

Introduction

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Across Iowa and the Midwest, from North Carolina and Pennsylvania in the East to Utah and Wyoming in the West, there are highly publicized debates, hearings, conferences, and trials concerning the environmental, social, and economic consequences of industrialized swine production. These events have captured national attention via a report by “60 Minutes”, a Pulitzer prize winning newspaper series from North Carolina, the *Wallstreet Journal*, the *L.A. Times*, national network news coverage, National Public Radio, and from stories in national news magazines.

Much of this attention focuses on environmental problems, the displacement of family farms by nonfamily corporations, and rural communities organizing to oppose industrial swine operations. The debate is familiar. On the one hand are visions of self-contained, perpetually sustainable family farms representing all that is best in the ideals of the yeoman farmer of Jeffersonian America and the rural social and economic prosperity that accompanies widespread, small owner-operated farms. On the other hand are conceptions of highly efficient industrial food production, the prosperity industrialization brings to rural communities, and the cheap food it offers consumers.

There are many more than two positions on these issues, and it is the politicization of rhetoric that forces people into a dualistic way of thinking. Since legislative, administrative, and judicial processes are supposed to be governed by scientific findings, proponents for each position search for relevant scientific results upon which to base their claims, hence science becomes politicized (Durrenberger 1992; Thu 1996). Both the Jeffersonian and the industrial perspectives have respectable academic support, and each has vocal critics.

Industrialized agriculture is a form of food production heavily dependent on fossil fuel-based energy inputs such as fertilizers, machinery, pesticides, and gasoline. Based on measures of energy expended per calorie of food produced, industrial agriculture is the most inefficient form of food production in the history and prehistory of humankind. Industrial agriculture is characterized by large-scale operations that substitute capital-intensive fossil fuel-based technology for people. Capital-intensive technologies and inputs are increasingly sold to industrial farming operations by firms operating off the farm with expectations of profit and capital accumulation that diverge from the interests of farmers. At its most extreme, operational management prescriptions are handed down to farmers directing them in the amounts and types of inputs to use as part of doing business with off-farm corporations. In addition, ownership becomes separated from the community so that profits are externally defined and assigned with a purely economic denominator while local benefits and costs that include quality of life, the environment, and human values, such as mutual trust and sharing, are largely ignored. Concentration of production and distribution into relatively few firms which integrate highly specialized operations such as food processing and marketing is common. And a highly specialized political apparatus extending into national, regional, and local governing bodies, as well as state-supported institutions to support and replicate the system, is typical of human organizations associated with industrial agriculture.

In 1940 and 1941 Walter Goldschmidt conducted research on industrialized agriculture in California and its relationship to quality of life. The results were unequivocal. The emergence of an industrialized form of agriculture resulted in measurable declines in social and economic conditions and the appearance of an urbanized configuration of human relationships and adaptation. Goldschmidt's detailed research on two rural communities revealed better conditions in the community associated with farms where the majority were owner-operated and managed and labor was primarily family-based compared to the community surrounded by industrialized farms in which ownership, management, and labor were largely divorced from each other. His research has been replicated and substantiated at different times and locations over the past fifty years (MacCannell 1988; Durrenberger and Thu 1996).

In the face of Goldschmidt's findings and a substantial body of subsequent research, the industrialization of agriculture continues largely unabated. This raises the vexing question—why? The predominant response, anchored in the spirit of Adam Smith and the industrial paradigm that John Ikerd discusses in his chapter in this book, argues for the inevitability of economic forces to shape forms of production and consumption in a free market. This widely held view, led by economists and agribusiness leaders (Tweeten 1983; Urban 1991) asserts that farmers make necessary rational decisions to industrialize based on

competitive market conditions in order to make profits and survive. Those holding this view respond to the problems raised by researchers in the Goldschmidt tradition by variously ignoring them, casting them as part of a scientifically disguised liberal political agenda, or using economic advantages they impute to industrialized agriculture as “evidence” to refute them. Frequently cited as evidence for the economic advantages of industrial agriculture are the wide availability of abundant food at extremely low cost to consumers and the record productivity and efficiency of modern farmers. In general, these economic advantages are viewed as outweighing the costs cited by researchers in the Goldschmidt tradition. Consequently, the problems cited by Goldschmidt and his contemporaries are hurdles to overcome in order to continue industrializing rather than signals of the fallibility of industrial agriculture.

