companies at other levels of production within its value chain



Company purchases competitors within the same industry

from seed variety and chemical inputs selection to irrigation techniques, and even crop insurance.

Companies may also seek to establish explicit or implicit cartels, involving price-fixing, market-dividing agreements or arrangements among a limited group of firms. The fertilizer industry, for example, has shifted back and forth between formal and informal cartels for much of the last century, with a small number of firms working in quiet cooperation to agree on industry prices (Gnutzmann & Spiewanowski, 2016; Taylor & Moss, 2013). Similarly, international grain trading companies have also existed under de facto cartel arrangements since the 1950s (Murphy et al., 2012). In fact, while fertilizer companies and traders are most commonly cited, every link in the industrial food chain has been structured under oligopolistic arrangements or monopsonistic conditions at one time or another.

Oligopolistic markets are deemed less competitive and at greater risk of collusive and coercive behaviour due to their high levels of concentration (Clapp, 2012; James, 2013; Hendrickson, 2014; Howard, 2016b). Oligopolies maintain their positions by creating barriers to entry for new firms and establishing mutually beneficial pricing arrangements. These are more common than outright cartels, and are harder to identify, given that companies are ostensibly in competition and are not acting explicitly for mutual advantage.

Oligopolistic Behaviour – In 2013, large chocolate manufacturers in Canada were closely examined for oligopolistic behaviour based on price collusion (i.e. illegally agreeing to set prices). As a result of the investigation, Hershey pleaded guilty of working with other dominant manufacturers (Cadbury, Mars, Nestlé) to raise prices in Canada. While the other firms denied the charges, they paid more than $22 million to settle a subsequent class-action lawsuit (Culliney, 2013).

WHAT DRIVES M&AS? A CLIMATE RIPE FOR CONCENTRATION IN THE AGRI-FOOD SECTOR

The current wave of consolidation is not a new phenomenon. Industrialization and the advent of new transportation and technologies (e.g. the telegraph and refrigerated steamships and railcars) spurred a first wave of mergers – not just in the US but in Western Europe, Argentina and Australia in the 1890-1900s (Du Boff & Herman, 2001; Friedman & McMichael, 1989). With the industrial revolution and new technologies came the widespread adoption of intellectual property regimes and the first series of antitrust regulations in the US (1890 Sherman Act). Intellectual property rights (both patents and trademarks) constituted barriers to entry for smaller companies; those who owned them benefitted from a comparative advantage over those who did not, allowing these first firms to consolidate their market position. Once a company obtained a more dominant position, it could buy smaller companies in order to benefit from new marketing techniques and technologies and expand their range of products and services (Drahos & Braithwaite, 2007; May & Sell, 2006).

After the First World War, fueled by market speculation and the expansion of IP regulation (in particular, *sui generis* – i.e. 'patent like' protection for plant varieties in the USA and some Western European countries), a second wave of horizontal mergers made sectors like seeds increasingly consolidated and subject to oligopolies (Drahos & Braithwaite, 2007; May & Sell, 2006). Industry restructuring after World War II encouraged a third wave of M&A activity – namely mergers between companies from previously unrelated industries (e.g. energy and petrochemicals companies with seed companies). Between the 1940s and 1970s, North America also began to experience the advent of larger supermarket chains, replacing local grocery stores.

Beginning in the 1970s and inspired by the rise of Chicago School neoliberal economic thinking, US anti-trust regulation was relaxed, allowing concentration to emerge as the leading growth strategy for firms[6] (Du Boff & Herman, 2001; Howard, 2016b). Across all sectors, M&As are considered a primary means to survive and thrive in highly competitive, large or even globalized markets – where the competition is itself increasingly consolidated. In particular, corporations tend to justify M&A deals in order to (KPMG, 2009):

- Maximize shareholder value
- Increase and/or protect market share
- Expand to new geographical markets
- Acquire new technologies/services/intellectual property
- Gain control over supply chains

To capitalize on the benefits above, economies of scale[7] are often cited as the main rationale for M&As, as purported drivers of innovation, profit and efficiency (Howard, 2016b). While the benefits to M&As for larger firms are clearer, for small and medium-sized enterprises ('SMEs') in particular, mergers with companies that are comparable in size may improve their access to credit or loans from a wider range of financial institutions – though with greater risk. M&As may also allow SMEs to achieve greater market access by pooling resources to compete with bigger players. An acquisition by a larger company can also appeal to SMEs, enabling founders to recover their original investment. Through consolidation, a company gains market power and can obtain a dom-

6. Interestingly, in 2017, the Chicago School appears to be reconsidering its views on competition policy, on the basis that corporate concentration has reached a scale that is harming employment and innovation while increasing prices. (The Economist, 2017c)

7. Economies of scale describe the cost-savings derived from increasing output of a product, reducing its per-unit fixed cost. Economies of scale may also lead to variable cost savings, gained by improving operational efficiencies and creating synergies. In the context of an M&A, a merged company's performance and value is meant to be greater than the sum of its previously separate parts (more on the industry rationale for M&As and the logic behind economies of scale is covered below).

inant position by creating barriers to entry for competitors and setting the "terms of exchange" (Foster & McChesney, 2012).

While this logic has been challenged, these orthodoxies have continued to hold sway. In recent years, market conditions have also become more favorable to M&A activity, enabling a new generation of M&As on an unprecedented scale: record-breaking stock market growth and low interest rates have helped to create the conditions for these deals. Statutory corporate tax rates have also declined in most OECD countries since the 1980s, in some cases by 50%. According to the McKinsey Global Institute, "by any measure, pre- or post-tax, corporate profits are up sharply" and "large firms have been the biggest beneficiaries of this extended bull-run" (2015, p.1). In the US, for example, the after-tax profits of firms are at their highest level as a share of national income since 1929. By contrast, across industrialized economies, labour's share of national income has dropped from 76 to 66% since 1980 (ibid, p.5).

The conditions have been particularly ripe for concentration in the agri-food sector, where M&A activity had been keeping pace with other sectors over recent decades. However, even before the recent spate of mergers, there were signs that agri-food consolidation was taking on new shapes and forms. Previous M&A activity in the agri-food sector came on the back of new global market opportunities and technological innovation. **Financialization** – i.e. the increasingly powerful role of financial actors, motives and trends in shaping global economic activity –has become a major driver of corporate consolidation across various sectors as investors demand higher and shorter-term payouts (Clapp, 2014; Isakson, 2014; van der Zwan 2014). Weak agricultural commodity prices drew financial investors to the sector in the early 2000s, attracted by the high returns that could be gained from growing resource scarcity (Ghosh, 2010) and to diversify their investment portfolios to hedge against inflation.

After the 2007-8 financial crisis, investors rushed to agricultural commodities – and land in particular – further driving up prices and volatility. Rather than investing in land as an immediate source of food production, these investments have increasingly been undertaken to diversify investment portfolios, hedging against risks taken in other financial markets, and speculating on the future value of the land (Fairbairn, 2014).

Many agribusinesses performed poorly following the even greater fall of commodity prices in 2013, attracting a further wave of **activist investors** – individuals or groups who purchase a significant share of a company's publicly-traded stock, or gain seats on the company's board, to force a major change in the company, including a merger or acquisition (George & Lorsch, 2014).

Financialization also influences agri-food industry trends through **passive investors**, who aim to maximize returns over the longer term. As insurance companies, banks, university endowments, pension and hedge funds and other institutional investors look for new and reliable investments, many have turned to all parts of the agri-food sector – including the purchase of agricultural land and water resources – by relying on professional asset managers (Clapp, 2017). These managers are generally rewarded based on their investment performances, and are thus highly motivated to improve company returns. Institutional investors now hold up to 70-80% of stocks in publicly-traded firms in the US, and often large shares of leading firms in the same sector (Azar et al., 2016) (See Table 1).

With pressure from both activist investors and asset managers, and the challenges mounting in food systems – from feeding the world's burgeoning population to addressing climate change – firms have increasingly turned to M&As, convinced by the need to pool resources and increase efficiencies for quick returns and long-term survival.

Dubbed the year of the "mega-deal," 2015 was one of the biggest years ever for global M&As,

TABLE 1 - PERCENTAAGE OF SHARED HELD IN THE SIX LARGEST AGROCHEMICAL FIRMS BY MAJOR ASSET MANAGEMENT FIRMS

	MONSANTO	BAYER	DOW	DU PONT	SYNGENTA	BASF
BlackRock	5.76 %	10.09 %	6.11 %	6.61 %	6.00 %	8.30 %
Capital group	2.68 %	3.68 %	3.60 %	10.69 %	4.01 %	0.91 %
Fidelity	3.12 %	1.71 %	1.17 %	3.54 %	0.21 %	0.50 %
The Vanguard Group, Inc.	7.33 %	2.30 %	6.27 %	6.87 %	2.28 %	2.31 %
State Street Global Advisors	4.63 %	0.50 %	4.14 %	5.01 %	0.40 %	0.45 %
Norges Bank Investment Management (NBIM)	0.81 %	1.64 %	0.43 %	0.63 %	1.75 %	3.00 %
% owned by top six asset management firms pre-merger	**24.34 %**	**19.93 %**	**21.72 %**	**33.36 %**	**14.65 %**	**15.47 %**

Source : Thomson Reuters Eikon Database (percentage of shares as of Dec.31, 2016) in Clapp, 2017

with 42,300 announced deals valued at $4.9 trillion (Reuters, 2015). There were 71 deals valued at over $10 billion in 2015, accounting for 41 % of total announced M&As. For the first time ever, seven M&A deals surpassed the $50 billion mark. Record deals have been struck in various agri-food sectors and related industries: food processing (Heinz and Kraft Foods - $55 billion, backed by 3G Capital and Berkshire Hathaway), beverages (AB InBev and SABMiller - $120 billion), chemicals (Dow Chemical and DuPont - $130 billion) and pharmaceuticals (Allergan and Pfizer valued at $160 billion). Although the M&As concluded since 2015 have not matched that scale, 2017 is fast becoming a major year in all sectors through the proposed merger of two of the world's top fertilizer companies (Agrium with Potash Corp.), the announced takeover of Monsanto by Bayer (two of the dominant six seed and pesticide enterprises), the Kraft-Heinz bid for Unilever, Amazon's recent acquisition of Whole Foods (backed by investment company, BlackRock), and more recent rumours of mergers involving Mondelez, Procter & Gamble or Kellogg.

Emerging markets have added a new and highly significant dimension to the evolving picture. Historically, corporate consolidation in food systems has been more prominent in the global North, and less so in the global South where food and agricultural markets are far more decentralized. However, by 2020, more than half of global GDP growth is expected to come from countries outside of the global North. For the first time, large corporations from emerging markets are becoming major drivers of M&A activity (see Box 1). In the past decade, the 50 largest firms from emerging economies have doubled their share of revenues from cross-border activity, from 19% to 40% (McKinsey Global Institute, 2015). The trend is most prominent in China, where large, mostly state-owned agri-food firms or 'Dragon Head Enterprises'[8] have spent a record $207 billion in foreign M&As (Bloomberg,

8. 'Dragon Head Enterprises (DHEs)', outlined in China's 1998 central policy, have been a key component of China's agricultural industrialization strategy and rural development (Schneider & Sharma, 2014). Primarily agri-food companies, DHEs designated by the government at the national, provincial and county level. They receive better access to government subsidies and support, and are intended to link smaller farmers with leading agribusiness companies to provide them with greater market access as well as technical and market information through vertical integration.

2016; Weinland et al., 2016) and through the state's ambitious Belt and Road initiative announced in 2013[9]. For state-owned enterprises like ChemChina, cross-border mergers are largely pursued to increase their "size and power" (Mitchell & Atkins, 2016), on the back of political mandates to boost agricultural productivity and increase national food security[10].

With slower growth in North American and European markets, agri-food firms are also focusing on emerging markets where increasing incomes, population growth and urbanization are fueling dramatic increases in demand for consumer goods as well as changing diets (i.e. animal protein and processed foods) (Goedde et al., 2015).

BOX 2 - THE M&A BOOM IN EMERGING MARKETS

- In early 2016, ChemChina's $43 billion offer for Swiss agrochemical giant Syngenta became the biggest-ever foreign acquisition bid by a Chinese firm. If approved, ChemChina will become the world's first or second largest agrochemical firm (depending on the outcome of other proposed mergers). With US and EU regulatory approval received in April 2017, the deal was confirmed in May 2017.
- Since the mid-1990s, Brazilian company JBS SA has become the world's largest meat processor following acquisitions in Brazil, Argentina, Australia, US, Canada and Mexico. The top 10 global animal protein companies now include two Brazilian companies (JBS and Marfrig) and China's largest meat processing company, WH Group, which acquired Smithfield Foods to become a major hog breeder and the world's largest hog producer and pork processor.
- China's COFCO Group (China National Cereals, Oils and Foodstuffs) is the world's fourth largest agricultural commodity trader, with annual revenues exceeding $64 billion. The state-owned grain firm catapulted into the major league of grain traders after taking controlling interests in Dutch grain trader Nidera Holdings in February 2017, as well as Singapore-based Noble Agri in 2016.
- The world's largest livestock breeders include the Asia Pacific region's leading agro-industrial food conglomerate, Thailand's Charoen Pokphand Group following an acquisition spree since 2016, and China's WH Group after its acquisition of US-based Smithfield Foods in 2013.

9. The One Belt One Road initiative is an ambitious economic development framework to boost trade and encourage Chinese and global economic growth. It is up of two main components the 'Silk Road Economic Belt' (the belt) and the other the '21st Century Maritime Silk Road' (the road) to improve infrastructure across Eurasia.

10. The Chinese state continues to play a leading role in determining the direction and pace of market expansion in China, through various degrees of control. Leading agri-food businesses in China continue to be domestically-owned either as state-owned firms, privately owned firms, partnerships between private and public firms, or joint ventures between Chinese and foreign firms. (Schneider, 2017)

01 Trends in agri-food industry concentration

Corporate concentration is a trend occurring throughout the entire industrial food system. Concentration impacts the full breadth of products purchased by producers to grow food, feed, and fuel: seeds and agrochemicals, fertilizers, animal pharmaceuticals, livestock genetics and farm equipment (See Figure 2). It also extends beyond agriculture, affecting commodity traders, food and beverage processors, and retailers. This section provides an overview of key consolidation trends at every link of the agri-food value chain, and is increasingly tying operations together between various sectors.

1.1 SEEDS AND AGROCHEMICALS

Some of the largest M&A deals in history have been proposed within the seed and agrochemical industries over the past two years, reviving a public debate on the implications of consolidation in the agri-food system. If the proposed mergers are accepted under current terms, just three companies could control more than 70% of agrochemicals, and more than 60% of proprietary seeds worldwide. Pending mergers could dramatically re-configure the combined $100 billion seed/pesticide market (ETC, 2015), with considerable knock-off effects in the closely-related sectors of livestock / fish genetics and pharmaceuticals, farm machinery, and even synthetic fertilizers.

A 2011 study by the US Department of Agriculture (USDA) examined global market concentration over a 15-year period, from 1994-2009, in the major five agricultural input industries – agri-chemicals, seeds, animal pharmaceuticals, animal genetics, and farm machinery (Fuglie et al., 2011). The research revealed that by 2009, the largest four firms in each sector accounted for more than 50% of global market sales – well beyond the 40% benchmark of an oligopolistic market. By 2014, 4-firm concentration in at least four of these sectors had continued to increase – ranging from 54% to 62% share of global market sales.[11]

Today, the proprietary seed industry is intimately linked to the world's largest agrochemical corporations. Syngenta (Switzerland), Bayer (Germany), BASF (Germany), DuPont (USA), Monsanto (USA), and Dow (USA), known as the 'Big Six', currently control both 60 % of the global seed market and 75% of the global pesticides market.

This integration has been almost a century in the making. Developments in breeding/hybridization in the US paved the way for the emergence of the commercial seed industry (primarily corn) in the 1930s, marking the first time that farmers were separated from effective reproduction of their seed crops. The first wave of seed industry consolidation dates back to the 1970s and 1980s when some 1,000 small and family-owned seed companies became the target of M&As (Fowler & Mooney, 1990). At that time, seed companies were successfully lobbying for "plant breeders' rights," the intellectual property laws that confer monopoly control over plant varieties. The profits to be gained from patented seeds became highly attractive investments to companies outside the seed industry, including petrochemical companies. For a brief time, Royal Dutch Shell was the world's largest seed company, while other fossil fuel companies including Atlantic Richfield, Diamond Shamrock and Occidental Petroleum followed suit. Chemical and drug companies such as Sandoz and Ciba-Gei-

11. The 2014 figures are based on ETC Group research. Information is not available to calculate the global market share for all sectors.

FIGURE 2 • TOP 10 SEED COMPANIES, 2014

(Data source: ETC, 2015)

The seed industry sells commercial crop seeds (primarily field crops and vegetable seeds).

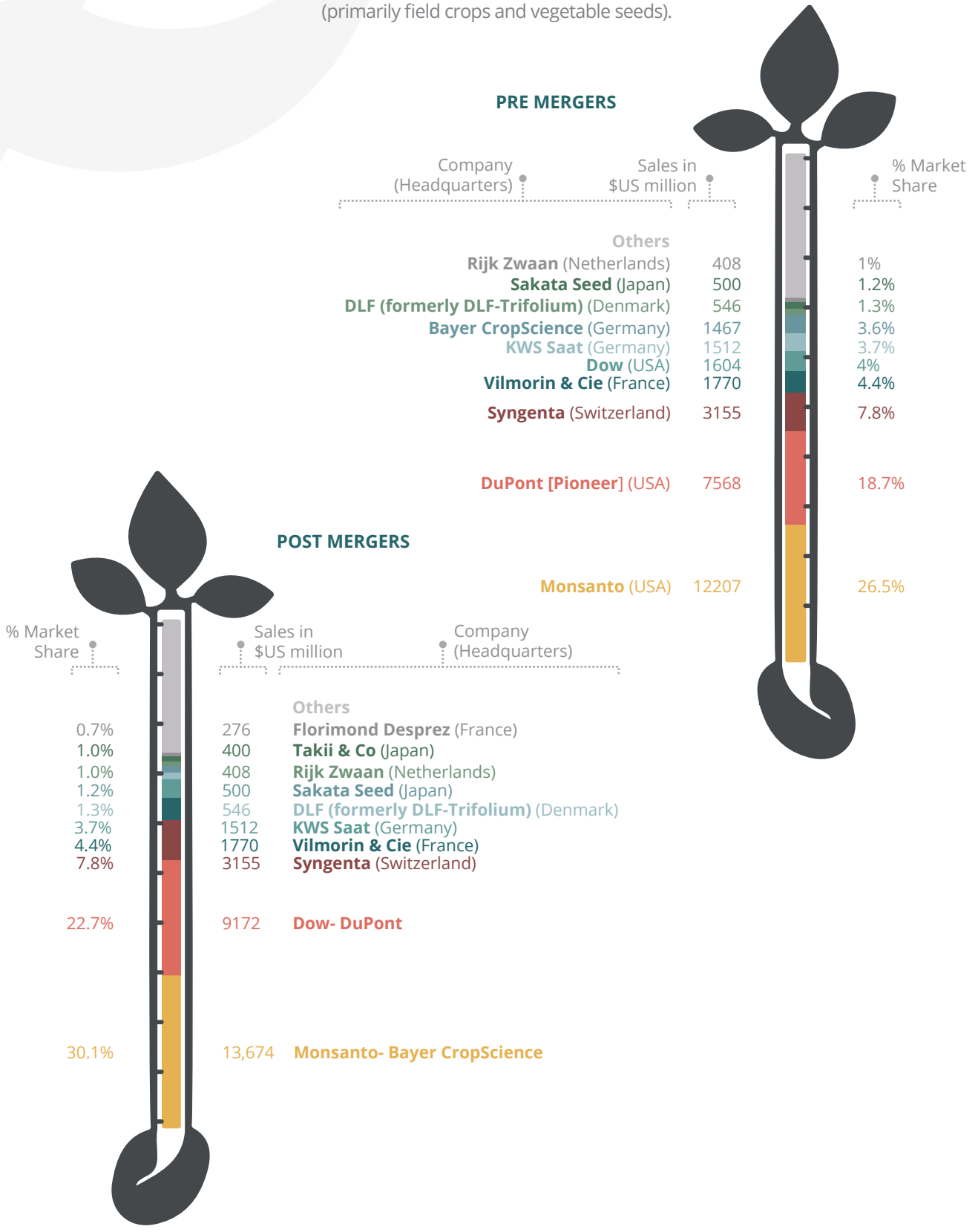


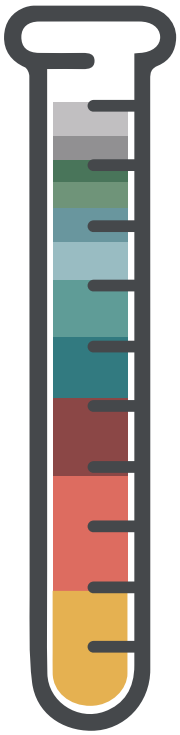
FIGURE 3 • TOP 10 AGROCHEMICAL COMPANIES, 2014

(Data source: ETC, 2015)

The agrochemical sector manufactures and sells crop chemicals or pesticides (including herbicides, insecticides and fungicides) used on agricultural crops.

PRE MERGERS

Company (Headquarters)	Sales in $US million	% Market Share
Others		
FMC	2,174	3,9
Arysta LifeScience (France)	2200	3,9
Nufarm (Australia)	2,281	4,1
ADAMA (Israel) (ChemChina subsidiary)	3,221	5,7
DuPont (USA)	3,728	6,6
Monsanto (USA)	5,115	9,1
Dow AgroSciences (USA)	5,686	10,1
BASF (Germany)	7,239	12,9
Bayer CropScience (Germany)	10,252	18,3
Syngenta (Switzerland)	11,381	20,3%



POST MERGERS

Company (Headquarters)	Revenue in $US million	% Market Share
Others		
BASF	7,239	12.9%
DuPont-Dow AgroSciences	9,414	16.8%
Syngenta-ChemChina (including ADAMA and Sanonda)	15,102	26.9%
Bayer CropScience-Monsanto	15,367	27.4%

gy (now Novartis), Pfizer, Upjohn, Celanese and Union Carbide (now Dow) also took to acquiring seed companies for their higher profit margins (Mooney, 1979).

The 1980s saw breakthroughs in the biosciences and the further development of intellectual property laws that allowed for the patenting of living organisms in the following decade. Plant varieties and livestock breeds (eventually including genes and traits) became essential assets for the evolving 'life sciences industry' that envisioned the integration of new biotechnologies across sectors. Seeds became logical and complementary acquisitions for pharmaceutical and chemical corporations investing in biotechnology. Today, some multinational firms – including Bayer and BASF – continue to support cross-sector research in pharmaceutical (human and livestock), chemical and agrochemical applications, while others have been divesting their agricultural units. For example, Pharmacia spun off Monsanto and AstraZeneca and Novartis spun-off their agricultural unit, Syngenta.

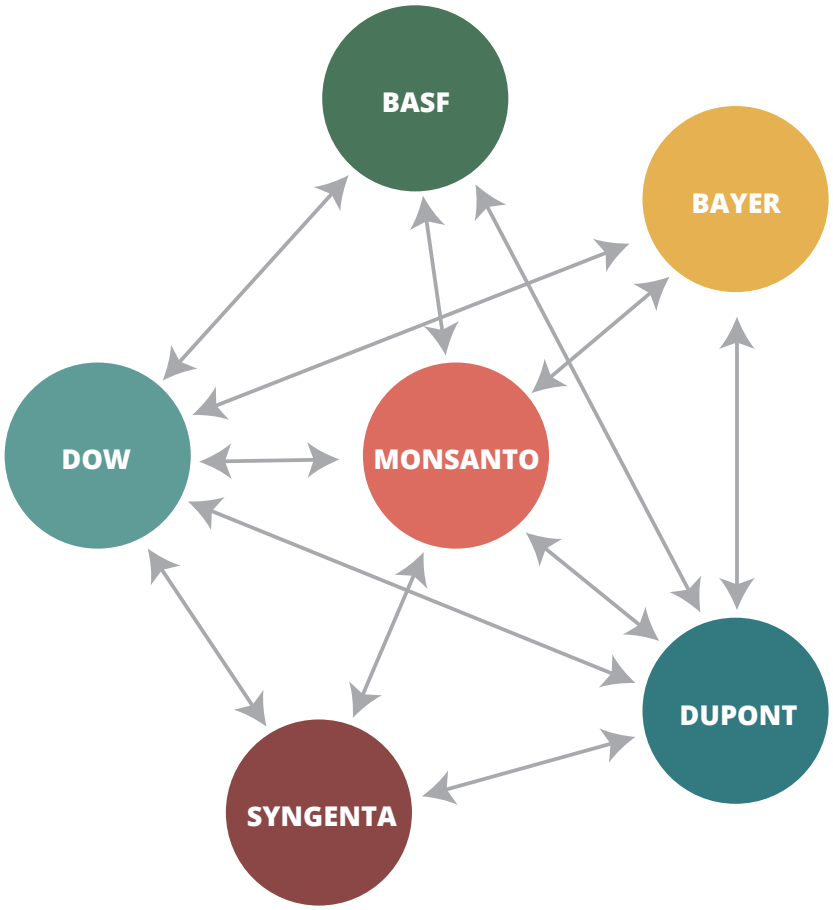
In 1996, the lucrative synergies between agrochemicals, biotech and plant breeding became clear when crop-chemical companies unveiled proprietary plant varieties dependent on proprietary pesticides, i.e. genetically-modified 'herbicide-tolerant' plant varieties. Since then, the seed industry has experienced a faster rate of concentration than any other input sector: the market share of the four largest firms more than doubled – from 21 to 54% – between 1994 and 2009 (USDA, 2014b). By 2009, thousands of once-independent seed companies and hundreds of pesticide companies, and later biotech start-ups, had morphed into six large corporations[12]. Supported by majority shareholders from the financial sectors (e.g. Blackrock and Vanguard are the first and second shareholders of both Monsanto and Bayer), almost all top six companies are currently vying to merge into three even larger agrochemical and seed firms.

Beyond M&A activity, it is important to take stock of other forms of concentration, particularly the inter-firm agreements on research and innovation that ultimately affect governance and power in the food systems. For example:

- **Cross-licensing of Intellectual Property**– The Big Six frequently rely on exclusive monopoly patents to share proprietary traits and technologies. The patent owner determines whether or not to license, or selectively license, their products, and how much to charge. The graphic below illustrates cross-licensing agreements between the Big Six for Genetically Modified (GM) seed traits in 2013. These agreements can be used to leverage dominant market share in patented traits by restricting access, controlling product introduction and limiting innovation. (See Fig.4)
- **R&D alliances** – For example, BASF and Monsanto have collaborated on R&D partnerships worth $2.5 billion since 2007. The companies have collaborated on six R&D projects: breeding, biotechnology, pesticides, agricultural biologicals, and precision agriculture.
- **Genetic trait agreement** – Five of the Big Six companies have forged agreements amongst each other that lay out the rules for access to genetic biotechnology traits at patent expiration. According to ETC Group (2013), these agreements are developed to mollify anti-trust regulators while advancing companies' collective market control, moving the sector towards a 'post-patent regulatory regime' heavily influenced by corporate decision-making.

