

The Commercial Ecology of Scavenger Capitalism: Monsanto, Fossil Fuels, and the Remaking of a Chemical Giant

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Monsanto's transformation from a chemical firm to a biotechnology business in the 1980s and 1990s reveals that an increasingly small corporate cartel gained dominion over petroleum refining byproducts and that this concentration of ownership had profound implications for the future solvency of Monsanto. As the price of petrochemical feedstocks rose, Monsanto, a company that made 80 percent of its products from fossil fuels, began to pursue an alternative path to profits. In short, concentrated corporate ownership of critical natural resources forced some companies in the chemical commodity production business to pursue radically new ways of generating cash flow. This was especially true for scavenger capitalists such as Monsanto, firms that had historically made their money by scavenging raw material stockpiles produced by booming commercial industries. For firms invested heavily in commodity production but lacking proprietary claims to critical natural resources, the key was finding new ways to make money without depending on fossil fuels. For Monsanto, biotechnology offered a way out.

"If we grow by using more stuff, I'm afraid we better start looking for a new planet."¹ Those were the ominous words of Robert Shapiro, Monsanto's chief executive officer in 1997. Since taking over the reins of the St. Louis-based firm in April 1995, Shapiro had helped oversee a radical transformation of the chemical corporation into a

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1. Magretta, "Growth through Global Sustainability," 82.

biotechnology business. True, Monsanto had begun this corporate restructuring in the 1980s, but it was Shapiro who witnessed the company's first real success in biotechnology. At that time, Monsanto announced that it would no longer generate profits by selling toxic chemicals. As Shapiro explained, Monsanto was now making money by replacing "stuff with information."² In what some have called the "Microsofting" of Monsanto, a chemical giant known for such toxic compounds as Agent Orange and PCBs was now promising to sell genetic software that could restore life on earth. Smaller was better for this new Monsanto. The firm would attract shareholders not by expanding commodity chemical production but by promoting ecological sustainability through trade in microscopic genetic codes.³

Monsanto's corporate transformation was unprecedented. No chemical company its size had wholly rebranded itself in such a fashion. It was a dangerous move. So why did Monsanto embark on such a risky venture?⁴

This question is related to one that has spurred recent business history scholarship. Over the past several decades, historians interested in the evolution of American capitalism have sought to explain why so many companies have abandoned commodity production ("making stuff") as a primary means of generating profits. After all, the winners at the top of the U.S. corporate economy in 2016 looked very different than the business titans of 1955. Certainly, some time-tested vertically integrated commodity producers, such as the Big Oil empire of ExxonMobil, remained at the top of *Fortune* magazine's most profitable firms list, but many others had chosen to follow a new path to big money. Four of the top ten most profitable firms in 2016—JP Morgan Chase (2), Wells Fargo (4), Citigroup (7), and Bank of America (10)—generated substantial revenue by selling intangible products, such as securities, insurance, and mortgages. Atop the list was Apple, which made most of its revenue from premium-priced iPhones manufactured by third-party entities like Foxconn in China. Gone from the list were companies like DuPont, US Steel, and Union Carbide, which ranked third, seventh, and fourteenth, respectively, on the 1955 *Fortune* posting. In short, many of the most profitable firms of the twenty-first century looked very different than the corporate

2. Ibid.,

3. Ibid. Gender studies professor Chaia Heller used "Microsofting" to describe recent trends in the "agricultural economy." See Heller, *Food, Farms, and Solidarity*, 118.

4. Monsanto Company 1983 *Annual Report*, 35. For a list of stock prices from 1988 to 1993, see Monsanto Company 1993 *Annual Report*, 1. All *Annual Reports* available from ProQuest Historical Annual Reports.

giants of old, many making money by selling premium technology products or intangible assets, not bulk commodities.⁵

In theorizing why this trend occurred when it did, some have aptly noted that “globalization” played a big role. American firms realized that they could use advanced transportation and communication technologies to access natural resources and cheap labor markets in far distant lands, especially in the wake of new neoliberal trade policies—NAFTA, WTO, and others—that reduced the costs of transacting business across international borders. Rather than manufacture products in-house, firms chose to buy instead of make, acting either as brokers or assemblers of cheap goods produced by independent global suppliers, which competed with one another for big corporate contracts in flush international commodity market.⁶

The Internet naturally made such global trade networks possible. Citing Ronald Coase’s transaction theory, journalist Bob Tedechi argued that the e-revolution of the 1980s and 1990s reduced the costs and uncertainties of negotiating and processing business transactions over long distances, thus allowing U.S. firms to scale down their managerial operations and outsource many production operations.⁷

New financial institutions and securities instruments developed in the late 1970s also paved the way for a new economy run by businesses that did not vertically integrate into bulk commodity production. Business historian Louis Hyman, economist Williamazonick, and other scholars have focused on changes in financial markets that made old ways of making money passé. Investment in the stock market, once an activity reserved for fewer than 1 percent of Americans in 1899, became commonplace practice for more than 30 percent of U.S. households by the end of the 1980s, thus allowing large amounts of capital to accumulate at America’s brokerage houses. At the same time as more people invested in the stock market, the

5. Current *Fortune* 500 list is sorted by most profitable firms on its website: <http://beta.fortune.com/fortune500/list/filtered?sortBy=profits>. For older listings, see *Fortune*’s online archive: http://archive.fortune.com/magazines/fortune/fortune500_archive/full/1955/401.html

6. Economist Richard N. Langlois has written extensively about this “de-verticalization” of the corporate economy, perhaps most notably in “Vanishing Hand.” In this article, Langlois emphatically declares, “The visible hand—understood as managerial coordination of multiple stages of production within a corporate framework—is fading into a ghostly translucence” (352).

7. Bob Tedechi, “A Nobel Prize-Winning Idea, Conceived in the 30’s, is a Guide for Net Business,” *New York Times*, October 2, 2000, C12. For a critique of the idea that the Internet leads to smaller firms, see Hal R. Varan, “If There Was a New Economy, Why Wasn’t There a New Economics?,” *New York Times*, January 17, 2002; Coase, “Nature of the Firm”; Langlois, “Vanishing Hand,” 377.

federal government also began deregulating the banking industry in ways that permitted riskier investments. In these high times for high finance, firms began to realize that they could make tremendous amounts of money by treating business units as assets in a trading portfolio, generating profits through stock swaps and other strategic manipulations of financial markets rather than by increasing the productivity of various operating divisions.⁸

Certainly, all of these forces—especially e-commerce and high finance—pushed and pulled corporations in the late 1970s toward a high-tech, information-trading economy in which many businesses shunned commodity production, but for chemical companies there was another factor at play, and one that has often been overlooked: lack of access to critical natural resources. For years, many chemical firms had made big profits sourcing their raw materials from the molecular byproducts of the fossil fuel industry. When oil majors, such as Standard Oil and Shell, refined petroleum to make gasoline (breaking up big chains of hydrocarbons through a heat-intensive process known as cracking), they produced dozens of compounds that the chemical industry highly prized. Flush with cash in the gasoline-guzzling days of the mid-twentieth century, the oil majors saw no harm in giving over large quantities of these chemicals at cheap prices to DuPont and Monsanto, which reassembled them into the plastics, PCBs, and popular products that made the modern world. Benefiting from this partnership, by the end of the 1970s, 80 percent of Monsanto's products ultimately came from fossil fuels.⁹

