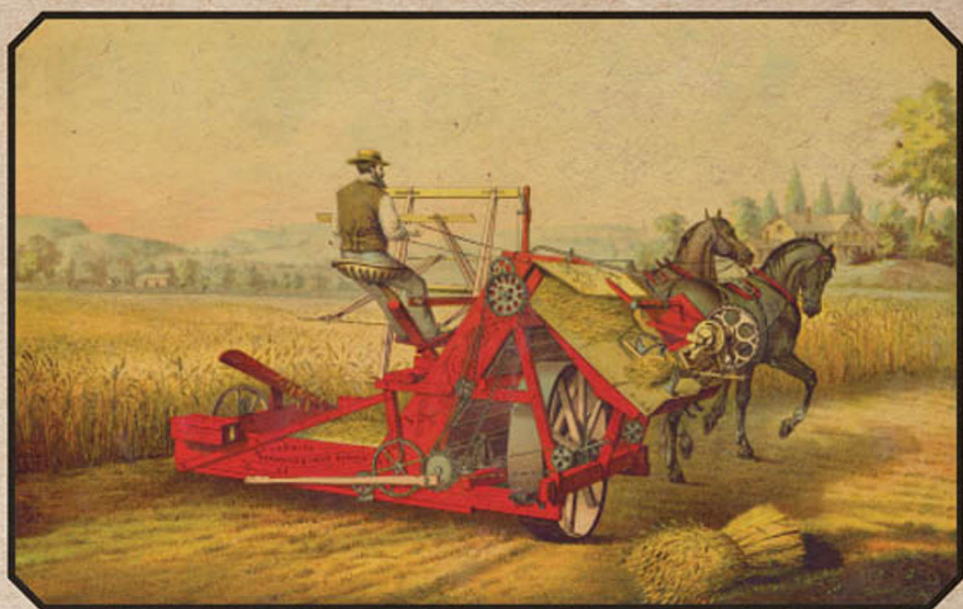


TITANS of **INDUSTRIAL** **AGRICULTURE**



**How a Few Giant Corporations Came to Dominate
the Farm Sector and Why It Matters**

JENNIFER CLAPP

TITANS OF INDUSTRIAL AGRICULTURE

One Planet

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DOMINATE THE FARM SECTOR AND WHY
IT MATTERS

JENNIFER CLAPP

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SERIES FOREWORD

This is at once an odd and exhilarating time to be alive. Our species, *Homo sapiens*, has had roughly 350,000 years on the planet. For most of that time our ancestors barely registered as a quiet voice in a teeming chorus. No more. Now, a human cacophony threatens the ecological foundations upon which all life rests, even as technological wonders point the way toward accelerating expansion. We find ourselves at a moment of reckoning. The next handful of decades will determine whether humanity has the capacity, will, and wisdom to manufacture forms of collective life compatible with long-term ecological realities, or whether, instead, there is an expiration date on the grand human experiment.

The One Planet book series has been created to showcase insightful, hope-fueled accounts of the planetary condition and the social and political features upon which that condition now depends. Most environmental books are shackled by a pessimistic reading of the present moment or by academic conventions that stifle a writer's voice. We have asked One Planet authors to produce a different kind of scholarship. This series is designed to give established and emerging authors a chance to put their best, most astute ideas on display. These are works crafted to show a new path through the complex and overwhelming subject matters that characterize life on our New Earth.

The books in this series are not formulaic. Nor are they Pollyannaish. The hope we have asked for from our authors comes not from overly optimistic accounts of ways forward, but rather from hard-headed and clear-eyed accounts of the actions we need to take in the face of sometimes overwhelming odds. One Planet books are unified by deep scholarly engagement brought to life through vivid writing by authors freed to write from the heart.

Thanks to our friends at the MIT Press, especially to Beth Clevenger, for guiding the One Planet series into existence, and to the contributing authors for their extraordinary work. The authors, the Press, and we, the series editors, invite engagement. The best books do more than convey interesting ideas: they spark interesting conversations. Please write to us to let us know how you are using One Planet books or to tell us about the kinds of themes you would like to see the series address.

Finally, our thanks to you for picking up and diving into this book. We hope that you find it a useful addition to your own thinking about life on our One Planet.

Sikina Jinnah and Simon Nicholson

PREFACE

My daily walk to work takes me down a short, one-block street called Sunshine Avenue. The street is poorly maintained, rarely has cars on it, and is filled with potholes. One side of the street has no sidewalk and is flanked by a gravel parking lot and a grassy field at the back of a retirement complex that I walk through to get to campus every day.

After several months of research for this book, I was surprised to read that the very first line of an article on the rivalry between different harvester companies in the 1930s mentioned Waterloo, Ontario, the town where I live. At first, I found it odd that a medium-sized Canadian city played a role in the story I was researching on the history of the big, multinational agricultural input companies. The article highlighted how the Waterloo Manufacturing Company, which produced threshers and farm engines beginning in the 1850s, partnered with H. V. McKay Company of Australia in 1930 to make a self-propelled combine harvester, known as the Sunshine Waterloo combine. The abandoned site down the road was where the Sunshine Waterloo factory once stood.

What happened to the factory? Ironically, the firm barely produced the combine harvesters it was built to manufacture. The Great Depression of the early 1930s meant that farmers did not have the funds to buy expensive harvesting machines. Smaller farm machinery firms were also up against the huge North American manufacturers like International

Harvester, which held over 80 percent of the tractor market in the United States at the time, and Massey-Harris, the dominant Canadian firm at the time. Those larger firms enjoyed a range of market, technology, and policy advantages not readily available to smaller firms. The Sunshine Waterloo manufacturing plant only narrowly avoided closure by diversifying out of farm equipment into other products, such as automotive parts, bicycles, roller skates, and baby carriages. A handful of the Sunshine Waterloo combines were sold on consignment for farmers farther west in the Canadian Prairies, but the plant never mass-manufactured them. By 1934 the Waterloo Manufacturing Company pulled out of the venture to focus on other industrial products like boilers and engines, and several years later, after the outbreak of World War II, the company started manufacturing armaments to stay afloat.

The Sunshine Waterloo Company never went back to making farm machinery and was eventually sold along with H. V. McKay in the 1950s to what by then was Massey Ferguson (the product of another merger between farm equipment firms). While there were a number of intervening factors, the Sunshine Waterloo Company simply could not compete with the big farm equipment firms that dominated the increasingly global market. Instead, it got swallowed by one of them. The factory was eventually demolished in 1994 when Massey Ferguson was bought by AGCO, now one of the four largest farm equipment firms in the world.

This account of a smaller firm succumbing to the power of a larger dominant firm in the agricultural inputs sector is not unique. There are likely hundreds of abandoned industrial sites scattered around the world that used to produce farm equipment a century or two ago. And it's not just farm machinery that has seen this pattern of big overtaking small. In seeds, fertilizers, and agrochemicals, it is a similar story. Today, just a handful of giant transnational corporations dominate all of these markets. This book is about what has driven that pattern of growing corporate concentration and bigness in agricultural inputs and why it matters.