12. Initially, innovation in crop biotechnology was spearheaded by small and medium-size start-ups (many were spin-offs from university labs). Of 27 crop biotechnology start-ups that were acquired between 1985 and 2009, 20 were acquired by one of the Big 6 or by a company that was eventually acquired by a Big 6 company (Fuglie et al., 2011). Between 1995 and 1998, approximately 68 seed companies either were acquired by or entered joint ventures with a handful of multinational corporations. Monsanto alone acquired almost 40 companies (including agricultural biotech start-ups and independent seed companies) (American Antitrust Institute, 2009). In 1996 there were 300 independent seed firms selling commodity crop seeds in the U.S. One decade later, only 100 of them survived (Wilde, 2009).

FIGURE 4 • CROSS LICENSING AGREEMENT FOR GENETICALLY ENGINEERED TRAITS
(Source: Howard 2016b)



1.2 FERTILIZERS

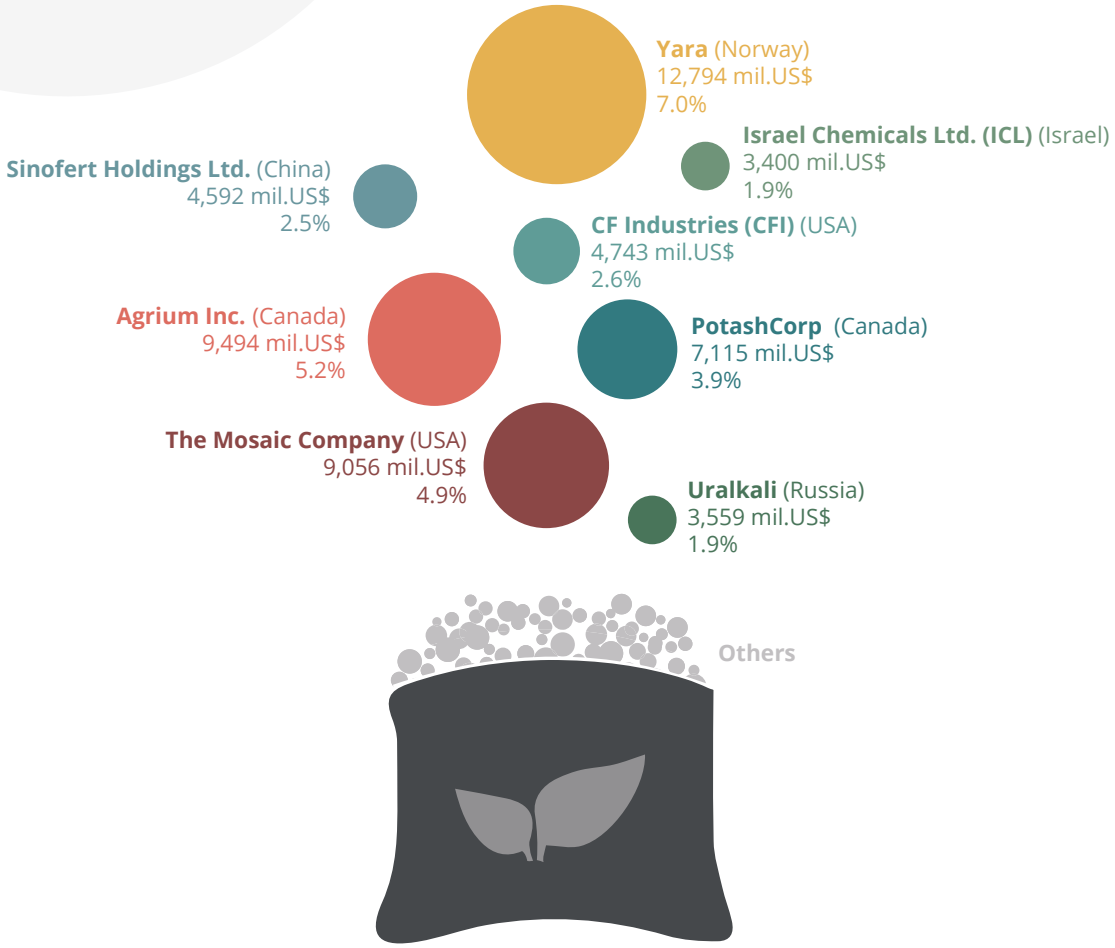
The fertilizer industry boasted annual revenue of $183 billion in 2014 (ETC, 2015). The top ten companies account for a 56% market share, through a wide variety of global networks and brands (IndustryArc, 2016). A range of factors make the sector inherently concentrated, and further consolidation in the fertilizer industry has looked likely over recent years - although some of the biggest deals have been derailed by market volatility.

Unlike other agri-food sector industries, the fertilizer industry is driven by intensive requirements for location-specific raw materials, such as minerals and natural gas. As a result, the sector has been historically structured around government-sanctioned export cartels based on the types of fertilizers located within their borders. Canada, China, the United States, India, and Russia control over 50% of the world's production of the primary materials needed to produce fertilizers[13] (e.g. ammonia, phosphate, potash) (Hernandez & Torero, 2013). Within each country, the top four firms control over half of production, with the exception of China where concentration is less pronounced (ibid). In North America, potash sales have been controlled by three companies (PotashCorp, Mo-

13. Other major exporting countries within the top five of one or multiple fertilizer types include Indonesia, Morocco, France and Belarus (Hernandez & Torero, 2013).

FIGURE 5 • TOP 10 FERTILIZER COMPANIES
(Data source: ETC, 2015)

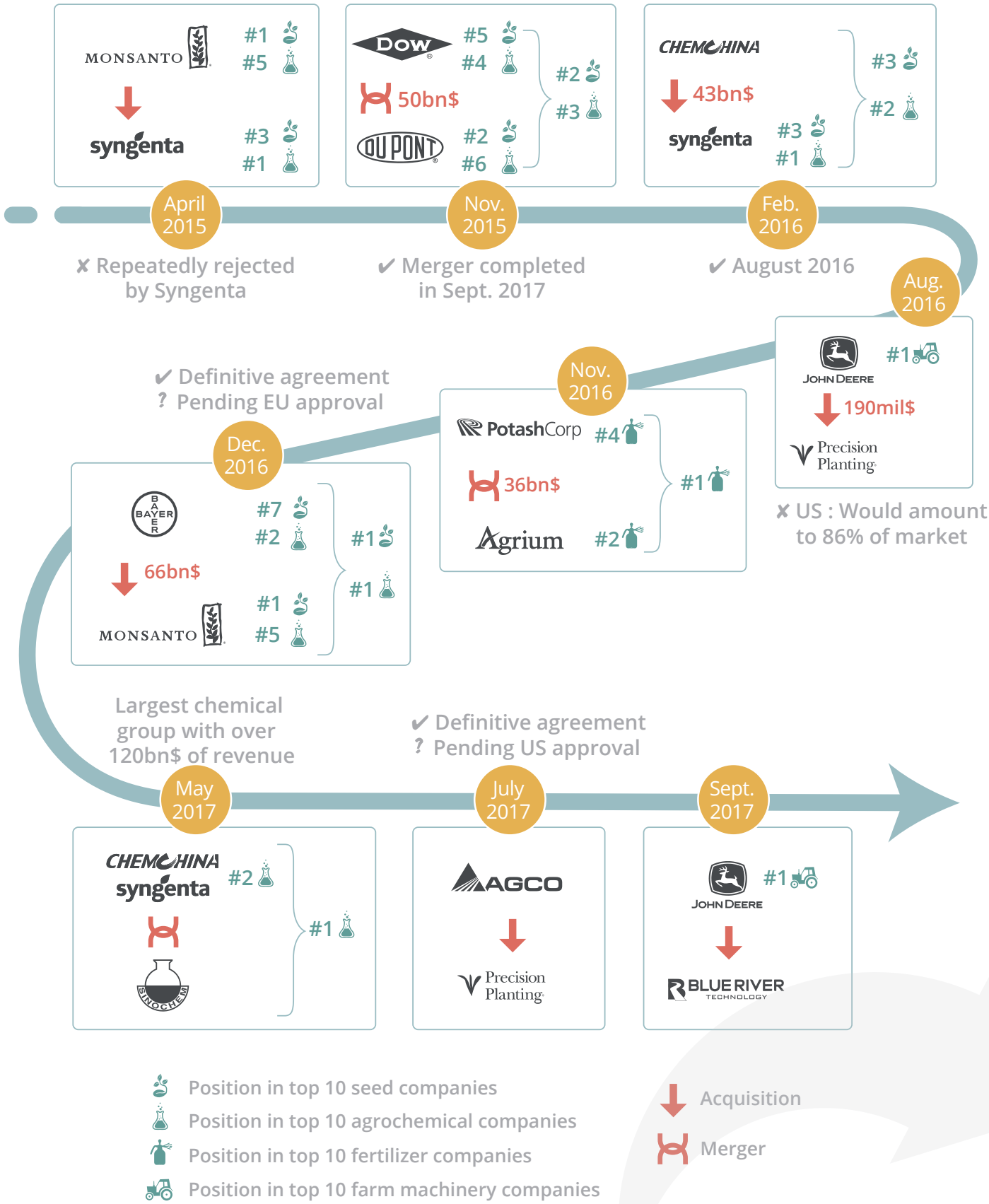
The fertilizer industry manufactures and sells inorganic, synthetic fertilizers. The three main agricultural fertilizer nutrients are nitrogen, phosphate and potash (or potassium).



saic and Agrium) through a marketing venture known as Canpotex (Canadian Potash Exporters). Even in this tight market, both vertical and horizontal integration have been and are still increasing: Mosaic (USA) was the result of Cargill's 2004 acquisition of mining company IMG Global – though Cargill spun off its majority stake in Mosaic in 2011. More recently, Potash Corp. has agreed to acquire Agrium. However, the fastest growth in the industry has been in the Asia-Pacific region: China and India are becoming the most attractive markets for fertilizer manufacturers.

Given the capital-intensive nature of the fertilizer industry, firms have consolidated to benefit from economies of scale. The size of the dominant firms has made it harder for smaller companies to enter and compete in the industry. The resulting concentration has paved the way for questionable pricing practices and 'tacit collusion', for example during the 2008 food price crisis (Lombord, 2013; Gnutzmann & Spiewanowski, 2014). Taking advantage of price shocks in related oil and agricultural commodity markets – the latter having risen by 1.5-1.9 times over the 2007-2008 period, fertilizer

FIGURE 6 • SAMPLE OF RECENT MERGERS IN THE AGRO-INPUT INDUSTRY



prices rose by 2-3 times over the same period (Hernandez & Torero, 2013), paving the way for record-breaking profits in the industry.

In turn, high fertilizer prices - and expectation of growing demand to meet the challenge of increasing agricultural productivity - made it one of the "hottest sectors" on stock markets in 2010 (Blas, 2010), sparking increased M&A activity. This included CF Industries' successful acquisition of Terra Industries (USA) for $4.7 billion, undercutting Agrium's more than $5 billion hostile bid for CF earlier that year. Unsuccessful bids also included the hostile $25 billion offer of mining industry giant, BHP Billiton (Australia), for Potash Corp in 2010. The offer was rejected on the grounds of "wholly undervaluing" Potash, whose net profits had more than doubled over the second quarter of that year (Potash Corp, 2010).

However, the production boost in the fertilizer industry – motivated by higher prices, low energy costs, and currency volatility in developing countries following the 2008 food crisis – led to a sharp drop in fertilizer prices in 2010 and again between 2014 and 2016 (Terazono, 2016b). In early 2016, fertilizer prices fell below the price of seeds for the first time since 2002 (Purdue University, 2016), reducing the pursuit of M&As due to lower annual profit margins. PotashCorp attempted a hostile takeover of K+S (Germany) in mid-2015, but withdrew its bid a few months later amid a commodity market downturn. Similarly, industry overcapacity and a related drop in profits have also led many agricultural input companies to divest from their low-margin fertilizer units, including both Cargill and Louis Dreyfus Commodities (Reuters, 2016).

Only two notable deals occurred in 2016: the first was the $8 billion acquisition of OCI (Netherlands) by CF Industries. The deal was called off following US Treasury Department's new rules on tax inversions, and CF and OCI's stated inability to restructure their deal to meet new regulation and shareholder demands. The second was an all-share merger agreement made between the fertilizer industry's second and fourth largest companies (Agrium and Potash Corporations) in September 2016 and completed in June 2017. The merger makes Agrium-Potash, now Nutrien, the world's largest fertilizer company, controlling 9.1% of the global market.

1.3 LIVESTOCK GENETICS

Like most other agricultural inputs, the livestock genetics (i.e. breeding) industry has experienced significant concentration since the 1980s, due to new and not-so-new technologies (e.g. artificial insemination – a comparatively old technology now much enhanced by Big Data genomics, gene or embryo transfers and large-scale cloning) and the related proprietary arrangements that help to maintain the pace of consolidation. The livestock genetics sector provides breeding stock (e.g. eggs, embryos, semen or live animals) for high-production breeds. In the case of poultry, pigs, cattle and aquaculture, seven leading firms dominate the livestock genetics sector (see appendix). For most major species, animal breeding markets are highly concentrated[14]:

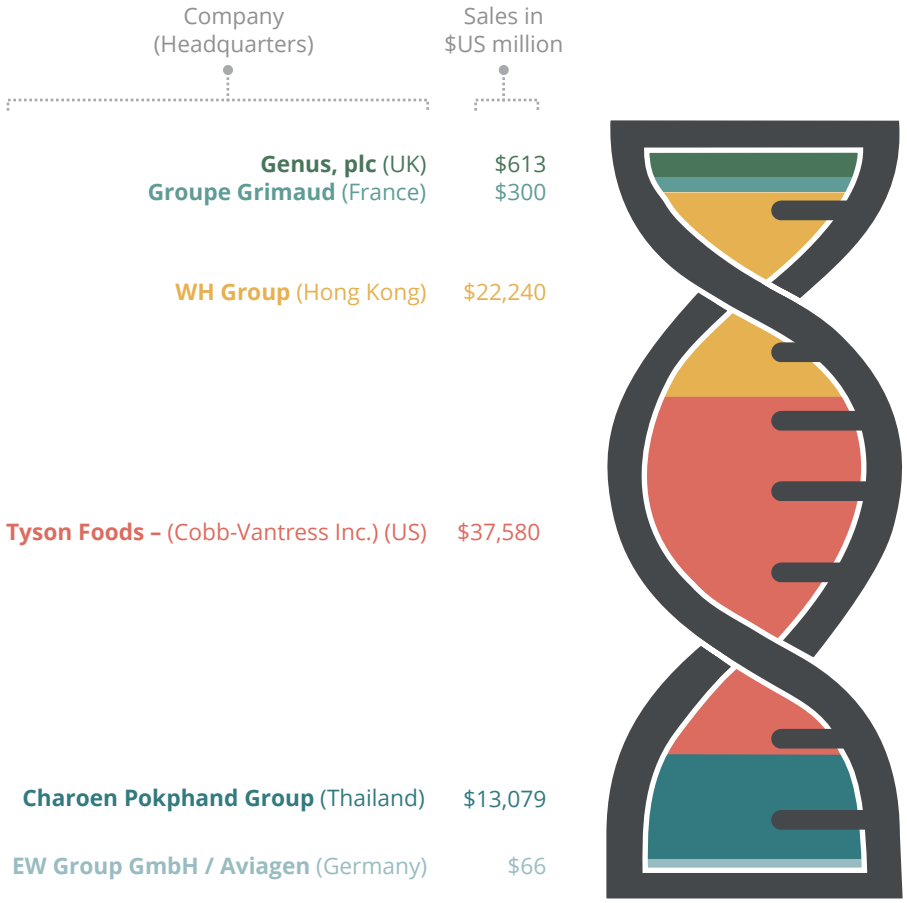
- **Broiler Genetics** (meat) – Three companies supply 95% of the commercial breeding stock for broilers: EW Group (Germany), Groupe Grimaud (France), Tyson (USA).

14. Cattle have lower reproduction rates due to a longer gestation period and require larger amounts of space than other livestock species such as poultry or pigs. As a result, the lower profitability of intellectual property protection of cattle breeding traits has limited consolidation in this sub-sector (Howard, 2016). Cattle breeding companies have also experienced national-level rather than global consolidation, as cattle breeding programs have more frequently relied on government support than for other livestock species, particularly regarding data management and genetic evaluation; this is due to the historic role of cattle as part of national agriculture (e.g. in the US, Canada, France, UK) (Rischkowsky & Pilling, 2007). However, Genus is emerging as a dominant player on the cattle breeding market, now supplying cattle genetics in over 70 countries. As artificial insemination technology improves and as companies like Genus consolidate their breeding programs globally, further concentration of cattle genetics companies is predicted over the coming years (ibid; Howard, 2016).

FIGURE 7 • TOP 10 LIVESTOCK BREEDING/GENETIC COMPANIES, 2014

(Data source: ETC, 2015)

The industrial livestock breeding sector focuses on genetic improvements and reproductive technologies for animal agriculture, including aquaculture and seafood.



- **Layer Genetics** (eggs) – Two companies, EW Group and Hendrix/ISA (USA) control an estimated 90% of layer poultry genetics worldwide.
- **Turkeys** – Two companies, EW Group and Hendrix Genetics, supply virtually all the industrial turkey genetics worldwide.
- **Pigs** – Three leading pig breeders, EW Group, Genus (UK) and Hendrix, supply almost all global pig stock.

Global livestock breeders utilize molecular breeding and genomics, and rely on Big Data to manage, manipulate and store genetic information. For example, Hendrix maintains "individual pedigree and performance data for millions of animals" to carry out genetic selection of breeding stock (Hendrix, 2016). However, it is difficult to estimate the value of the livestock genetics sector and the amount of money it devotes to R&D. As in many other agri-food sectors, companies are not required to disclose the necessary information to fully evaluate their markets. In virtually all cases, elite livestock genetics is proprietary and there is little more than anecdotal information available about the value and volume of specific livestock breeds sold and distributed worldwide.

Four of the seven largest global livestock breeders are 'pure play'[15] genetics companies that focus on multi-species animal breeding/genetics (e.g. Hendrix Genetics, Groupe Grimaud, EW Group are privately held; Genus is publicly-traded); however, in 2014, Genus announced a partnership with ABP Foods (one of Europe's largest beef processors) to deliver a proprietary genomics technology platform for the producer's meat supply chain. The other three leading global livestock breeders are highly vertically-integrated firms whose interests include animal protein production and processing: Tyson Foods (US); WH Group (Hong Kong) and Charoen Pokphand Group (Thailand). With enormous growth in aquaculture in recent years, five of the seven largest global breeders have also begun to diversify into aquaculture/fish breeding stock (ETC Group, 2013).

The increasingly industrial nature of the livestock sector - and particularly the 'Concentrated Animal Feeding Operations (CAFO) that characterize production in North America and beyond - is driving a quest for new economies of scale and vertical integration (IPES-Food, 2016; Weis, 2013). Food safety and animal slaughtering regulations have also worked in favor of this integration, where complex and costly regulations encourage consolidation as a means to comply.

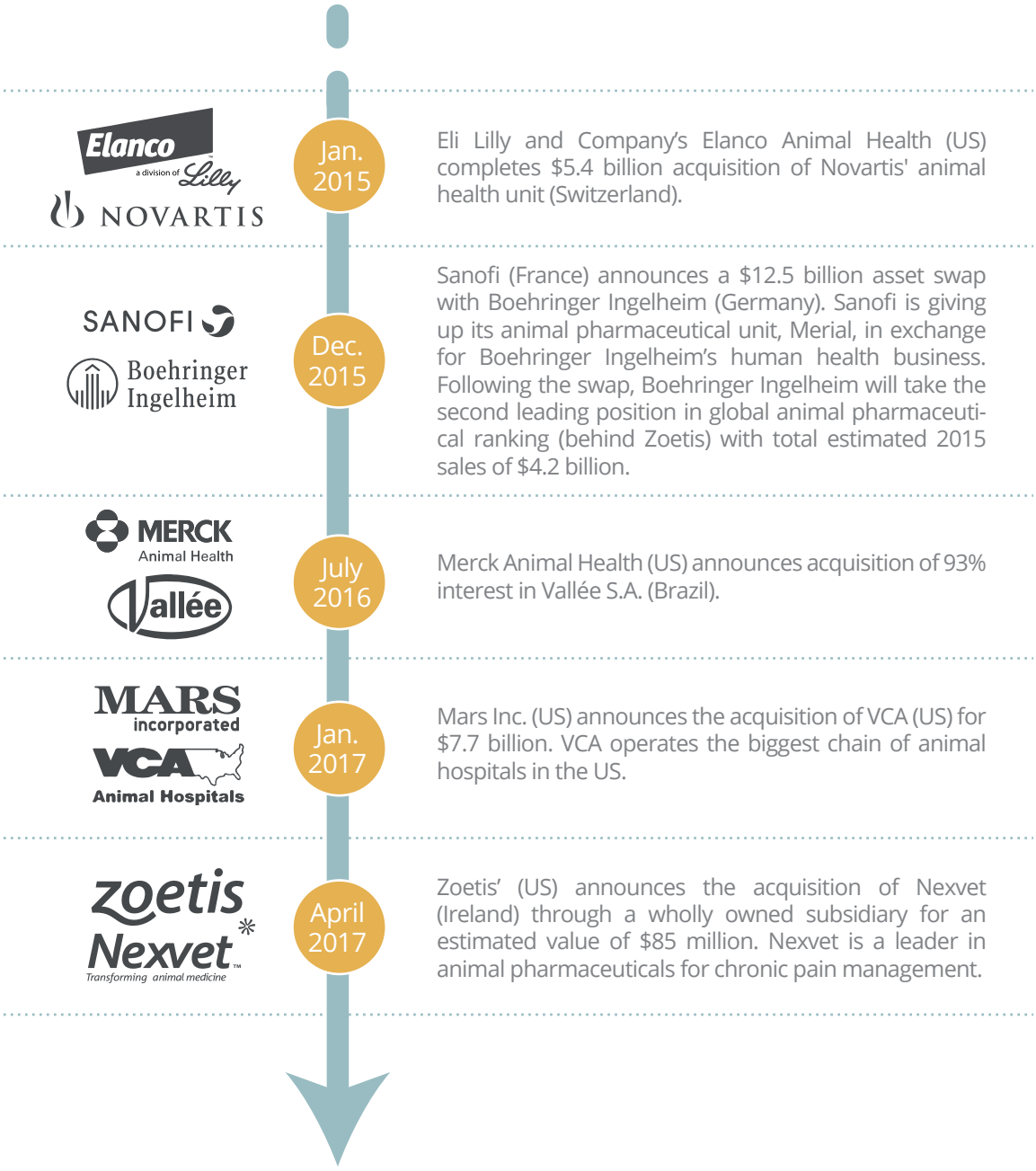
Industrially farmed animals typically require high-protein feeds, veterinary drugs (e.g. antimicrobials, vaccines and, most controversially, antibiotics for growth and production volume enhancement) and climate-controlled, biosecure facilities that are designed to prevent the introduction and spread of disease. Several global livestock breeders are developing in-house animal health operations, and are furthering integration with animal pharmaceutical firms when possible. Industrial breeding stock is drawn from a narrow selection of highly uniform breeds. In particular, the dependence of limited breeding stock on the availability of accompanying veterinary pharmaceuticals (e.g. antimicrobials, vaccines) to maximize production and to control the spread of virulent disease, has paved the way for greater integration between livestock genetics and animal pharmaceutical providers. For example, Groupe Grimaud recently acquired two biopharmaceutical subsidiaries for the development of vaccines. Privately-held EW Group (owner of Aviagen) is also involved in animal health, but few details are available.

BOX 3 - CONCENTRATION IN PRACTICE: CASE FROM THE ANIMAL GENETICS SECTOR

Two companies control an estimated 90% of laying chicken genetics worldwide. In 2014, the North American poultry industry got an unexpected wake-up call about the genetic vulnerability of its elite breeding stock: hatching rates suddenly went down due to unexpectedly low fertility in a popular breed of rooster, the standard Ross male, whose progeny then accounted for about 25% of US chickens raised for slaughter. The Ross male rooster is owned by Aviagen, a subsidiary of EW Group (Germany). Reuters reported that the problem came from "an undisclosed change [Aviagen] made to the breed's genetics" which caused the bird to lose fertility (Polansek, 2014). The genetic glitch not only caused a shortage of breeding stock supplies and drove up the price of chicken, it also heightened concerns for Canada's chicken industry, which imports all of its parent breeding stock from the US. As one Canadian egg producer lamented, "it's the US or nothing." (Friesen, 2014)

15. Pure play companies refer to those focusing on either one product or industry.

FIGURE 8 • SAMPLE OF RECENT ANIMAL PHARMACEUTICAL MERGERS - COMPLETED, PROPOSED AND PENDING



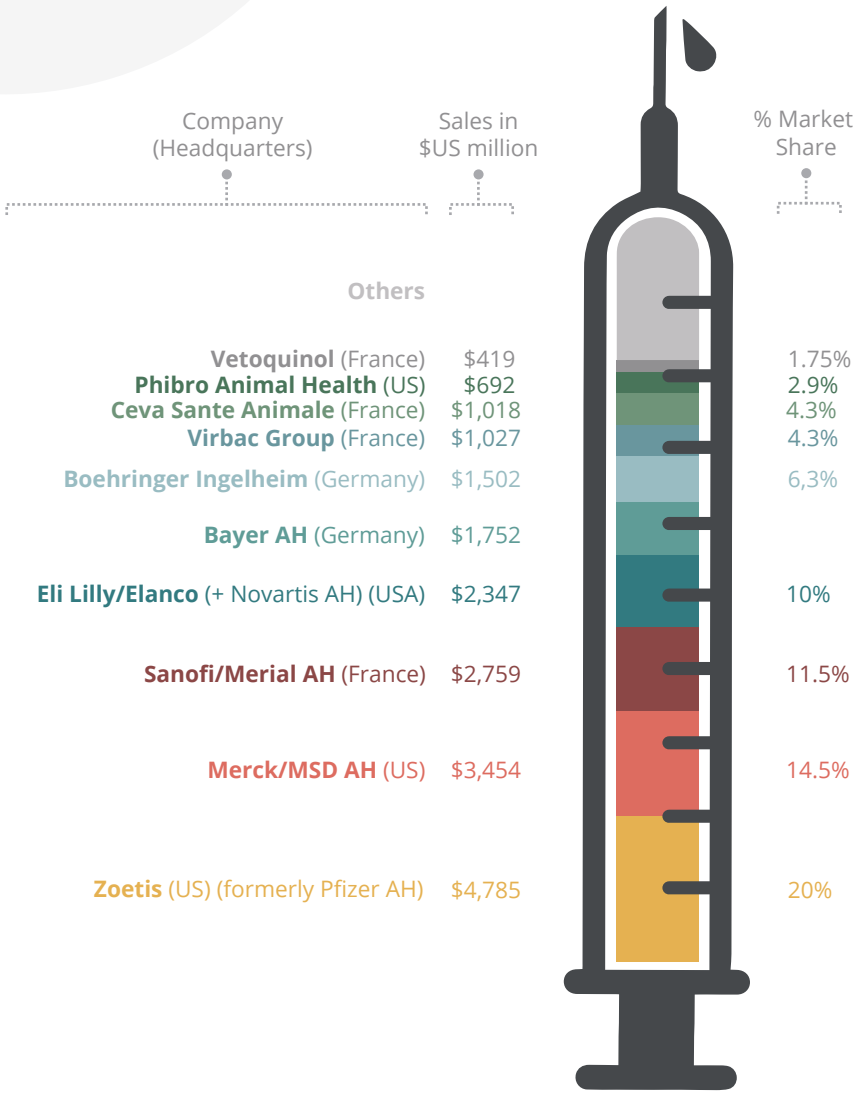
1.4 ANIMAL PHARMACEUTICALS

All the largest animal health companies are associated with – or are spin-offs of – major pharmaceutical companies. As described above, the links between animal pharmaceutical firms and livestock breeders are strong, meaning that vertical integration across the livestock chain is high. There is also a high degree of concentration within the animal pharmaceutical sector. According to agribusiness consultancy Informa (Animal Pharm unit), the world market for animal health products reached $23.9 billion in 2014, with eight firms accounting for nearly 80 % of the industry's sales (Informa, 2015). M&A spending in animal health has dramatically increased over recent years, from $1.1 billion in 2013 to an estimated $12.2 billion in 2015 (Informa, 2016).