One seemingly sensible approach to assessing industrial agriculture is to articulate and assess its advantages and disadvantages, a kind of cost-benefit analysis. For example, does the fact that U.S. consumers have cheap food outweigh problems created by industrialized forms of food production? As reasonable as it sounds, this approach ignores a fundamental component of industrial agriculture. An intrinsic feature of industrialized agriculture is the concentration of power over the production and distribution of precious resources as Senator Robert Morgan shows in his chapter on the political connections behind North Carolina’s corporately dominated hog industry. Industrial agriculture has survived and prospered for the last half century because certain sectors benefit. Beneficiaries of industrial agriculture have a vested interest in predisposing the questions and rhetoric to assess its efficacy (Hightower 1973; Thu 1996). If profit is the principal measure of success, the more profit that is reaped, the better able the beneficiaries are to promote the advantages of industrialized agriculture and discredit even those who hold valid scientifically based countervailing views. This means that those in privileged positions can produce the knowledge necessary to support their vested interests.

Even when overwhelming scientific evidence attests to problems from the system that produces and distributes a particular commodity, such as tobacco, the enormous political and economic power attained by those in control counteracts rational assessment. Hence, the issue becomes not just one of producing and weighing objective evidence, but identifying those who are producing the evidence, how they are asking the questions, why they are producing the research, how it is being used, and who the beneficiaries are. As many of the chapters show in this book, the interlinkages between science and politics are intrinsic to industrialized food production and inherently tilt any assessment in its favor. Consequently, assessing the advantages and disadvantages of industrial agriculture is not simply a matter of examining the weight of scientific evidence, but also of examining biases in assumptions, the “paradigms” as John Ikerd calls them in his chapter, that underlie the evidence. For example, what

are the assumptions that underlie economic measurements of productivity and efficient food production?

This volume focuses on the rapid industrialization of swine production in the United States and the consequences for its rural health, including the physical, social, psychological, economic, and political well-being of people. Most of these issues are not incorporated into economic analyses of food production, but as this volume demonstrates each has a distinct, often measurable, and very human cost. Contributors come from broadly contrasting disciplinary and vocational backgrounds, including a veterinarian, two farmers, a farm organization leader, a former U.S. senator, an agricultural economist, a medical psychologist, and anthropologists. Despite divergent backgrounds, a consistent theme emerges consisting of the broad rural health consequences of industrial swine production. Goldschmidt's findings that industrial agriculture results in a number of socioeconomic problems is as cogent today as it was in the 1940s. However, many of the issues raised in this collection go beyond those identified by Goldschmidt. Nonetheless, the underlying assumptions concerning the efficacy of industrial agriculture and many of its consequences remain remarkably similar.

This volume provides a broad and coherent picture of issues and problems associated with the industrialization of swine production. There is a reasonably well articulated dominant view of the advantages of industrialized swine production in the public domain. It is especially evident in the doctrines of various agricultural organizations and commodity groups. This volume identifies and challenges the assumptions of those views with concrete examples and evidence. As such, we can predict with reasonable certainty on the basis of Goldschmidt's experience (1978) that it will be castigated by proponents of industrial agriculture as an example of rhetoric from "antigrowth interests." In contrast, members of anti-industrial agricultural groups may embrace it as ammunition for their political causes. These typical responses reflect the point that for too many, the lines have been drawn, positions staked out, and interests entrenched, and for them this volume will do little beyond affirming our expectations or theirs. We can do no more than point out that we are not political activists and that we neither promote nor defend industrial agriculture based on any political agenda. Rather, as researchers with cross-cultural experience studying food production systems, we identify, analyze, and assess patterns of food production and their relationship to human adaptations.