However, this cozy relationship began to sour during the 1970s, as refineries increasingly reclaimed chemicals once handed over to chemical companies at bargain rates. This was problematic for practitioners of scavenger capitalism, such as Monsanto, that had historically made their money by feeding off the byproducts of other industries. Big Oil's consumption of critical natural resources changed

8. Ott, *When Wall Street Met Main Street*, 2, 100–101, 235. Julia Ott shows that the roots of contemporary financial markets date back to the 1910s and 1920s, when the idea of “shareholder democracy” became deeply embedded in the American psyche. See also Hyman, “Rethinking the Postwar Corporation.” For more works examining how changes in financial markets shaped corporate restructuring after 1970, see Lazonick and O’Sullivan, “Maximising Shareholder Value”; Lazonick, “Financialization of the U.S. Corporation”; Zorn, Dobbin, Dierkes, and Kwok, “Managing Investors”; Englander and Kaufman, “End of Managerial Ideology”; Davis, “New Finance Capitalism.”

9. Monsanto Company 1980 *Annual Report*, 26. For a brief history of the U.S. petrochemical industry, see Aftalion, *International Chemical Industry*, 129–131, 214–215.

Monsanto's commercial ecosystem. If the firm was to survive, it was going to have to adapt to a new environment.¹⁰

The term scavenger capitalism is largely absent in the business history literature and journalists rarely deploy the phrase in the popular press. A Google books search for "scavenger capitalism" yielded only a handful of results (and business historians penned none of the works). These few Google hits included books that merely had the words scavenger and capitalism close to one another in separate sentences. A similar search in JSTOR yielded no results, while a review of ProQuest Historical Newspapers resulted in one hit (a 1992 *Los Angeles Times* article about Wal-Mart).¹¹

Nonetheless, to call pre-biotech Monsanto a scavenger capitalist is not an exaggeration. From birth, Monsanto pursued capital accumulation by recycling waste from other businesses. Take caffeine, a product Monsanto sold to the Coca-Cola Company in the early twentieth century. Up until the 1950s, Monsanto produced most of its caffeine from what was called "waste tea leaves"—broken and damaged tea leaves that were unwanted by tea traders. Monsanto recycled this waste, processed out the caffeine, and made a tidy profit as it supplied the soft drink industry. Into the mid-twentieth century, the firm continued to profit by tapping into raw material stockpiles generated by businesses that were, like tea traders at the turn of the century, running their businesses day and night to feed exploding consumer markets. Monsanto mined the excesses of the oil industry, an industry whose refineries were running red-hot to keep up with demand of a car-crazed nation. Here Monsanto's role as scavenger took on new meaning, as the resources it needed ultimately came from the carcasses of creatures that had died millions of years ago. This was how scavenger capitalism worked in the early twentieth century. It involved finding a business in the middle of a production bonanza and siphoning off some of the byproducts that business

10. Economist Richard Langlois, in explaining the "vertical unbundling" of big firms in the 1980s and 1990s, argued, "Like a biological organism, an organization confronts an environment that is changing, variable and uncertain. To survive and prosper, the organization must perceive and interpret a variety of signals from the environment and adjust its conduct in light of those signals." Despite this brief discussion of the environmental forces shaping corporate governance, Langlois was not particularly concerned in his work with ecological influences on the boundaries of the firm. His statement is, nevertheless, apt when applied to the chemical industry. Monsanto's commercial ecology was changing dramatically by the 1970s, and corporate organisms had to adapt in order to acquire the natural resources they needed to be remain profitable. Langlois, "Vanishing Hand," 354.

11. "Retailer Forgot What It's About; Wal-Mart Didn't," *Los Angeles Times*, January 29, 1992, D1.

did not particularly prize. In this way, Monsanto accrued cheap raw materials to make its chemical creations.¹²

This was not necessarily a bad thing. As historians Andrew Hurley and Jonathan Wlasiuk have shown, toxic waste generated by oil refineries prior to the American petrochemical renaissance often flowed uninhibited into waterways. As a result, Monsanto's recycling practices actually kept *some* unwanted chemicals from sullyng streams near oil refineries (though toxic substances nevertheless found their way into the natural environment further down the commodity chain). Thus, though we may think of scavengers, either natural or corporate, as repulsive creatures, they often served an important function in repurposing unwanted resources.¹³

Monsanto's system of making money through waste reclamation might have continued into the late twentieth century, but by the 1970s the firm's suppliers began to leave fewer and fewer scraps for the hungry pack of chemical firms demanding more and more fossil fuel inputs. What would be the fate of the chemical industry in this time of scarcity?

Monsanto's remarkable transition from chemical king to biotechnology business showed how contests over natural resources were integral in shaping the corporate economy of the twenty-first century. In the 2014 *Journal of American History* interchange concerning recent scholarship on the history of American capitalism, very little was said about the ecological demands of modern corporations.¹⁴ This article addresses this gap, bringing firms back to ground to examine their natural resource dependencies. Without cheap oil, Monsanto could not thrive, so it got to work investing in a new biotechnology future centered on feeding the world. This is the story of the raw material realities that helped spur that world-changing leap.

The Making of a Fossil Fuel Scavenger

In 1901 druggist John Francis Queeny incorporated the Monsanto Chemical Company in St. Louis, Missouri, hoping to make millions of dollars selling saccharin, a new artificial sweetener some five hundred

12. For more on Monsanto's caffeine trade with caffeine, see Elmore, *Citizen Coke*, 53–75.

13. See Hurley, "Creating Ecological Wastelands"; Wlasiuk, "Company Town on Common Waters." Petrochemical firms' ability to capture waste produced by refineries should not be overstated. As both Hurley and Wlasiuk pointed out, pollution problems associated with refineries continued well into the petrochemical boom of the twentieth century. For more on corporate waste recycling in the early twentieth century, see Desrochers, "Invisible Hand"; Desrochers, "Industrial Ecology."