This story is one with many fascinating details about the people, technologies, policies, and broader market dynamics in the farm machinery, fertilizer, seeds, and pesticides industries. Because it seems a shame to leave out these details, the result is a longer book than I initially intended to write. But I have tried to write each chapter in a way that it can stand

alone to some extent, such that readers can pick and choose which chapters might interest them the most. Readers should, however, be sure to start with the introduction, which sets the scene by describing the core arguments of the book as a whole.

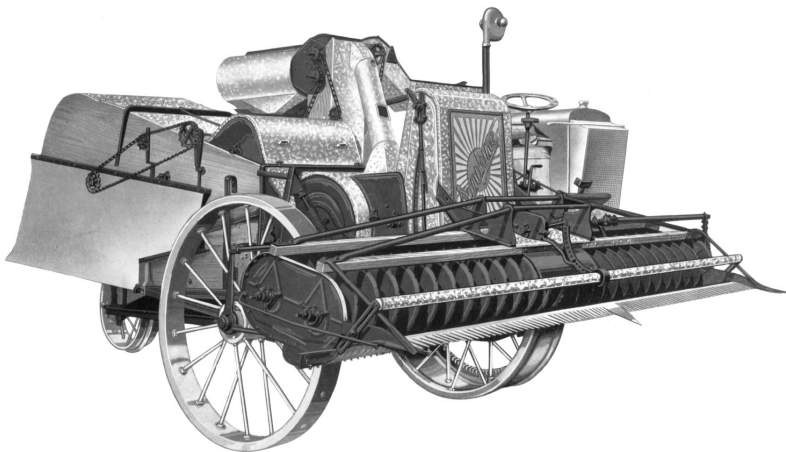
I should also comment on the approach I take in this book in light of the goals of the book series in which it appears. I believe that the kind of hope this series seeks to instill depends on a deep and sober understanding of the complexities of our current predicament. In my view, that requires an appreciation of history. Specifically, in the case of this book, it means a close and detailed study of the origins of corporate dominance within industrial agriculture, as well as the challenges it presents. Only from that historical foundation is it possible to chart a hopeful course forward.

This project would not have been possible without help and support from many. I am grateful to the Social Sciences and Humanities Research Council of Canada for a grant that supported this work (grant 435-0664-2020). I am also very appreciative of the Canada Research Chairs program and the Faculty of Environment at the University of Waterloo for invaluable research support. I am deeply grateful for the generosity of the Killam Trusts. My 2020 Killam Research Fellowship, now known as the Dorothy Killam Fellowship, provided me with the invaluable gift of time to focus on research and writing. I am also grateful to the Rockefeller Foundation's Bellagio Center Residency Program, from which I benefited in November 2019, just as I was getting this project off the ground. The focused time I had in Bellagio was vital for shaping the project, and I gained many insights from interactions with the other residents. I also extend my thanks to Beth Clevenger at the MIT Press for her interest in this project, as well as to Simon Nicholson and Sikina Jinnah for their enthusiasm to have the book reside in their MIT book series. I am also grateful to Anthony Zannino and Judith Feldmann for their work in shepherding this book through the publication process. And I am thankful to three anonymous referees who provided invaluable comments on an earlier draft of the manuscript.

I gained important insights from many people who kindly offered their time to engage with me on this topic while I was working on this book. Some offered to read all or parts of the manuscript when I was in the

process of writing it. Others spoke to me at length about the topic. Some shared vital information that was not easy to access. They provided enormously helpful feedback and perspective that deeply enriched the analysis. I am deeply indebted to Molly Anderson, Hilde Bjørkhaug, Jostein Brobakk, Mary Clock, Andrea Collins, Emile Frison, Keith Fuglie, Shane Hamilton, Angela Hilmi, Phil Howard, Claire Kelloway, Bob Leibenluft, James MacDonald, Sarah J. Martin, Nora McKeon, Philip McMichael, Sofía Monsalve Suárez, Pat Mooney, Maren Oelbermann, Raj Patel, Helena Shilomboleni, Matt Stoller, Mohammad Torshizi, Anders Wästfelt, and Kate Weaver. A number of current and past students also provided outstanding assistance with research and graphics as well as collaboration on related projects, including Taarini Chopra, Kestrel DeMarco, Rebecca Dragusin, Zachary Grant, James Hannay, Indra Noyes, Jenna Phillips, Sarah Louise Ruder, and Rachael Vriezen. I am indebted to a number of librarians and archivists who helped me find specific documents as I researched this topic, including at the FAO Archives and Library, the University of

SUNSHINE - WATERLOO



ONE-MAN - SELF-PROPELLED
COMBINE THRESHER

0.1 Sunshine Waterloo Combine Thresher. *Source:* The Ellis Little Local History Room, Waterloo Public Library.

Waterloo, the Waterloo Public Library, the McLean County Museum of History, and the Vintage Machinery website.

I thank my children, Zoë and Nels Helleiner, for their patience, especially during the pandemic, when I found endless ways to share my excitement about the history of tractors, fertilizers, seeds, and pesticides during dinner conversations. I am grateful to the companionship of my cat, who patiently sat beside me for many hours as I wrote this book and urged me to take occasional breaks. My most special thanks go to my partner, Eric Helleiner, for his willingness to listen to me as I worked out how to approach this topic and formulate my arguments. I could not have completed this work without his love and support. Finally, this book is dedicated to my parents, Jack and Judy Clapp, who taught me the importance of history and the value of critical thinking.

LIST OF ABBREVIATIONS

AAA	Agricultural Adjustment Act
ABC	American Agribusiness Council
AFBF	American Farm Bureau Foundation
BASF	Badische Anilin & Soda-Fabrik
BIO	Biotechnology Industry Organization
Bt	<i>Bacillus thuringiensis</i>
CEMA	Comité Européen des Groupements de Constructeurs du Machinisme Agricole
CFS	UN Committee on World Food Security
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Mexican Maize and Wheat Improvement Centre
CLI	CropLife International
CR4	four-firm concentration ratio
CSIPM	Civil Society and Indigenous Peoples' Mechanism
CSR	corporate social responsibility
DOJ	US Department of Justice
EPA	US Environmental Protection Agency
ESG	environmental, social, and governance
EULA	end-user license agreement
F2F	farm to fork
FAO	Food and Agriculture Organization of the United Nations

FBN	Farmers Business Network
FDI	foreign direct investment
FI	Fertilizer Institute
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FNRL	Fixed Nitrogen Research Laboratory
FTC	Federal Trade Commission
GM	genetically modified
HYV	high-yielding variety
IARC	International Agency for Research on Cancer
ICI	Imperial Chemical Industries
ICP	Industry Cooperative Program (FAO)
IFA	International Fertilizer Association
IFDC	International Fertilizer Development Center
IP	intellectual property
IRRI	International Rice Research Institute
ITC	International Trade Commission
LISA	low-input sustainable agriculture
MAP	Mexican Agricultural Program
MNC	multinational corporation
MOU	memorandum of understanding
NCGA	National Corn Growers Association
NGO	nongovernmental organization
NPK	Nitrogen, phosphorus, and potassium
PAN	Pesticide Action Network
PCS	Potash Corporation of Saskatchewan
PEA	Phosphate Export Association
PPP	public-private partnership
PVPA	Plant Variety Protection Act
R2R	right to repair
SDGs	sustainable development goals
TRIPS	trade-related intellectual property rights
TVA	Tennessee Valley Authority
UAN	urea ammonium nitrate
UCC	Union Carbide Corporation
UNFSS	UN Food Systems Summit