There are many rural community members, policy makers, farmers, rural researchers, and students of agriculture who are honestly uncertain about the best direction. This volume is for them. The contributions presented here provide a legitimate counterweight to overly rosy rural development scenarios often painted for rural communities considering industrialized swine facilities. Moreover, it provides those who propose to promote, build, or operate such

facilities a clear view of legitimate issues and problems they should consider. For still others, such as anthropologists, rural sociologists, and others interested in structural changes in agriculture, broad rural health issues, and their relationships to human adaptation, it provides theoretical and practical insight into a range of intertwined issues.

THE INDUSTRIALIZATION OF THE SWINE INDUSTRY

There are few topics, perhaps none, that take up more print and library space in the U.S. than agriculture. Except for air and water, nothing is more basic to human survival than food. The amount of research and printed materials on agriculture appears to have grown inversely to the declining number of farmers over the past sixty years. As a Norwegian farmer once quipped, “we keep getting more agricultural experts and more advice when there are fewer and fewer of us” (Thu 1996). Part of the reason for this is obvious, researchers and various agricultural experts are among the beneficiaries of an industrialized form of agriculture. A cycle of dependency emerges in which new methods of food production that require technical expertise are offered only to be discarded as obsolete as new innovations are recommended to farmers to enhance their competitiveness.

The industrialization of swine production fits a well-documented pattern of technological innovation in agriculture. As Jim Braun, himself a pork producer, describes in his chapter, the most evident of these innovations is the development of confined swine production technologies in the early 1970s that moved hogs from pastures and partial shelters to completely enclosed facilities specially designed to control each step of the production process. These long, low-lying metal buildings are arranged in multiple rows with no signs of farm houses, barns, farm implements, or even livestock traditionally apparent on family farms. In their place, open air waste pits called “lagoons”, metal office buildings, and the frequent arrival and departure of large transport trucks provide an industrial factory appearance to pork production. A city dweller would be hard-pressed to figure out what sort of livestock is being produced, since many hogs in these facilities do not see the light of day except on the way to market. Many of these changes are patterned after technological developments in the poultry industry as John Morrison, executive director of the National Contract Poultry Growers Association, discusses in his chapter.

Factory-style swine production facilities are fairly standardized, consisting of multiple long, low-lying metal buildings set atop concrete foundations, rows of ventilation fans protruding from the sides and ends, elevated bulk feeder tanks with feed augers to move feed inside, and frequently a nearby outdoor lagoon to hold animal waste. The interiors are also similar, characterized



Figure 1
Family Hog Farm.



Figure 2
Industrial Hog Operation.

by rows of holding pens, slotted floors that allow waste to wash into a pit below where it is later pumped or flushed to an outdoor lagoon for anaerobic decomposition, auger-driven feeding pipes fitted along the ceiling with outlets to feeding troughs connected to each pen, automated watering systems, and walkways between rows of pens. Enclosed facilities allow better control over factors critical to growth and profits, including exposure to climatic and other environmental fluctuations (particularly in temperate climates), feeding regimens, and reproduction. In addition, genetic selection provides swine that convert feed to meat more quickly and with less fat, so leaner hogs are market ready sooner. Differential weaning processes based on sex, separate and frequently quarantined production facilities for each stage of growth, and the use of antibiotics all contribute to increased disease control. In addition, capital investments in technological advances reduce the amount of labor required to produce each hog.