14. Beckert et al., "History of Capitalism."

times sweeter than table sugar that was derived from coal tar—a black syrupy byproduct of the coal refining industry. A native Chicagoan who had worked in the drug business since he was thirteen years old, Queeny first became interested in saccharin in the late 1890s while purchasing products for the Meyers Brothers Drug Company in St. Louis. At that time, American pharmaceutical and chemical companies trailed far behind their European competitors, especially the German powerhouse Merck of Darmstadt, which, with superior technology and vertically integrated factories, undersold more modest American firms. As a result, Meyers Brothers depended on Merck for its saccharin supplies, acting as a kind of U.S. distributor for the German firm.¹⁵

Witnessing the incredible popularity of saccharin, especially within the burgeoning U.S. soft drink market, Queeny believed that he could make a lot of money as the first American manufacturer of the chemical. Working deep into the evening after shifts at Meyers Brothers, Queeny set up a rudimentary manufacturing plant in downtown St. Louis in 1901. With \$1,500 of his own money and a \$3,500 loan, Queeny, at the age of forty-two, soon got the plant up and running with the help of three Swiss chemists—Louis Veillon, Gaston DuBois, and Jules Bebie—collectively known as the “triumvirate from the Swiss Alps.” Queeny decided to name his firm the Monsanto Chemical Works after his beloved wife, Olga Mendez Monsanto, whose Spanish maiden name means “sacred mountain.” The company’s first major client was the Coca-Cola Company of Atlanta, Georgia, which purchased virtually all of the chemical firm’s saccharin. To this day, Monsanto gives credit to Coca-Cola for keeping it afloat in the early days. Without Coca-Cola, there would have been no Monsanto.¹⁶

From its founding, the Monsanto Chemical Works financial fate was linked to fossil fuels. Saccharin came from coal tar, a substance that by the early 1900s garnered the obsession of chemical engineers around the world. Coal tar contained a host of organic compounds that could be extracted and recombined to form new synthetic chemicals, including aspirin and caffeine. For Monsanto, coal tar was “nature’s storehouse,” a “junk pile of the chemical manufacturer” that offered the chemical firm endless prospects for new chemical development.¹⁷

15. For a history of Monsanto written by the company’s former director of public relations, see Forrestal, *Faith, Hope, and \$5,000*, 12–20. On the history of saccharin, see de la Peña, *Empty Pleasures*.

16. Forrestal, *Faith, Hope, and \$5,000*, 17–20. For Monsanto’s credit to Coca-Cola, see the company’s website: <http://www.monsanto.com/whoweare/pages/monsanto-history.aspx>

17. Spears, *Baptized in PCBs*, 33; Untitled document dated December 1916, Series 3, Box 1, Folder: Coal Tar, Monsanto Company Records, 1901–2008, University Archives, Department of Special Collections, Washington University Libraries (hereafter, Monsanto Company Records).

Originally, however, Monsanto did not create its products directly from coal tar produced in the United States, preferring to buy intermediates—chemicals that formed the building blocks for more complicated industrial compounds—from Europe. In the case of saccharin, Monsanto relied on a critical input supplied by the Sandoz Company in Basel, Switzerland. The story was much the same for Monsanto's other product lines developed in the first decade of growth—which included laxatives, flavoring extracts, sedatives, and more—all of which came from intermediate chemicals shipped from Europe.¹⁸

The outbreak of World War I changed all of this. Embargos associated with war meant that Queeny had to find ways to synthesize compounds starting with domestic raw materials. If Monsanto was going to survive, Queeny was going to have to find the building blocks of modern chemistry on American soil.¹⁹

However, there was a problem: coal tar was being wasted in the United States. American coal-processing factories had gotten a late start in developing systems that reclaimed tar byproducts; even as late as 1916, Monsanto complained that such profligate habits had led to a lack of ample feedstocks needed for domestic chemical manufacture. The company claimed that less than 25 percent of coke ovens in the United States had tar reclamation systems. "The result," one Monsanto executive exclaimed, "has been a shameful and needless waste of nature's stores that should be a cause of humiliation to any country." Tapping into utilitarian rhetoric espoused by Progressive Era conservationists, Monsanto urged coal processors and the American government to do everything in their power to make sure "a large, natural resource will be conserved," thereby ensuring "profitable employment ... for thousands of our people."²⁰

In short, Monsanto pitched coal tar as a homegrown resource that, if recycled, could liberate America from foreign chemical dependencies, and it seemed American coal-processing firms were buying into the patriotic pitch. After all, for coal companies, reclaiming tar seemed like a lucrative way to turn waste into wealth. In 1918 the U.S. Tariff Commission reported that tar reclamation was taking off in the coke industry and calculated that U.S. coal tar production had more than doubled since 1913. Monsanto now had access to a

18. Forrestal, *Faith, Hope, and \$5,000*, 17, 23, 26.

19. *Ibid.*, 28; Spears, *Baptized in PCBs*, 36.

20. Untitled document dated December 1916, Series 3, Box 1, Folder: Coal Tar, Monsanto Company Records. For more on Progressive conservation, see Hays, *Conservation*.

valuable industrial waste product that could help it gain the autonomy it needed from overseas suppliers.²¹

Mining processed coal waste for hidden chemical potentialities, Monsanto made big profits in the 1920s. Following a brief downturn in the postwar recession, Monsanto saw its net income explode, from roughly \$336,000 in 1925 to \$1.69 million in 1929, a fivefold increase.²²

By this time, there was a new president at Monsanto. In 1928 John Queeny had been diagnosed with tongue cancer and was told he only had a short time to live, so the company patriarch decided to transfer power to his thirty-year-old son, Edgar Queeny. An Ivy-league graduate known for his often cold and calculating personality, Edgar Queeny was an ambitious businessman committed to brokering big mergers that would dramatically expand Monsanto's product lines in the decades ahead. He was brazen—so brazen, in fact, that John Queeny once quipped that his son's desire to "change everything" would "ruin Monsanto," but that prediction would prove wrong.²³ By the time Edgar stepped down as Monsanto's head in 1960, he could boast net profits totaling over \$67 million, a far cry from the roughly \$672,000 attained by his father in 1927.²⁴

One bet that paid off for Edgar Queeny was his decision to commit Monsanto to a new fossil fuel feedstock: byproducts of petroleum refining. Like his father, he was keenly interested in identifying raw material repositories that promised seemingly endless opportunities for growth, and oil seemed like the next best thing.

By the 1930s, the United States had become the largest petroleum producer in the world. The great oil field discoveries of the early twentieth century in California and the Southwest, including Texas's great Spindletop gusher of 1901, led to a surge in domestic petroleum production that carried on well into the 1950s. The ease with which oil could be transported through new pipelines made the new fuel preferable to bulky coal clumps. In 1934 Monsanto president Edgar Queeny heralded "revolutionary changes resulting from the utilization of petroleum products for the production of chemicals," and noted that the company could now depend on "relatively cheap

21. U.S. Tariff Commission, *Report on Dyes and Related Coal-Tar Chemicals*, 15; "\$1,500,000 to Be Spent on The East Side Plant," *St. Louis Post-Dispatch*, September 16, 1917, 20B.

22. Monsanto Company *Annual Reports*, 1921–1929.

23. Hubert Kay, "Monsanto and the American Idea," unpublished manuscript, E-1-E-7, E-16, E-54, Series 6, Box 1, Folder: "Monsanto and the American Idea" (Hubert Kay), 1st Draft (Forrestal's Copy), Monsanto Company Records.