FIGURE 9 • TOP 10 ANIMAL PHARMACEUTICAL COMPANIES, 2014

(Data source: ETC, 2015)

The animal pharmaceutical industry sells commercial products for livestock productivity/health and companion animal (pet) health, including medicines and vaccines, diagnostics, medical devices, nutritional supplements, veterinary and other related services. (This sector does not include livestock feed and pet food products.)



Recent consolidation in the animal pharmaceutical industry is attributed to the pursuit of brand and market positioning and the potential to lower R&D costs (Al-Muranni, 2016). Beyond M&A activity, consolidation is also taking the shape of inter-firm agreements between leading global firms, including Boehringer Ingelheim (Germany), Vetoquinol (France), or Zoetis (USA). A further trend includes the rise of geographically-targeted M&As and other structural arrangements by newer industry players, including CAHIC (China), to gain better access to American and European markets.

Although the sector is small in relation to other nodes of the agri-food industry, consolidation among animal pharmaceutical firms has been extensive enough to spark anti-trust concerns,

even requiring companies to divest certain assets in order to pursue further deals of significance (PricewaterhouseCoopers, 2015).

Despite considerable consolidation, the relatively small size of the animal pharmaceutical sector may suggest that these firms have little power to influence food systems. Indeed, at just under $24 billion, the animal pharmaceuticals sector has the smallest global market of all the agri-food industries – except livestock genetics[16].

However, animal pharmaceutical companies have been increasing their influence by interacting not only with livestock producers, but also with packers, retailers, and food companies to develop programs and shape communications around key food system issues including food safety, animal welfare, and antimicrobial resistance (Buhr et al., 2011).

1.5 FARM MACHINERY

The global farm machinery market has seen similar degrees of concentration to the seed and agrochemical sectors - and represents an even bigger industry in terms of total sales, estimated at nearly $114 billion (ETC, 2015). The three biggest farm machinery companies – Deere (USA), CNH (Netherlands), Kubota (Japan) – accounted for almost half of global farm machinery sales in 2014 (ETC, 2015). However, the combined sales of these top three farm machinery firms were double those of the top three pesticide sellers. In 2014, Deere's farm machinery sales—though down dramatically from just a year earlier—topped $26 billion, an amount nearly equal to the combined seed sales of the 'Big Six' companies.

Precision agriculture refers to farm management practices that involve the use of technology (GPS, communication technology, etc.) meant to optimize field-level management, enhance agricultural performance through better use of inputs, and improve the ability to predict and mitigate environmental risks.

In order to compete with Deere, recent analysis suggests that the five other leading machinery companies (CNH, Kubota, Mahindra, Claas, and AGCO) may seek to merge with one another. Some, analysts believe the more likely scenario is for the leading firms to acquire smaller harvesting and implements manufacturers in an effort to drive revenue growth (Rabobank, 2015). Speculation has also risen around the possibility of Deere seeking to transform one of its strategies alliances with the Big Six into an acquisition.

Indeed, vertical integration between the input and machinery sectors is already well advanced, with Big Data opening the door towards increasingly consolidated offerings to farmers. On-farm hardware (e.g. tractors, combines, sprayers) is now outfitted with digital tools (e.g. remote sensing, aerial imaging, wireless data servers) to provide prescriptions for how, where and when farmers should irrigate, fertilize and plant seeds and apply pesticides. Newer agricultural equipment such as driverless tractors (using GPS) and drones also rely heavily on digital input.[17] While seed and pesticide companies have rushed to develop and control data on soil, weather and crop yields,

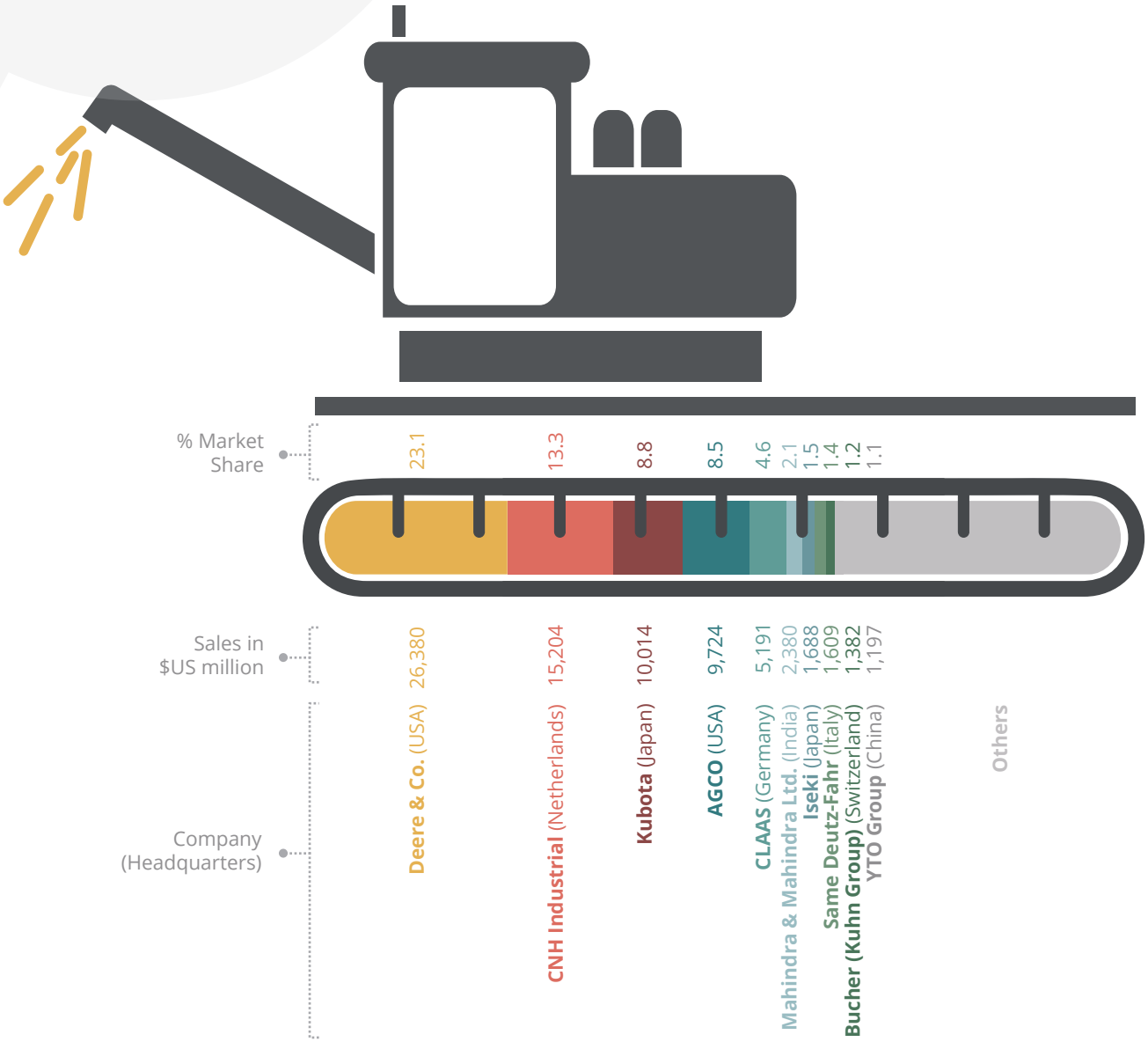
16. 60% of animal drugs sold in 2014 were generated by use for farm animals, while the remaining 40% was marketed to pets (Ward, 2015). However, statistics vary greatly depending on the region; in China, for example, over 95% of animal pharmaceutical sales are for use in the livestock sector, half of them purchased by the pork industry (Harkell, 2015).

17. Deere & Co. has been selling self-guided tractors for more than a decade and sells its technology in more than 100 countries (see Peterson, 2015). Drones have been used for spraying crops in Japan since the late 1980s, where an estimated one of every three bowls of rice has been sprayed by one company's drones (Yamaha) (see Inagaki, 2015).

FIGURE 10 • TOP 10 FARM MACHINERY COMPANIES, 2014

(Data source: ETC, 2015)

The farm machinery sector manufactures equipment used in the context of agriculture. This includes, for example, tractors, haying and harvesting machinery and equipment used for planting, fertilising, plowing, cultivating, irrigating, spraying, etc.



machinery companies have begun to lead a new wave of input integration through new data-driven technologies.

In November 2015, Deere announced its intent to acquire Monsanto-owned Precision Planting LLC, a precision agriculture equipment firm, as well as a second agreement with Monsanto-owned Climate Corporation, allowing some of Deere's equipment to connect with Monsanto's Climate FieldView platform wirelessly, in-cab and in 'near real time' (Deere, 2015).[18] Three months prior to the acquisition of Precision Planting LLC, AGCO (USA) announced a deal to outfit a line of its planters with Precision Planting technology. AGCO also collaborates with Bayer, DuPont and BASF (Grassi, 2015). However, in 2017, Deere and Monsanto abandoned the Precision Planting deal when both the Brazilian government and the US Department of Justice blocked it on the grounds that Deere would acquire an overwhelming monopoly over precision farming technology (Plume, 2017). Still, the Brazilian and US decisions may only have been more of a bump in the road : in July 2017, AGCO announced its acquisition of Monsanto's Precision Planting LLC to strengthen its ability to "help farmers increase their productivity" (Monsanto, 2017) and Deere made an offer for another Monsanto spin off with the same technologies, Blue River (Lev-Ram, 2017).

Machinery firms are also expanding their reach into other parts of the food chain, with some players bringing a huge range of activities under one roof. Mahindra & Mahindra (India) is the world's sixth biggest farm equipment company with more than $2 billion in annual agriculture equipment sales, and more than $17 billion in total sales across 20 industries. The company has 155 centers throughout India to sell the company's farm equipment, seeds, pesticides, fertilizers, irrigation tools, soil testing and 'agri-counseling' to producers. Since 2000, under Mahindra Shubhlabh Services, the company diversified to become India's largest fruit exporter. In 2014, a joint venture between Mahindra & Mahindra and Univeg (Belgium) further expanded the company into fresh fruit supply for domestic and international markets. Since 2015, the company has been making further plans to better connect the 3 million producers who use their farm machinery to Indian consumers, by creating their own brand of cereals and pulses – marketed as more traceable, higher quality products (Times of India, 2015; Mahindra, 2016).

1.6 AGRICULTURE COMMODITY TRADERS

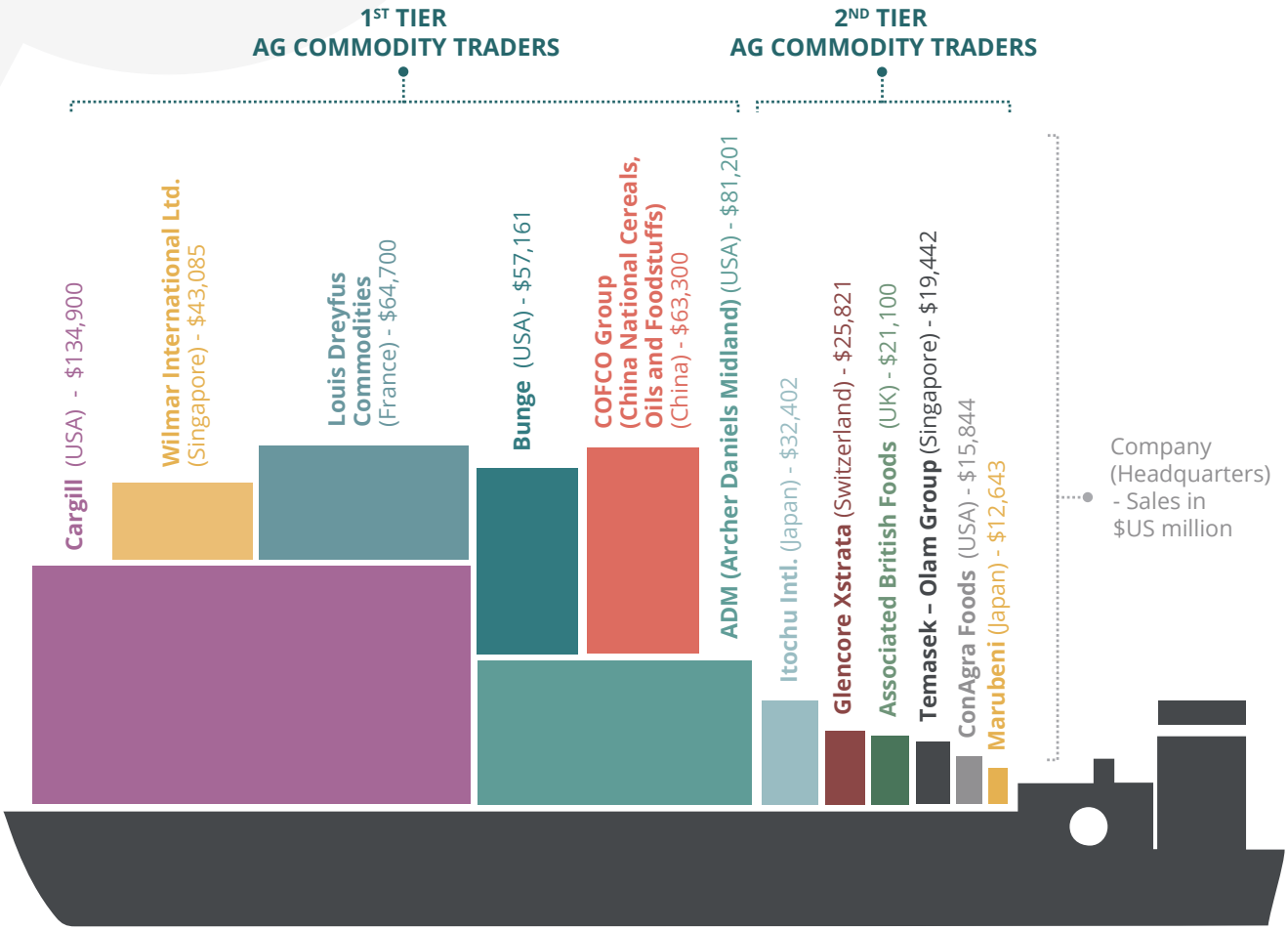
Gauging the extent of concentration in the commodity trade sector proves difficult as, historically, the dominant companies have been privately-held businesses; much data remains proprietary and companies are rapidly globalizing and diversifying their activities. The available estimates, however, suggest that commodity trade is one of the most concentrated nodes of the chain. The four major corporations that produce, process, transport, finance and trade food and agricultural commodities have traditionally been known as the ABCD: ADM - Archer Daniels Midland (USA), Bunge (USA), Cargill (USA), Louis Dreyfus Commodities (France). Collectively, they have been estimated to account for up to 90% of global grain trade (Murphy et al., 2012). More recently, new players have come onto the market, consolidating their positions with a flurry of M&A activity. Several Asia-based commodity giants, dubbed the NOW group - Noble Agri (Hong Kong) and Olam (Singapore), Wilmar (Singapore) – have

18. Deere & Co. launched a joint venture called SageInsights with DN2K, a developer of software systems that remotely monitors, displays and controls farming assets in 2015. Deere also acquired Monosem, a European precision-planter manufacturer in early November 2015, on day prior to announcing its acquisition of Precision Planting LLC. More recently, Deere bought a majority stake in Hagie Manufacturing, maker of high-clearance sprayer equipment in March 2016. Deere will integrate its precision technology into Hagie sprayers.

FIGURE 11 • TOP AGRICULTURAL COMMODITY TRADING COMPANIES, 2014

(Data source: ETC, 2015)

The world's largest agricultural commodity traders are diversified firms that produce, process, transport, finance and trade food and agricultural commodities (food, feed and biofuels) on a global scale.



ADM, a self-described "integrated global merchandiser of agricultural commodities and processed products", owns approximately 1,900 barges, 13,100 rail cars, 250 trucks, 1,200 trailers, 10 oceangoing vessels; and leases some 560 barges, 15,500 railcars, 340 trucks, 120 trailers and 21 oceangoing vessels (ADM, 2016).

Temasek, the state-owned investment company in Singapore, now owns 80 % of Olam – a major player in cocoa, coffee, cashew, rice and cotton in Asia and the Middle East, and holds assets in COFCO.

emerged as primary competitors to the ABCD. In addition, China's giant state-owned grain firm, COFCO, catapulted to a top-ranking position amongst grain traders after spending $2.8 billion to take a controlling interest in the Dutch grain trader Nidera Holdings BV in 2014. COFCO further acquired Noble Agri in December 2015. In 2016, the combined revenues of the leading six agricultural commodity traders, also known as 'First Tier' companies, was $364.644 billion – far exceeding the combined global markets for seeds, pesticides, farm equipment and fertilizers.

The sector is changing in other ways. Traders increasingly depend on Big Data technologies for both commodity transactions and market speculation. According to Richard Payne of Accenture, commodity traders are understandably apprehensive about the disruptive effects of Big Data (Meyer, 2016). Climate change pressures and the complexities of new technologies make some of the traders' conventional wisdom less pertinent today, while making the information owned by companies like Deere or Monsanto more relevant. The mergers evolving at both ends of the system – and the rapid rise of state-supported players in China and elsewhere – contribute to the insecurity of traditional industry leaders.

Today, the old-time grain traders also deal with a much wider variety of food and agricultural commodities than they have historically. The ABCD companies are now often landowners, input suppliers, livestock producers, processors, bulk commodity shippers, financiers and more (Murphy et al., 2012). Simultaneously, new players are entering the agricultural commodity arena, including leading mineral/fuel/forest commodity traders and ever more concentrated maritime container/tanker networks. Other large agribusinesses, such as Unilever, are setting up their own trading subsidiaries. The net effect of these changes is the bundling of basic food commodities with base metals and fuels into multi-commodity transactions (Clapp, 2015).

Despite new entrants, the dominance of mega-firms within agricultural commodity trading reinforces industry concentration, reducing the need for specialized independent traders, making it harder for them to compete, and perpetuating an ideology that firms must consolidate to survive (van Dijk et al., 2011; Hoffman & Clarke, 2015). The result is the emergence of "cross-sectoral value chain managers [...] with enormous power to shape key aspects of the global food landscape" (Clapp, 2015, p.126).

Due to abundant harvests (and the commensurate price decline), some traders are also facing larger debt loads. Some are responding by divesting assets. For example, by mid-2016:

- Glencore Xstrata (Switzerland), with a $26 billion debt load, announced plans to sell a 40% stake in its agriculture business to Canada Pension Plan Investment Board for $2.5 billion in cash (Bray, 2016).
- Louis Dreyfus Commodities is looking for joint venture partners to invest in or acquire the company's metals, orange juice, dairy and fertilizer businesses (Blas, 2016).
- Bunge may become the target of a takeover, rather than the dominant trader it has been for more than a century (Hume, 2017).

Others are continuing to diversify and expand their operations in response - albeit without M&As. For example, in 2014, ConAgra (USA) and Cargill partnered with CHS Inc. (USA) to form Ardent Mills, a jointly-held North American flour milling operation that would control around one-third of US milling capacity. In a rare anti-trust maneuver, the US Department of Justice ordered the venture to divest four of its flour mills to ensure competition in some regions (US Department of Justice, 2014). It is unclear whether this move into processing will prove a durable strategy. Certain assets, such as flour mills, turn into financial burdens when grain stocks fall short – as they did during the 2008 food price crisis (Meyer, 2013).

Cargill may also be leading a new trend of investing in highly-speculative start-ups, spending $3.5 billion in new upscale ventures such as salmon aquaculture (with the purchase of Ewos in Norway). To diversity its portfolio and capitalize on potential new consumer trends, the company has also partnered with Silicon Valley start-ups like Calysta – a fish, livestock and pet nutrition company, and is investing in high-risk newcomers like Memphis Meats, a company developing lab-grown beef, chicken and duck (The Economist, 2017a). Lastly, the head of Cargill's agricultural supply chain unit also reported that major customers, especially buyers from Asia, are opting to self-organize to source their own commodities directly – catalyzing another wave of consolidation by the largest players to avoid losing market share (Terazono et al., 2016).

1.7 FOOD AND BEVERAGE PROCESSORS

Food and beverage (F&B) companies handle the post-harvest processing of raw agricultural commodities into foodstuffs (for human consumption) and feedstuffs (for animal consumption). All leading F&B processors are closely linked to farmers, other raw material producers and suppliers as well as to leading food retailers (see Section 2.). Because of the size and scope of the food and beverage processing sector, it is difficult to provide reliable figures on the value of the global market. As such, we provide both a general overview of trends within the F&B industry and more specific insights from the meat and seafood sub-sectors.

It is estimated that the top 10 F&B companies account for 37.5% of the market share of the world's top 100 food companies, all of whom had revenues in excess of $35 billion in 2014. Putting this into perspective, the combined revenues of the Top 10 F&B companies – $494 billion - exceed the combined market value of the seed, agrochemical, farm equipment, fertilizer and animal pharmaceutical sectors ($471 billion). In 2014, sales of the world's top 100 F&B companies, together, topped $1.3 trillion.

A number of trends have accelerated the pace of consolidation in the F&B processing sector. First, while the largest processors remain profitable, industry growth has been lackluster, especially in higher income markets. Between 2009 and 2015, the top 25 US companies dropped the equivalent of $18 billion in market shares (Kowitt, 2015). Revenue growth of the world's 50 biggest F&B companies dropped to 1.7% in 2014, from 2.9% in 2013 and from 5.6% in 2012 (Daneshkhu, 2016). The sector's response has been a move towards consolidation, including major M&As, driven forward by both a desire to capture new markets through international expansion and to attract private equity firms, while still avoiding (or appeasing) 'activist investors' and their quest for severe cost-cutting measures for rapid shareholder returns.

The sector has also been restructured - including via M&As - in response to changes in consumer preferences. In the Global North, the main source of growth in the F&B industry has been the purchase of products perceived to be fresher/healthier - particularly by younger consumers. The F&B industry's dedication to flagship brands and foods is proving less successful due to the preferences of a new generation of consumers for unprocessed foods: breakfast cereal sales plummeted 29% between 2000-2015, while canned soup sales have stagnated over the past decade (Snyder, 2016; Halzack, 2017; Daneshku, 2016).

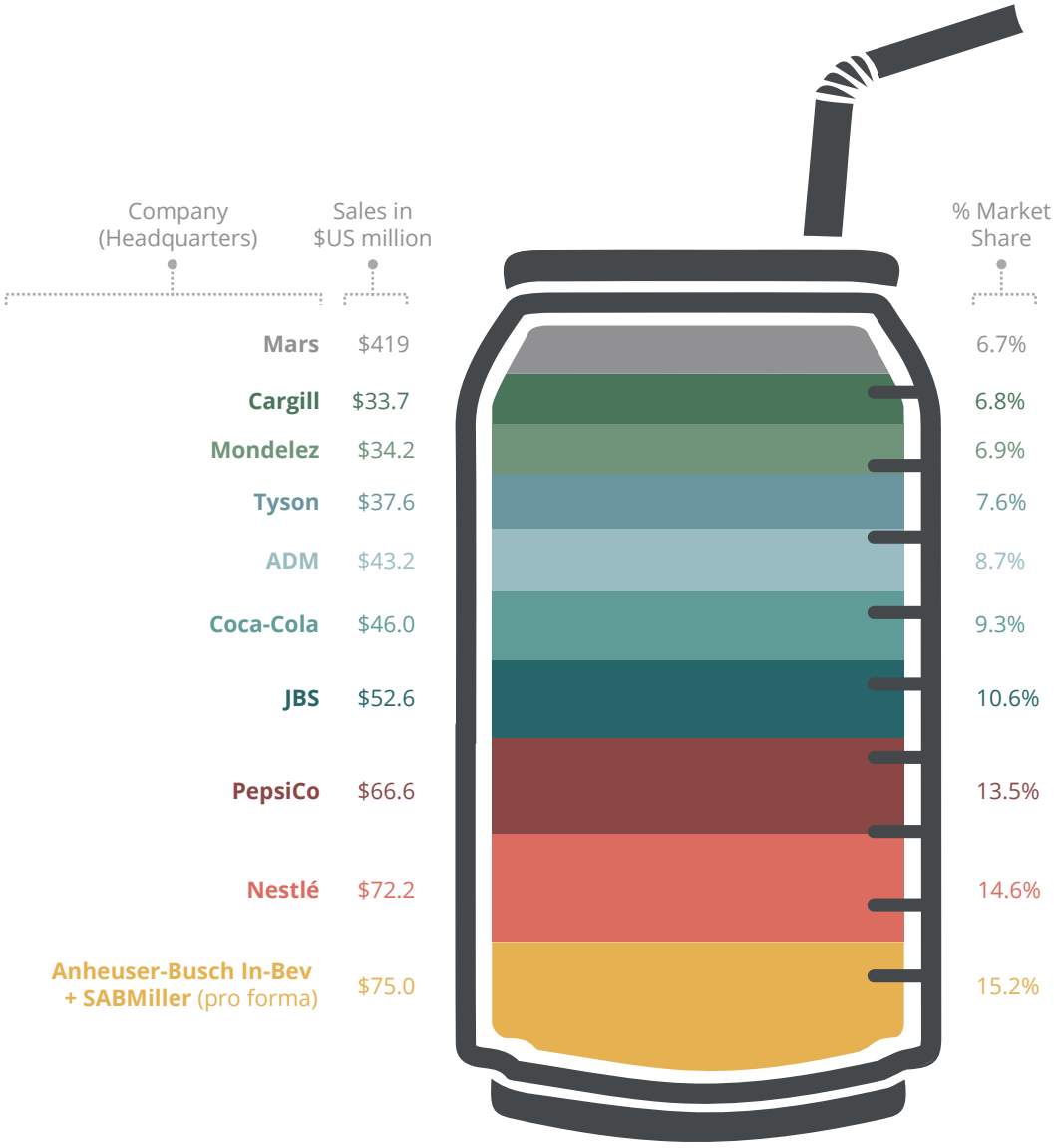
Large packaged food processors have struggled to adapt quickly and stay relevant. Most large food processing companies have responded by revamping product portfolios, adding new brands or acquiring brands that are perceived as "healthy," "natural" and "organic" (Heneghan, 2015). The trend is not new, but it is currently driving M&A activity in the F&B sector. Over the past three years, for example:

- General Mills (USA) acquired Annie's Inc. (USA) for $820 million
- Hormel (USA) acquired Applegate Farms (USA) for $775 million

FIGURE 12 • TOP 10 FOOD AND BEVERAGE COMPANIES, 2014

(Data source: ETC, 2015)

The food and beverage industry focuses on the post-harvest processing of raw agricultural commodities into products – both foodstuffs and feedstuffs for human and animal consumption.