UPOV	Union for the Protection of New Plant Varieties
USDA	US Department of Agriculture
WEF	World Economic Forum
WHO	World Health Organization
WTO	World Trade Organization

1

INTRODUCTION

The agricultural inputs industry is big business. Every year, farmers around the world spend hundreds of billions of dollars on farm machinery, fertilizers, seeds, and pesticides. Although agricultural inputs are a huge sector of the global economy, a relatively small number of very large transnational corporations collectively command the lion's share of the market. For the world's farmers, the names of these firms are all too familiar. In agricultural seeds and pesticides, they are Bayer, Corteva, Syngenta Group, and BASF. The household names in farm machinery—such as tractors and combine harvesters—are John Deere, CNH Industrial, AGCO, and Kubota. And when farmers need fertilizer, they are often buying from big global firms: Nutrien, Mosaic, Yara, and CF Industries. Of course, other large firms in these sectors are also vying for market share, but these are by far the biggest ones.

It is remarkable that the sector looks the way it does today—with only a handful of global firms providing such a large share of world's farm inputs—considering that just a few hundred years ago, agricultural inputs were not usually widespread market commodities. Farmers typically saved their own seeds to plant the next season; used available waste materials and crop rotations to ensure that plants received sufficient nutrients; intercropped plants to keep pests at bay; and used hand or horse-drawn implements that they could craft themselves to till the soil and harvest

crops. No doubt there was some local commercial trade in some of these farm inputs dating back even further than a few centuries ago, but as late as the mid-nineteenth century, agricultural inputs were not very commodified and certainly not dominated by transnational corporations.

This book explains how we got from there to here. In other words, it outlines how the agricultural inputs sector came to be dominated by just a few gigantic agribusiness firms—the titans of industrial agriculture. It begins by showing how the roots of today’s giant agribusiness firms in fact run deep. Already by the early twentieth century, some parts of the sector—especially farm machinery—were controlled by just a few massive firms. By the mid-twentieth century, this was true of the entire sector, including not just farm machinery but also fertilizers, seeds, and pesticides. Each of these four industries has a specific history, from initial widespread commodification in the early to mid-1800s to dominance by just a few very large firms by the early to mid-1900s. Tracing these separate trajectories, however, reveals that they share some broad similarities. The firms that rose to the top benefited from distinct market, technology, and policy advantages that enabled them to gain power and wealth.

Once these firms became large and dominant, they leveraged various dimensions of their power and wealth to shape markets, technological innovation, and government policy processes in ways that enabled them to grow even bigger as they acquired their rivals, even as they often changed names while undergoing consolidation. In short, bigness soon begot more bigness, and the power of the big players became increasingly entrenched and globalized. Over the past century, the sector was restructured over and again, but always with just a few firms taking a commanding lead over the others. In the past fifty years, the seed and agrochemical pesticide industries—once entirely separate sets of firms—combined into one set of firms that sold both products, tethering together seeds and agrochemicals with agricultural biotechnology, which modified seeds to work with specific chemical herbicides. The fertilizer and farm machinery sectors also saw major consolidation, which dramatically reduced the field of firms to a handful in each sector that dominated globally by the turn of the twenty-first century. As this consolidation continued apace, farmers became locked into industrial production systems that made them increasingly dependent on the large agricultural input firms.

In 1999, US Secretary of Agriculture Dan Glickman expressed his concern about farmers' loss of power in relation to the large agricultural companies: "There's a fear this will turn into 14th-century feudalism. Those farmers will become serfs. We're not there yet, but it may be coming."¹

Many would say we are already there. The Big Ag companies that dominate the inputs sector have grown even bigger in the decades since Glickman's observation, with the latest major restructuring taking place since 2015. The most recent round of mergers reduced the number of dominant players in the seed and agrochemical pesticide industry from six to just four. It also saw two of the major fertilizer firms combine forces and integrate activities not just horizontally across the main nutrient inputs of nitrogen, phosphate, and potash, but also vertically along the supply chain from production to retail. At the same time, all the major firms in the agricultural inputs sector began a flurry of acquisitions of smaller technology firms to place themselves in the race for digital or biological dominance in agriculture—or both.

The complex history that generated today's concentration in the agricultural inputs sector is frequently obscured from view and replaced by a much simpler explanation often promoted by the leading firms themselves. According to that version of history, today's large and dominant firms were able to rise above the rest simply because they were more efficient and more successful at innovating in ways that made them market leaders. This efficiency of large firms in concentrated markets, the argument goes, translates into lower prices and better products for their customers.² Ed Breen, CEO of DuPont, exemplified this view when Dow and DuPont announced their merger in 2015. The merger resulted in the creation of three new firms, including Corteva Agriscience, a new giant agricultural input firm, which Breen declared "will be able to allocate capital more effectively, apply its powerful innovation more productively, and extend its value-added products and solutions to more customers worldwide."³

A deeper historical look at the drivers behind the rise of corporate concentration and bigness in the agricultural inputs industry exposes this "bigger is always better" narrative for what it really is: a myth. There were in fact multiple factors that encouraged consolidation, including direct support from governments, technological lock-ins, and preferential access to financial capital. This closer read of history shows that in

line with studies of other sectors such as automobiles, airlines, and pharmaceuticals, the dominant firms did not become big and dominant by simply being “better” at what they do.⁴ Over and over again, these other kinds of factors enabled the lead firms to extend their dominance by merging with or acquiring their rivals while discouraging competition from would-be challengers.

Why does it matter how these firms got so big and powerful? If large companies in the sector are able to deliver productivity-enhancing inputs, and farmers continue to buy them, then perhaps bigness is not an issue. That is what the giant firms want us to believe. They point to increased agricultural productivity under the corporate-dominated industrial agricultural model as evidence of the benefits of bigness. These firms often portray themselves as the only actors capable of ensuring sufficient food production to “feed the world.” When Bayer announced its acquisition of Monsanto in 2016, its CEO at the time, Werner Baumann, stressed this approach: “This combination is going to create a global leader in agriculture and realise the shared vision of an enhanced agriculture offering that is ultimately going to deliver earlier access to better solutions for growers, so that they can help contribute to closing the gap between supply and demand that is unfolding with an ever growing population in the world.”⁵

The notion that we need industrial inputs from the Big Ag firms to ensure global food supply has long been a powerful narrative. That view, which draws on what many analysts deem to be flawed neo-Malthusian thinking, extends far beyond corporate headquarters and into policymaking arenas.⁶ Indeed, the issue of corporate dominance in food systems barely registered at the 2021 UN Food Systems Summit, which was tasked with finding “game-changing solutions” to transform food systems to make them more equitable and sustainable. This lack of attention to corporate dominance sits in sharp contrast to growing civil society and anti-trust movements that have focused on this very problem.⁷

The rise of corporate power in the sector matters because it has enormous implications for the future of food systems.⁸ Most directly, the titans of industrial agriculture exercise their power to shape markets in ways that weaken competition and reduce choice. They also direct innovation in ways that prioritize profits over the public interest. And they exert political influence over policy processes in ways that advance their

interests while undermining democratic participation. More broadly, the rise of just a handful of powerful firms selling farm machinery, fertilizers, seeds, and pesticides cannot be easily separated from the transformation of agriculture into a large-scale industrial activity, which has generated enormous social and ecological consequences that threaten the planet and the future of food systems. The model of agriculture that these firms developed and have refined over the past two centuries has become locked in, such that shifting away from it is especially challenging, despite the growing awareness of the need for food systems transformations to address the social and ecological impacts of the industrial model.