24. Monsanto Company 1927 *Annual Report*, 6; Monsanto Company 1960 *Annual Report*, 1.

and typically American raw materials.” That same year, the company organized the Monsanto Petroleum Chemicals subsidiary, officially signaling its entrance into the petrochemical business.²⁵

The fact that the oil industry initially chose not to fully integrate into its own chemical manufacture made Monsanto’s petrochemical boom possible. Business historians from Harold Williamson to Alfred Chandler have long held up petroleum majors, such as Standard Oil, as models of vertical integration. In *The Visible Hand: The Managerial Revolution in American Business*, Chandler called Standard Oil “the first of the great integrated industrial consolidations,” and discussed how oil companies purchased “tank cars, ships, and other facilities” to achieve economies of scale.²⁶ It is true that oil companies controlled expensive fixed assets and combined marketing, transportation, and production operations under consolidated management. In addition, several oil companies began chemical manufacture as early as the 1930s. Monsanto’s move into petrochemicals, however, reveals that the oil industry’s vertical integration was never wholly complete. Chandler briefly noted this in his work on the chemical industry, but it is a muted point that is worth highlighting here. Precisely because oil firms did not initially integrate into total reclamation of its valuable waste products, chemical firms were able to become leading players in the petrochemical processing industry.²⁷

Over the course of the next four decades, Monsanto became increasingly dependent on both American and international oil refineries for the raw materials it needed. The firm diversified into an amazing array of new petroleum-based product lines after the 1930s, from synthetic pesticides to nylon clothing as well as a variety of plastics used for everything from automobile manufacturing to electrical engineering. Monsanto was essentially covering America’s cornfields, cars, and consumers with oil.

Even as the company became addicted to petroleum, Monsanto did not initially integrate backward into ownership of its own oil refineries. As it had with coal-processing firms, Monsanto chose to act as a buyer of petroleum byproducts rather than its own raw material supplier. This was because it was cheaper to scavenge on the waste byproducts produced by American refineries than it was to

25. Monsanto Company 1934 *Annual Report*, 12–13; Forrestal, *Faith, Hope, and \$5,000*, 73; McNeill, *Something New Under the Sun*, 297–298. On transportation infrastructure’s effects on oil prices, see Jones, *Routes of Power*, 144–150. For an excellent collection of essays on the history of oil production and consumption in the United States, see Black, Merrill, and Priest, “Oil in American History.”

26. Chandler Jr., *Visible Hand*, 352, 422.

27. Williamson and Daum, *Age of Illumination*; Williamson, *Age of Energy*; Chandler Jr., *Shaping the Industrial Century*, 144–158.

source such products in house. Refineries in the United States processed crude oil into gasoline at a remarkable pace in the 1940s and 1950s, responding to the exploding demand generated by wartime industries and the postwar consumer craze for automobiles. As a result, chemical compounds refined from gasoline began to pile up, creating a stockpile ripe for chemical company exploitation. It was on this pile of refining byproducts that Monsanto built its petrochemical empire.²⁸

Throughout the 1950s, Monsanto never faced any real problems scavenging raw materials from independent refiners, but this did not prevent the company from considering investing in the oil industry. In 1955 Monsanto finally decided that its addiction to oil warranted vertical integration into the refining industry. That year the company purchased the Lion Oil Company, breaking with a long tradition of buying instead of making its own petroleum byproducts. A major oil refining and petroleum business based out of El Dorado, Arkansas, Lion Oil owned over one thousand oil wells in eleven states, and the company had plans to explore “for new oil and natural gas reserves” in “almost one-third of the nation.”²⁹ In 1956 Monsanto announced that Lion Oil was also investigating drilling opportunities overseas in Italy, Venezuela, and Spain. Roughly five years later, the company broke ground on a major refining plant in Chocolate Bayou, Texas.³⁰

Despite these investments, Monsanto continued to source most of its raw materials from independent refineries. In 1975, two decades after beginning its own oil exploration, the company reported that in-house refineries supplied just a third of the company’s raw material needs, with two-thirds coming from independent suppliers. Monsanto was still beholden to powerful oil interests for the raw materials it needed. The “Seven Sisters,” which included American giants such as Esso and Texaco, supplied much of Monsanto’s demand before 1960, but increasingly the company also turned to new suppliers in the Middle East and other parts of the world.³¹

Over time, this dependency became problematic. By the late 1960s, big changes in the oil industry began to thwart Monsanto’s scavenging practices. As CEO Richard J. Mahoney explained in 1988, several of

28. In 1988 former CEO Richard J. Mahoney commented on the origins of Monsanto’s oil addiction: “The company grew rapidly in the 1930s with the invention of polymerization technology and the availability of low-cost petrochemicals left over from oil refining.” Mahoney, *Commitment to Greatness*, 8.

29. Monsanto Company 1955 *Annual Report*, 8, 10.

30. Monsanto Company 1956 *Annual Report*, 4, 5; Monsanto Company 1958 *Annual Report*, 6; Monsanto Company 1961 *Annual Report*, 5.

31. “Energy: Probing the Problem,” *Monsanto Magazine* (Spring 1975), 17, Series 8, Box 13, Folder: *Monsanto Magazine 1974–1975*, Monsanto Company Records.

the oil majors—including BP, Exxon, and Conoco—increased investment in petrochemical manufacturing technology by 1970, using up compounds these firms had once “been ‘giving away’ to Monsanto and other chemical converters.”³² The oil majors were aggressively expanding into Monsanto’s commercial markets as competitors and they had a critical advantage: control over petrochemical feedstocks. This was a serious problem for Monsanto.³³

Scavenging Tactics in a Time of Scarcity: The 1970s Oil Crisis

As Monsanto entered the 1970s, Big Oil was putting the pinch on the company, but other forces were helping to drive up petrochemical feedstock prices. Beginning in 1970, oil production in the United States began to decline. It seemed the American oil boom of the early twentieth century was finally coming to an end, and U.S. petrochemical companies perforce had to look overseas for supplies. To make matters worse for Monsanto, in the early 1970s environmental activists led several successful campaigns to prevent construction of an Alaska oil pipeline. For American chemical companies, it seemed fossil fuels in the northern reaches of North America would remain out of reach for years to come.³⁴

In 1972 the Club of Rome put out their popular polemic, *The Limits to Growth*, which warned how natural resource scarcity would soon curb future economic growth. Many scholars and businessmen criticized *Limits to Growth* for its doom-and-gloom predictions, suggesting that technological innovations and new scientific discoveries would allow firms to overcome the limits outlined in the book. Despite this espoused confidence in salvation through innovation, some businesses were concerned about dwindling natural resource stocks. In the case of Monsanto, the Club of Rome’s rhetoric was fast becoming a reality.³⁵

32. Mahoney, *Commitment to Greatness*, 9.

33. Fred Aftalion and Alfred Chandler noted that some oil companies, such as Shell, integrated into production of chemicals as early as the late 1920s, but the scale of integration hastened by the 1960s. For example, Exxon Chemical Company, started in 1966, would become the fourth-largest chemical concern in the United States by 1981. By this time, Monsanto had become deeply concerned about the price of raw materials derived from oil and natural gas. Aftalion, *International Chemical Industry*, 262–263; Chandler Jr., *Shaping the Industrial Century*, 144–174.