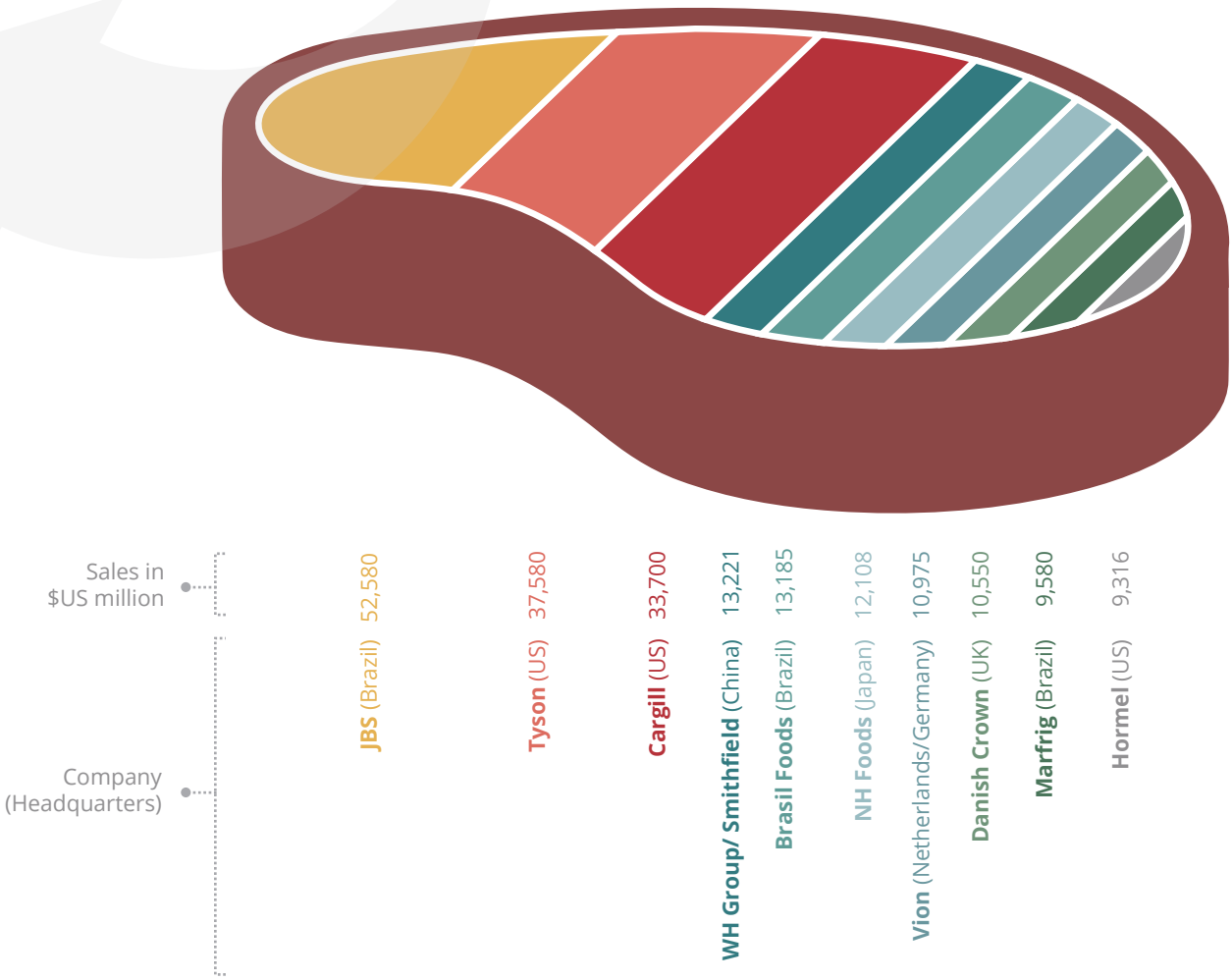


- Hain Celestial (USA) acquired Rudi's Organics (USA) for $61.3 million
- Mondelez (USA) acquired Enjoy Life Snacks (USA)
- Hershey (USA) acquired Krave Pure Foods (USA)
- Unilever (USA) acquired Talenti (USA) and Grom (Italy)
- Danone Foods (France) acquired WhiteWave Foods (USA) for $12.5 billion[19]
- Campbell (USA) acquired Pacific Foods (USA) for $700 million (still on hold in October 2017 due to former Pacific Foods shareholder lawsuit against Pacific Foods)

19. For disclosure, IPES-Food receives substantial financial support from a private family foundation whose wealth is derived from Danone Foods. Following a principle of independent research, IPES-Food does not believe that its research or recommendations are in any way affected by this financial support.

FIGURE 13 • TOP 10 MEAT PROCESSING COMPANIES, 2014

(Data source: ETC, 2015)



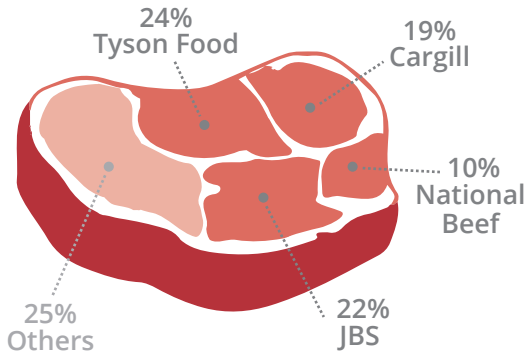
The meat processing sub-sector offers a further snapshot of recent consolidation in the F&B processing industry (see Box 6). According to the OECD (2016) and FAO (2014), demand for global meat production has increased by 20 % over the last decade, driven by rising protein consumption in emerging economies. While production rates are expected to slow, they are still estimated to be 17% higher than over the 2012-2014 period (ibid). In this context, companies based in the Global South are playing a leading role in F&B industry concentration. The top 10 global meat processing companies now include two Brazilian companies (JBS and Marfrig) and one Chinese industry leader (WH Group/Smithfield). Anticipating growth in urban markets, Cargill is expected to develop a meat processing operation in sub-Saharan Africa in the next decade, while Thai food processor, CP Foods, built its first chicken farm and feed mill in Tanzania in 2010 (Bunge, 2015).

Consolidation in the animal processing sectors (and the retail sector beyond that - see below) also translates into significant shifts in the way livestock production is organized, driving a de facto consolidation and standardization of production upstream, often in the shape of 'contract farming' (see Section 2). As much of 70-80% of pork sales in Italy and the UK are carried out through medium or long-term contracts (Antoine et al., 2014). A decade ago, contracts between breeders and processors accounted for almost 60% of all pork (Miele & Waquil, 2007).

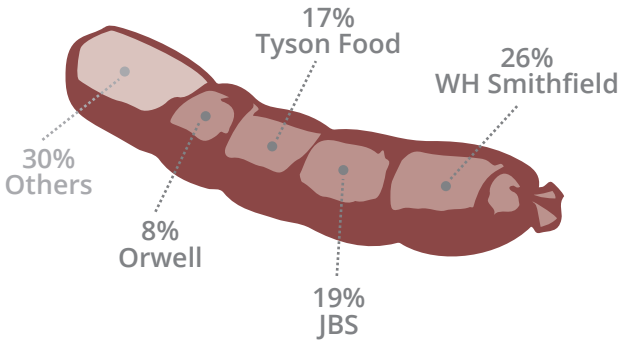
FIGURE 14 • CONCENTRATION IN THE MEAT PROCESSING INDUSTRY

(Data source: ETC, 2015)

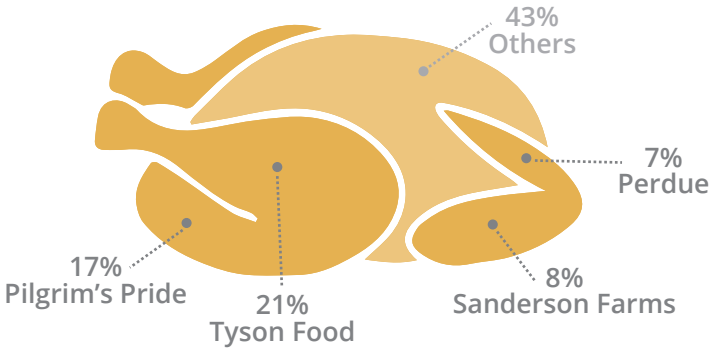
4 FIRMS CONTROL 75% OF BEEF SLAUGHTER



4 FIRMS CONTROL 70% OF PORK SLAUGHTER



4 FIRMS CONTROL 53% OF CHICKEN SLAUGHTER



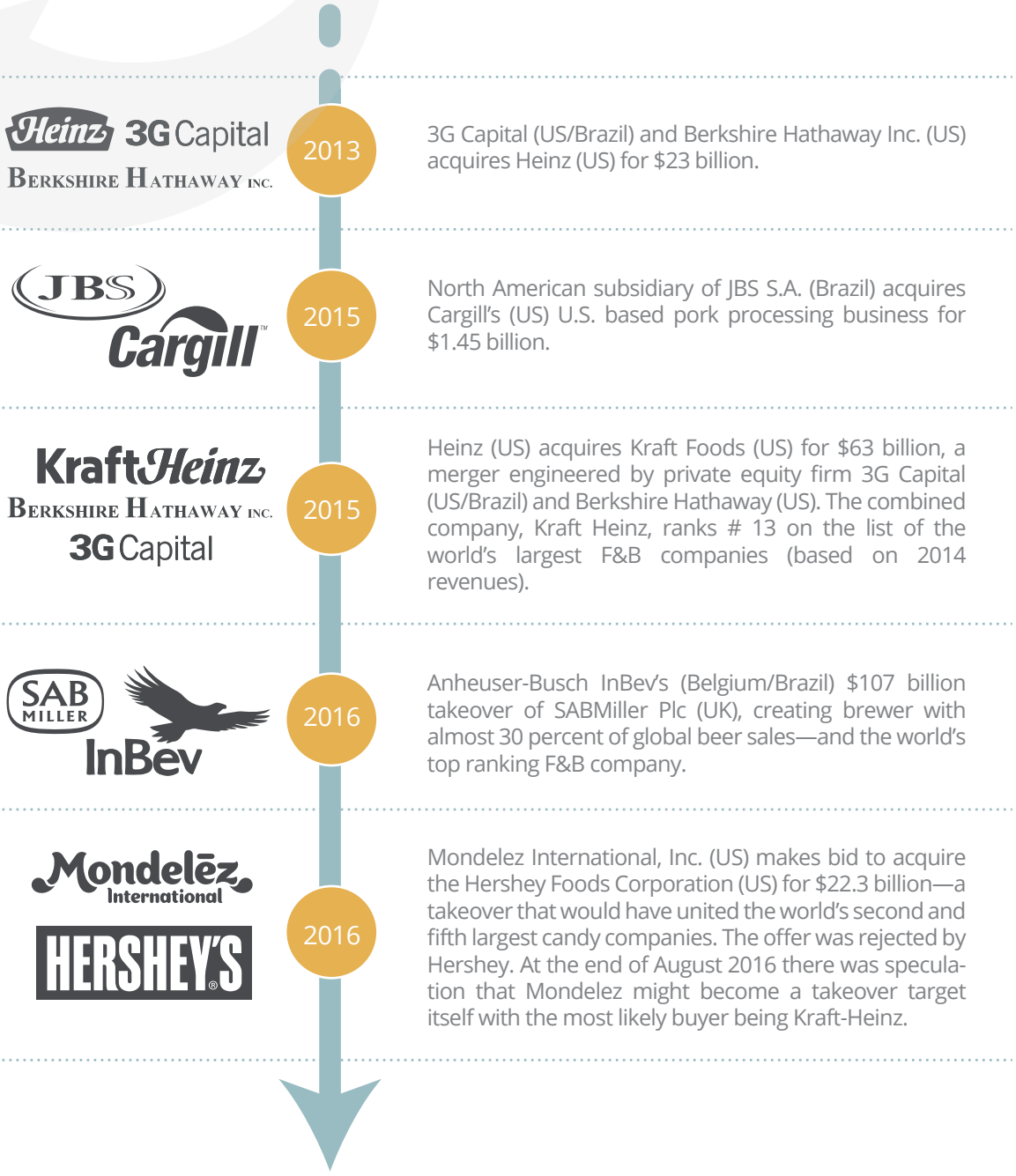
In the US, from 1993 to 2010, the share of hogs sold independently on cash markets dropped from 87% to 5-7% (Hayenga et al., 1996; USDA, 2010). The majority of hogs are now controlled either through direct corporate ownership or highly-restrictive production contracts by four meatpackers – WH/Smithfield, Tyson, JBS and Cargill, many of whom own subsidiary processing companies around the globe (Douglas, 2015). Throughout most of the US, pork producers only have access to one of these four firms – who, together, control 65% of the market.

The US model of contract farming has also had an influence on Chinese pork processors since the late 1990s. Leading state-subsidized processing companies, mainly 'Dragon Head Enterprises', have been rapidly adopting contract farming models to increase productivity and control over broiler chickens and hog production[20] (Schneider & Sharma, 2014; Patton, 2015).

The seafood production and processing sector, which includes both aquaculture and wild-caught seafood, provides another ex-

20. Authorities look to DHEs to serve as the model for modernizing China's agriculture through scaled up production and vertical integration (Schneider & Sharma, 2014). 70% of production for livestock processing DHEs must come from contract farming, shareholding or "cooperation" between rural households and DHEs. In 2011, over 110 million rural households were involved in DHEs who provide 70% of pork and chicken for domestic consumption (Huang, 2011). All but one of China's top 10 pork processing firms has DHE status.

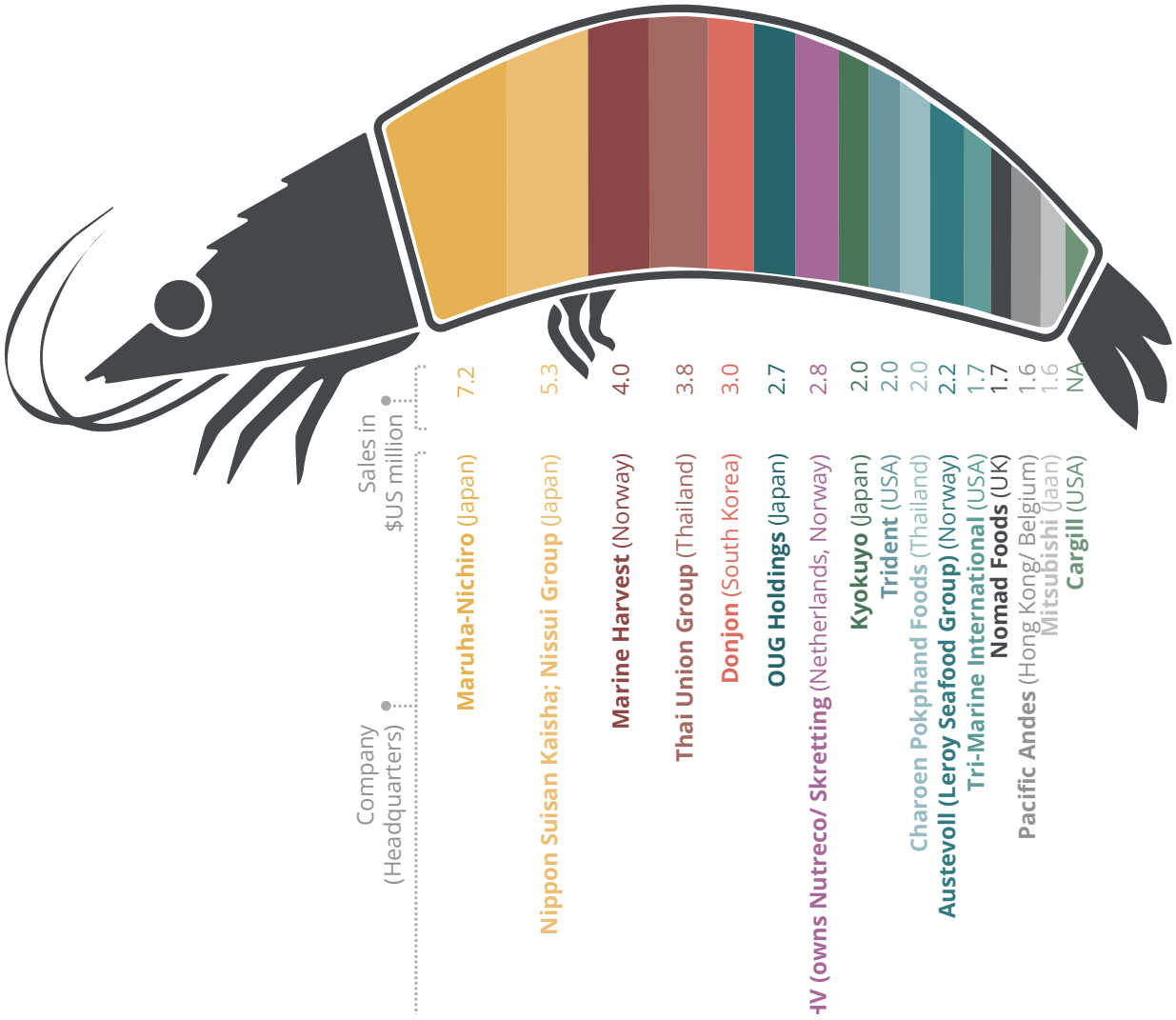
FIGURE 15 • SAMPLE OF RECENT FOOD AND BEVERAGE INDUSTRY MERGERS - COMPLETED, PROPOSED AND PENDING



ample of rapid consolidation. The period between 2010 and 2013 saw 212 M&As in the global seafood industry, a trend that is still ongoing (M&A International Inc., 2013). Together, the 15 largest companies account for an estimated 44 % of the combined revenues of the leading 100 seafood companies (Undercurrent, 2016). Not only is seafood the most globally traded segment of the animal protein industry, it is also the food commodity of highest traded value, garnering more than US$140 billion in 2014 – and doubling in value since 2009. Today, salmon and shrimp together account for 36 % of the total value of traded seafood (Terazono, 2016a).

FIGURE 16 • TOP 10 SEAFOOD COMPANIES, 2014

(Data source: ETC, 2015)



1.8 FOOD RETAILERS

In 2014, the value of global retail spending on food was $7.5 trillion[21]. The world's top ten grocery retailers make up 29.3 % of total sales, while the leading three retail companies, Walmart, Schwarz Group and Kroger, represent 5.6% of global grocery spending. Walmart far outweighs food retail competitors in revenue terms, with nearly half a trillion dollars in total revenue in 2014. With over 11,500 stores in 28 countries, Walmart is not just the world's largest retailer and the world's biggest grocery store chain; it is also the fifteenth largest public company overall (Gensler, 2016).

While there appears to be a lesser degree of concentration in the global food retail industry compared to other sectors, markets are highly concentrated on a regional level, with recent

21. This assumes that Planet Retail's $7.5 trillion global market figure reflects grocery sales only—not electronics, fuel, kitchenware, etc., which are found in all big box "grocery" retail stores. In 2012, the USDA's Economic Research Service (ERS) put the global grocery spend at approximately $4 trillion (USDA, 2016).

FIGURE 17 • TOP GROCERY RETAILERS, 2014

(Data source: ETC, 2015)

Grocery retailers sell perishable and non-perishable foods to consumers via retail outlets (stores or online). The world's largest grocery retailers sell non-food products (i.e., non- edible grocery) along with food.

consolidation efforts remaining consistent with this trend. Unlike agricultural inputs or raw materials, most food products are purchased by individuals in the direct vicinity of their home, meaning that the concentration of retailers in a given region is what matters in terms of shaping food systems and food choices.

The top four US food retailers accounted for just under 40% of national grocery sales in 2015 – double the four-firm concentration ratio from the early 1990s (USDA ERS, 2016). In 2011, the largest five retailers in thirteen EU members states had a combined market share of over 60%[22]. In Denmark and Estonia, this

22. The 13 countries include Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Portugal, Sweden and the United Kingdom.

retail market share exceeded 80% (European Commission, 2014b).

A growing trend is the rise of e-retailing. Three of the world's top eight grocery retailers - Walmart, Tesco, and Costco - are now also among the world's top e-retailers, occupying the positions of fourth, sixth, and sixteenth largest e-grocers respectively (National Retail Federation, 2016). The prevalence of online grocery shopping varies widely in countries across the world, with a global average of 3.9% of national "grocery" markets (Kantar Worldpanel, 2015). While this percentage appears minimal, analysts highlight that a 1% increase in online grocery buying in the USA (from the current 0.8%) represents $7 billion (ibid). South Korea's online grocery shopping well exceeds the average at 13.2%; the UK's online grocery shopping is the second largest market, accounting for 6% of grocery sales (ibid). A 2015 study from IGD claims that China is the world's biggest market for online groceries—valued at $41 billion in 2015 and predicted to grow to $178 billion in 2020 (Byfield-Green, 2015). More recently, Amazon's use of Big Data to track consumer shopping habits and preferences also has investors speculating that the company could become one of the world's top 10 food retailers within a decade; already, the company provides consumers with cell phone applications and online systems for grocery delivery, and will soon expand to restaurant delivery, its own brand of prepared meals, and cashierless and sensor-based supermarkets integrated with its online customer platform – a development likely to affect its recent acquisition of Whole Foods.

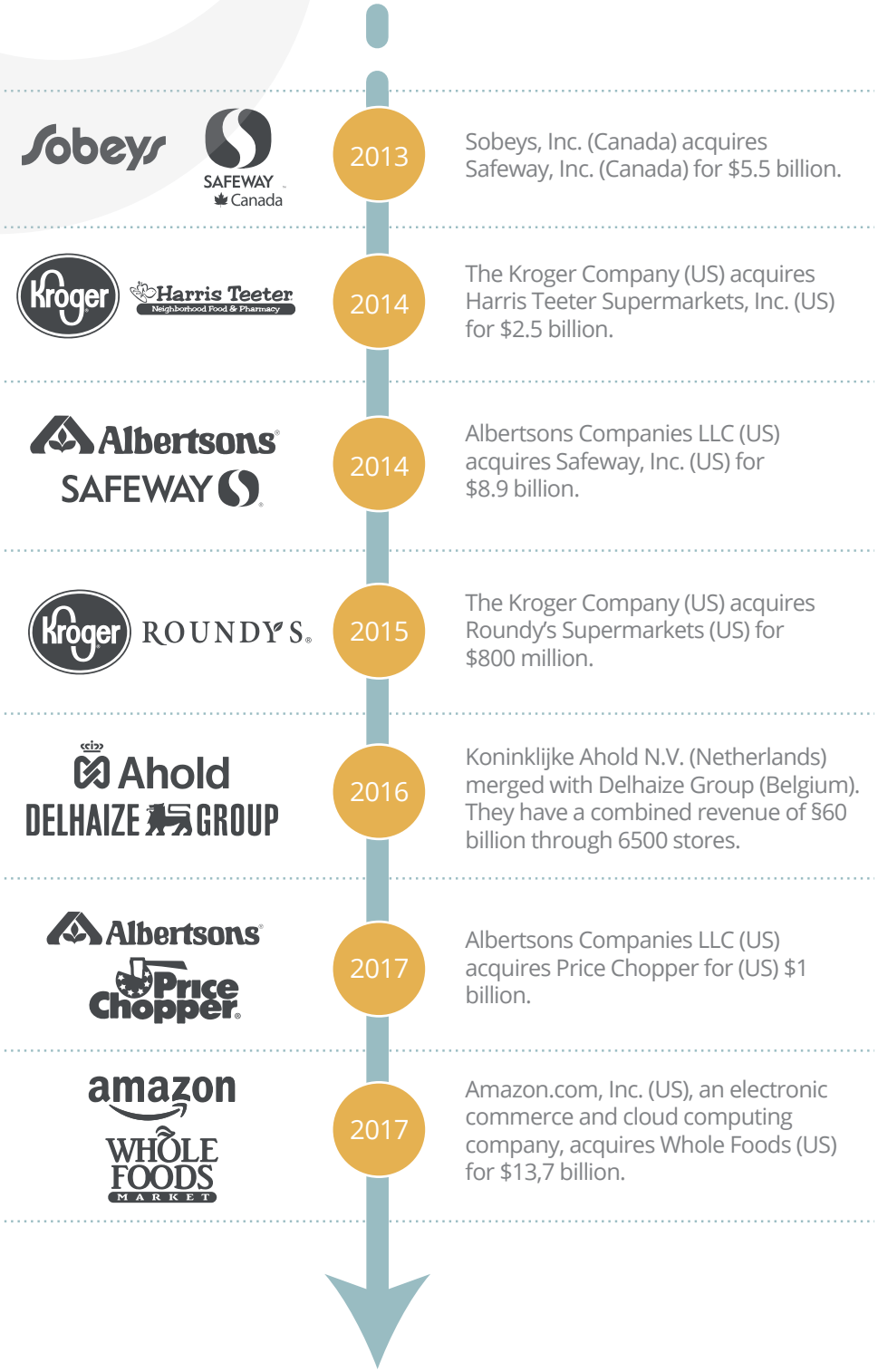
CONCLUSION ON THE CURRENT STATE OF CONCENTRATION ACROSS THE AGRI-FOOD SYSTEM

A significant horizontal and vertical restructuring of food systems is clearly underway within and across all agri-food sectors. Agrochemical companies are acquiring seed companies, paving the way for unprecedented consolidation of crop development pathways and controlling access to farmers. The fertilizer industry's dependence on limited and location-specific potash and phosphate renders the sector inherently concentrated and recent industry overcapacity and a drop in prices is now driving further integration. At the same time, the fertilizer industry is experiencing moves to diversify and integrate across food system activities, via hostile takeovers, buying and selling off regional assets and joint ventures – with mixed results.

Meanwhile, livestock and fish breeders and animal pharmaceutical firms - relatively small and often-overlooked sub-sectors in the agri-food complex - are pursuing deeper integration with each other and with producers to meet the needs of the industrial livestock industry, and to continue shaping those needs. Leading farm machinery companies - already possessing huge market shares - are looking to consolidate up- and down-stream, and are moving towards ownership of Big Data and artificial intelligence through control of satellite imagery, robotics, and trending market information.

In the middle of the chain, agricultural commodity trade remains dominated by a handful of actors - including new mega-players from emerging markets - with trading, shipping and processing increasingly rolled together into highly-integrated operations straddling different commodity sectors and regions, and independent grain traders finding it ever more difficult to compete. Food processors and retailers are the biggest players in the system. To maximize revenue growth, they are seeking

FIGURE 17 • SAMPLE OF RECENT FOOD RETAILER MERGERS - COMPLETED, PROPOSED AND PENDING



international expansion and capturing new segments of the market to meet changing consumer demands. Many leading F&B processors already control the digital data for raw material sourcing, processing, marketing and delivery. Because of sourcing and quality concerns, they are moving upstream to better oversee their supply; to meet changing consumer demands, they are reconstructing their images through the acquisition and creation of seemingly healthier brands.

At the end of the chain, retailers are struggling to consolidate their position in developed markets while simultaneously globalizing their activities to access growth markets. New actors such as Amazon are vying to harness Big Data possibilities in order to track and analyze consumer shopping habits to strengthen both in-store and online delivery systems.

The current financial climate facilitates M&As – from the mounting pressures exerted by active and passive investors to the borrowing incentives created by a decade of low interest rates. In addition, technology has always driven consolidation in the agri-food sector, and today its role is even more prominent. Beyond the physical (e.g. drones) and scientific (e.g. gene editing) technologies behind agri-food sector consolidation, information technology comes out as the newest driver of consolidation. There are now three kinds of related information central to corporate strategies: 1) The genomic information and gene editing techniques needed to rapidly adapt crops and livestock species to shifting conditions and locations (e.g. DuPont's screening of plant DNA to identify 'climate-resistant genes'); 2) the weather and soil information needed to quickly adapt seasonal production decisions (e.g. John Deere's ability to obtain near real-time soil analysis); and 3) market information needed to guide production and marketing strategies, both in accessing information on competitors and on consumers (e.g. Kroger's consumer data-mining). Moving far beyond commodity-market analytics, Big Data is now relevant to all areas of industrial agriculture and its information requirements. It connects inputs—seeds, fertilizers and chemicals—to farm equipment and F&B processers and retailers to consumers in an unprecedented way, and in the process, data has become a major driver of consolidation.