These technological changes accompany rapid structural changes. The number of swine producers has declined precipitously from 750,000 in 1974 to 157,000 by the end of 1996 (USDA). Between 1994 and 1996 one out of every four hog producers left the business. And by the end of 1996, 3 percent of producers representing the largest corporate operations in the United States produced 51 percent of all the hogs, while 21 percent of all hogs were grown under contract—a situation fraught with social and economic problems that John Morrison describes in his chapter on the poultry industry. Producers that remain are larger and increasingly use outside capital to purchase new technologies. The traditional swine producing areas of the Midwest and the Great Plains are facing increasing competition from nontraditional areas such as North Carolina, Colorado, and Utah utilizing the latest technology and cheap labor to offset the cost of grain imported from the Midwest for feed. As a consequence, locally grown or purchased inputs for the production process are replaced with increasingly larger shares of purchased inputs from outside the locality (Chism and Levins 1994; Lawrence 1994).

Ownership, management, and labor become separated both economically and socially. In one form, producers contract with large companies or corporations to produce hogs. In these “risk-sharing” ventures, the farmer produces hogs owned by someone else following a standardized production protocol specified by the contractor. In such a system, wealth and profits are extracted from local economic systems which, even where standards of living increase, become increasingly dependent on control from outside systems. Yet total production per farm increases, with a concomitant increase in production efficiency as measured by output per unit of labor. However, profit margins narrow as increasing output saturates markets, pushes consumer prices lower, and pits farmers against farmers in a competitive “treadmill” of producing more product for less money (Durrenberger and Thu 1996). This is particularly true

for farmers who, in contrast to food processors and distributors, are not in a position to pass along increased production costs. In contrast, vertically integrated systems wield complete control over the entire production and distribution process, from genetic stock to the grocery store shelf, so corporations can track and adjust costs across the entire food production and distribution process to maximize profits.

Consumer demand for pork in the United States has remained steady for the past ten years (*Feedstuffs* 1994). However, pork's share of total domestic meat consumption has declined since 1950 (Van Arsdall and Gilliam 1979). Nonetheless, pork accounts for 40 percent of world meat consumption, the single largest source of animal protein (United Nations 1991). U.S. pork exports have soared in the past couple of years, outstripping imports for the first time. Many of these burgeoning markets are appearing in eastern Asia, particularly Japan and the Pacific Rim. Markets in Mexico and Canada continue to be strong as well. Many of the larger swine producers are tailoring their meat to the specific consumer preferences of these markets, for example marbled pork in Japan. Moreover, some U.S. consumers are expressing an increasing desire for leaner meats of all types, including pork.

Swine industry leaders (Keppy 1995), agricultural economists (DiPietre and Watson 1994), and others (Williams and Pfouts 1995) point to consumer demand as a driving force behind industry changes. It is true that some consumers desire leaner meat, but it is not accurate to say they are therefore demanding industrialized production facilities. If industrialized swine facilities were the only form of production capable of producing leaner meat, such an argument might have merit. Randy Ziegenhorn describes one such alternative in his chapter on independent swine producer networks. There are other alternatives as well, including swine hoop structures resembling tent-covered wagons that are beginning to appear on the Iowa landscape. These facilities are far less capital intensive, more acceptable to neighbors and rural communities, and can be quite profitable for independent producers (Honeyman 1994).

It is true that meat packers are demanding leaner, more standardized carcasses and that larger producers tend to meet these demands better. Similar to other food industries such as fishing (Durrenberger 1996), it is the signals from processors, not consumers, that producers receive and act on. However, the profits of packers, processors, and retailers mitigate the signals of consumers when making demands upon swine producers. As Mark Grey describes in his chapter on the packing industry, a standardized hog carcass allows for the use of cheap, unskilled labor in a factory-style disassembly and packing process. The importation of foreign labor has a range of community costs that Grey details in a rural Iowa community. Is a processor's demand for a standardized carcass the same thing as consumer demand, or are packers manipulating the rhetoric of consumer demand to justify their demand for standardized carcasses

in order to import unskilled labor from Mexico and Southeast Asia? This raises a more fundamental question of distinguishing the rhetorics of profits and consumer preferences in shaping changes in the organization and technologies of food production.