34. “U.S. Oil Production Keeps Rising Beyond the Forecasts,” *New York Times*, January 25, 2014, B3.

35. Club of Rome, *Limits to Growth*. For an excellent treatment of this publication’s reception in the 1970s, see Sabin, *The Bet*, 80–95.

A year after the Club of Rome published *Limits to Growth*, the Organization of Petroleum Exporting Countries (OPEC) oil embargo hit. This had a devastating effect on the American economy because the United States had become increasingly reliant on foreign oil as the pace of U.S. petroleum production began to decline. OPEC producers in Arab nations could manipulate world prices through cartel coordination. Oil prices more than tripled between 1973 and the end of the embargo in March 1974, rising from less than \$3 a barrel to roughly \$14.³⁶

At first, this was actually a boon for Monsanto. As Mahoney explained years later, “The oil shock of 1973–1974 ... fueled ... optimism by creating product shortages that allowed chemical companies to raise their prices substantially.”³⁷ Scarcity was something Monsanto could exploit in the short term. In 1974 Monsanto boasted a “20 percent return on shareholders’ equity,” the largest return in company history to that point.³⁸

Nevertheless, in the long run, the oil crisis would worsen an already serious supply-side shortage. U.S. oil production continued to diminish throughout the decade, and in 1979, when Iran, under the leadership of revolutionary Islamic fundamentalist Ayatollah Khomeini, broke off diplomatic relations with the United States, petroleum prices skyrocketed to more than \$39 a barrel. Monsanto simply could not manufacture a profit margin if it had to purchase such expensive feedstocks.³⁹

Fearing financial ruin, Monsanto went to Congress to seek relief from its supply dilemma. In 1975, Ernest S. Robson Jr., energy and materials executive at Monsanto, proposed that Congress take measures to reduce gasoline consumption by approximately 8 percent. This would free up energy for industry and consumers alike. In imposing new regulations on fuel consumption, however, Robson argued the government need not focus on Monsanto: “We do not need regulation to make us conserve. We know fuel conservation is in the best interest of our industry as well as the United States and its citizens.” Besides, Robson added, “It must be recognized that there is no significant conservation or conversion potential for petrochemical feedstocks.” Monsanto was already operating at maximum efficiency, Robson argued.⁴⁰

36. “Oil Tops Inflation-Adjusted Record Set in 1980,” *New York Times*, March 4, 2008; Nelson, *Guide to the Presidency*, 868.

37. Mahoney, *Commitment to Greatness*, 9.

38. *Ibid.*

39. “Oil Tops Inflation-Adjusted Record Set in 1980,” *New York Times*, March 4, 2008.

40. U.S. House Committee on Ways and Means Hearing, *Energy Crisis and Proposed Solutions, Part 4*, March 14, 17, 1975, 94 Cong., 1st Sess., 1623 (hereafter, U.S. House Committee, *Energy Crisis*).

Throughout the 1970s, Monsanto pitched itself as a paragon of conservation rather than a profligate consumer of scarce natural resources. According to Monsanto, the company had always been a scavenger, turning waste products of the oil industry into valuable consumer and industrial products. Take plastics, the company argued in a 1972 company newsletter: “In earlier days the raw materials used to manufacture most plastics once went out the stack as waste and gases, thus actually contributing to air pollution. Plastics technology, therefore, is in fact conserving what once was wasted.”⁴¹ Monsanto was not part of the problem; it was the solution. Mining the dustbins of other industries, Monsanto was repurposing refiners’ refuse.

According to Monsanto, the firm’s waste recycling practices on the frontend of the business were just part of what made the company great for a society facing scarcity. In his 1975 testimony to Congress, Robson posed the rhetorical question: “Why can’t we just cut out all those petrochemical-based products and go back to natural materials?” To do so, Robson, argued, would have devastating consequences for the environment and national security. “Take textiles, for example. To return to natural materials would require the planting of 16 million new acres of cotton ... acreage [that] would have to be taken from food production.” Much the same with synthetic rubber, which, if replaced with natural sources, would expose “the United States to future embargo of another critical material produced abroad.” The only real, tenable solution to the country’s energy crisis was more oil: “The name of the game must be greater domestic supply.”⁴²

Even if Congress put its government muscle behind new drilling projects, this was never a real solution for Monsanto. As one company official explained, the company knew that it was a “midget compared to the major [oil] producers,” generating just 15,000 barrels of oil a day, compared to the 150,000–200,000 produced by “one of the ‘small’ majors.”⁴³ Almost twenty years since deciding to buy Lion Oil, it was clear Monsanto was never going to be able to supply its own petroleum needs, and the prospects of relief from outside the company were bleak. As *Monsanto Magazine* noted, “looking for oil and gas in traditional domestic areas” was “no longer a highly profitable business,” and even if big refineries managed to find new reserves, it was clear these firms were not giving away their valuable

41. “A Special Report: Plastics and the Environment,” *Monsanto: World Headquarters Newsletter* 16, no. 4 (June 26, 1972), 3, Series 1, Box 1, Folder: Accounting Department (Folder 1), Monsanto Company Records.

42. U.S. House Committee, *Energy Crisis*, 1623.

43. “The Search for Oil: Every Little Bit Counts,” *Monsanto Magazine* (Winter 1974), 4–5, Series 8, Box 13, Folder: *Monsanto Magazine* 1974–1975, Monsanto Company Records.

petroleum byproducts like they had in the past. In this new era of Big Oil integration into chemical manufacture, raw materials were going to be hard to come by for chemical companies lacking access to vast oil reserves.⁴⁴

Thus, as Monsanto entered the 1980s, it could no longer scavenge on cheap natural capital as it had in the 1950s and 1960s. Declining American oil production, coupled with petroleum firms' consolidated control of compounds released during refining processes, portended major problems for the St. Louis chemical company. Considering these realities, the task before Monsanto was to figure out a way to make big profits without relying on Big Oil.