While concentration is more pronounced in certain sectors, consolidation now characterizes all industries to some degree. More importantly, dominant firms no longer operate in one industry, but across multiple industries, expanding their activities and influence beyond individual points in the supply chain. The lines between agri-food sub-sectors have become increasingly blurred, making it harder to isolate firms and their activities, let alone to gauge the full extent of consolidation across food systems and develop relevant policy responses. Consolidation is occurring in response to a variety of different drivers, from short-term market fluctuations (both upturns and downturns) to longer-term trends that put an increasing premium on economies of scale (i.e. the spread of an industrial agriculture model based around large volumes of undifferentiated commodities and packages of mutually-dependent inputs, and pressure from financial actors). Moreover, concentration in the agri-food industry is also taking on a logic of its own, with firms consolidating in reaction to similar steps being taken by new and traditional competitors. In other words, in line with economic orthodoxies and historic trends, firms across the agri-food sector view consolidation as a necessary and even inevitable growth strategy. Nonetheless, the recent spate of M&As takes this to a new scale in terms of the extent of vertical and horizontal integration already in place, with powerful new drivers entering the fray and accelerating the process.

02 The Impacts of Concentration

The overview in Section 1 showed that current consolidation trends have major implications for the shape and structure of food systems. The unprecedented concentration now sweeping across the sector has been accompanied by a revolution in business tactics and technologies. These shifts have major implications in terms of how and to what extent challenges like climate change and global hunger will be addressed. In this section, we identify the key impacts of ongoing concentration, and of recent M&A activity in particular, with a view to understanding how it affects our ability to respond to these challenges and, more broadly, to build socially, environmentally and economically sustainable food systems.

Isolating the specific impacts is challenging. With a handful of firms controlling more than half of global markets in their sectors, the actions/impacts of those companies and of the broader sector are hard to extricate from one another – a challenge facing competition authorities when they evaluate M&As (see Section 3.a). Meanwhile, the increasing connections between the various sectors and the globalized nature of food systems – both trends reinforced by recent consolidation – make it difficult to attribute specific impacts (e.g. environmental degradation, poor working conditions) to specific developments at a given link of the chain.

The analysis below is therefore focused on the big picture, asking how industry consolidation is reinforcing and reshaping the broader dynamics and imperatives of global food systems. Eight major impacts of consolidation are presented below:

IMPACT 1
Redistributing costs and benefits along the chain, and squeezing farm income;

IMPACT 2
Reducing farmer autonomy in a context of 'mutually-reinforcing consolidation';

IMPACT 3
Narrowing the scope of innovation through defensive and derivative R&D;

IMPACT 4
Hollowing out corporate commitments to sustainability;

IMPACT 5
Controlling information through a data-driven revolution;

IMPACT 6
Escalating environmental and public health risks;

IMPACT 7
Allowing labour abuses and fraud to slip through the cracks;

IMPACT 8
Setting the terms of debate and shaping policies and practices.

IMPACT 1

Redistributing costs and benefits along the chain, and squeezing farm income

The economies of scale brought about through consolidation are generally considered to lower costs throughout the chain. However, these supposed efficiencies have not translated into lower input costs or greater choice for farmers. For example, from 1990-2015, the price of farm inputs in the US rose faster than farmgate commodity prices; seed prices rose twice as fast as farmgate crop prices (Fuglie et al., 2011; Schnitkey & Sellars, 2016). In the EU, farm input costs increased by almost 40% between 2000 and 2010, leading the European Parliament and other actors to raise concerns about the implications for farm viability (European Parliament, 2011). The implications are most worrying in regions and sectors where the number of suppliers and buyers is particularly limited. For example, the high input and service costs – and low product prices – offered to sugarcane farmers by large sugar mills in Southeast Asia reflects the lack of alternative processors accessible to farmers in the region – and squeezes their incomes (AAN-ESAN, 2009; Clay, 2004; UNDP, 2010).

The current spate of mergers is likely to exacerbate these trends. One estimate suggests that seed prices for corn may increase by 1.6-6.3%, while soy seed is expected to increase by 1.3-5.8% as a result of the Dow-DuPont and Bayer-Monsanto mergers (Bryant et al., 2016). Industry observers point out that higher seed and input prices reflect the increase in the value-added characteristics developed by industry R&D programs – particularly genetically modified (GM) seed traits, due to rising technology licensing fees[22]. However, this 'value' has not generally translated into higher margins for farmers, while those wishing to move away from an input-intensive mono-cropping model face a variety of obstacles and path dependencies (IPES-Food, 2016).

The implications of consolidation in the commercial input industries is not immediately obvious for the millions of farmers around the world for whom commercial seeds, pesticides, fertilizers and veterinary antibiotics are in any case out of financial reach. The vast majority of the world's farmers continue to self-provision in seeds

22. As noted by Clapp (2017), licensing fees were easy to track in the 1990s and early 2000s, when they were accounted for separately in seed contracts between farmers and agribusiness firms. Today, these fees have been integrated into the overall seed price and are harder to isolate. However, in 2007, Fuglie et al. (2011) identified that licensing fees made up 30-75 % of the GM seed costs in the US and EU.

(Neate & Guei, 2010). Though the situation varies by crop and region, 80 to 90% of the seeds planted by farmers in developing regions come from the peasant or community networks – that is, farm-saved seeds, including seed exchanges with neighbouring farms and seed sales from local markets or seed fairs; the remaining 10 to 20% is supplied commercially – that is, through seed companies, government seed sources and other institutions (Jarvis et al., 2000; CIAT, 2014).

However, even these small and largely self-sufficient producers are not immune from the broader social and economic impacts of industry consolidation, as informal seed networks in the Global South are increasingly squeezed out (see Impact 8). Meanwhile, contract farming arrangements - in which inputs are often provided by the buyer - are bringing increasing numbers of smallholders in the global South into the orbit of global supply chains and multinational buyers, with a range of implications (see Impact 2).

Increasingly consolidated food processing, distribution and retail sectors also allow costs to be shifted up the chain and farmgate prices to be driven down. In many rural areas, smallholder farmers and cooperatives are reliant on a limited number of buyers, who are able to set the terms and the prices (Domina and Taylor, 2010; Moss and Taylor, 2014). For example, US livestock producers commonly find themselves in markets with only one or two processors to whom they can sell their products. In such markets, producers received 8% less income than those in areas with more options (MacDonald & Key, 2012).

The bargaining power of big buyers can coerce discounts and/or pass costs traditionally assumed by retailers back up the chain. For example, one study demonstrates that the UK's dominant retailers pass the costs of their internal compliance standards onto their producers in both the global North and South, who must often adhere to multiple and often divergent rules (Fuchs & Kalfagianni, 2010; Dolan & Humphrey, 2004). Priority is frequently given to the largest producers capable of both absorbing the higher costs of compliance and meeting high volume requirements; these larger producers are themselves often owned or under contract with exporting companies.

Further, retail chains often require suppliers to pay 'slotting fees' to stock a new product in their stores, as well as the 'pay-to-stay fees' charged to maintain access to shelf space for existing products. New or smaller suppliers may not be able to access adequate shelving space as slotting fees run high – in the tens of thousands of dollars for products placed in supermarkets across a region, or hundreds of thousands if shelved across a country (Copple, 2002). For some manufacturers, this results in billions of dollars spent on shelving fees per year, representing over half of the supermarket industry's total annual profits (Fields & Fulmer, 2000). In the US, the Federal Trade Commission held public workshops on these fees in 2000, little was concluded beyond noting that the issue deserved greater scrutiny (US Federal Trade Commission, 2003b).

Industry consolidation – and the accompanying shifts in practice and redistribution of costs – has not paved the way for systematic decreases in consumer food prices, an argument often used to justify M&As. In the broadest and most comprehensive review of mergers to date in a variety of sectors, consumer prices in the US were in fact found to increase on average by more than 4% – and up to 9% for more than 60% of the products surveyed in highly concentrated markets (Kwoka, 2015)[23].

23. While research calculations are based on refereed journals and working papers, Kwoka cautions that results were derived solely from industries with available data and in which there is policy interest. Still, additional studies on the impact of mergers on prices all note price increases – though some more modest (see for example Mariuzzo et al., 2016; Langenfeld, 2017)– as a result of industry concentration and whether prices resulting from industry mergers were remedied by anti-competition law.

Studies further demonstrate that retail sector concentration leads to higher prices over the long term as dominant retailers lack the incentive to pass on savings to consumers. For example, while farmgate coffee prices fell by a staggering 80% between 1997 and 2002, retail prices only dropped by 27%; coffee companies, meanwhile, saw their profits rise by 41% in the case of Starbucks and by 20 % for Nestlé in 2001 (Charveriat, 2013). These patterns are manifesting themselves across the economy. A working paper for the National Bureau of Economic Research, surveying corporate markups across several US industries between 1950 and 2014, concludes that prices exceeded costs by an average of 18% until 1980, but the gap has now risen to 67% (De Loecker & Eechkout, 2017). In addition, mergers also dull the incentive to innovate to provide lower-cost products and services (Carstensen, 2000; Weis, 1989; Howard, 2009) – the broader implications for Innovation are discussed in Impact 3).

As M&A activity increases, industry collusion and price-fixing is more likely to occur, with detrimental effects to both producers and consumers. In late 2016, a series of lawsuits were filed by US chicken farmers against major poultry processors, alleging collusion that resulted in up to a 50% premium being paid by consumers for their meat (Shanker, 2016; Leonard, 2017). Facilitated by proprietary information sharing and deals made between company executives at private events, leading companies such as Tyson Food Inc. and Pilgrim's Pride Corp. were accused of purposefully holding down supply to drive up prices from 2008 onwards (ibid).

In other words, while consumer food prices may remain close to historical lows, industry consolidation is unlikely to be a key driver of this trend – even as farmgate prices are driven down and farm incomes are systematically squeezed. Moreover, delivering 'cheap food' is an increasingly problematic benchmark of progress in food systems, given that food prices so often fail to capture the many environmental and social externalities of industrial food production, or to reflect the full costs and value of sustainable forms of production (the 'expectation of cheap food', as a factor locking in industrial food systems, is addressed in IPES-Food, 2016).

IMPACT 2

Reducing farmer autonomy in a context of 'mutually-reinforcing consolidation'

The huge bargaining power of highly concentrated processors and retailers not only allows costs to be passed up the chain, but also reduces farmer autonomy and exposes them to economic risks.

For example, farmers are becoming more vulnerable to sudden and unilateral shifts in sourcing policies from the handful of dominant buyers. As the major food and beverage industry players amend production standards to satisfy new consumer trends, producers are often required to accept the changes with little warning (Rotz & Fraser, 2015). For example, in March 2015 Chile's giant salmon industry nearly capsized after Costco drastically reduced imports. Costco opted to buy from Norwegian producers, in response to concerns regarding the over-use of antibiotics by Chilean salmon producers (Esposito, 2015). At the time, Costco sourced about 90% of the 600,000 pounds of salmon fillet it sold per week from Chile, accounting for about 8.5% of all Chilean salmon exports to the US.

Similar disruption occurred on the back of a sudden decision by US candy firms – including Hershey Co. – to go GMO-free in 2016, in response to growing concerns over GMOs among young consumers (Charles, 2016). Almost half of the US sugar supply is derived from GM sugar beets, while the other half comes from sugar cane, which has not been genetically modified on a commercial scale. GM-sugar beet sales plummeted by 41% as a percentage of all sugar sales over the course of the year, resulting in significant financial losses to beet farmers. Though the majority of these farmers operated under contract with large firms, contractors can use the flexibility in contracts to terminate or change them with little notice, including if producers fail to comply with new standards (Worldwatch Institute, 2007; Howard, 2016b). Famers wishing to transition struggled to find non-GM seed, the availability of which had been declining since 2005, when the seven largest sugar beet processors in the US switched to GM beets (see also Impact 6).

Supply shifts such as these may reflect much-needed attention to sustainability, public health and consumer concerns on the part of the food industry. However, the necessary shift towards sustainable farming practices is unlikely to occur in a context where farmers lack predictability and control over decision-making regarding their own livelihoods – and may be forced out of farming altogether.

These examples illustrate the risks of the contract farming arrangements that are increas-

ingly prevalent across food systems, and represent a form of de facto consolidation. A key impact of concentration in downstream sectors is to trigger "mutually reinforcing dual consolidation" across food systems (Farina et al., 2005). Large retailers prefer 'one-stop' sourcing from large-scale wholesaler and processing firms, allowing them to reduce transaction costs and to benefit from a wider diversity of products than could be offered by smaller companies (Reardon et al., 2010). The processing industry, in turn, relies on a handful of buyers for the majority of sales. In 2014, for example, a single buyer, Walmart, accounted for 10% of Heinz Foods' revenues, 19% of ConAgra's, and 26% of Kraft's net sales (Lindeman, 2015). With the 2015 merger of Kraft and Heinz, the food processing giant had become reliant on a single buyer (Walmart) for over one-third of its sales.

Reliance on a small number of buyers has major knock-on effects on the structure and nature of agriculture. Particularly in the livestock sector, farmers are increasingly entering into highly-standardized production contracts to supply one of the handful of major processors. These contracts generally require specific volumes, consistency, and quality of agricultural commodities, and determine how animals or crops are to be grown, which inputs are used, who provides them, and the price farmers will receive. Production contracts are not exclusive to consolidated companies (e.g. a livestock farmer may contract a grain farmer to supply them with feed), but are increasingly linking actors with major discrepancies of scale and bargaining power. Almost 90 % of chicken farmers in the US operate under contract with major nation-wide or multinational firms – up from less than 10% in the 1950s (National Chicken Council, 2012; USDA, 1999).

Optimistically, these arrangements bring the expertise and assured sales of a reduced number of purchasing agents to the farmgate, while buyers benefit from a consistent and controlled supply (Glover and Kusterer, 2016). Contract

FIGURE 18 - CONCENTRATION IN THE EUROPEAN SEED MARKET

(Friends of the Earth, 2014)

5 COMPANIES CONTROL

75%

of the market for maize seed

4 COMPANIES CONTROL

86%

of the market for sugar beet seed

5 COMPANIES CONTROL

95%

of the market for vegetable seed*

*Monsanto alone controls 24%

farming allowed the US poultry industry to drive down production costs and undergo rapid economic growth through the adoption of new technologies on a massive scale (e.g. around disease control and feed improvement) (Ogishi et al., 2003).

This shift has major impacts on farm autonomy, however, and threatens the long-term sustainability of food systems, including in economic terms. The spread of contract farming has brought key farming assets under the ownership of non-farming food chain actors, while enforcing consolidation across the world of seemingly independent farm holdings. As contracts are seldom made publicly available, there is insufficient data on how and under what terms contract farming occurs. In practice, the underlying power imbalances often pave the way for unfavourable and restrictive conditions for farmers, who tend to have limited market information and few alternative outlets to make their decisions (De Schutter, 2011).

Farmers in the Global South are particularly vulnerable to risks such as limited transparency of price determination, contractual terms which may be broken if the market changes or conditions are not deemed satisfactory, loss of flexibility over production methods and inputs, and indebtedness to contractors. For example, in Eastern and Southern Africa, smallholder farmers enter contracts with large sugarcane estates that provide them with seeds, fertilizers and transport. However, contracts tend to require farmers to sell 100% of their cane production to the estate, with loan repayments tied to the delivery of these volumes (FairTrade Advocacy, 2014). Arrangements of this type have often been found to entrench farmers in cycles of poverty and dependency (see for example Singh, 2002; Guo et al., 2005).

In this context, efforts to improve the conditions and oversight of global supply chains and contract farming arrangements are essential. However, further consolidation along the agri-food chain is likely to exacerbate the existing power imbalances that pave the way for unfavorable conditions – and ultimately undermine the autonomy and viability of farming around the world.

IMPACT 3

Narrowing the scope of innovation: defensive and derivative R&D

Consolidation across the agri-food industry has a major impact in shaping R&D pathways and the broader innovation climate in food systems. Over the past 30 years, global private sector investment in agricultural R&D has risen faster than public R&D spending in OECD countries (Pray & Fuglie, 2015). By 2013, private R&D accounted for almost half of agricultural research (Jaruzelski et al., 2017), with public research declining and increasingly focused on complementing and facilitating private R&D (e.g. through IPR protections).[24] In its 2011 study on concentration in agricultural inputs, the USDA observed that the share of private R&D performed by the largest firms was even greater than their market shares (based on 2010 figures in Fuglie et al., 2011). For example:

- The top eight seed/biotech companies accounted for 76% of all R&D spending in this sector
- The top five companies accounted for over 74% of agrochemical R&D
- The top four companies performed over 57% of farm machinery R&D
- The top eight companies accounted for over 66% of R&D in animal health

To put this in perspective, in 2013 the combined R&D budgets of the Big Six agrochemical and seed companies, valued at $6.59 billion, was six times larger than the total USDA Agricultural Research and Information budget ($1.1 billion) (USDA, 2013), and twenty times bigger than the CGIAR's $332.2 million expenditures on crop-oriented research/breeding in the same year (CGIAR, 2013).

The pooled resources and combined weight of increasingly consolidated agribusiness firms has long been touted by industry leaders as the key to a dynamic innovation climate. Such arguments date back to the 1980s, when Don Duvick, the research director of Pioneer Hybrid (then the world's largest seed company, later merged with DuPont and now merged with Dow) made the case that the increased research capacity of merged companies would allow for greater and faster 'diversity in time': input companies would have a research pipe-

24. Public R&D spending in the Global South is on the rise, including Brazil, India, and China. From 2008 to 2013, China increased it spending by almost 70 %, and is now contributes a majority of the net global growth in public-sector agricultural R&D. (Jaruzelski et al., 2017)

line providing farmers with an annual turnover of varieties in response to rapidly evolving diseases or pests, and other environmental stresses. From this perspective, consolidation is required to deliver the scale (research costs, infrastructure requirements) and scope (global applications) to rapidly invent and deploy new technologies around the world. This stands alongside the 'diversity in space' customarily practiced on the farm, whereby farmers protect their harvests with species and genetic diversity in the field (e.g. by intercropping, mixed crop-livestock farming). In addition, a different version of 'diversity in time', e.g. the use of crop rotations, has traditionally been adopted by farmers to boost resilience and mitigate risks. By contrast, farmers relying on the research pipelines of agribusiness firms may be left to shoulder the risks, e.g. of pest outbreaks, while seed companies supply their customers with new, resistant seeds in following years.

More broadly, evidence from a range of sectors suggests that economies of scale fail to translate into dynamic innovation strategies, with highly concentrated markets often working against innovation. In an overview of innovation in the US automobile, computer and pharmaceutical industries, Adams and Brock (2004, p.49) noted that innovation in oligopolistic markets often comes "reluctantly" from leading companies when it occurs at all. A further study conducted by the US Federal Trade Commission suggests a strong negative correlation between high levels of market concentration and innovation (FTC, 2003).

Buyouts are often pursued with innovation in mind, but primarily in terms of consolidating R&D costs - not increasing the quantity or quality of innovation. While private companies now make up a larger portion of total R&D spending in many sectors, the R&D budgets of large firms are frequently downsized as a result of consolidation (Lynch & Chazan, 2014). Moreover, mergers between R&D-oriented firms have been shown to reduce the types of innovation that are practiced (Moss, 2016; Haucap & Stiebale, 2016). The dominant trend is for large firms to buy out, enter licensing agreements, or partner with start-ups to fill in their innovation gaps. While the trend towards scaling innovation is not inherently problematic, analysts – including Chicago School economists - are increasingly concerned by the capacity of dominant firms to stifle bourgeoning competition through buyouts (The Economist, 2017c). Already, the leading companies in about two thirds of the 900 monitored industrial sectors have significantly increased their market share since the 1990s, while startup companies have diminished in number and in size (ibid).

While the net R&D figures above suggest that today's dominant agri-food companies are addressing the innovation challenge head-on, a closer look at research and innovation trends suggests that disincentives to innovation and increasingly defensive modes of R&D (i.e. R&D intended to defend existing products or technologies in the face of new competition or regulations, instead of investing in new ideas) are the reality in these highly concentrated markets. A series of significant and highly-anticipated advances have failed to materialize since the agri-food industry stepped up its consolidation in the 1970s. For example, commercial breeders initially argued that intellectual property protection would give them the incentive to domesticate new species of fruits and vegetables or, at least, to expand the market for a wider range of crops; however, there has been little to no increase or expansion (Dutfield, 2000; Phillips McDougall, 2013).

While the volume of R&D spending in the agri-food sector may be high, the scope remains strikingly narrow. The consolidation and privatization of R&D budgets has focused innovation on a narrow range of crops, technologies and approaches, creating path dependencies that detract from research on traditional crop varieties or social innovation strategies (Rahman, 2009). R&D spending has centered on crops and technologies with the highest commercial returns (Piesse & Thirtle, 2010), providing lit-

tle space for commercial innovation for crops that are often most important for smallholder farmers in the South, and for delivering diverse, nutrient-rich diets. As much as 40% of private breeding research goes to one crop, maize (Fujisaka et al., 2011).

In crop chemicals, the number of new active ingredients undergoing R&D decreased by 60% between 2000 and 2012 (Phillips McDougall, 2013). Recent trends suggest that the majority of patents being registered do not represent new breakthroughs - let alone innovations with relevance for the challenges food systems now face. According to USDA researchers, three firms (DuPont, Monsanto, Syngenta) accounted for nearly three quarters of all US patents issued for crop cultivars between 1982 and 2007 (ibid). As mentioned by industry analysts, "on a global basis, [...] a greater share of R&D investment is being spent on defending products as they come off patent, including seed treatment and formulation technologies – rather than new active ingredient research" (ibid).

For example, with only a handful of firms selling Bt cotton or GM soybeans (Naseem & Oehmke, 2008), the path dependencies are greater still for GM crops. Once a company has gone through the costs and regulatory maneuvers to bring a pesticide to market, it is more lucrative for companies to breed GM seeds that boost sales of proprietary chemicals than to develop alternative agronomic solutions to pests, diseases and changing climatic conditions (Glover, 2010). Between 1995 and 2005, pesticide development costs rose by 118%—but the greatest share of R&D expenditures went to preserving sales of old chemical products facing patent expiration. The dependence on a firm's old proprietary technologies appears to actively constrain innovation (Gapper, 2015). For these companies, the practical cost of bringing a new pesticide to market averages around US$286 million, while the cost of bringing a new GM variety is closer to US$136 million (ETC, 2015). The approaches adopted by dominant firms also impact other companies' capacity or willingness to innovate. An increasing market share for transnational corporations in transitional economies has been shown to reduce local innovation and knowledge diffusion outside a company's own networks (Voinea, 2008).

Consolidation is also affecting the innovation climate in food processing and retail, cementing a focus on product differentiation over other forms of innovation. Here, new product lines are proliferating faster than ever. The food and beverage industry typically introduces over 21,000 new food and drink products per year (USDA, 2014a). However, this should not be confused with meaningful steps to innovate in terms of how those products are produced, composed, sourced and delivered (and the resulting implications for sustainability). While consumers may believe they are choosing among diverse products made by competing companies, they are often selecting among only notionally – or promotionally – different products from the same firm (ibid). ConAgra, for example, sells six different brands of popcorn, all containing a nearly identical ingredient list. In the US, margarine sales display a similar trend, with two firms – Unilever and ConAgra – accounting for 51.2% and 16.9% of sales through their six and four different brands respectively (Howard, 2016b). Similarly, new products introduced onto the market under different brands, such as breakfast cereals, are often made up of variations of the same ingredients – with a majority of product investment going into marketing rather than innovative R&D (Lawrence, 2008).

This illusion of product diversity reflects the extensive and growing consolidation of the sector. A 2013 study of supermarket consolidation in the US found that four leading grocery retailers controlled 63.3% of sales of 100 basic grocery items, and more than 75% of sales for 32 of these items (Food & Water Watch, 2013). This type of consolidation does not preclude genuine innovation between product lines. However, the same supply chains and same logics are likely to

underpin many of those products, meaning that much of the choice and diversity at consumers' fingertips - and the implicit innovation in food retail - may be illusory. Indeed, a number of studies in Europe and the US demonstrate that increased market power results in reduced innovation efforts by manufacturers and food processors (Dobson et al., 2001; Roeder et al, 2000; US Federal Trade Commission, 2003a). As in the input sectors, corporate concentration can lead to barriers to entry – to the detriment of smaller and potentially more innovative actors. For example, new entrants can be shut out when dominant actors pay retailers to exclude products similar to theirs (Howard, 2016b).

A defensive R&D paradigm therefore runs across food systems and has been cemented by the rapid consolidation at the field and fork ends of the chain. These trends have major implications for sustainability, allowing resources to be diverted away from investment in product innovation (e.g. reformulation of ingredients) or in improving agricultural practices. The resulting innovation climate reinforces the focus on 'high-tech' lab-based micro-innovations that have macro (i.e. global) applications: a privately-owned pesticide, a drying process, or a nutritional supplement. Alternative paradigms based on decentralized 'wide-tech' approaches are kept off the table; the potential of a 'wide tech' innovation paradigm to underpin more sustainable food systems is discussed in Section 3.

IMPACT 4

Hollowing out corporate commitments to sustainability

Above and beyond the dominance of specific firms, the process of continual buyouts may in itself undermine firms' abilities to meet their stated commitments to sustainability – let alone to think beyond these pledges and consider more fundamental shifts in their business models. As described in Impact 2, large firms tend to buy out or partner with start-ups to fill their innovation gaps. In the food retail and processing sectors, this often takes the shape of emerging 'healthy' or 'sustainable' brands being bought up by dominant groups. This may allow smaller firms' commitments to sustainability to be gradually hollowed out and subsumed into the practices of the parent company.

Developments in the organic sector demonstrate these risks. In 1995, the American organic processing industry was relatively competitive, with 81 major independent brands on the market. By 2007, all but 15 of these brands had been acquired by multinational food processors (Howard, 2016a). As a result of acquisition, many brands experience a reduction in their commitment to sustainability, the introduction of cheaper, substitute ingredients, or image makeovers dictated by their parent companies. Frequently, changes to companies' own standards are made with little to no warning or notification to consumers. For example, US beverage company, Silk Soymilk, moved towards cheaper, imported, non-organic soybeans to supply a new line of "all natural" milk alternatives following its buyout by F&B conglomerate Dean Foods in 2002 (Cornucopia, 2013). Similar ingredient changes were noted following Coca-Cola's acquisition of Odwalla, and Hearthside Foods' (now Post Food) acquisition of Peace Cereal.

Some companies have gone so far as to create artificial brands or products that give the impression that they are locally sourced. Leading European supermarkets Tesco (UK) and Aldi (Germany) have used fictional farm names that sounded respectively British or German, allowing consumers to believe that their products were local (Levitt, 2016).

Via buyouts, larger companies have also been able to gain representation in industry associations, such as the Organic Trade Associations in the US, allowing them to exert downward pressure on standards – a trend already observed in the US, the EU and New Zealand (Campbell & Liepins, 2001; Warner, 2005; Corporate Watch, 2008; Jaffee & Howard, 2010).