Concerns about corporate concentration today extend well beyond the agricultural inputs sector. For example, we have heard a lot in recent years about the concentrated power of the Big Tech firms, which are often put in a longer historical context of corporate dominance in other sectors, such as oil and railways.⁹ Until recently, there has been much less attention paid to the power of big, concentrated firms in the agricultural sector within this broader discourse on corporate power. And there has been even less attention paid to the long history of the dominant firms in the sector. The long view of corporate dominance in the agricultural inputs sector that I take in this book is important because today's agribusiness titans have an extensive lineage back to some of the original firms in the sector, from which we can learn a great deal about the nature and dynamics of corporate power more generally.

I was motivated to focus on bigness in the agricultural inputs sector after reading *Other People's Money and How the Bankers Use It* (1914), by Louis Brandeis, US Supreme Court justice and critic of large corporations and their power. In this short but powerful work, he wrote: "Size, we are told, is not a crime. But size may, at least, become noxious by reason of the means through which it was attained or the uses to which it is put. And it is size obtained by combination, instead of natural growth, which has contributed so largely to our financial concentration."¹⁰ For Brandeis, the concentration of wealth went hand in hand with the concentration of power and political influence, which ultimately undermined democratic institutions. He is widely quoted as saying, "We must make our choice. We may have democracy, or we may have wealth concentrated in the hands of a few, but we cannot have both."¹¹

Brandeis sought to understand how concentrated market structures emerged. He stressed that this understanding must come not from theorizing, but from detailed study of the experiences of the firms involved, especially as they rose to power in the late nineteenth and early twentieth centuries—a period of expanding industrial capitalism. Brandeis emphasized that monopolies were not “natural,” nor were they simply the result of the superiority or greater efficiency of certain firms over others. Rather, he believed that the suppression of competition was due to either “ruthless processes” or “improper use of inordinate wealth and power.”¹² My aim in this book is to investigate the details of how this process unfolded in the agricultural inputs sector.

In tracing the rise of corporate dominance across four agricultural input industries, this book chronicles many stories that are punctuated with fascinating characters and complex dynamics. Because this is a long book, I provide next in this chapter a brief overview of the key themes that emerged from the analysis. I advance three broad points. First, I show that dominant agribusiness firms over the past two centuries benefited from market advantages, technological change, and state support within the wider economy in ways that enabled them to expand and capture commanding market shares. Second, I explain how those firms, once big, actively used their already advantaged position to exercise influence over those same market, technology, and policy contexts in ways that enabled them to extend their dominance. Third, I make the case that there are extensive costs to having just a few large firms dominating the agricultural inputs industry, including the immediate costs of concentration and the exercise of corporate power, as well as the wider costs of the industrial agricultural model developed and promoted by those same firms.

HOW THE AGRICULTURAL INPUT FIRMS GOT SO BIG

Throughout this book, I explain how the dominant firms in the farm machinery, fertilizer, seeds, and pesticides industries grew so big and powerful in the first place and how they continued to get bigger. It is important to pause briefly here to define what I mean by *big*. Although there are numerous works on the question of corporate dominance in the

economy more broadly, *bigness* is difficult to define in specific, numerical terms. What may be considered “big” differs by sector, and there are data gaps and weaknesses that make exact measurement tricky. Most analysts consider big firms to be those that lead in what economists call oligopolistic markets, where just a handful of firms hold a significant share of a market. These firms are often easy to spot, even if it is hard to measure them precisely.¹³ Usually such corporations are found within markets where the top four firms control 40 percent or more of the market. The 40 percent threshold for this four-firm concentration ratio (often called the CR4 for short) is a general one; beyond this threshold, economists believe that competition is likely to be weakened.¹⁴ The emphasis in this book is not on measuring precise concentration ratios in the input industries, but rather on the idea that a small number of firms can dominate markets by making up a large share of the market and that this market domination has important implications.

Critical analysts argue that the top agricultural input firms are large and powerful today because of the unequal dynamics generated by industrial capitalism—especially the drive on the part of firms for profit accumulation. This process was turbocharged by the rise of neoliberalism in the 1980s, as states implemented hands-off regulatory processes that put businesses in the driver’s seat. These forces are indeed important and inform this analysis. At the same time, it is also instructive to disentangle the key constituent aspects of these broader dynamics of capitalism, including the way in which the drive for profits in the marketplace intersects with government policies and technological change. What I found is that dominant firms in the sector had distinct advantages along each of these dimensions that allowed them to climb to the top of the market, typically by acquiring other firms until they had amassed a significant market share. Echoing Brandeis’s findings from a century earlier, being “better” or “more efficient” was not a predominant force. I next outline the importance of the market, technology, and policy factors that benefitted the dominant firms. I separate them into three distinct categories to highlight the conceptual framework being employed for this analysis, but in practice, the ways in which these factors encouraged bigness in the sector are often deeply entwined with one another.

MARKET AND FINANCIAL DYNAMICS

Economic explanations for corporate bigness usually focus on some element of market dynamics. “Economies of scale,” commonly cited, occur when average costs of production fall as output is increased. In other words, as firms expand their scale of production, they can often benefit from lower costs per item they produce, making them more efficient. Economies of scale have indeed been important to some extent as the agricultural input industries have grown in size. Many of the early firms in this sector were established at the same time that national and regional markets were emerging in the late 1800s in the United States, Canada, and Europe, with new transportation technologies such as railways enabling those firms to produce goods on a larger scale for wider markets.¹⁵ As markets became more globalized after World War II, firms that were already set up with large-scale production had an advantage in reaching worldwide markets. Although economies of scale can explain bigness to some extent, the concept also has limits. As firms get larger, they can actually encounter “diseconomies of scale,” whereby they get so big that they become inefficient.¹⁶

Privileged access to capital has favored certain firms and enabled them to become large through mergers and acquisitions of their rivals. Firms in sectors that are highly concentrated can access funds for such deals by coordinating implicitly or explicitly with other large firms to fix higher prices or by participating in cartels to manage prices and supply, practices that dissuade competitors from entering the market.¹⁷ Firms across all of the agricultural input industries have a long history of engaging in such practices, even though many of those activities have long been forbidden by state competition policies.

The largest firms also typically have cozy relationships with financiers and wealthy investors, who encourage merger deals as a way to achieve higher earnings on their investments. To meet investor demands for higher returns, many firms have ramped up their pursuit of mergers and acquisitions, especially in response to agricultural boom-and-bust cycles that create market opportunities. In boom times, when agricultural prices are rising, there can be mergers that try to capitalize on expanding demand as well as new opportunities that may arise from technological developments. In down times, when agricultural prices are falling, financial investors typically encourage firms to join efforts to save costs

and achieve “synergies”—a euphemism for cutting jobs and combining research and development efforts. Investor pressure for consolidation has become more pronounced since the 1970s, when a broader shift toward the prioritization of “shareholder value” meant that the primary role of firms was increasingly seen to be delivering value to shareholders rather than serving the needs of society.¹⁸ Consolidation, in other words, means more market share, which translates into higher profits and more income for investors. Dominant firms’ privileged access to finance creates further barriers to entry that make it difficult for other firms to enter the market because they cannot match such levels of investment.