The "Microsofting" of Monsanto: Biotech as a Solution to Natural Resource Scarcity

Gender studies scholar Chaia Heller used the term "Microsofting" in 2007 to describe Monsanto's transformation from making chemicals to selling seeds. As she explained, "Just as customers must buy Windows when they buy many PC computers, farmers must buy chemical and other inputs when they buy genetically modified seed."⁴⁵ Heller's comparison of Microsoft with post-1980s Monsanto is apt, because, by the 1990s, executives at the St. Louis firm were very much enamored with the business models coming out of Silicon Valley. As Bob Shapiro made clear in his 1997 *Harvard Business Review* interview, Monsanto's top executives believed that "the substitution of information for stuff is essential to sustainability."⁴⁶ In the future, the firm would sell "DNA-encoded information" to America's farming families, giving them the genetic software they needed to reap profit from the Earth.⁴⁷

Economic pressures brought on by a changing commercial ecology pushed the company to make this big leap. Monsanto's financial returns were dismal in 1980. That year net profits were less than half of what they had been in 1979, dropping from roughly \$331 million

44. Ibid.; Chandler Jr., *Shaping the Industrial Century*, 152. When I speak of scarcity in this article, I am not suggesting that global peak oil production had already taken place by the 1970s. Annual global oil production would continue to rise in the final decades of the twentieth century, but Monsanto did not know this would happen during the energy crisis. In the 1970s, oil companies recycled their petrochemical feedstocks, thereby reducing supplies available to the St. Louis chemical firm.

45. Heller, *Food, Farms, and Solidarity*, 118.

46. Magretta, "Growth through Global Sustainability," 82.

47. Ibid.

to \$148 million.⁴⁸ It seemed the oil problem was not going away and it was clearly affecting the chemical companies' ability to sustain growth. Something had to be done.

In this time of crisis, Mahoney first became president and then also CEO of Monsanto. He had witnessed firsthand how changes in the petroleum industry had affected the petrochemical industry in the 1970s. A chemist by training with a degree from the University of Massachusetts, Amherst, Mahoney joined Monsanto as a chemical engineer in 1962. He had worked in pesticide, fertilizer, herbicide, and plastics divisions of the firm, and had an intimate knowledge of the fossil fuel feedstocks that fed these enterprises. A confident and disciplined worker, he lived by the motto FILO—First In, Last Out—recognizing that he had to pay his dues if he wanted to rise to the top. When he became CEO in 1984, he felt he had put in the long hours and earned the right to speak confidently about where the company needed to go in the future.⁴⁹

For Mahoney, it was clear that Monsanto's inability to scavenge for cheap feedstocks made future growth in the petrochemical business impossible. Later in his career, reflecting on the early 1980s, he wrote, "The once cheap hydrocarbons were no longer cheap. Whereas Monsanto once took 10 cents' worth of oil or gas hydrocarbons and added 30 cents' worth of technology, we were faced with buying 30-cent hydrocarbons and selling a finished product into a marketplace that allowed us to add only 10 cents of our technology. The value we added was dwindling—a guaranteed recipe for disaster."⁵⁰

In 1982 Monsanto explained to its shareholders that it had no choice but to make big changes. That year, Chairman of the Board John Hanley reported that he, Mahoney, and other top leadership at the firm had "candidly debated the proper course for the future" and decided that "raw materials, particularly petroleum-based ones, had become too large a component of too many of our products." Over 80 percent of what the company sold came from hydrocarbon feedstocks, making the company unreasonably "vulnerable to the cyclical fluctuations of the economy." The company planned to slowly divest from commodity chemical production while pursuing a "strategy to expand toward higher-value proprietary and specialty products."⁵¹

Hanley and Mahoney tapped Howard A. Schneiderman to lead this new product development initiative. A former professor and dean at

48. Monsanto Company 1979 *Annual Report*, 1; Monsanto Company 1980 *Annual Report*, 2.

49. Mahoney, *In My Opinion*, 19.

50. Mahoney, *Commitment to Greatness*, 10.

51. Monsanto Company 1982 *Annual Report*, 7; Monsanto Company 1980 *Annual Report*, 26; "Dramatic Climb by Oil Prices Gives U.S. Chemical Industry Executives a Headache," *The Sun* (Baltimore), December 2, 1979, K9.

the University of California–Irvine, Schneiderman came to Monsanto in 1979 to help expand a pilot biotechnology program. He was one of the leading figures in developmental biology, pursuing cutting-edge research in genetics that focused on DNA codes regulating cellular growth. In 1982 Schneiderman told shareholders that his prime objective was to develop new products that were “less dependent on raw material costs” and which “have a strong proprietary character.” Without going into research specifics, he added: “We are going to be selling products for what they *do* rather than what they *are*.”⁵²

In 1984 Monsanto spent over \$150 million dollars in biotechnological research and development, creating the Chesterfield Village Life Sciences Laboratory. The company invested in a variety of projects, from developing a bovine growth hormone (rBGH) that would help cows produce milk, to isolating genetic sequences that would engender pesticide-resistance in genetically modified (GM) crops. Monsanto was certain that development of these products would take time, but expressed hope in 1984 that “important traits of plants, including stress-, herbicide-, and pest-resistance ... may be possible to transfer ... to important crop species in the next few years.”⁵³

While investing in biotechnology, Monsanto simultaneously got out of the petrochemical business at a remarkable pace. In 1988 Mahoney reported that the company had “closed down businesses with sales of more than \$4 billion,” including its fossil-fuel enterprises and much of its commodity chemical operations. As a result, the company’s investment in bulk commodity chemical production declined from 30 percent of total assets in 1980 to just 2 percent eight years later.⁵⁴

Monsanto’s competitors did not follow the same path as the St. Louis firm. On the contrary, DuPont decided that its best bet was to acquire Conoco Oil in 1981. Much like Monsanto’s Lion Oil merger in 1955, DuPont believed the Conoco purchase would give the company “a stronger position to compete with the oil companies.”⁵⁵ This was a big deal, costing over \$7 billion and making it, according to the *Christian Science Monitor*, “the nation’s largest merger.”⁵⁶ DuPont was doing what it thought it had to do to thrive in a new

52. Remarks to Shareholders by Howard A. Schneiderman, Monsanto Shareholders Meeting, April 23, 1982, 2, Series 14, Box 6, Folder: Hanley, John W. (Remarks [Shareholders Mtg., 1982-83]), Monsanto Company Records.

53. Monsanto EMC Report on Biotech, April 23, 1984, Series 1, Box 1, Folder: Biotechnology (Association of Reserves, 1984–1989), Monsanto Company Records; Mahoney, *Commitment to Greatness*, 20.

54. Mahoney, *Commitment to Greatness*, 12–13.

55. “Takeover of Conoco Backed by Du Pont’s Shareholders,” *New York Times*, August 18, 1981, D4.