Moreover, as companies expand across sectors, are bought out, or strive to meet the pres-

sures from powerful 'activist investors'[25], the personnel in the boardroom tends to change even more rapidly than usual. As a result, CEOs and board directors with a personal commitment to sustainability may be replaced, or may struggle to internalize their values in the merged enterprise or to build trusting relationships with other partners in the change process (e.g. NGOs, consumer groups). A lack of board or new investor support, and a need to minimize short-term risk, have often been cited by CEOs as reasons for failing to commit to strong sustainability schemes (Confino, 2014; Pompper, 2015). Accountability can fade as well, lost in acquisitions, successive boardroom overhauls or rebranding exercises, even as companies continue to announce new and seemingly ever-greater commitments to sustainability.

BOX 4 - SHIFTING PRIORITIES: THE CASES OF KEURIG GREEN MOUNTAIN AND GREEN & BLACK'S

Originally a small-scale specialty coffee company, Green Mountain Coffee Roasters (US) made its name as one of the first environmentally and socially sustainable companies in the 1980s. Green Mountain was the first to introduce organic coffee on the US retail market and to adopt a strong corporate social responsibility scheme. The company is now one of the leading global suppliers of organic and fair-trade coffee. Following Coca-Cola's purchase of a 10% share in the company, and Keurig Green Mountain's acquisition by private equity firm JAB Holding Co. in 2015, the company has progressively reduced its spending on social responsibility programs, namely its previous initiatives to improve the livelihoods of the coffee-growing communities who supply them. In 2006, the company's ethos was further questioned following its acquisition of brewing-machine manufacturer Keurig – the company known for non-recyclable non-biodegradable single-serve coffee containers, K-Cups pods. After strong civil society and consumer lobbying, Keurig Green Mountain began manufacturing recyclable K-cups in 2015 and announced it would make 100 % of K-Cups recyclable by 2020. The company continues to receive criticism, however, for the energy-intensive nature of coffee pod production, now sold through major coffee companies and restaurants including Starbucks and Dunkin' Donuts.

Founded in 1991, Green & Black's (UK) began as a pioneer organic and Fairtrade chocolate brand. Bought out by Cadbury in 2005 (later acquired by US food giant Mondelēz International in 2010), the company has progressively shifted away from its commitments. In August 2017, for example, Green & Black's launched its first non-organic non-Fairtrade chocolate bar. The new bar (along with many Cadbury products, also owned by Mondelēz) will now be sourced through the Cocoa Life, a private certification scheme set up by Mondelēz – raising concerns over the strength of the scheme's commitments (Smithers, 2017).

The burgeoning sustainability claims made by companies must be seen in this context. According to industry trade group FoodDrink Europe, 82% of food and drink manufacturers in Europe are implementing strategies to ensure "the sustainable sourcing of their ingredients" (Michalopoulous, 2015). For example, PepsiCo claims to work with growers in Belgium, the

24. Activist investors are individuals or groups that buy a large number of a public company's shares (or obtain seats on its board) with the objective of effecting major changes in the company to make it more profitable.

Netherlands, France and Germany to increase the use of organic fertilizers, and is testing technologies in Spain and the UK to use water and fertilizers more efficiently, while Kellogg maintains the company is engaging with 15,000 smallholder rice growers across the world by 2020. Monsanto and Syngenta host initiatives for smallholder producers around the world to provide access to their inputs and training support – drawing on corporate social responsibility (CSR) schemes as a key promotional tool. However, studies have increasingly revealed that the involvement of agrifood corporations in the development of sustainability initiatives (e.g. sustainable sourcing, private fair trade schemes) have tended to yield watered-down standards (Dauvergne, 2017; Jaffee & Howard, 2010), while CSR schemes have continued alongside business-as-usual practices with problematic impacts.

Commitments to sustainability may be further undermined by the increasing prominence of actors from outside the food sector via recent M&As (see Section 1). Private equity firms are driving buyouts across various agri-food sectors, while traditional grain traders are being displaced by logistics and transport giants operating across fuel, mineral and crop commodity sectors. Actors entering the food and farming sector from the outside could disrupt the status quo in a variety of ways, and may come with sustainability commitments of their own. However, as food becomes another tradable commodity in broad portfolios, the strategies employed are unlikely to be tailored to addressing the specific and acute risks in food supply chains. Moreover, buyouts tend to be driven by radical restructuring plans, and almost inevitably require major turnover of personnel. As described above, this can undermine sustainability pledges and dissipate accountability.

The recent entrance of Amazon and other logistics / e-retail firms into the agri-food sector not only accelerates the trend towards greater concentration in food retail, but is also likely to have implications for sustainability. As described in Section 1, food retail may be on the cusp of a digital transformation driven by cell phone applications, online grocery delivery, cashierless and sensor-based supermarkets integrated with online platforms - and the use of Big Data to track preferences and revolutionize stocking policies. For some within the industry, this heralds much-needed disruption in the way of doing business in the food retail sector. Aside from the introduction of barcodes and RFID tags, core practices have not substantively changed since the advent of the supermarket (Collins, 2017), while innovation has tended to focus on (often superficial) product differentiation over other forms of innovation (see Impact 4). Already, online retailers and delivery companies are quickly adapting to sustainability-minded consumers; though still niche enterprises, businesses such as US-based Relay (merged with Door to Door Organics in January 2017) offer locally-grown foods with strong price guarantees for farmers (Mitchell, 2014).

However, it is unclear whether these models can be sustained as buyouts multiply and huge players come into the sector. For some, the Amazon-Whole Foods merger signals a race to the bottom, paving the way for smaller suppliers (e.g. those currently working with Whole Foods) to be displaced by industrial-scale organic operations, or to compromise their own standards in the face of the downward price pressures brought to bear by Amazon (Dewey, 2017; Figuerido & Molidor, 2017). Meanwhile, an e-retail revolution in the grocery sector risks further disconnecting consumers from the realities of food production - with implications for sustainability (IPES-Food, 2016).

IMPACT 5

Controlling information through a data-driven revolution

Big Data has the potential to drive major changes in food systems in and of itself. It is also emerging as a major driver of industry consolidation (see Section 1), and effectively requires vertical integration to bring its benefits to full fruition. These data are only valuable insofar as they can be accrued on a large scale and deployed through the various nodes of the food chain. The resulting emergence of highly-integrated firms whose *raison d'être* is Big Data has major implications for how food systems will evolve – and whether and to whom the benefits of this data revolution will accrue.

The potential of Big Data to revolutionize the agri-food industry through increased efficiency and lowered costs is "celebrated" by data researchers and industry leaders alike (Crawford et al., 2014: p.1666). Big Data is already finding widespread applications through the precision technologies (e.g. for more targeted chemical input usage) employed by a growing number of farmers. It also underpins the field of agricultural biotechnology, as well as the new technologies predicted to be transformative for agriculture and food systems as a whole, such as synthetic biology, RNA interference [RNAi] or gene editing (Kahn, 2015). The claim follows that the era of Big Data will increase innovation through "better science" (see Data Science Institute, 2014; Shaw, 2014); Big Data's analytical tools (e.g. algorithms that uncover patterns in data using super-computers) surpass the need for traditional scientific methods (i.e. hypothesize, model, test) in their ability to collect and analyze massive sets of continuously updated data in record time.

However, as M&A activity proliferates and this data is consolidated in the hands of a narrow group of firms, the barriers to entry in the agri-food sector are likely to be greater than ever. In 2016, reports published by the US Council of Economic Advisers, as well as French and German competition authorities, failed to draw strong conclusions on Big Data's relationship to corporate concentration and competition (US Council of Economic Advisers, 2016; Autorité de la Concurrence, 2016). Nonetheless, the reports all noted that Big Data in the hands of a few dominant players could prevent smaller firms from entering the marketplace. While start-ups are driving the use of data technology in agriculture, they are being rapidly bought out by farm machinery companies and commodity traders. Meanwhile, smaller firms seeking to retain their independence may not capitalize on their innovation potential when competing against much larger companies who can more easily collect, analyze and manage the near-totality of relevant data.

Furthermore, as Big Data comes into the orbit of an increasingly-consolidated group of input agribusinesses, and becomes a central tenet of the products they offer, farmers may find themselves faced with a host of restrictive conditions - and ever-fewer alternatives. Farmers have been collecting information for 10,000 years for their own use, to share with their communities, and more recently, to give to agronomists or researchers to analyze. However, on-farm devices now transfer data wirelessly to the equipment or applications' corporate servers - often with limited farmer knowledge or opaque consent procedures. Even though some agribusinesses have confirmed that farmers ultimately own the raw data gathered on their farm, it is less clear whether that data remains theirs during all parts of the analytics process, or how farmers might be able to opt out of data collection and transmission (Khan, 2013). Questions thus remain over the ethical use of Big Data analytics, data ownership, and whose interests it will ultimately serve (see Section 3.3).

There are also implications in terms of farmers' control over the equipment and production technologies they will increasingly use in a data-driven environment. For example, under the original terms of the Digital Millennium Copyright Act, a farmer could not change out a tractor part, hire a local mechanic or take any action that could disable the equipment's Technological Protection Measures (TPMs) (See Box 5). Due to licensing rights, TPMs make it illegal for those who own equipment to modify or gain access to the machinery's management software. After 40,000 public comments supporting an exemption to these measures for farm machinery, the US Copyright Office ruled against the farm equipment industry and in favour of an exemption with restrictions (US Federal Register, 2015). The exemption took effect in October 2016 for a period of two years, but may still be overridden by companies like Deere with its current licensing agreements[25].

BOX 5 - CONCENTRATION, COST AND DATA PROTECTION: THE CASE OF TECHNOLOGICAL PROTECTION MEASURES (TPM) OF FARM EQUIPMENT

Due to Technological Protection Measures (TPMs), new and high-tech farm equipment have become a "nightmare" for farmers when they are in need of repairs (Wiens, 2015). This has exacerbated problems for farmers who are generally unable to afford new equipment, particularly in light of the recent drop in commodity prices. A large number of farmers have come to increasingly rely on older machines, both to avoid the high cost of new machinery or due to the farmers' inability to have proper access to the means to fix them. Others have even come to rely on hacked firmware purchased online to do their own repairs and avoid expensive fees (CBCRadio, 2017). As explained by one farmer:

"The problem is that farmers are essentially driving around a giant black box outfitted with harvesting blades. Only manufacturers have the keys to those boxes. Different connectors are needed from brand to brand, sometimes even from model to model—just to talk to the TECU [tractor electronic control unit]. Modifications and troubleshooting require diagnostic software that farmers cannot have access to. Even if a farmer managed to get the right software, calibrations to the TECU sometimes require a factory password. No password, no changes—not without the permission of the manufacturer." (Wien, 2015)

25. In October 2016, Deere's licensing agreements for embedded software still include closes prohibiting the modification of its software: https://www.deere.com/privacy_and_data/docs/agreement_pdfs/english/2016-10-28-Embedded-Software-EULA.pdf

Data-driven agriculture reinforces the need for farms to scale up and draw on credit, as generally only larger mono-cropping operations can afford the specialized machinery and communication technology necessary to benefit from Big Data analyses (Carolan, 2017). This has major implications for sustainability, given the severe environmental and social impacts associated with highly-specialized industrial forms of agriculture generate a range of (see IPES-Food, 2016).

A Big Data-centric knowledge paradigm, and the rush to own and access that data, also reinforces power imbalances in food systems (Knezevic & Bronson, 2016) and reinforced a focus on specific knowledge and innovation paradigms, further marginalizing alternative, e.g. peasant-led, innovation systems. The tension between these paradigms, and the scope for harnessing Big Data in more equitable ways, will be addressed in Section 3.

IMPACT 6

Escalating environmental and public health risks

The environmental impacts generated by industrial food systems are widespread, from declining pollinator numbers to soaring greenhouse gas emissions, and raise major doubts about the resilience and future productivity of agriculture around the world (IPES-Food, 2016). By reinforcing the incentives and infrastructures of the industrial model (see Impacts 1-3), industry consolidation is helping to exacerbate these impacts.

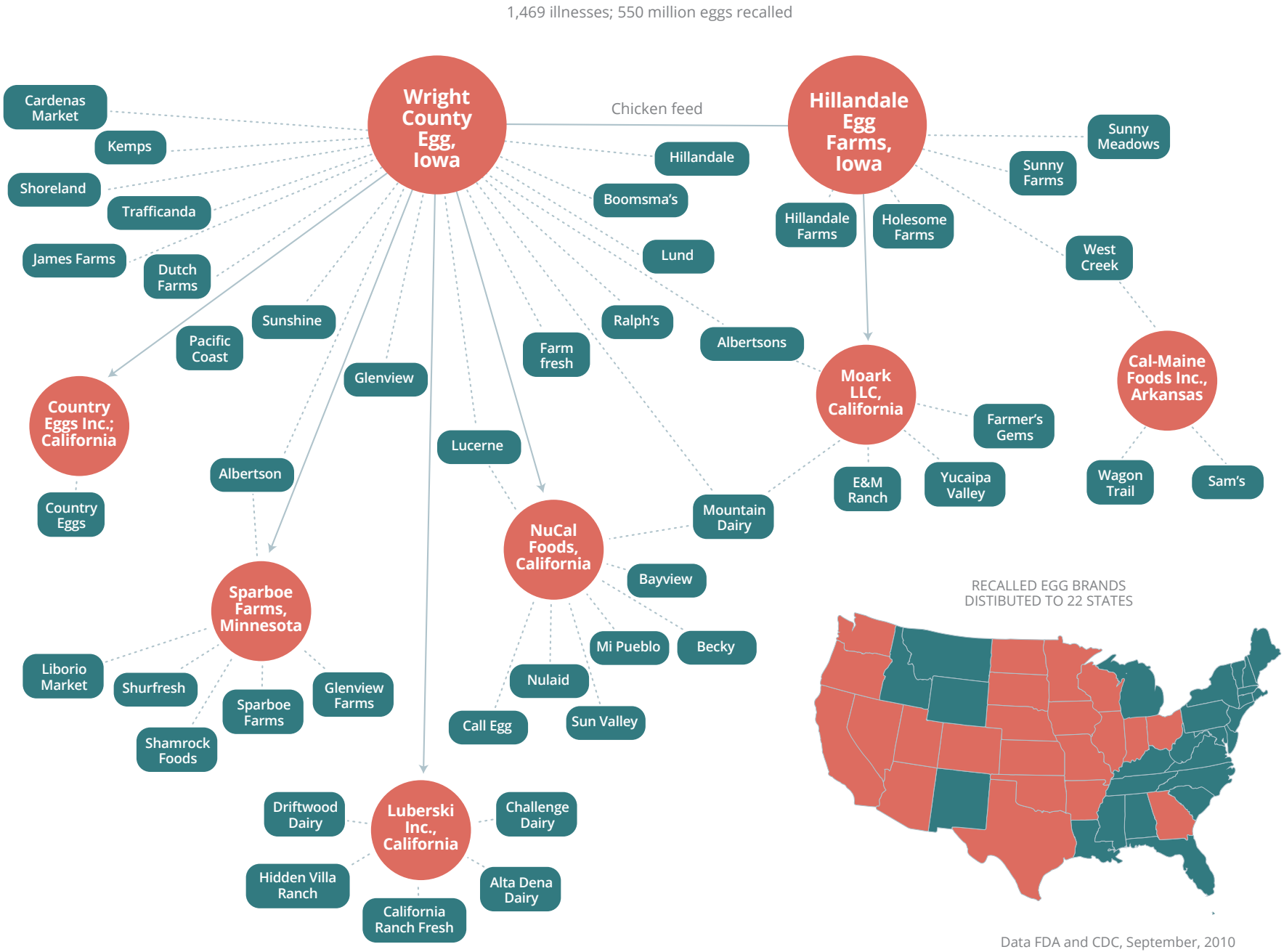
Furthermore, consolidation is generating a series of more direct environmental risks linked to the erosion of genetic diversity in food systems. The narrowing of R&D pathways has gone hand in hand with increased consolidation across the chain (see Impact 3). The resulting erosion of genetic diversity in crop research and in the field leads to a host of risks. For example, scientists have long warned that escalating the use of Bt maize hybrids that are genetically modified to resist European corn borer or corn rootworms could trigger evolved resistance in pests (Gray, 2011). In 2012, scientists confirmed that rootworms, the most destructive insect pest for US maize, had become resistant to one of Monsanto's genetically modified maize seeds containing the Bt strain, Cry3Bb1 (Gassmann et al., 2011). Scientists cautioned that the only way to slow evolving resistance of corn pests was to plant larger 'refuge' areas of non-GM maize.[26] Yet such a recommendation could not be effectively implemented due to insufficient availability of conventional maize seed (non-Bt) and a subsequent reduction in the mandated size of refuges - a decision alleged to have been heavily influenced by industry lobbying (Charles, 2012; Keim, 2014, Tokar, 2006).

The prioritization of these pathways also means under-valuing – and sometimes actively eroding – the smallholder systems which offer forms of diversity-based resilience. Nearly 7,000 different plant species and as many as 2.1 million unique plant varieties are both cultivated and wild-harvested for food (IPES-Food, 2016). In contrast, and to the extent that intellectual property certificates are a measure of varietal development, commercial breeders have less than 104,000 plant varieties in circulation, more than half of which are ornamentals (ETC, 2015). The genetic diversity publicly available to plant researchers for breeding has declined by 75% since the 1960s (FAO, 1993). Reduced crop diversity is also reflected in

26. The planting of a non-Bt "refuge" is designed to prevent or delay resistance by increasing the probability that any resistant insects would mate with non-resistant insects (from the non-Bt areas); the resulting offspring would not be resistant.

FIGURE 18 • THE 2010 MULTI-STATE SALMONELLA OUTBREAK IN EGGS

(Data source: Howard, 2016)



the declining rates of seed saving and replanting, as producers opt for annual repurchasing of seeds and as Intellectual Property Right (IPR) laws prevent seed saving, exchange and sale (Howard, 2009). Notably:

- A study in 2013 on maize variety availability in Spain, Germany, Austria and Switzerland confirmed that farmers benefit from a wider choice of seeds in countries encouraging local breeding companies and stronger restrictions on GM technology (Hilbeck et al., 2013).
- A study of five Nordic countries indicated that the consolidation of seed companies and the reduction of plant breeding programs (from 1950 to 2015) have resulted in a decrease in the number of available cultivars, a shift in focus toward crops and hybrids that are more profitable to companies, and termination of breeding programs for locally-adapted and indigenous crops (Solberg & Breian, 2015).

In the livestock industry, the world's seven dominant breeders develop only five animal species, and fewer than 100 breeds are commercially significant. As the livestock industry experiences further vertical integration, development and dissemination of livestock genetics is controlled by companies rather than farmers and ranchers (Heffernan, 2005; Kemp, 2001). Some 9,000 unique and locally-adapted breeds and at least 38 livestock species are maintained by small-scale producers and pastoralists (IPES-Food, 2016), but continue to face replacement or genetic dilution because of indiscriminate cross-breeding. Nearly 100 livestock breeds became extinct between 2000 and 2014, while 17% of the world's farm animal breeds are currently at risk of extinction (FAO, 2015).

Zoonotic and food-borne disease risks also tend to proliferate in a context of increased consolidation in livestock farming (e.g. the spread of CAFOs) and between livestock breeders, animal pharmaceutical firms, and meat processing companies. The already-suppressed immune systems and genetic susceptibility of reduced breeding stocks kept in large industrial facilities can contribute to higher rates of disease transmission, leading to increased animal and public health risks (Otte et al., 2007). Food-borne disease risks can also be amplified through centralized operations producing for global value chains, despite attempts to increase biosecurity and traceability. For example:

- Groupe Grimaud, the world's second largest animal genetics company, lost half its business in 2006 following a virulent avian flu epidemic after centralizing global operations in one location in France and reducing its available number of genetic lines (Howard, 2016b; van der Sluis, 2012). While ownership of the company is still centralized, Groupe Grimaud has since spread their breeding operations over more locations around the world (Howard, 2016b).
- In 2010, a salmonella outbreak was attributed to two egg producers in the same county in Iowa, but led to the recall of more than 500 million eggs sold to distributors and wholesalers in 22 US states and Mexico, which were then sold under at least 45 different brand names across the United States. (US FDA, 2010)
- Since July 2017, millions of eggs produced in concentrated operations in Belgium and the Netherlands have been removed from the market after being found to contain Fipronil, a banned anti-lice insecticide with known harmful impacts on liver, kidneys and thyroid. National and European food safety agencies failed to react promptly, despite tip-offs about Fipronil use dating back to November 2016. National authorities were unable to identify the exact amount of contaminated eggs that entered their respective countries. In total, 15 European countries have been affected, with the contamination further spreading to Switzerland, Malta, Hong Kong and possibly Africa – to whom the EU exports older laying hen meat that is not sold on European markets. As a result of the scandal, over 180 Dutch farms were temporarily closed and Dutch farmers are estimated to have suffered a loss of at least $11.9 million (Boffey, 2017; Berlin, 2017; Deutsche Welle 2017).

IMPACT 7

Allowing labour abuses and fraud to slip through the cracks

Industry consolidation has failed to eradicate endemic abuses and malpractice in food systems - and may exacerbate the risks by reinforcing current supply chain models, with their highly dissipated responsibility and persistent blind spots. Some of the world's largest processing companies, including Nestlé and Kraft, have admitted to finding child and slave labour conditions within their coffee and cacao supply chains (Clarke, 2015; Hodal, 2015). Surveys demonstrate that leading chocolate companies cannot always guarantee that human rights are respected along their supply chains, despite vertical integration of ownership (SwedWatch, 2006). More specifically, Nestlé stated that it is impossible to "fully guarantee" against human rights abuses when sourcing from countries with limited labour law enforcement – in response to allegations of slave labour on Brazilian coffee plantations, cacao plantations in the Ivory coast, and fisheries in Thailand (Hodal, 2015; Kelly, 2016). Nestlé, Kellogg's and Reckitt Benckiser have all also cited a limited ability to trace the practices of their millions of palm oil suppliers (Davies, 2016). The coffee sector faces similar challenges, with 25 million small-scale coffee producers around the world and more than 40% of the global retail market share controlled by two companies (Nestlé and JAB Holding Co.) (Bailey, 2015).

Forced labour in global seafood operations involving tens of thousands of workers—mostly impoverished migrants, women and children—was also the subject of in-depth reports in 2015. Associated Press journalists traced shrimp produced by forced labour from Thailand in products sold in virtually all major US and European supermarket chains (including Walmart, Carrefour, Costco, Kroger, Safeway, Sysco, Whole Foods and more) (Mason et al., 2015). Restaurant supply chains, well-known seafood brands and best-selling pet foods were also involved. Investigative journalism also exposed that the majority of fish caught around the world are filleted in China, where low-waged female workers provide cheaper labor than machines (Lawrence, 2013).

A recent investigation in the US further exposed the dangerous working conditions of those working in slaughterhouses and meat-processing plants across the country (Harvest Public Media, 2016). Reports found that the four largest poultry processors in the US — Tyson Foods, Sanderson Farms, Perdue Farms and Pilgrim's Pride — recurrently violate workplace safety rules (US Department of Labor, 2017; Human Rights Watch, 2005).

Large scale retailers typically require suppliers to fulfill a set of private standards and to comply with national laws and regulations. In response to growing consumer concern and pressure from civil society groups for more ethical supply chains, Nestlé, Walmart and many other processing companies have developed codes of conduct to protect workers from exploitive labor practices, and have made some efforts to inform their suppliers of these ethical codes. However, the same suppliers also face the reality of downward cost pressures, high volume requirements - and few alternatives (see Impacts 1 and 2). Furthermore, major retailers continue to source disproportionately from countries and regions with lower labor regulations (Rioux, 2015; Food Chain Workers Alliance, 2015). In this context, corners get cut and malpractice arises - and is therefore built into the system, even if not officially condoned by the most visible, public-facing actors, i.e. food and beverage processors and retailers.

While supply chain consolidation has paved the way for some improvements in traceability over the years, significant cases of food contamination and food fraud have continued to slip through the cracks. The 2013 European horsemeat scandal provides a key example of each link in the food chain passing on responsibility for fraud (see Box 6). In a subsequent report on food fraud, the European Parliament listed recent concentration at the wholesale and retail levels as factors encouraging "unscrupulous practices in the food supply chain" (2013). The case also shone a light on the realities of highly-concentrated retail operations and the traceability and accountability challenges they raise: the factory that supplied burgers to Tesco uses ingredients from some 40 approved suppliers in mixtures that can vary up to every half hour (Lawrence, 2013).

BOX 6 - THE 2013 UK HORSEMEAT SCANDAL

The scandal broke out when prepared foods labelled as beef were found to contain undeclared horsemeat. While major retailers in the UK, including Tesco, Asda, Burger King and Aldi, apologized to their customers for the mishap, the retailers claimed they were unknowing victims of fraud. Yet, ABP, Europe's leading beef processor who produced burgers for all four retailers also sought to pass blame on to one of its traders, Norwest Foods (Lawrence, 2013). Norwest Foods is said to have purchased the horsemeat from a businessman, Willy Selten, who himself purchased from a supplier not approved by major retailers. Polish workers in one of Selten's factories later exposed that they processed horsemeat and mixed it with beef at the end of their normal shift, often paid in cash (Lawrence & Domokos, 2013). Yet, Selten also denied any accounts of fraud.

IMPACT 8

Setting the terms of debate and shaping policies and practices

Ultimately, consolidation not only enables dominant companies to increase their market share and potentially their profits, but also provides them with the means to set the terms of debate and thus to defend the status quo. Indeed, dominant firms have succeeded in shaping the innovation climate, convincing the public and regulators alike that scale is necessary for innovation and technological progress, and making themselves synonymous with innovation. They have also normalized the shifting of costs onto - and value away from - farmers and small-scale operators. In other words, they have succeeded in shaping dominant worldviews in "politics, society and culture" (Di Muzio, 2013, p.6).