All of these market factors have been important in helping to explain concentration and consolidation in the agricultural inputs sector, as will become clear in the following chapters. Mass manufacturing in large factories that began in the latter part of the nineteenth century brought down average costs for the production of farm equipment and tractors in the United States, for example, enabling those firms with patent protection to capture large portions of an expanding market and earn huge profits. Firms across all four inputs have engaged in extensive mergers and acquisitions in concert with wealthy financiers and investors for well over a century, as exemplified by the 1902 megamerger that brought together seven farm equipment manufacturers under one new firm that suddenly commanded 85 percent of the US tractor market. Firms in the input industries also have a long history of engaging in the formation of cartels, some of which still exist today in the fertilizer industry.

TECHNOLOGICAL CHANGE

Technology also plays a role in explaining the rise of corporate bigness. Firms with pioneering entrepreneurs and inventors are often at the cutting edge of technological changes that can transform markets in ways that give the first movers distinct advantages in the market.¹⁹ When first movers have intellectual property protection over their inventions, such as patents or trade secrets, they are well placed to make enormous profits if those technologies are widely adopted. Firms that control existing assets that are suddenly deemed important or useful to new production processes can also benefit. These factors were important across the

agricultural input industries, as the firms that rose to the top of their sectors by the mid-twentieth century often were in positions to capitalize on new technologies and new uses for existing materials to drive profits and command market share.

Technological change can also alter the structure of an industry in ways that encourage corporate mergers.²⁰ Just as fossil energy in the form of coal and then petroleum gave rise to large-scale manufacturing firms, it also encouraged the industrialization of agriculture.²¹ The invention of techniques to synthesize nitrogen-rich ammonia in the early twentieth century, for example, created entirely new dynamics in the fertilizer industry that shifted its focus from guano trading firms to chemical companies, very few of which initially had access to the new process. Technological complementarities within and across the agricultural inputs sectors also mattered, such as the development in the 1990s of genetically modified (GM) seeds that work with specific herbicides, which encouraged consolidation among top firms in the seed and agrochemical industries.

Related to these dynamics are technological lock-ins, which have benefited larger firms. As a technology becomes dominant and widely adopted, the benefits accruing to its users and to its producers tend to increase. Firms that produce dominant technologies often benefit from network effects, including increased sales as the number of users of that technology grows as well as sales of complementary products that are linked to the original technology, which tend to lock in users to certain technological pathways. Sectors with locked-in technologies tend to be more oligopolistic, especially when there are significant barriers to entry for newcomer firms.²² These dynamics are prominent today in debates over the power of Big Tech firms, but they also have long-standing relevance to the rise of bigness in the agricultural input sector.

The protection of intellectual property (IP), through patents or trade secrets, was a vital factor in the early development of the seeds, agrochemicals, fertilizer, and farm machinery sectors. Those industries experienced breakthrough innovations such as the hybridization of seeds, the development of synthetic pesticides using organic chemistry, nitrogen synthesis, and new machinery designs and features that benefited the first movers. Lock-ins also developed across all four inputs, especially as machinery, fertilizers, seeds, and agrochemicals were increasingly

developed by firms to work together in farm fields. This planned lock-in reinforced the use of all of these inputs through industrial farming practices that were subsequently globalized under the Green Revolution after World War II.

POLICY CONTEXT

Various government policies and regulations have long played critical roles in shaping the rise of the big agricultural input companies. Laws protecting IP enable inventors to claim exclusive rights to their innovations. Patent protection, for example, gives firms a temporary legal monopoly over their intellectual property for a specific period, typically around twenty years. States typically support this kind of IP protection to encourage innovation. Some analysts contend that the largest and most profitable firms today are those that control the most valuable portfolios of IP rights, which generate large cash flows that they can use to buy up would-be competitors.²³ IP protection has been especially important in the rise to bigness of the firms in the agricultural input industries, which has given those firms first-mover advantages.

A great deal has been written more broadly—from both critical and mainstream perspectives—about the ways in which firms have benefited from state policies that have championed their industries through subsidies, access to state-sponsored R&D funding, and other policies and regulations that favor certain products and industries. Across all the agricultural input industries, state support was extremely important in building up the sector, and some firms benefited handsomely. The US government, for example, provided the bulk of the basic research that supported seed hybridization, from which just a few firms with privileged access to key seed varieties and breeding processes benefited.²⁴ State-funded research and development also benefited large firms in both the fertilizer and agrochemicals industries.

Weak and uneven competition policies (referred to as “antitrust” in the United States) also played a significant role in the rise of big firms in the agricultural inputs sector. The 1890 Sherman Act in the United States, as outlined by the US Federal Trade Commission, prohibits “every contract, combination, or conspiracy in restraint of trade” and any

“monopolization, attempted monopolization, or conspiracy or combination to monopolize.”²⁵ In other words, it outlaws collusion and monopolization. The United States passed subsequent rules to strengthen competition laws by the mid-twentieth century. The 1914 Clayton Act, for example, prohibits activities that weaken competition, such as mergers that result in less competitive markets, the tying or bundling of related products, predatory pricing (charging low prices to drive out competition and then raising them), and interlocking directorships where individuals sit on the boards of competing companies.²⁶ Although other countries also put competition policies in place—such as Canada’s Anti-Combines Act of 1889, which predates the Sherman Act—there is no global agreement on competition policy, and the rules across jurisdictions vary.

The robustness with which competition authorities have enforced laws has varied over time. The United States strictly enforced antitrust laws in the early part of the twentieth century, for example, a key factor in the trust-busting that dismantled large firms that tended toward monopoly. Standard Oil, for example, which controlled not only the oil market but also the oil trading infrastructure, was broken up in 1911. These laws were also instrumental in several big antitrust cases against firms in the farm machinery, fertilizer, and agrochemical sectors in the early twentieth century. But as the ideology of neoliberalism rose in the 1970s and 1980s, antitrust laws were interpreted in new ways that allowed more corporate consolidation to occur. Mergers across all the agricultural input industries since 2015 have been in part linked to this weakening of antitrust rules, with many countries following the US lead since the 1980s in watering down how antitrust rules are applied.²⁷

EXTENDING BIGNESS: THE EXERCISE OF CORPORATE POWER AND ITS CONSEQUENCES

In addition to explaining how the agribusiness titans grew so big over the past century and a half, this book explains how their bigness enabled them to shape the very same market, technology, and policy contexts in ways that extended their dominance. In practice, these various kinds of power are entangled with one another. For example, the power to shape markets

often derives from the power to influence policy and vice versa, and dominance in the marketplace can privilege certain technologies over others. When firms adopt certain kinds of practices, it is a sign that they are seeking to exercise their power to strengthen their position in the market.