56. Ron Scherer, “Du Pont to Swallow Conoco in Record-Breaking Merger,” *The Christian Science Monitor*, July 7, 1981

commercial environment. Dow Chemical also kept a sizable portion of its commodity chemical business into the 1980s, hoping to weather the storm. As late as 1990, the *New York Times* reported that Dow's "commodity chemicals still represented nearly a third of the company's sales, more than at competitors like Monsanto and DuPont."⁵⁷ Chemical companies were experimenting with different strategies, watching one another adapt to the realities of the day. Over time, however, both Dow and DuPont began to follow Monsanto's lead, aggressively unloading their bulk commodity chemical assets, which had become by 1997 "the dirty word of the industry," according to the *Wall Street Journal*.⁵⁸ DuPont dumped Conoco in 1998 and a year later acquired Pioneer Hi-Bred International, signaling its commitment to securing a top position among firms with capital investments in biotechnology. By the 2010s, headlines read "Dow Chemical Lists Commodity Chemicals Businesses for Sale," and DuPont investor reports explained spinoffs of chemical assets as "DuPont's transformation to a higher growth, higher value, global science and innovation company."⁵⁹

Long before all of this, Monsanto had been more radical in its divestment strategy. In the 1980s, Monsanto's Mahoney believed reducing its reliance on petrochemicals promised his company liberation from the vagaries of the natural world and international trade. This, after all, had long been the core mission of the chemical industry: to break through ecological limits imposed by nature through clever manipulation of molecular compounds. In 1945, for example, Monsanto argued that its production of synthetic caffeine would "not be subject to the vagaries of nature," and when the company finally succeeded in producing caffeine from coal tar, it called the achievement "another chemical victory over nature."⁶⁰ Roughly forty years later, Richard Mahoney made a similar pitch. The company had finally shrugged off its "traditional dependence on cyclical commodity businesses" that placed the company forever "at the mercy of

57. "For Dow Chemical, the Good Times Stall," *New York Times*, October 19, 1990, D1.

58. "DuPont Agrees to Purchase of Seed Firm," *Wall Street Journal*, March 15, 1999, A3.

59. "Dow Chemical Lists Commodity Chemicals Businesses for Sale," *Reuters*, December 2, 2013, <http://uk.reuters.com/article/dowchemical-assets-idUKL4N0JH2UC20131202>; "DuPont Completes the Spin-off of the Chemours Company," DuPont Company investor relations website, <http://investors.dupont.com/investor-relations/investor-news/investor-news-details/2015/DuPont-Completes-Spin-off-of-The-Chemours-Company/default.aspx>. For a discussion of DuPont's evolution up to the 1980s, see Ndiaye, *Nylon and Bombs*.

60. Company publication written by Braxton Pollard, "NOW—Synthetic Caffeine," undated document, Series 3, Box 1, Folder: Caffeine (General), Monsanto Company Records; Report on Caffeine and Theobromine, prepared by John Ragsdale, 1945, *ibid.*; News Release on Monsanto Synthetic Caffeine Operations, 1945, *ibid.*

forces outside [its] control.” This was a new Monsanto. “Restructured to reduce [its] exposure to the uncontrollable,” the company would now be “far more *makers* of conditions than *responders*.”⁶¹

Biotechnology offered an attractive means of moving Monsanto beyond oil. Limiting its frontend investments in bulk production of material products, Monsanto planned to sell a microscopic product—a kind of genetic software—that could be inserted in the hardware of plant and animal life. Shot into seed germplasm with the help of a “gene gun,” this software could be rapidly dispersed to farmers across the globe. Added to plasmids in microscopic bacteria, genetic cassettes could turn living cells into “biofactories” capable of churning out copious quantities of valuable antibiotics, pesticides, and hormones. Thus, lab-created biotech products promised to radically reduce Monsanto’s demand for petroleum feedstocks.⁶²

Monsanto’s transition to this new corporate model took time, and the company even went into the red for a few years, but by the mid-1990s the company could boast a series of successful new GM and biotech products that promised a bright future for the firm. In 1996 Monsanto released Roundup Ready (RR) soybean seeds, which were genetically modified to tolerate Monsanto’s signature herbicide, Roundup, one of the few chemical products Monsanto held onto as it transitioned to biotechnology. That same year, the company introduced Bollgard, a cotton seed that contained a bacteria-derived gene coding for the production of a toxin called Bt that repelled insects.

By this time, Bob Shapiro had replaced Richard Mahoney as chairman and CEO of the company. Shapiro had come to the firm in 1985 when Monsanto bought Searle, a pharmaceutical company known most notably for its successful aspartame sweetener, NutraSweet, which Shapiro had helped launch in the early 1980s. Unlike Mahoney, who was a staunch Republican and prolific conservative columnist for newspapers across the country, Shapiro was a Democrat, someone sympathetic to the political rhetoric of the liberal left. A fan of early 1990s environmental luminaries, such as Paul Hawken, Bill McDonough, and Amory Lovins, Shapiro believed that biotechnology could be used to improve the health of the global environment, a cause he fervently supported. As Shapiro explained, “The earth’s ecological system cannot withstand unlimited increases in the amount of material produced and consumed, but it can withstand exponential increases in knowledge and information.”⁶³ Throughout the

61. Mahoney, *Commitment to Greatness*, 42–43.

62. Monsanto Company 1996 *Annual Report*, 12.

63. Carl Franken, “Monsanto Breaks the Mold,” *Tomorrow* magazine (May/June, 1996), 62, Series 14, Box 26, Folder: Shapiro, R. (Speeches) 1996, Monsanto Company Records.

1990s, Shapiro preached Monsanto's mission to "produce much more with much less raw material and energy."⁶⁴

Shapiro ballyhooed that biotechnology was good for both Monsanto and its traditional clients, especially farmers around the world. GM crops that produced their own Bt toxin would allow farmers to reduce their dependence on pesticides, which came from expensive petroleum feedstocks. Furthermore, GM plants would allow farmers to cut down on fertilizer demands and weeding operations, since Monsanto's herbicide-resistant crops would allow farmers to spray fields liberally with chemicals that killed unwanted plant species. By the 2000s, Monsanto lauded what it called "no-till farming," arguing that GM crops would eliminate the need for frequent tillage, thereby helping farmers to "reduce fuel use by at least 9–15 gallons per acre."⁶⁵

A firm that had made its name feeding farmers petrochemical products was now suggesting it could help curb farmers' dependence on fossil fuels. In other words, Monsanto was turning concerns about oil scarcity into a powerful marketing opportunity, recognizing that the threat of fossil fuel shortages could actually help it sell new products rather than impede its growth.

Monsanto's promise of petroleum liberation did not prove entirely unfounded. Studies in the 2000s and 2010s showed that GM crops planted via no-till techniques helped farmers reduce fuel costs associated with maintaining farmland. For example, farmers using herbicide-resistant crops did not have to spend as much time removing weeds from their fields and therefore did not have to run diesel-guzzling tractors as long as they had in the past.⁶⁶

Nevertheless, farmers that switched to GM crops never fully curbed their dependence on oil. After the 1970s, farmers did begin to reduce their fossil fuel use, thanks to improved machinery and new tilling strategies, and total energy consumption on U.S. farms dropped from 2.4 quadrillion Btu to 1.7 quadrillion Btu by 2002. GM technology may have contributed to this, but since 2002, and in the period of GM crops most rapid expansion in the United States, energy use leveled off at around 1.5 Btu, where it remained as of 2011. In short, major reductions in fossil fuel use on farms largely predated the golden era

64. Robert Shapiro, "A New Model of Growth and Sustainability," *Strategy and Leadership* (May/June 1996), 51, Series 14, Box 26, Folder: Shapiro, R. (Speeches) 1996, Monsanto Company Records; Monsanto Company 1997 *Annual Report*, 11.