Consumer preferences are influenced by a number of complex factors (Griffith and Johnson 1989), involving much more than a simple single-dimensional desire for something such as “leanness.” For the past fifty years, the real trend in consumer demand has been for food requiring less preparation time and effort. In the 1960s, approximately two-thirds of all consumed food came from grocery stores and only one-third from food service operations (Wolt 1996). Thirty years later consumers get more of their food from food services than from grocery stores. As Christopher Wolt, director of Strategic Food Resources for Noble and Associates, pointed out at the 1996 National Forum for Agriculture, health considerations such as cholesterol, fat, and salt content are becoming less important factors in consumer food choices. Approximately eight percent of the U.S. population, actually makes primary food consumption decisions based on health-related factors such as leanness. If changes in the pork industry were truly a response to consumer preferences, we would be seeing not an increasingly lean pork, but pork that is easier for the consumer to prepare.

Some consumers do want leaner meat, but their demand has little to do with how that lean meat is produced. The demands of industries that provide the building materials, veterinary supplies, feed supplements, and other inputs for this new type of swine production are likely more powerful than consumers in shaping forms of food production. Consumers buy what they are offered. Furthermore, there is no reason to assume that consumer preference for a particular food item is the same thing as a demand for a particular technology or form of production to produce that food item.

Even if consumer demand has little role in determining forms of swine production, conventional economic wisdom of the industrial paradigm suggests that large-scale industrial swine production facilities must be productive, efficient, and most of all profitable, otherwise they would not be proliferating and surviving while vast numbers of smaller, independent operations are disappearing. And if this is the case, is it not reasonable to assume that a more efficient form of production is better for the overall rural health of agricultural regions in the United States? Much of this line of reasoning is predicated on assumptions rooted in economies of scale, as well as assumptions about which factors should be included and considered in measurements of productivity, efficiency, and profitability. Assumptions are not facts.

Economies of scale refer to situations in which a constant proportion of resource inputs results in a disproportionately higher rate of outputs or profits simply because of the size of the operation or business. For example, a farm with one thousand hogs creates more than twice the output and/or net profits

than does a five hundred-hog operation. Similar advantages might be gained even if resource inputs are not proportionately increased with growth, as long as net profits increase faster than an increase in inputs. For example, ten hogs might be added to an existing operation with two hundred head without any increase in heating costs, relatively small increases in water usage and labor, and proportionately modest increases in maintenance and veterinary costs, which make the increased cost of feed worthwhile because of proportionately increased profits.

Some argue that the rapid growth of large-scale swine operations is occurring because their scale allows them to achieve increases in production efficiency and economic profitability by virtue of their size. However, we are aware of no data on the production efficiencies and profitability of the largest swine operations in the country, particularly the largest fifty seven which market more than fifty thousand hogs each. This data is closely guarded proprietary information of the firms themselves. Data do exist on the production efficiencies and profitability of most swine producers. Studies (Iowa Farm Business Association 1992; Mueller 1993) indicate economies of scale are achieved in very modest-sized swine operations, and that size has little to do with efficiency of production and profitability. In an analysis of 705 hog farms in Illinois, Mueller (1993:4) showed that critical factors for profitability were the number of pigs weaned per litter, weight gain efficiencies, price of feed, and market price. In a step-wise regression analysis, size of operations explained less than 5 percent of the variation in profitability. In other words, scale was the least important determinant of profitability. These findings substantiate earlier studies conducted on agricultural operations generally which show that modest-sized operations capture the bulk of economic efficiencies, and larger operations have little to no advantage in terms of economies of scale (see Madden 1967 for a summary).

The fact that large-scale operations are not inherently more efficient than their smaller counterparts does not mean smaller operations are efficient. What it does mean is that smaller operations are not inefficient by virtue of their size. Analyses of swine production records shows a range of production efficiencies; some producers are more effective than others. The response of national and state pork producer groups, farm organizations, and many agricultural economists is to place industry problems on the shoulders of independent producers whom they cite as poor managers and inefficient producers. For example, listen to the chastising editorial words of the editor of *Pork 94* (Miller in *Pork 94*, 5 October) a monthly magazine for pork producers: "I can't help wonder what the payoff would be if some producers put as much time and energy into upgrading their own operation as they spend worrying about the 'big boys.' The real question should be: What have you done for yourself lately? It doesn't

matter how much money the other guy makes. What's important is that you're profitable. If you're not, why not?"