POWER TO SHAPE MARKETS

Large and dominant firms have the ability to shape the contours of the marketplace. Economists call this market power, and it refers to the capacity to raise prices above competitive levels by controlling key aspects of the market, resulting in excess profits.²⁸ Market power helps explain both how firms can raise funds to get big and how they can stay big. Large and dominant firms can extend their market power by taking actions that reduce competition, such as by erecting barriers that dissuade entry into the market for other firms. The larger the share firms have in the market, especially in highly concentrated sectors, the more capacity those firms have to exercise market power. Although formal collusion among firms to raise prices is technically illegal under competition policies, it becomes increasingly easy for dominant firms in highly concentrated sectors to tacitly follow price increases of other top firms without hurting sales.²⁹

These kinds of practices have been common in the agricultural inputs sector. For example, the dominant firms have been able to push up prices well beyond their costs of production, especially for products with few competitors, such as GM seeds, without fear of losing markets. Similarly, farmers have long been suspicious that fertilizer firms have curtailed production and elevated prices in times of rising crop prices as a way to capture excess profits. Firms in the sector have also erected barriers to entry, as we have seen with firms acquiring numerous patents for a certain type of product—such as genome-edited crops—that allows them to act as a gatekeeper for certain technologies. Firms also engage in vertical integration across inputs sectors, such as the merging of production, mixing, and retail in the fertilizers sector, which makes it difficult for newer firms to compete. All of these strategies reinforce the concentrated nature of the inputs markets in ways that give these firms additional power to shape the terms of the market in ways that expand their ability to raise profits and thereby accumulate more capital.

POWER TO SHAPE TECHNOLOGY

Firms at the top of concentrated sectors also have enormous power to shape technology and innovation pathways in ways that serve their own interests. This kind of technology power is an aspect of corporate power that I would argue, along with international relations scholar Robert Falkner,³⁰ deserves more attention in the literature and in competition policies. It is related to what international political economy expert Susan Strange called “knowledge power”—the power to access and use knowledge in ways that advance one’s interests, such as shaping the direction of technological innovation to create or extend a market advantage.³¹

Economists recognize that firm size can affect innovation, although whether larger or smaller firms have more innovation capacity is subject to debate. It comes down to differing views on incentives. On one hand, because of their access to greater amounts of capital, larger firms have more funds to invest in R&D. On the other hand, why would a monopolist invest in innovation if it did not need to do so to continue to sell its products? There is an emerging middle ground position in this debate that recognizes that large firms may indeed lead in spurring some innovation, but beyond a certain point, the innovation intensity of large firms declines.³² This insight is important for understanding the technology power of large and dominant firms in the agricultural inputs sector because it indicates that they have the power to both encourage *and* stifle innovation to suit their priorities.

The dominant firms also have the capacity to spend large amounts on what might be seen as defensive R&D rather than innovation that breaks new ground and establishes better ways to do things. That is, they may be spending on research for innovation, but their efforts on this front focus on ways to shore up markets for their existing products, especially as patents for particular products expire, rather than investing in novel ideas that are likely to lead to transformative breakthroughs.³³ Whether the dominant firms focus on novel or defensive innovation, economist Mordecai Kurz notes that in the absence of strong public policy to regulate market power, “innovators are able to drive out competitors and turn a small initial competitive advantage into a sprawling monopoly.”³⁴

The exercise of technology power has long been extensive in the agricultural inputs industry and is accentuated by the fact that corporate R&D

in the agricultural inputs sector now outpaces all public sector agricultural R&D. Although investment in R&D in the combined seed and agrochemical industry initially increased following the corporate mergers and acquisitions of the 1990s, by the early 2000s, that innovation had already begun to decline.³⁵ Moreover, the innovation in which those firms invested overwhelmingly focused on genetically modifying seeds to work with existing products, such as glyphosate-based herbicides, which increased chemical sales, rather than new seed traits that would have been useful for farmers, such as higher-yielding and drought-resistant varieties. Similarly, firms in the sector are now investing in digital and biological technologies, also with a view to extending the use of existing herbicides.

POWER TO SHAPE POLICY AND GOVERNANCE

Large firms have the power to shape the direction of policy and regulations that affect their businesses. In the agricultural inputs sector, they have long used this power to press for rules that enable them to expand their businesses. They do this through multiple strategies that are outlined in the literature on the different dimensions of corporate political power—some of which are more visible than others.³⁶

One of the more visible and direct ways that agribusiness firms have attempted to shape policies is by lobbying policymakers. When firms lobby, either individually or through industry associations in which they are members, they are attempting to directly influence the behavior of another actor to generate certain outcomes. Agribusiness firms can also have somewhat direct influence over policy by nominating private sector executives for government regulatory positions and then rehiring those executives when their time in government has ended, in what is often termed the revolving door. Firms can also access direct channels of influence over policy through their engagement in public-private partnerships with governments or international organizations.³⁷

The big firms in the agricultural inputs industry also can influence policy in less direct and sometimes less visible ways. They can leverage their structural position in the marketplace to set regulatory agendas and benefit from policy advantages. Governments, for example, often pursue policies that serve the interests of large and powerful firms even

in the absence of those firms expressing their preferences via lobbying. They do this simply because those firms provide jobs and tax revenue and governments do not want them to relocate. Firms also set agendas by establishing voluntary industry codes of conduct, thus shaping the broader context of policymaking, including in ways that make those rules de facto conditions for operation for smaller firms, which can make it difficult for the latter to compete.³⁸ Agribusiness firms also actively use other indirect strategies to influence the discourses and narratives that are the backdrop to the broader policy context. Dominant firms can shape ideas that influence the public's reception of their businesses by engaging in public debates, sponsorship of scientific studies, corporate advertising, and other forms of public messaging.³⁹

When large firms are able to exercise these kinds of power, they undermine processes for democratic participation in the policymaking process. As the following chapters outline, the big agricultural input firms have actively sought to influence government policies since the 1800s. They have spent hundreds of millions of dollars to lobby governments, sponsored scientific studies on agrochemicals in a bid to influence regulatory decisions, engaged in partnerships and multistakeholder initiatives in the agricultural sector, and pushed voluntary industry measures as a means to dissuade governments from pursuing stricter regulations.

THE BROADER COSTS OF CORPORATE CONCENTRATION AND POWER IN THE FOOD SYSTEM

Corporate concentration in the agricultural inputs industry matters in multiple ways. The analysis in this book notes the extensive costs to having just a few large firms dominating in a concentrated agricultural inputs industry. These costs arise because the dominant firms have exerted their power for nearly two centuries in ways that support their business model, which is based on a continuation of industrial agricultural production methods.

The firms in the agricultural input industries claim that bigness enables them to deliver better products that will increase farmer profits. But the pricing and innovation implications of concentration noted above bring these claims into question. Critics have long insisted that the various

dimensions of power at the disposal of the agribusiness titans result in greater inequities. Farmer livelihoods are at risk from growing corporate concentration and power in the food system, which directly affects their production costs. Especially vulnerable to these effects are the nearly 600 million small-scale farming households around the world that produce a significant proportion of the world's food. Small-scale enterprises that seek to provide alternative inputs to farmers also face huge obstacles to entering the market and are disadvantaged in terms of access to funding for research and development. As a result, farmers have fewer input choices available to them. And if these effects result in an increase in production costs for farmers, it can push up food prices.