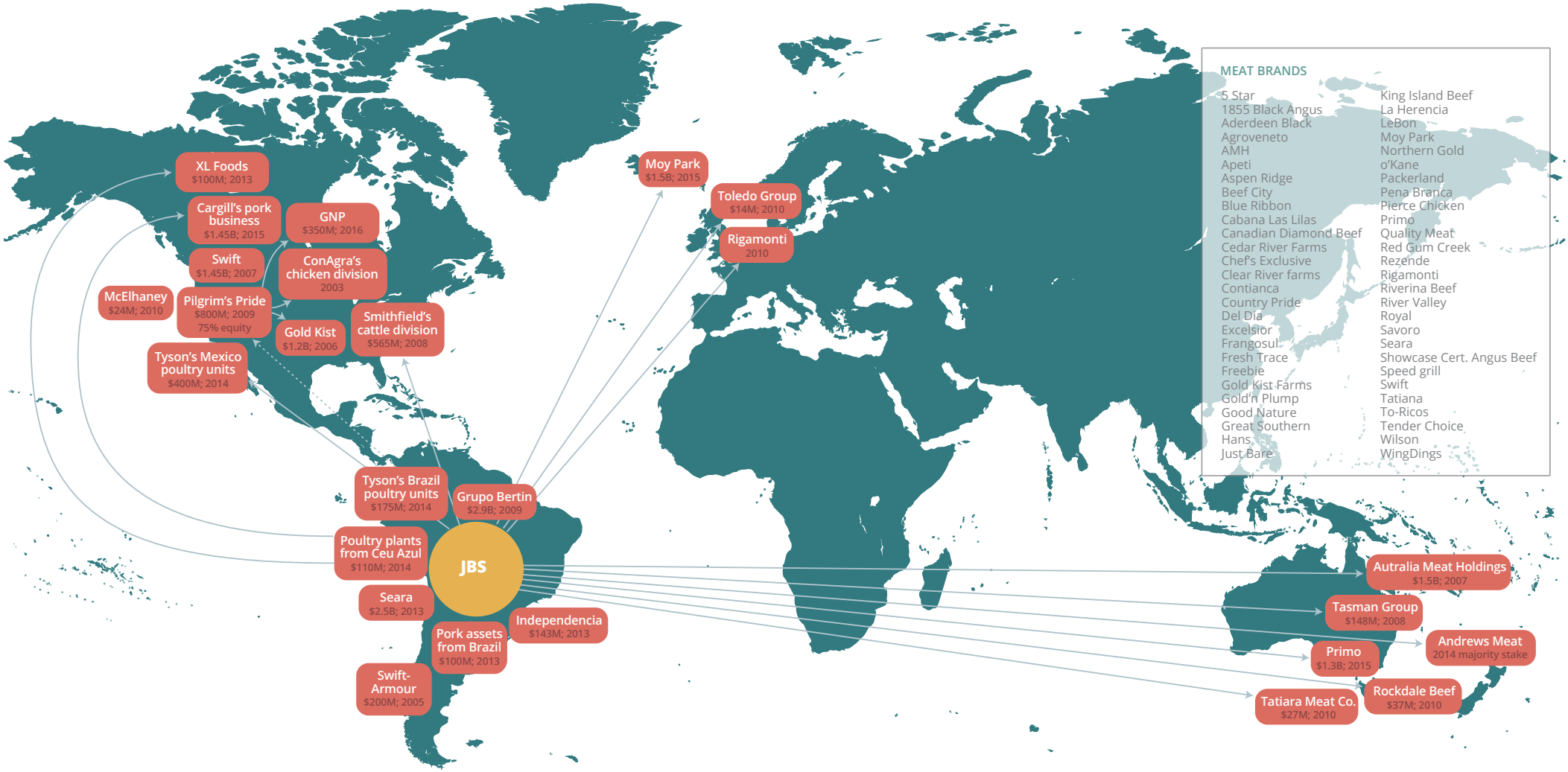
A November 2016 report by ProPublica revealed that, in the US, university-affiliated economists specializing in anti-trust are frequently hired by corporations to convince government regulators that proposed mega-mergers do not threaten competition. However, their recommendations are offered as independent expertise rather than as lobbying work. The scholars use complex economic forecasts to predict the effects of mergers. But the reports are not made public, and after a merger is approved, the U.S government no longer has access to the companies' proprietary data, making it ever more difficult to verify these forecasts. As mentioned by Seth Bloom, former general counsel of the US Senate Anti-trust Subcommittee, "there are few government functions outside the CIA that are so secretive as the merger review process" (Eisinger & Elliott, 2016).

However, the power and influence of corporate actors in shaping government policies is long-standing, and goes far beyond lobbying against anti-trust measures. Agribusiness interests are well represented not only in the G7 capitals but throughout the G20 and beyond, while also using discourse (e.g. public relations campaigns, media, etc.) to influence public views more broadly (see Clapp & Fuchs, 2009; Corporate Europe Observatory & Friends of the Earth, 2017). Since 1979, the number of employees in the US government responsible for giving legislators unbiased fact-based evidence has declined by 40% (The Economist, 2017b). Incoming policy-makers in particular are heavily reliant on lobbyists for information, grossly diminishing the possibility for independent, unbiased, decision-making (Drutman & Teles, 2015).

In 2015, the combined spending for all agribusiness lobbying in Washington reached $130 million, exceeding the lobbying expenditure of the defense industry (Open Secrets, 2016). Lobbying power is also brought to bear

FIGURE 19 • JBS GROUP OWNERSHIP CHANGES, 1996 TO 2016

(Source: Howard, 2016)



BOX 7 - LOBBYING AT MULTIPLE SCALES: SMITHFIELD'S PUSH TO WEAKEN US STATE LEGISLATION

Since the early 2000s, Smithfield (now Chinese-owned WH/Smithfield), the largest pork company in the world, has worked to overturn US state laws restricting corporate ownership of livestock and land. Already, large livestock processors have overturned most federal restrictions on corporate ownership of livestock and vertical integration since the 1980s. State-level legislation is the final frontier. As such, Smithfield has lobbied to remove state restrictions on vertical integration across the US, including Iowa Code 9H on Corporate and Partnership Farming to "preserve free and private enterprise, prevent monopoly, and protect consumers". Following challenges made by Smithfield, the Iowa state law was deemed unconstitutional and amended in 2003. In Nebraska, Bill LB176 was passed in February 2016, allowing international pork processors to own hogs within the state. The bill met with strong resistance from independent pork producers and the Nebraska Farmers Union, who requested that key voting senators return campaign contributions made by WH/Smithfield (Nebraska Farmers Union, 2016).

at the state and local levels. Since 2013, US and foreign-owned food, farming, and biotech industries have spent over $192.8 million to influence GMO labelling legislation, state-based referenda on GMO labelling laws, and other issues relating to consumer access to information (EWG, 2016). Yet, numerous polls show that Americans are in favour of mandatory GMO labelling. The top six contributors, Coca-Cola, PepsiCo, Kellogg's, Kraft Heinz Co., Land O'Lakes and General Mills, spent over $20.6 million in 2015 just to lobby against GMO labelling, helping to contribute to the narrow defeat of bills in three states (ibid).

Agribusiness consolidation also paves the way for extending political influence to new regions of the world. For example, the ChemChina-Syngenta deal may have major implications for the future of Africa's agricultural development. Already, ChemChina has major operations in South Africa through its subsidiary company, Adama/Makhteshim-Agan – the largest agrochemical supplier in the state.

In some cases, excessive power has paved the way for long-term collusive relationships between dominant firms and regulators. For example, the recent release of the 'Poison Papers' revealed 50 years of scientific studies, internal memos, testimonies and correspondence between the US chemical industry and US federal agencies dating back to the 1920s. The papers demonstrated decades of erroneous scientific data used to approve the use of certain chemicals and pesticides on the market, despite understanding of its hazards (Poison Papers, 2017).

More recently, the world's largest meat processor, JBS, and the world's largest poultry exporter, Brasil Foods/BRF (both Brazilian), were among 21 companies immersed in a tainted meat scandal. In 2017, Brazil charged meat exporters for bribing 1,829 politicians, regulators and inspection authorities and accessing state regulators' computers to grant themselves export licenses without inspection (Leahy, 2017). Brazil exports $12.6 billion worth of meat to countries including Japan, China, Canada, Chile, the EU and Egypt. The scandal sparked temporary bans on Brazilian meat by a number of major importers including China, the European Union, Chile, Egypt, Saudi Arabia and South Korea (ibid). Brazil's agriculture minister attributed JBS's ability to bribe officials to its dominant size in the Brazilian marketplace, criticizing BNDES,

Brazil's state development bank and major financing agent for national development, in particular for facilitating high levels of industry concentration in the country (Mano, 2017).

Concentration of power also allows corporations to exert major influence on the global governance of food systems - and particularly international trade policies and agreements (McNeill et al., 2017; Murphy et al., 2012). The investor-state dispute settlement systems (ISDS) written into bilateral investment treaties have allowed companies to sue foreign governments should changes in national policies affect company profits, including future profits. Investor-state trials most frequently benefit large businesses. While there were only three cases filed for ISDS in 1995, by January 2016 there had been over 700 lawsuits, with a record of 70 filed in 2015 alone. To date, 72% of ISDS cases have been filed against developing and emerging economies (Corporate Europe Observatory, 2016). By the end of 2015, 72 % of the decisions on jurisdiction, and 60 % of cases decided on the merits were won by investors (Mann, 2015). This is alleged to reflect the small number of arbitrators of ISDS cases, predominantly private practice lawyers, who just as frequently serve as corporate counsels (EPRS, 2014; Corporate Europe Observatory, 2012).

Foreign companies have also been able to leverage investment protection chapters of trade agreements, when regulations represent obstacles to their growth. For instance, in 2009, the Corn Products International (US) vs. Mexico trial awarded $58.4 million to the American company for a government tax levied on beverages sweetened with high fructose corn syrup (HFCS), by invoking clauses within NAFTA to claim that the tax proved a hidden form of protectionism. The same year, Cargill (US) was awarded $90.7 million by Mexico after challenging the same tax (Government of Mexico, 2009).

In some cases, the threat of a lawsuit may be sufficient to exact favourable outcomes for businesses. The specter of legal action is seen to have played a role in sparking shifts in the legislative agenda, including Canada dropping anti-smoking policies following threats of dispute from major tobacco companies (Greider, 2001) or the dilution of German environmental standards following an investment treaty claim made by Vatttenfall, a leading Swedish energy company (Bernasconi, 2009).

In other cases, government priorities are alleged to have been shaped by powerful and increasingly consolidated corporate interests. A political economy analysis found that Thailand, like many countries in the Global South, has internalized the priorities set by corporate actors and international regulators like the WTO to support further industrialization of food systems, becoming complicit in the dispossession of their farmers and rural communities and ignoring the long-term costs (Chiengkul, 2017). Intellectual property rules have been identified as a key entry point for this reprioritization of national interests, namely through the national application of the WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights. These place mounting pressures on governments in the Global South to develop both IPR and non-IPR regulations (e.g. standards for seed marketing and exchange). Though farmers' rights were established under the FAO International Treaty on Plant Genetic Resources for Food and Agriculture in 2004, IP rules have often worked in contradiction to them – putting local, traditional, and indigenous seed systems at risk (Wattnem, 2016). Major agri-food industry players have also sought to influence the international climate agenda, often via public private partnerships with large but not diversified membership (see Box 8).

In brief, consolidation is shifting the locus of food system governance away from local and national governments and into the hands of a limited number of increasingly dominant multinational firms, allowing imperatives to be aligned with private profit-driven interests, fundamentally undermining decision-making for the public good.

BOX 8 - SHAPING THE INTERNATIONAL CLIMATE AGENDA

The Global Alliance for Climate Smart Agriculture (GACSA), hosted by FAO, was created to inform the debate at the international institutional level, especially the UN Framework Convention on Climate Change (UNFCCC), to support agricultural production systems and projects deemed 'climate smart'. Formally launched in 2014, GACSA's membership includes 22 national governments, agribusiness lobby groups (60% of which represent the fertilizer industry), the international public sector (e.g. Consultative Group on International Agricultural Research – CGIAR), universities and NGOs (GRAIN, 2015; CIDSE, 2015). GACSA also includes representatives from the World Business Council for Sustainable Development (WBCSD), which includes companies such as Coca-Cola, DuPont, Kellogg's, Dow, Monsanto, Walmart, Tyson Foods, PepsiCo and Unilever.

Public-private partnerships, now enshrined in UN SDG 17, may also serve to legitimize a narrow series of actors as the sole 'voices of agriculture'. For example, the Water Efficient Maize for Africa partnership (WEMA) aims to develop drought-tolerant and insect-resistant maize, relying on both conventional, marker assisted and GM approaches. The partnership brings together five national agricultural research centres (Kenya, Mozambique, South Africa, Tanzania, Uganda), Monsanto, USAID, the Bill and Melinda Gates Foundation, the Howard G. Buffett Foundations and the International Maize and What Improvement Centre (CIMMYT) – a research centre within the CGIAR. Brokered by the AATF (African Agricultural Technology Foundation), the project gives Monsanto a leading voice on African agriculture's response to climate change, but also possible access to elite germplasm held in public trust by CIMMYT and the national gene banks.

03 Moving forward

Building a new anti-trust environment, addressing the root causes of consolidation in food systems and promoting food system transformation

As demonstrated in Section 2, the high and rapidly increasing levels of concentration in food systems is generating a variety of risks and raising major questions about sustainability. Consolidation across the agri-food industry has made farmers ever more reliant on a handful of suppliers and buyers, further squeezing their incomes and eroding their ability to choose what to grow, how to grow it, and for whom. The emergence of increasingly dominant retail and processing firms has driven concentration along the chain in order to provide the requisite scale and volume, enforcing a *de facto* consolidation of agriculture. Meanwhile, upstream consolidation has left farmers hostage to a handful of suppliers and mounting commercial input costs.

Increasing market concentration has also narrowed the scope of innovation, reinforcing a focus on input traits and on major crops promising greater returns on investment. Companies have shifted R&D resources to the least risky modes of investment, e.g. focused on protecting patented innovations and creating barriers to entry. Meanwhile an explosion of new product lines is providing an illusion of innovation in processing and retail – but often amounts to little more than the repackaging of existing products. Genuine innovation is emerging from start-ups, but tends to be diluted as smaller brands and companies are bought out by mega-firms.

Furthermore, consolidation is driving a reduction in seed and livestock genetic diversity, while amplifying the risks of disease proliferation in increasingly centralized and homogenized systems. Rampant M&A activity is also raising major questions about accountability, as product rebranding, company buyouts, boardroom turnover and the opacity of long value chains erode commitments to sustainability and open the door to abuse and fraud. It is also bringing financial players, e-retailers, and logistics firms to centre-stage in defining the trajectory of food systems – raising further questions about the prospects for building greater sustainability and accountability.

Perhaps most crucially of all, the rush to control plant genomics, chemical research, farm machinery and consumer information via Big Data is driving mega-mergers – and stands to exacerbate existing power imbalances, dependencies and barriers to entry across the agri-food sector. Access to and ownership of data often remains unclear. In this context, the data revolution could exacerbate some of the most pressing problems in food systems, including restrictions on farmers' choices and the difficulty for innovative start-ups to access data.

Crucially, these impacts tend to exacerbate and lock in problems that are already endemic in today's predominantly industrial food systems. Rather than putting food systems on a path to sustainability, consolidation reinforces the logic of the industrial model – and its major social, environmental and economic fallout (see IPES-Food, 2016). The inequitable distribution of costs, risks and value along the chain is now a long-standing source of tension in highly-industrialized systems, with farmers locked into growing more of the same commodity in order

to meet their daily income needs. Yet higher production inevitably leads to oversupply and reliance on commodity buyers, perpetuating a vicious cycle of diminishing farm incomes, low bargaining power and unsustainable livelihoods (De Schutter, 2010).

Ultimately, the impacts of concentration reflect the logic underpinning it. Consolidation is not fundamentally driven by concerns for food security, sustainability or even increased innovation – and is not delivering these outcomes. Instead, consolidation has followed a cyclical logic, with one major merger triggering increased M&A among competitors. It has come in response to the market uncertainties which increasingly concentrated and highly financialized food systems help to drive. Finally, consolidation has been pursued to capture new technologies or control technology 'network effects' within and between sectors, as well as to maintain a system of capital accumulation and low-cost commodity supply. Consolidation may therefore succeed in these objectives, while undermining the sustainability of food systems on multiple fronts.

It is clear, therefore, that ongoing consolidation across the agri-food sector represents an obstacle to building more sustainable food systems, not a pathway towards it – and further consolidation will be increasingly damaging. These risks clearly outweigh any potential gains from consolidation, and tend to come at a major price elsewhere in food systems.

Like the banks that by 2007 had become 'too big to fail', the emerging mega-firms have made themselves a central cog in food systems, and a major amplifier of risks – acting to reduce their own private risk at the expense of social and environmental sustainability. The agri-food giants may not be 'too big to fail', but have become *too big to feed* humanity sustainably, too big to operate on equitable terms with other food system actors, and too big to deliver the types of innovation we need – and too big to change course.

Solutions to tackle concentration must not only address its specific impacts along the value chain, but also put a stop to the interconnected and self-reinforcing processes that incentivize consolidation and allow dominant actors to gain further advantage. Steps to reform the scope of anti-trust rules and ensure their effective usage are key to addressing consolidation in the agri-food sector. However, these steps may not suffice, in the face of the rapid and unprecedented M&A activity in food systems, the already extensive consolidation across agri-food sectors - and the major power imbalances that lock the status quo in place. Steps to build a healthier anti-trust environment therefore need to be embedded in a more fundamental recalibration of the imperatives, paradigms, power relations and governance structures in food systems. In other words, the incentives in food systems must be realigned so that consolidation is no longer the prerequisite for firms to survive and thrive, so that startups are not automatically subsumed into mega-firms, so that food security is not contingent on a handful of firms and their proprietary data, so that accountability cannot be lost in the merry-go-round of brands and boardroom personnel, and so that farmers, small-scale manufacturers and consumers have viable options other than to accept the terms set by multinationals in global supply chains. Steps to address the risks of industry consolidation are therefore essential steps to build sustainable food systems- and must be taken regardless of whether current peaks of M&A activity are sustained.

The potential for reforming anti-trust rules is discussed in Section 3.1. The subsequent sections examine the broader shifts that are required to counter the effects of consolidation and rebuild food systems on a different basis: new global governance structures through which to regulate concentration (Section 3.2); new knowledge paradigms to harness the benefits of innovation more evenly (Section 3.3); and new economic paradigms to underpin sustainable supply chains and sustainable food systems.

3.1 BUILDING ON EXISTING FOUNDATIONS TO CREATE A NEW ANTI-TRUST ENVIRONMENT

In principle, competition (or anti-trust) laws aim to discourage anticompetitive practices, including unhealthy levels of concentration and the abuse of dominant positions. Implemented through both public and private enforcement at the domestic level, governments seek to limit the formation of monopolies and cartels, in part by monitoring M&As.

Following the global economic liberalization of the early 1990s, American and European legal arrangements have set precedents for many national competition laws, setting the terms of debate on how consolidation is understood and regulated around the world. To date, over 120 countries have some anti-trust or competition regulation (Morton, 2016). At the domestic level, competition law is enforced through competition authorities and private enforcement. With the rise of transnational enterpris-

BOX 9 - KEY ANTI-TRUST LAWS IN THE USA AND EU

All current anti-trust measures in the US are based on one of the following three federal acts:

US Sherman Act, 1890	Prohibits corporate activities that restrain competition and trade; Prohibits monopolies and attempts to monopolize.
US Clayton Act, 1914	Prohibits price discrimination, exclusive dealing, tying and reciprocal arrangements that reduce competition; Prohibits M&As, joint ventures and company structures that diminish competition.
Federal Trade Commission Act, 1914	Established Federal Trade Commission; Regulates unfair or deceptive acts in trade and commerce; Interprets Sherman and Clayton Acts and other competition laws and regulations. Anti-trust laws are upheld by the Federal Trade Commission, US Department of Justice, and state governments.
	While competition law has existed since the creation of the European single market, **European** anti-trust laws are now based on two central articles within the Treaty on the Functioning of the European Union:
EU Treaty of Lisbon, 2007, Article 101(2)	Prohibits anti-competitive agreements and price fixing in both horizontal and vertical agreements;
Article 102	Prohibits firms from power abuses when holding a dominant position in the market (unfair prices, limiting production).

Competition law is then enforced by either the European Commission or National Competition Authorities of individual member states, working in cooperation to ensure proper and coherent application of rules throughout the EU.

es and globalization, national authorities seek to cooperate to share information and enforce rules (Papadopoulos, 2010).

However, anti-trust laws often fail to ask the right questions on industry consolidation. Both European and US competition regimes are underpinned by 'consumer welfare', which is the standard against which 'unfair' market activity is assessed. The focus on how consumers are impacted draws attention to competition and end prices, and the demand side of food systems more generally. The impacts of concentration on production and processing activities are therefore made secondary: whether a farmer has been paid fairly has little impact on the (economic) welfare of the customers (e.g. a farm income squeeze may even boost 'consumer welfare' by making products cheaper) unless clear abuse of dominant position is proven. The environmental or public health impacts are also kept outside these frames. Moreover, placing the emphasis on consumer welfare – an intrinsically subjective concept – makes it a delicate matter to regulate, and generally leaves interventions exposed to accusations of paternalism (De Schutter, 2010; Hendrickson & James, 2016).

This approach leaves major regulatory gaps. Amazon, for example, has been able to satisfy anti-trust regulators on the basis of the low prices and diversity of products it delivers to its consumers (Khan, 2017). Data implications represent a further blind spot. In August 2017, only two months after the proposed merger, the US Federal Trade Commission approved the Amazon-Whole Foods deal as it was only seen to involve 2% of the US food retail market. The FTC, however, ignored any possible impacts of Amazon's ownership and use of consumer data.

The focus on consumers' interests also raises questions about the jurisdictional efficiency of existing regulations. For example, if Country A and B's anti-trust regulatory scope are both limited to their own jurisdictions, and standards are set to meet the interest of consumers living in Country B though production happens in country A, companies will more often than not benefit from de facto immunity (De Schutter, 2010; Colene et al., 2013). In other words, the ability of a competition authority to prevent possible abuses of a dominant firm from another jurisdiction is, at best, limited.

> "The extraordinary thing is that because of its clout, industry has been able to commit what appears to be a criminal offence – selling the public horsemeat falsely labelled as beef – and just say they are sorry and didn't know. If every petty crook could get off by saying I didn't mean to and I didn't know, then our criminal justice system would be in a very sorry state."
>
> *– Barry Gardiner, Shadow Secretary of State for Energy and Climate Change in January 2016 on the UK horsemeat scandal*

In addition, given the variety of ways in which companies tend to collaborate and collude in food systems, it is often difficult to gauge the extent of a given company's power and influence in the marketplace. Primary concentration indicators such as market concentration ratios, though based on complex statistical models, fail to capture the influence gained by informal means. Current indicators only tend to focus on economic power, and rarely speak to the socio-cultural or political influences acquired by corporate actors and the impacts those may have on food system sustainability.

Implementation of current legislation poses further problems. In the US, of all 15,000 M&A deals that took place between 2005 and 2014, only about 3% were subject to scrutiny by anti-trust regulators (The Economist, 2016). In the EU, of the 1,300 mergers considered between 2004 and 2012, 83 – or 6.4% of cases – were

found to raise concern (European Competition Network, 2012), but only 8 were prohibited as only M&As passing a certain market turnover threshold[27] are considered relevant for anti-trust.

However, the tide may now be turning. In 2016, regulators from 26 jurisdictions[28] intervened in more merger cases than they had done in previous years (Allen & Overy LLP, 2017). While 7 deals were prohibited and 13 deals abandoned in 2015 in all sectors of the economy, 2016 saw 8 deals prohibited and 23 deals dropped (ibid). Of note, only 2 of the 8 deals were prohibited by EU legislators and none by the US, though both jurisdictions are still considered global leaders in anti-trust.[29]

The agri-food sector has itself remained largely immune from the new tide of anti-trust activity. In its 2014 review of mergers, the OECD acknowledged that the regulatory trend is to make M&As easier for merging parties, and recognized that current policies tend to play out to the detriment of those most negatively affected by food system concentration (OECD, 2014). The capacity of anti-trust regulators to keep pace with rapidly expanding agri-food M&As remains weak (Schanbacher, 2014). Even though fines have been levied against several companies for abuses of power, regulators (particularly in the EU and US) have come under increasing fire for failing to address the impacts of existing agri-food sector concentration and the new generation of M&As (Leonard, 2014) – including the influence exerted by firms over political processes. The reluctance to file cases in major agricultural industries has itself been alleged to reflect corporate lobbying influence (see Impact 8).

Nonetheless, the growing resolve to tackle anti-competitive practices across the economy may now be permeating food systems. Steps being taken in a variety of different jurisdictions and in a variety of sectors may be starting to create a less conducive environment for M&A activity. In some cases, these measures seek to redefine anti-competitive practices and to reframe the scope of anti-trust rules. Steps to date may not be sufficient to reverse the current direction of travel. However, they point the way to key entry points where action is already occurring and could be taken further:

i) Addressing unfair practices in supply chains. Legislative and judicial bodies around the world are showing more interest in tackling excessive power in food supply chains and its impact on farmers and consumers alike:

- In 2010, an investigation by the South African Competition Commission charged a number of leading milk processors with price fixing for raw and processed milk, and restricting market competition.
- In June 2017, the South African Commission began an investigation into the grocery retail market, on the basis of unfair competition practices within the sector.
- In 2016, the European Commission published a report on unfair business-to-business trading practices in the food supply. The EU Directive on Unfair Commercial Practices adopted in 2005 is also currently undergoing evaluation to assess whether the regulatory framework is meeting its purpose of supporting small and medium sized enterprises and curbing abuses within the food supply chain.

27. A turnover threshold refers to the combined annual turnover of merging parties used to assess whether mergers by Member States or the Commission.

28. With a focus on trends in the US, EU and China, the survey also included Australia, Brazil, Canada, India, Japan, South Korea, Singapore, South Africa, Turkey, and COMESA countries. The sectors most subject to anti-trust intervention were the Consumer & Retail sector (43), followed by Industrial & Manufacturing (35), Technology, Media and Telecommunications (25) and Life Sciences (21). The Telecoms, Transport and Life Sciences sectors were subject to a higher share of anti-trust intervention than their share of overall M&A deals would suggest. Intervention relating to the agri-food sector were not singled out.

29. The agri-food sector has not been assessed in available recent global analyses. However, the food sector was identified as the fourth sector with the most publicly-reported ongoing investigations by the European Commission (Clifford Chance, 2016), mostly due to political and social opposition to these trends.

ii) Considering the collective impact of sector-wide consolidation and redefining a competitive market. As M&A activity has escalated, a number of calls have been made for mergers to be considered as a whole, rather than in isolation, to acknowledge the unprecedented power a handful of consolidated firms to collectively shape food system dynamics (ETC, 2017; Friends of the Earth, 2017; TWN, 2017). Actions are being taken and proposals are being made for new ways of defining and measuring anti-competitive practices, often on the basis of considering food systems as a unique sector with high social importance:

- "Creeping concentration", i.e. a series of minor mergers leading to high levels of market concentration, is coming to the attention of regulators in Australia and elsewhere.
- In Ireland, the Competition Authority considers concentration along the whole supply chain in order to assess market power resulting from vertical integration (OECD, 2014).
- In France, the M&A vetting process has been amended to give more space to the participation and the concerns of competing enterprises not immediately affected by the proposed merger. A related law further stipulates that companies looking to close a site – including following a takeover – must first set it up for public sale and/or attempt to find a buyer.
- In South Africa, the 2012 review of the Walmart (US) and Massmart (South Africa) merger sparked unprecedented public debate. Though the merger was ultimately approved with conditions, it highlights the possibility of drawing on a more integrated competition review process. During the review, a number of government departments brought forward opinions and conditions on the case, allowing authorities to recognize the impacts of mergers beyond consumer welfare and competition, including employment and displacement of small business suppliers.

iii) Shifting the burden of proof onto companies. Some proposals are now being made for companies to proactively justify their M&A activity:

- In July 2017, the US Democrats presented their new political platform, the "Better Deal", urging a new precautionary approach to current and future mergers. The vision included setting new standards for a more holistic, long-term view of concentration's effects on the economy and society, and better monitoring of a company post-merger. While still focused on consumer welfare, in September 2017, Democrats on the US Senate Judiciary Committee's anti-trust panel stipulated that companies seeking a mega-merger would have to show that the deal would not hurt consumers and demonstrate its benefits, rather than simply relying on the FTC to judge the impact of mergers on consumers (US Democrats, 2017). The Better Deal goes so far as to acknowledge the detrimental impact on farmers and rural communities likely to result from the Dow-Dupont, Monsanto-Bayer and Syngenta-ChemChina mergers, as well as the influential role large corporate actors have in shaping policy. It identifies the food and beverage sectors as two of the five key industries requiring more stringent anti-trust monitoring.

iv) Cracking down on tax inversions. The quest for fiscal advantages often drives M&A activity (see Section 1). In particular, firms have relocated to and declared profits in low-tax locations, i.e. 'tax inverstions'. Cutting off those benefits is starting to emerge as an effective tool to rein in consolidation:

- Despite the record number of deals announced in 2016, the year also experienced a record number of failed mergers. These unsuccessful deals have primarily been attributed to US regulators tightening rules on corporate tax inversions, thereby discouraging US-based companies from relocating overseas for purely fiscal purposes (Picker, 2016).
- Like the failed OCI and CF merger, Allergan and Pfizer's $160 billion deal fizzled out in April 2016 after the US Treasury Department tightened rules; a successful merger would have enabled US-based Pfizer to benefit from Ireland-based Allergen's tax domicile, avoiding an estimated $1 billion in taxes.

v) Taking technology firms to task. EU anti-trust regulators have show increasing willingness to challenge technology companies. The quest to control and deploy Big Data is a major driver of agri-food sector consolidation (see Impact 5). Steps to regulate technology firms are therefore relevant, and could provide a stepping stone for comprehensive oversight of data concentration in food systems:

- In June 2017, EU regulators did not hesitate to land Google with the largest anti-trust fine ever in the EU, in addition to demands to change the company's shopping and related search services.
- The Google verdict follows a 110 million euro fine levied against Facebook for providing misleading information on its acquisition of WhatsApp in May 2017 (EC, 2017), and a 13 billion euro fine to Apple due to preferential tax treatment in Ireland in 2016 (EC, 2016).
- The 'Better Deal' platform adopted by US Democrats (see above) pledges to take on mega-mergers and to account for the role of Big Data control and its possible effects on limiting competition and undermining consumer privacy.