65. Monsanto Company 2004 Pledge Report, 19, ProQuest Historical Annual Reports. For data on Bt cotton and pesticide use, see Stone, "Field Versus Farm in Warangal."

66. Duke and Powles, "Glyphosate-Resistant Crops and Weeds," 349; Soane et al., "No-till," 79.

of GM crop adoption and in the heyday of GM growth, the promise of dramatic energy savings never materialized.⁶⁷

Indirect fossil fuel consumption through the use of fertilizers and herbicides, both synthesized in factories dependent on substantial fossil-fuel inputs, also remained high by the 2010s. In fact, according to a 2013 study published by the nonprofit organization Food and Water Watch and publicized in *Forbes* magazine, the total amount of glyphosate herbicide “applied to the three biggest GE crops—corn, cotton and soybeans—increased 10-fold from 15 million pounds in 1996 to 159 million pounds in 2012.”⁶⁸ Of course, much of this glyphosate still came from Monsanto in the form of Roundup, a trademarked chemical Monsanto never abandoned because it continued to yield strong returns for the firm. It seemed Monsanto was still willing to sell oil-dependent products to farmers as long as they could charge a premium price.⁶⁹

Fertilizers derived from fossil fuels also remained in high demand on farms using Monsanto GM seeds in the 2010s. Despite a sharp decrease in fertilizer use on U.S. farms after 2004—caused largely by rising fossil fuel costs that drove up prices—fertilizer use began to climb once again after 2010, from 21 million tons that year to 22 million tons a year later. World demand for fertilizers also grew between 2010 and 2014, especially in China and India, where GM crops made major inroads in the 2000s.⁷⁰

In short, fossil fuels were still an integral part of Monsanto’s moneymaking enterprise because the company’s farming clients still depended on copious quantities of synthetics derived from oil and gas to survive. Thus, roughly two decades after Monsanto began its biotechnology business, it had failed to deliver on its promise to replace “stuff with information.” In fact, it seemed new information actually meant more stuff, at least in the case of herbicide for farmers now reliant on Roundup Ready crops.

67. On energy use reduction in U.S. agriculture from 1970 to 2002, see Schnepf, *Energy Use in Agriculture*. On energy use since 2001, see Beckman, Borchers, and Jones, *Agriculture’s Supply and Demand*. The author would like to thank Kansas State University professor and sustainable agriculture specialist Mike Bomford for his assistance in finding these materials.

68. Beth Hoffman, “GM Crops Mean More Herbicide, Not Less,” *Forbes*, July 2, 2013.

69. For another study detailing increased herbicide use on GM crops in the United States, see Benbrook, “Impacts of Genetically Engineered Crops,” 1. Charles M. Benbrook is a Harvard-trained agricultural economist now at Washington State University. For studies detailing energy estimates for herbicide and pesticide production, see Helsel, “Energy Use and Efficiency”; Helsel, “Energy and Alternatives”; Helsel, “Energy in Pesticide Production and Use.”

70. United States Department of Agriculture, Economic Research Service, “Fertilizer Use & Markets,” http://www.ers.usda.gov/topics/farm-practices-management/chemical-inputs/fertilizer-use-markets.aspx#.U_9j7bxdUd8; Food and Agriculture Organization, *Current World Fertilizer Trends*, 29.

Conclusion

In 1997 Bob Shapiro oversaw the final stage of Monsanto's metamorphosis into a biotechnology business. That year, the company unloaded its remaining chemical manufacturing assets to a new firm called Solutia, finally saying goodbye, once and for all, to almost all of its chemical past—except precious brands such as Roundup.

For some outside observers, it was the backend of Monsanto's business that bred the Solutia divestment. After all, in the 1990s, the company faced a multimillion-dollar class action suit brought by the citizens of Anniston, Alabama, who had suffered debilitating ailments caused by Monsanto's unregulated dumping of toxic polychlorinated biphenyl (PCB) chemicals in city waterways. Expensive proposals for cleanup of toxic wastes at other company sites loomed as well. Thus, Monsanto's spinoff of its chemical business, many environmentalists argued, was merely a crass effort to unload toxic environmental liabilities weighing down the firm. Writing to the *New York Times* about Shapiro and Monsanto in 1999, one concerned citizen exclaimed, "Their goals are not environmental preservation but profit, profit, profit. These guys aren't being green; they're seeing green!"⁷¹

This makes for a tidy story, but it does not take into account the deep historical roots of Monsanto's dramatic transformation. Concerns about environmental liabilities at the backend of the business certainly shaped corporate decisions, but pressing natural resource problems at the frontend of the business also influenced Monsanto's radical rebranding. In the late 1970s, oil prices were rising, and Monsanto was having trouble creating the profit margins it needed to make money off its chemical commodities. In short, concerns about ecological resources were at the heart of the corporate restructuring story, but it was supply-side shortages, not simply downstream environmental dilemmas, that prodded corporate leaders to make the daring jump into the biotechnology beyond.⁷²

Monsanto's story should inspire scholars to think more broadly on how natural resource demands reshaped corporate America from 1970 to today. The leaning of the corporate economy that began in the 1970s—a metamorphosis chronicled by historian Louis Hyman, economist Richard Langlois, and others—occurred precisely as America faced an energy crisis that forced businessmen, politicians, and citizens to question dangerous dependencies on fossil fuels.

71. "It Isn't Easy Being Green," *New York Times*, September 12, 1999, 271. For an excellent history of the PCB conflict in Anniston, Alabama, see Spears, *Baptized in PCBs*; Love, *My City Was Gone*.

72. Monsanto Company 1980 *Annual Report*, 26.

This connection between some firms' limited access to critical natural resources and corporate restructuring during this period needs more scholarly attention. After all, corporations are organisms that metabolize natural capital to generate financial capital. When natural resources become scarce, corporations make evolutionary adaptations to adjust to their commercial ecosystem. That is exactly what Monsanto did to survive, abandoning its scavenging practices in an environment that was becoming increasingly hostile to its survival and venturing to the new fertile field of biotechnology, where alpha predators had yet to emerge. Now, Monsanto sits atop the food chain—quite literally. Getting there was a risky gamble, but it seems to have paid off. The questions today are: What will be the fate of the oil titans that grew so large and so big by hoarding fossil fuels and the derivatives thereof? What will happen to these corporate creatures that depend on energy-dense diets to survive? After all, those who study the natural world know that large organisms with such tremendous consumptive needs are often the most vulnerable when environmental conditions change. Today, some are calling for a transition to a world economy that does not depend on fossil fuels. If Big Oil does not make aggressive adaptations to this new commercial ecosystem, petroleum potentates may well go the way of the Jurassic giants they now dig up from their graves.⁷³

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73. Langlois, "Vanishing Hand"; Hyman, "Rethinking the Postwar Corporation." See also Lazonick, "Financialization of the U.S. Corporation."

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