There are also massive implications that arise from the broader development and spread of the industrial agricultural inputs that have been delivered by large, concentrated firms. The introduction and evolution of the industrial model of agricultural production were intimately shaped by the large agribusiness firms in the farm machinery, fertilizer, seeds, and agrochemicals industries since at least the mid-1800s. From their earliest days, the industrial versions of these inputs have been critiqued for their enormous social and ecological consequences, although critics' voices were often drowned out by promoters of those technologies.

The social costs of the industrial agricultural model go beyond the impacts of higher prices. The diffusion of farm machinery on a wide scale has long been associated with rising concentration in landholdings and displacement. In most industrialized countries and increasingly in less industrialized countries, average farm sizes have grown as the number of farms and farmers have been declining. This process began as early as the mid-1800s with the initial adoption of industrial farm tools such as steel plows and mechanical reapers, which enabled settlers in North America to move westward and clear new lands, displacing Indigenous peoples from their lands. There is also a long history of racial discrimination and harsh working conditions, including forced labor, associated with the fertilizer sector.

The advent of tractors and modern inputs in the early twentieth century accelerated the concentration of landholdings and displacement. As tractor use expanded in the early 1900s, many farmers sought to increase the size of their farms. Farming larger tracts of land lowered the cost per

acre of operating farm machinery and increased revenue, making the adoption of other inputs such as synthetic fertilizers, hybrid seeds, and pesticides more affordable. Poorer farmers and those who did not own farmland, including many Black farmers who rented farmland or worked as sharecroppers on others' land, were displaced in this farmland consolidation process. These social costs of the rise of the corporate-led industrial agricultural model have long been overshadowed by narratives of the necessity of industrial inputs to "feed the world." It is important not only to recognize this history of the early development of industrial farm inputs and its human costs, but also to address the injustices that took place in the name of the industrial farming model that powerful corporations today work so hard to uphold.

The industrial agricultural model supported by large input companies also has widespread ecological and health costs, many of which have been increasingly recognized as the model has emerged and evolved. Soil fertility was a major issue of concern in the mid-1800s, and it was a key factor in the drive to find artificial fertilizers to counter soil deficiencies. But by the early twentieth century, there were concerns about the impact of overplowing and the use of synthetic fertilizers on soil quality. In addition, land clearing for large-scale industrial monoculture farming has raised concerns about biodiversity loss for at least a century.

The industrial model of agriculture is widely associated with increased emissions of greenhouse gases, not just from the fossil fuels needed to propel machinery on the farm but also from plowing soil that releases carbon and because pesticides and artificial fertilizers are petroleum-based products. These latter two inputs are also responsible for significant chemical runoff, resulting in pollution that is a threat to human and animal health and ecosystems. Additionally, as weeds become more resistant to the application of widely used herbicides, the big corporations are rolling out or reviving even more toxic chemicals to address the problem. Early environmental and health critics of industrial agriculture such as Rachel Carson were often harshly critiqued by the large corporate players. The big firms claimed that these critics had limited scientific expertise and were overstating the problems. However, large corporate firms in the sector are now increasingly being forced to acknowledge and respond to these environmental concerns, even as they continue to fight

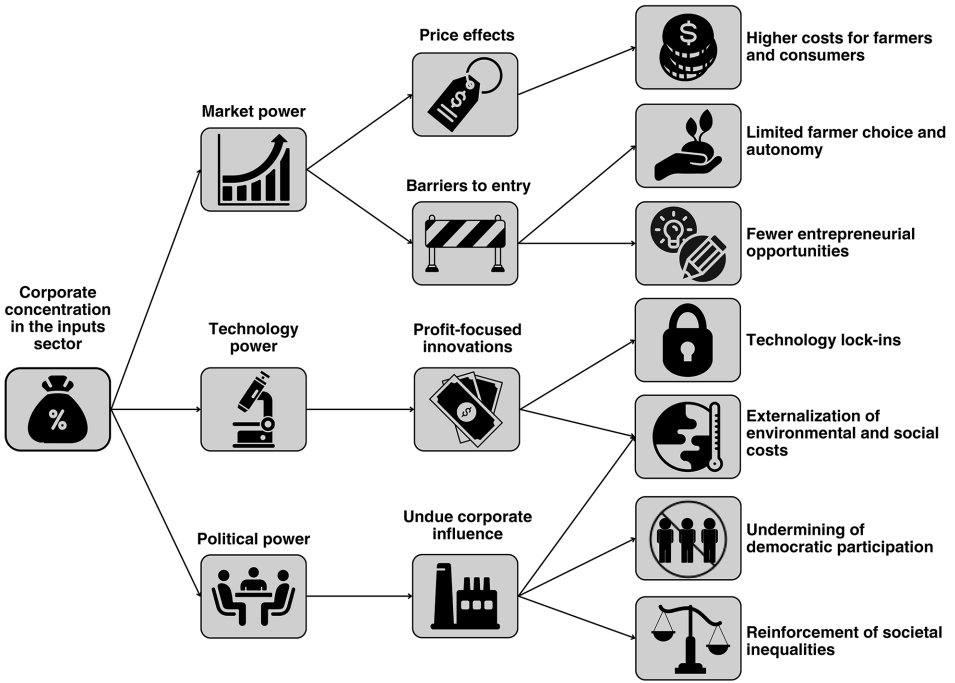
for regulatory processes to approve of the very products that have caused those problems.

Of course, many factors contribute to the social and ecological problems generated by industrial agriculture. But a deeper historical analysis reveals that it is impossible to disentangle the large and dominant firms that shape the markets, technologies, and policies that underpin the industrial agricultural model from the many problems associated with that model. The extraordinary power that firms in the sector have in shaping markets, technological pathways, and policy frameworks is deepening the lock-in of the industrial agriculture, which presents an enormous challenge to the project of food systems transformation. Instead, the large, powerful firms are advocating for what they call “transformation,” but which many critics say is really just a set of minor tweaks to the industrial farming model that continues to deliver excessive profits and control to the existing big firms within the system.⁴⁰

The political power and actions of the large industrial input firms also illuminate the ways in which democratic participation in the policy-making process is being undermined by those dominant firms. As fewer, larger firms preside atop the sector, their voices become amplified because there are fewer well-funded actors vying for the ear of policymakers. And as these firms increase their presence in other policymaking forums, including multistakeholder initiatives in the field of food systems governance, they are crowding out the voices of farmers, civil society, environmental organizations, and marginalized people whose lives have been profoundly affected by the large-scale industrial agriculture advocated by powerful firms.