These examples highlight the potential to address consolidation in the agri-food sector by reforming the scope of anti-trust rules, implementing existing anti-trust rules more aggressively, and addressing cross-cutting incentives and drivers of consolidation (e.g. via fiscal policies, data rules). Further movement in this direction is therefore crucial, but must be accompanied by a series of broader shifts in food systems (see Section 3.2-3.4).

3.2 NEW GOVERNANCE STRUCTURES: A TREATY TO DELIVER TRANSNATIONAL OVERSIGHT OF AGRI-FOOD CONSOLIDATION

Addressing the effects of industry concentration requires a strong and innovative global governance approach to complement national oversight. Given the explosion in global M&A activity, the economic scale of the merged entities, and the many social, environmental and economic risks described above, the lack of an appropriate international covenant to address corporate concentration represents a major deficit. That there is no international agreement is testimony to the economic importance and political sensitivity of M&As for national sovereignty, and raises questions about power imbalances between regulatory regimes of the global North and global South.

Since 1996, following the conclusion of the WTO agreement and the failure to address competition in this setting[30], the OECD has taken a leadership role in developing "best practices" among member governments. In a recent review of progress, the OECD noted that the overall trend among anti-trust/competition policy regulators within the OECD was increasingly favourable to larger and larger M&As. While generally favorable to facilitating further M&As in the sector, the OECD nonetheless cautioned that countries in the global South should carefully design and develop their own competition oversight, to counter excess influence and pressures from outside agencies (OECD, 2008). As M&As are often inspired by the need to command new technologies, and the direction of new technologies is especially hard to forecast, it becomes of even greater importance for the countries in which these technologies will be deployed to be active decision-makers.

30. During the 1996 Singapore Ministerial Conference, WTO members discussed setting up three new working groups on trade and investment, trade and competition policy, and transparency in government procurement. Countries in the global South strongly opposed their inclusion in negotiations on the basis that the scope was unclear; furthermore competition policy was considered to be one of the areas in which the global North could continue to unilaterally impose its standards on the rest of the world (Sandrey, 2006).

A first step to address concentration at the global level could involve undertaking a collaborative assessment of impacts in food systems. Various intergovernmental bodies should work together to monitor the impacts of increased concentration at various levels (e.g. the Committee on World Food Security (CFS) on rights, FAO on food and agricultural policies, the Convention on Biological Diversity on biological diversity, UNCTAD and FAO on commodity trade, ILO on labour and producer livelihoods, WHO, with FAO, on food quality and nutrition, STI on technology). Meanwhile, national competition authorities should, as a matter of course, seek the advice and experience of other relevant government departments. This could include consulting relevant bodies to hold key justifications for M&As up to scrutiny, e.g. the assertion that industrial food systems and a consolidated agri-food sector deliver 'cheap food'. Advocacy and civil society groups must also be encouraged to consider concentration in their local, regional and global contexts.

To facilitate these assessments, relevant indicators of concentration in various agri-food sectors need to be established, taking account of the risks of concentration of power and political influence, and of the fact that food is not a commodity like any other. Widely accepted indices such as the Herfindahl-Hirschman index (HHI) or the 4-firm concentration ratio (CR4) may not be appropriate to capture the risks in food systems, and are unable to measure the more complex facets of concentration (e.g. cross-licensing agreements, vertical integration). More sophisticated and cross-cutting indicators of concentration could pave the way for regulatory agencies to address the risks of specific forms of vertical integration. Measures would first have to be taken to redefine and broaden the scope of what constitutes a 'relevant market' when reviewing a particular merger. For example, this might include prohibiting any company to market seeds whose viability and/or productivity depends on the application of a companion chemical licensed to or controlled by that company. Further, competition law could be strengthened to break up agricultural input sectors so that pesticide companies cannot also own seed companies, nor farm machinery companies control chemicals, seeds, or crop insurance. Similar steps could also address intellectual property restrictions on seed saving and exchange, or on the proprietary rights relating to farm machinery repair.

A second and more ambitious step could see the development of a UN treaty on competition that directly addresses the differing needs and concerns of all member states. To this end, the recent work at UNCTAD (UN Conference on Trade and Development) in presenting a Model Law on Competition Policy and the Set of Multilaterally Agreed Equitable Control of Restrictive Business Practices should be noted. Although these are only templates for governments, they could provide the basis for developing a global treaty to be implemented by national governments. In light of the apprehension of many governments in the global South for the WTO to tackle international competition policy, any international treaty would have to ensure that all countries are given equal weight in the process (Sandrey, 2006).

While it will be a challenge to accommodate competing interests, and the process may take several years, a carefully constructed international agreement of this type could reinforce more transparent and integrated policy-making at the domestic level. The governing mechanisms of such a treaty are not discussed here; however, to be effective, a Treaty would have to include at least basic provisions in the following areas:

- The greater the concentration and the wider the social and environmental implications of a merger, the greater the disclosure should be of so-called Proprietary Business Information to Third Parties and the public at large. The Public Interest

must have priority over private business information.

- Given that many OECD states encourage pre-merger announcement consultations between regulatory agencies and merging companies (when an M&A may be under negotiation and several months away from submission to an authority), Third Parties (including other enterprises, CSOs and governments) should have a similar opportunity to informally present their perspectives on whether the merger should occur in order to establish a cross-cutting body of information that may be helpful to decision-making.
- CSOs with a track record of experience on competition issues, perhaps in cooperation with concerned legal experts, should be granted permanent Third Party intervention status in reviews of M&As and other forms of consolidation (both internationally and in national competition authorities).
- CSOs should be able to address both market concentration and potential technological transformations impacted by concentration, particularly their effects on the global South.
- Regulatory authorities should ensure that Third Party interveners have adequate time and access to sufficient resources and information to participate fully in the process. The instruments of the Treaty may determine the legitimacy of Third Party participation and financial and information requirements.
- Where the merging Party or regulatory authorities recognize that the proposed M&A has wide extra-territorial impacts (related to either current or future markets or technologies), the deal should be submitted to the Treaty's appropriate mechanism for review.
- The Treaty's governing body (and, possibly, some national jurisdictions) may determine to review approved M&As at specific intervals (e.g. three years and six years) after the M&A is completed, and if the conditions of the merger have not been met, the merger should be amended or nullified.

3.3 NEW KNOWLEDGE AND INNOVATION PARADIGMS: FROM HIGH-TECH TO WIDE-TECH

Many of the risks of agri-food industry consolidation are underpinned by knowledge and information: how it is framed, who controls it and who has access to it. In an era of Big Data, ensuring the coexistence of different knowledge systems, and the different food and farming systems they underpin, emerges as a major challenge.

As consolidation intensifies, it is increasingly difficult to obtain crucial pieces of information along the chain, e.g. access to proprietary livestock and crop genetics information, and agrochemical research data, data gleaned from farm machinery sensors, private research relevant to food safety. While many farmers recognize the advantages of Big Data, questions remain over ownership and access to data gathered on the farm (see Impact 5). For example, it is unclear whether on-farm data collected by one company can only be used and accessed through that same company's data analytics software, and whether a farm could then choose to share its data elsewhere. Paired with a decline in the number of independent information providers and researchers, limited access to proprietary data and technologies reduces the capacity to take proactive initiatives and mitigate potential losses in the face of crisis. In addition, monopoly control over key production data, e.g. on harvest times and volumes, could be used to manipulate the market (Noyes, 2014). The aggregation of consumer data by retailers poses similar questions. In general, data is gathered to gain competitive advantages and create additional value, without compensating or seeking due consent from those from whom data is extracted (Sykuta, 2016; Sadowski, 2016).

The basis of trust and equal relationships between different food system actors that would be required in order to harness the benefits of Big Data for all is clearly lacking. As M&As increase the consolidation of data among a limited number of actors, urgent steps are re-

Open-Source technology: The Oggun tractor.

Drawing from the concept behind open source data technology, CleBer LLC developed the Oggun tractor in 2014 to empower small farmers to build their own machinery anywhere in the world. CleBer uses Open System Manufacturing. With no proprietary rights or patents on the Oggun tractor, the company provides farmers with the full design and parts list of their tractor, so it can be built, adapted and repaired as farmers themselves deem necessary. The tractor can be built from easily accessible parts from multiple local manufacturers and vendors. Open System Manufacturing can be globally applied but focuses on local production, providing accessible, low-cost farm machinery to small farmers.

quired to shed light on questions of access and ownership, to forge more equitable conditions, and to safeguard against the excesses of highly concentrated information, knowledge and innovation processes.

However, addressing these challenges may require nothing short of a change of paradigm. In contrast to the current 'high-tech' approach that governs knowledge and innovation, a 'wide-tech' paradigm would shift the focus to diversified and decentralized innovation, locally-applicable knowledge and open access. 'Wide-tech', a term coined by the ETC Group, refers to the highly-decentralized smallholder-led innovation practices based around macro-technological changes for micro environments (i.e. local farms, abattoirs or fisheries) (ETC, 2009). Wide-tech embraces the principles of traditional, local or indigenous knowledge systems or by aspects of agroecology - approaches too often dismissed as antiquated. While the innovation strategy is wide or "macro", its impact is "micro" and attuned to the sustainability of the immediate environment. It innovates from the whole production environment—taking in, for example, crop, livestock, garden and agroforestry possibilities and complex local strategies to improve yield and reduce pests and diseases. Though the wide-tech paradigm primarily concerns agricultural innovations, it can also be observed in terms of the social and organizational innovations reshaping food distribution and retail, e.g. Community Supported Agriculture (CSA) schemes.

Long-standing approaches of this type have allowed producers to exchange information and share research within their ecosystems and often beyond. For example, in response to hierarchical information systems, peasant innovation networks, such as campesino a campesino movements, have developed and spread farming knowledge for over 30 years by empowering farmers through equal exchanges (Rosset et al., 2011; Sosa et al., 2010). Small farmers have improved and adapted their practices in response to a changing environment, drawing from local knowledge and biodiversity to generate innovation without the use of Big Data. Some of the most resilient innovation strategies have come from approaches blending modern science and indigenous knowledge systems; these have been found to improve food security while promoting agrobiodiversity and securing sustainable livelihoods for farmers (IPES-Food, 2016). It is through farmers and farming communities, and linking various knowledge systems, that the majority of crop and livestock biodiversity is maintained (Altieri et al., 2011; Holt-Giménez et al., 2010; Méndez et al. 2016).

The general embrace of high-tech approaches has meant that these modes of innovation and exchange have received insufficient attention - and have often faced obstacles in order

to endure alongside the dominant knowledge and innovation paradigms. Steps must urgently be taken to ensure coexistence and complementary between high-tech and wide-tech approaches. In some circumstances, high-tech innovations with global applications are highly significant, and under the right conditions, could complement rather than displace location-specific innovations (e.g. by narrowing the information gap for consumers on where their food comes from). Big Data could be extremely beneficial if leveraged by open-source analytical tools, whether to understand the spread of pests, to monitor changes in climatic conditions, or to develop new farming practices.

Farmers' groups and open-source information start-ups are indeed looking to draw on the benefits of Big Data, while striving to keep farm data in the hands of farmers (Khan, 2013). Some new IT companies are driving a shift towards crowdsourced non-proprietary exchanges of information and research, not only within local communities but with small producers and processors facing similar conditions around the world, e.g. on pest control techniques. Unlike the vertical information flows between agri-input corporations and farmers, a number of initiatives are seeking to create multi-directional models of knowledge sharing. In Tanzania, an initiative to create farmer-to-farmer networks through mobile media seeks to empower farmers to be both producers and consumers of knowledge, placing all of those involved on more equal footing, and valuing traditional knowledge in addition to "techno-scientific" solutions (Tisselli et al., 2015).

In areas where digital networks are more accessible, promising tools allowing greater farmers access and control over data and equipment are emerging, e.g. the ISOBlue (part of Purdue University's Open Ag Toolkit) and FarmLogs data analytics softwares. To address prohibitive TPMs, FarmHack was created as a global open-source platform for farmers to share designs for building and modifying tools and machinery. However, all claims to full farmer control over data collection warrant careful scrutiny. Meanwhile, open-source platforms carry their own risks. Platforms such as DivSeeK share genomic information from public gene banks to improve innovations in plant breeding, but this has raised widespread concern that it could lead to proprietary access to public germplasm for the Big Six companies (Hammond, 2013). What matters then is whether farmers are being invited to shape the context in which their knowledge is collected and disseminated, as well as how open-source platforms intend to use their data (Bronson & Knezevic, 2016). Open-source strategies must also be mindful to avoid biases toward the farmers and farming systems (e.g. for export commodities) that can afford top-tier machinery and sensors. Not only might smallholder producers be excluded from the data flow, but their priorities could be swept away as policymakers concentrate on the information made available to them. The dissemination of innovations must therefore include horizontal and participatory mechanisms such as farmer-to-farmer knowledge sharing workshops and platforms, and farmer/researcher participatory research.

3.4 NEW ECONOMIC PARADIGMS: FROM CSR TO EQUITABLE SUPPLY CHAINS

Consolidation - from agribusiness mega-mergers to the upscaling of farms - has become synonymous with global supply chains and mainstream food distribution and retail systems. Operating at scale and integrating different nodes of the chain have become pre-requisites for sustaining the supply chains that deliver high volumes of food commodities to global markets. To resist further consolidation and counter its effects, mainstream supply chains and food distribution systems may therefore need to be circumvented and progressively replaced by alternative systems based around fundamentally different principles. In other words, it is not only new knowledge and innovation paradigms, but also new economic paradigms, that are required.

Social benefits and economic capital must be redistributed and better circulated if consolida-

tion and its impacts are to be countered. While business-led change should be encouraged, changing power dynamics within global food systems requires a diversity of actors to mobilize, new relationships to be forged between food production and consumption, and new networks of distribution and exchange to grow (Scrinis, 2013; Ferrando & Vivero-Pol, 2017).

Many initiatives and actors driving alternative food system practices have already been documented in IPES-Food's first thematic report (2016). Some of the most promising initiatives include short food supply chains, direct marketing schemes, cooperative marketing and purchasing structures, and local exchange schemes (e.g. farmers' markets, sustainable local public procurement, community and school gardens, CSAs, and seed-saving and machinery cooperatives). In the Global South, local exchange systems, local markets, and on-farm direct consumption - often based around principles of food sovereignty and local community empowerment - are offering promising alternatives. Social and solidarity economies emerged in Latin America as a response to the wave of economic liberalization policies in 1980s and 1990s. These movements are driven by community-based enterprises designed to meet local needs, and include producer and consumer cooperatives, local credit associations, collective kitchens in Latin America or tontines in Africa, organizations to support marginalized economic actors (e.g. landless workers), and fair trade schemes (Miller, 2002; Reintjas, 2003; Neatman, 2002).

While sometimes equated with multinational firms, the private sector is made up of a diversity of enterprises, from small-scale farms and fisheries, cooperative business arrangements, to for-profit social enterprises, and in almost every sector, new businesses are emerging to meet the so-called triple bottom line of economic, environmental and social sustainability. Moving beyond short-term business demands or the 'charity model' of philanthropic and corporate social responsibility initiatives, a number of entrepreneurs are attempting to carve out niches within food systems and diversifying market options.

In some sectors, new practices are rapidly becoming the norm, and are paving the way for meaningful de-consolidation. In the North American and European beer sectors, small craft brewers and their customers are shifting towards locally-made, higher-quality products. In the Netherlands, many artisanal brewers are developing a collaborative business culture rather than one of competition, in which knowledge and skill sharing is encouraged (Thorsøe et al., 2016). Most major beer firms are realizing the impacts of this disruption too late, and are struggling to adapt: following conventional wisdom, AB InBev is still in pursuit of further M&As to increase its market shares, including its acquisition of SABMiller in 2016 – backed by 3G Capital. A number of industry analysts have concluded that the industry giant seems unwilling to accept that further growth is no longer a viable strategy (Holloway et al., 2016)[30]. Indeed, further M&As in the beer industry appear to be back-firing: large beer companies' acquisition of similar brands or smaller craft breweries are only further alienating an already dwindling customer base (Leonard, 2012). For example, 44% of young American beer consumers claim to have never tried major brands such as Budweiser (Holloway et al., 2016).

However, the alcoholic beverage sector also provides ongoing examples of the relentless buying out and cooptation of smaller brands across food systems (see Impact 4).

30. Business analysis have even noted that it would highly unlikely for anti-trust authorities to allow further mergers by AB InBev within the beer sector, given current levels of market concentration. However, this has led to further speculation that AB InBev may seek to expand to new sectors, with Coca-Cola or Pepsi as a likely target (Colvin, 2017). Already, AB InBev partnered with Starbucks on the ready-to-drink Teavana brand tea in 2016. In July 2017, AB InBev announced its upcoming acquisition of Hiball, a San Francisco-based producer of energy drinks and organic sparkling juices and waters for an undisclosed amount.

Indeed, despite industry disruptions, large brewers still command the data and the algorithms needed to manage hundreds and even thousands of micro-breweries. In other words, the "long tail"[31] of small markets can be easily swept up by large companies, who have the ability to manage and integrate businesses operating at any scale for relatively low transaction costs - and are able to offer diverse product lines while deviating little from business as usual.

As noted above, the Community Supported Agriculture (CSA) model is another promising source of disruption and de-consolidation of food systems. The direct marketing and farmer-consumer solidarity model underpinning CSAs was first developed in Japan in the 1970s, but has since gained ground in other parts of East Asia, and across Europe, North America and Latin America. The model offers a localized response to consolidated, opaque food systems and ushers in new and direct forms of cooperation and exchange that redistribute risks, e.g. with consumers agreeing to provide upfront support to producers at the start of the season. In 2015, CSAs fed almost half a million Europeans, over 100,000 people in China and over 11 million people in Japan. (Augère-Granier, 2016; Hitchman, 2015; Obe, 2013).

Alternative business models and alternative food system practices are therefore challenging mainstream markets - even if they are yet to transform them. Not all alternative food strategies are intrinsically sustainable. However, they are providing a strong and growing counter-narrative to concentration, and are providing real-life examples of the benefits of a less consolidated food system: reconnecting people with food production, rebuilding accountability, reinvesting brands and products with meaningful standards, and paving the way towards a more equitable distribution of costs and value. Alternative supply chains and business models do not necessarily yield cheaper products - but nor does consolidation systematically reduce food prices (see Impact 1). More information about the real cost of food (i.e. what is included in the price and what is externalized) and greater consideration of the value of food is therefore crucial to build support for these alternatives, and to question the assumed efficiencies of consolidated systems. Further analysis and communication of the environmental, social, and economic costs, i.e. 'True Cost Accounting', as well as the subsidies underpinning major agricultural commodities and supply chains, is therefore key - although challenging to achieve given the difficulties accessing data.

Allowing more diversity and alternative practices to flourish also requires specific institutional arrangements, enabling policy environments, strong social networks, and markets able to support new innovative entrants considered above. Already, government actors are beginning to support alternative economies in a number of ways:

- In July 2014, the French government adopted a comprehensive framework law recognizing social and solidarity economies as a means to encourage entrepreneurship and economic growth in support of sustainable local development (Ministère de l'Economie et des Finances, 2014).
- In 2006, South Korea became the first Asian country to enact a legal framework for social enterprises, with the Ministry of Agriculture, Food and Rural Affairs introducing support for community enterprises in rural areas in 2010 (Bidet et al., 2015).
- The EU has increased its support for alternative and local food systems initiatives; for example, measures within the Common Agricultural Policy's 'Rural Development' pillar allow support to be channeled to developing and local supply chains.

31. In business terms, the "long tail" of a market refers to the growing demand for niche products that are in lower demand and/or with lower sales volume than dominant products, but collectively make up a large enough market share to rival or exceed the demand of the most popular products.

Examples of integrated food policies from the local to the national level

Initiatives to implement integrated food and agricultural policies are cropping up around the world. Local food policy councils are bourgeoning across North America and Europe. For example, bringing together city departments, NGOs, academia, business and the health sector, the **City of Medellin**, Columbia, established a public policy on food security, food sovereignty and nutrition to foster healthy accessible diets for all its citizens (IPES-Food, 2017a). At the end of 2015, the newly-elected government in **Canada** adopted a proposal from the civil society umbrella group, Food Secure Canada, to establish a **National Food Policy** as a priority and carried out a careful process of local to national consultations toward that end in 2017. At the national level, the **UK's People Food Policy** published in June 2017 drew on the inputs of over 80 food and farming organizations to develop at set of integrated policy proposals to transition towards a sustainable national food system (A People's Food Policy, 2017). In 2016, IPES-Food launched **"Towards a Common Food Policy for the EU"**, a multi-stakeholder process to co-develop integrated food policies at the European level.

Ultimately, supporting these alternatives requires the development of integrated food policies to drive a sequenced shift away from industrial food systems and the highly consolidated companies and supply chains on which they rest. Integrated and participatory processes are essential to move beyond the traditional policy siloes that obscure long-term food systems thinking. A policy framework focused on delivering sustainable food systems would help to overcome the narrow focus on consumer choice that governs anti-trust regulation, placing these concerns side by side with strategies to improve farmer autonomy and access to seeds and inputs, or designing diversification strategies to curb the public health risks posed by consolidated livestock operations. It is impressive to monitor the growing number of national food policy initiatives around the world and, especially, to note their grassroots nature and their inclusive approach in bringing together, for example, smallholder producers with anti-poverty movements in urban and rural areas, as well as nutritionists and educators.

CONCLUSION

This report has sought to take stock of how this consolidation is occurring across different agri-food industries, and to identify the impacts that pose the greatest risks to the development of sustainable food systems. It has also identified the steps that are required, from regulatory reforms to broad paradigm shifts, in order to counter the effects of concentration and to address the incentives that continue to encourage consolidation across food systems. Steps to address the risks of industry consolidation are also essential steps to build sustainable food systems, and cannot be further delayed.

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Panel members

Bina Agarwal is former president of the Int. Society for Ecological Economics, and an expert on land rights & food security who has published award-winning books on gender and land issues and received the Padma Shri prize from the President of India.

Molly Anderson is a specialist in hunger, food systems, and multi-actor collaborations for sustainability who has led inter-disciplinary academic programmes and participated in regional food system planning.

Million Belay, founder of the MELCA-Ethiopia NGO and the Alliance for Food Sovereignty in Africa (AFSA), is an expert and advocate for forestry conservation, resilience, indigenous livelihoods and food and seed sovereignty.

Claude Fischler has headed major French research institutions and served on national and European-level food safety committees, and has a long track-record of innovative inter-disciplinary research on food and nutrition.

Emile Frison is an expert on conservation and agricultural biodiversity who has headed global research-for-development organisation Bioversity International for ten years, after holding top positions at several global research institutes.

Steve Gliessman founded one of the first formal agroecology programs in the world, and has more than 40 years experience of teaching, research, publishing and production experience in the field of agroecology.

Corinna Hawkes is an expert on food systems nutrition and health who participates in the World Health Organization's Commission on Ending Childhood Obesity and regularly advises governments and international bodies.

Hans Herren is a World Food Prize (1995) and Right Livelihood Award (2013) Laureate, and has managed international agriculture and bio-science research organizations as well as playing a leading role in global scientific assessments.

Phil Howard is an expert in food system changes and the visualization of these trends. He has authored prominent contributions to the public debate on concentration, consolidation and power in food systems.

Martin Khor is Executive Director of the South Centre, an inter-governmental organisation helping to assist developing countries in trade and climate negotiations, and a former director of the Third World Network.

Olivier De Schutter is co-chair of IPES-Food. He served as UN Special Rapporteur on the right to food from May 2008 until May 2014 and was elected to the UN Committee on Economic, Social and Cultural Rights in 2014.

Olivia Yambi is co-chair of IPES-Food. She is a Senior Consultant on Nutrition and Sustainable Development who served as UNICEF Country Representative in Kenya (2007-2012) and has held other senior roles in the UN system.

Melissa Leach is Director of the Institute of Development Studies (IDS) at the University of Sussex and founder of the ESRC STEPS (Social, Technological and Environmental Pathways to Sustainability) Centre.

Lim Li Ching is a leading NGO researcher with expertise on sustainable agriculture, biotechnology and biosafety who served as regional lead author in the international IAASTD process and has contributed to several UN reports.

Desmond McNeill is a political economy and global governance expert who has led the Centre for Development and the Environment at the University of Oslo, and chairs the Independent Panel on Global Governance for Health.

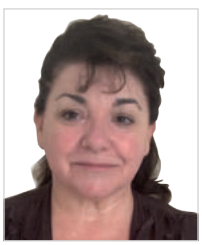
Pat Mooney is the co-founder and executive director of the ETC Group, and is an expert on agricultural diversity, biotechnology, and global governance with decades of experience in international civil society.

Maryam Rahmanian is an international consultant on issues related to biodiversity and agroecology. She was a Research Associate at the Centre for Sustainable Development and Environment (CENESTA), an Iranian NGO from 2001 to 2014.

Cécilia Rocha is Director of the School of Nutrition at Ryerson University (Toronto), and a leading authority on food and nutrition policies in Brazil, including the successful experiments in the municipality of Belo Horizonte.

Johan Rockstrom is a leading global expert on resilience, global sustainability and sustainable development who spearheaded development of the 'Planetary Boundaries' framework to identify key environmental thresholds.

Phrang Roy has served as Assistant President of IFAD and Assistant Secretary General of the UN, and has more than 30 years of international experience supporting rural development, small-scale and indigenous communities' agriculture.



Laura Trujillo-Ortega is an expert in the political ecology & economy of global food networks. She has taught in the US, Spain and several Latin American countries, as well as co-founding two NGOs for agroecology.

Paul Uys has 40 years of global retail experience specializing in brand creation, product development and sustainable sourcing, and now advises several bodies on sustainability issues, including the Marine Stewardship Council.

Notes

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