APPROACH AND CONTRIBUTIONS

The analysis that underpins this work is guided by several broader conceptual frameworks grounded in diverse literatures. I employ international political economist Susan Strange’s approach of focusing on changing dynamics among state policies, markets, and technological developments as key to understanding shifting power relationships in the global economy.⁴¹ I also draw on insights from the international political economy and environment literature, which examines the relationship between



1.1 How corporate concentration can affect food systems. Image by author.

broad structural trends in the global economy, including technological change and the exercise of corporate power, and the environment.⁴² Ideas from the science and technology studies literature on technological lock-ins and path dependencies are also relevant, helping to explain the interplay of scientific advances, economic dynamics, and institutions in shaping new technological paradigms.⁴³

Any project with problem-driven research questions is necessarily interdisciplinary. In the course of research for this book, I drew on a wide range of literatures that touched on my research questions, albeit from vastly different angles. These literatures included the fields of food studies, agricultural history, business, economics, political science, environmental studies, and more. I also drew on some primary data, including databases of corporate financial statements and lobby registers, as well as the historical archives of the Food and Agriculture Organization (FAO) of the United Nations and several local libraries. At times, it was overwhelming to

take in information from these various quarters, but doing so was essential to get the big picture across the four input industries and to understand the range of forces affecting change and consolidation in the sector over the past two hundred years, as well as the wider impacts. I hope I have done justice to these bodies of work in putting this story together.

This book seeks to advance the literature in several ways. First, it contributes to current debates about the rise of corporate concentration and power and its influence on the wider political economy and the role of competition and antitrust policies in addressing it. As noted earlier, much of the attention in recent work on this theme has focused on consequences of the ascent of the Big Tech firms, but this pattern has long affected a range of sectors.⁴⁴ This study shows that patterns of corporate concentration and power in the agricultural inputs sector have deep roots that date back to at least the mid-1800s. In fact, many of the dominant firms in the market today can trace their lineage to the earliest firms in the sector, showing that their dominance has been in place for well over a century. This long historical trajectory of the dominant agribusiness firms offers a unique insight into not only how they attained power in the first place, but also how they have been able to remain large and dominant in the contemporary era. The lessons from the agricultural inputs sector thus have relevance for our understanding of the dynamics of corporate concentration and power more generally.

Second, this book also contributes to the literature on the historical evolution of industrial agriculture and the role of corporations within it. It is the first work to take a deep historical look at the rise and evolution of all four of the main agricultural input industries—farm machinery, fertilizer, pesticides, and seeds—in an integrative fashion. There are, of course, a number of excellent historical studies of agricultural inputs, and that work was deeply informative to my own research.⁴⁵ However, most of that previous literature focuses on one or perhaps two of the input sectors rather than the full suite. Examining the rise of the lead firms across all four inputs in tandem through a long historical time frame shows that the reasons for corporate dominance and power, although somewhat specific to each input sector, also are similar in other respects. In particular, it highlights the importance of market, technology, and policy contexts to the rise of bigness in all these industries, as well as the similarities in the

ways they exert influence over those same contexts to stay big. This integrative approach also reveals interconnections and technological lock-ins across the sectors that have contributed to the endurance of both the industrial agricultural model and the dominance of the leading firms that have promoted it, despite the known costs of this approach.

Third, this book contributes to the food studies literature as well as broader debates over the transformation agenda of food systems. Although there is wide agreement on the costs of the industrial agricultural model and the need to make food systems more equitable, healthy, and sustainable, there remains sharp disagreement over the direction of that transformation and the appropriate role of agrifood corporations. These divisions were on full display at the 2021 UN Food Systems Summit.⁴⁶ The corporate-driven vision—to further embrace the latest technological advances to reduce the worst impacts of industrial agriculture—is increasingly being challenged by an alternative perspective that seeks a complete transformation away from the industrial model that does not rely on industrial inputs. The historical and integrative approach of this book shows that the evolution of the industrial model of agriculture has long been shaped by a small set of dominant firms, making it difficult to disentangle the firms that promote that model from its wider consequences. It also reveals that concerns about the wider costs of the industrial agricultural inputs are long-standing. These insights suggest that any agenda for food systems transformation must squarely address the question of corporate power and its consequences. I see this work as complementing what some call the “corporate food regime”—the notion that corporations and financial actors have hegemonic influence over the governance of the global food trade, especially since the rise of neoliberal capitalism in the 1980s.⁴⁷ This book is focused on the historical trajectory of the firms that shaped agricultural production methods rather than the norms governing food trade, although of course the two intersect in important ways.

BRIEF PLAN OF THE BOOK

This book is organized chronologically as well as thematically. Part I focuses on the early development of industrial agricultural inputs and how they became concentrated industries. Chapters 2 through 5 provide

an overview of how each of the four main agricultural inputs—farm machinery (chapter 2), fertilizers (chapter 3), seeds (chapter 4), and pesticides (chapter 5)—rose from their initial widespread commodification in the 1800s to corporate dominance and control by the early to mid-twentieth century.

Part II of the book focuses on the consolidation and expansion of the industrial agricultural model and the firms that spawned it from the mid-twentieth century. Chapter 6 reflects on the ways in which this corporate-led industrial agricultural model became locked in and globalized, despite its known consequences, including by large corporate players and through the Green Revolution. Chapter 7 provides an overview of the consolidation of the farm machinery and fertilizer industries that took place in the second half of the twentieth century. Chapter 8 examines the merging of the pesticide and seed industries into one set of firms that specializes in both products starting in the 1970s.

Part III examines the drivers and consequences of the most recent round of consolidation in the agricultural inputs sector. Chapter 9 outlines the main drivers of the megamergers across the sector after 2015, highlighting the deepening role of financial factors as well as new technological developments, including the rise of digital farming and genome editing, in encouraging consolidation. Chapters 10 to 12 focus on concerns about the exercise of power by the dominant firms in the sector following the most recent mergers, examining their ability to shape markets (chapter 10), the technological context (chapter 11), and policy and governance (chapter 12).

In the concluding part, chapter 13 reflects on broader lessons and the potential pathways that lie ahead on this issue. Based on the book's analysis, the chapter charts out the public policy responses that might be able to effectively counter corporate dominance in the sector. The chapter also discusses several movements that are currently pushing for reforms to address corporate power in the agricultural input industries. These include calls from various quarters within civil society to replace the current system with agricultural models that sit in opposition to industrial agriculture, especially agroecology, which embeds deep ecological principles as well as more equitable and participatory governance systems in the agricultural system. There is also a growing movement of antitrust

reformers who are pushing to strengthen competition rules in the face of growing corporate power in a digital age. These antitrust reformers have identified agriculture as a key area where corporations have extraordinary power. Whether these diverse movements can effect change in the sector is not yet clear.

A FEW CAVEATS

It is important to note several caveats to this work. Much of the analysis in part I, which focuses on the rise and exercise of power of the large agricultural input firms, draws on examples from North America and Europe, where these firms initially rose to dominance. Later parts of this work discuss implications of the power of these firms in less industrialized country contexts as well, but there are still many examples from North America and Europe, where data were more easily available to me as a researcher based in Canada. If I had more time and space, I would have liked to have gone into more detail to understand better how the power of the agribusiness titans plays out in different developing country contexts. Many of the examples of agricultural inputs are those developed for use with industrially grown commodity grain crops like maize, wheat, and soy—the main crops for which many of the industrial inputs were initially developed. These same inputs are, of course, used in the production of other food and industrial crops, but I chose to keep the focus mainly on commodity grain crops to keep the research scope manageable. And while this book focuses specifically on agricultural inputs, other parts of agrifood supply chains, where similar dynamics are at play, are also highly concentrated. I hope that this book provides a framework for future work that understands corporate power and lock-ins in these other contexts.

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