The dominant rhetoric of swine industry change focuses on problems of production efficiency among individual producers. Producers are cited for poor record keeping, use of substandard genetics, inadequate herd management, and their reluctance to expand and invest in the technological tide of the future. This approach assumes that efficiency is the key to survival. However, if larger producers are not inherently more efficient than their modest-sized counterparts, why do they continue to survive while smaller producers are disappearing? A few facts cast light on an important dimension of this trend and challenge assumptions about efficiency.

Approximately thirteen percent of U.S. pork production comes from the fifty-seven largest producers; each producing more than fifty thousand hogs annually. These fifty-seven companies have increased production at a rate that far exceeds that of smaller producers (Grimes and Rhodes 1994), despite the fact that domestic consumer demand has remained constant. In 1994, this resulted in a deluge of hogs into the market that set national production records. As a result, hog prices nose-dived from fifty cents to less than twenty-seven cents a pound. In real dollars, this is the lowest price since the Depression. For most family farm producers, cost of production is approximately thirty to forty cents a pound. How long can even the most efficient family hog producer survive losing ten cents on every pound of hogs? Large-scale corporate producers gobbled up domestic market share at the expense of independent family producers if for no other reason than their massive production. Large-scale producers were not just responding to open market pressures of supply and demand, they were creating them. The issue was not who was most efficient, rather who had the resources to shape the structure of the market. Furthermore, as producers and processors collaborate, there simply is no market.

A comparable point was made concerning a prevailing misguided view that farms that were weeded out during the 1980s farm crisis were inefficient. As the agricultural economist Neil Harl demonstrated, efficiency was largely irrelevant to survival during the 1980s crisis. "What occurred in agriculture in the 1980s in terms of firms failing because equity was exhausted or operating credit was denied had little to do with efficiency and did not represent a continuation of the long-term trend toward greater efficiency in agriculture. In fact, the firms at risk were some of the most efficient in the industry and were operating at or near the point of greatest efficiency" (Harl 1990: 20). The idea that changes in the swine industry reflect a natural process of survival of the most efficient is also an assumption, not a fact. It may well be that, similar to the 1980s, survivors are those who have access to the most capital by establishing appropriate "relationships" with economic power centers, as the pork producer

Jim Braun discusses in his chapter. If this is the case, adaptive responses by individual producers to become more efficient by focusing on reducing their costs of production could be misguided.

Even more fundamental is a critical examination of assumptions concerning how efficiency is conceptualized and measured in agriculture. Efficiency of production is typically measured by examining the cost and amount of inputs and related expenses compared to outputs consisting of food commodities and profit. The operation that can produce the most food with the fewest and least costly inputs at a maximum profit is the most efficient. Types of inputs and related expenses usually included in measures of efficiency and productivity are things such as land, machinery, fuel and oil, utilities, labor, seed, feed, veterinary supplies and services, fertilizer, herbicides, pesticides, insurance, building repair, machinery and building depreciation, and interest, among others (Iowa State University 1991). Outputs include crops and livestock produced. Profits are calculated by subtracting the cost of inputs and related expenses from the money received from marketing crops and livestock. Efficiency is then calculated by comparing various dimensions of the relationships between inputs and outputs. For example, machinery costs per acre, cost of livestock feed per unit of animal growth, expenses per bushel of grain, and more general calculations such as value of farm production per dollar of expense or percentage return relative to total equity. But certain measures are utilized to calculate efficiencies while others are excluded. For example, farming is among the most dangerous occupations in the country, with known elevated rates of disabling illnesses such as respiratory diseases among swine confinement production workers described by Kelley Donham in his chapter in this volume. What are the productivity and health care costs of respiratory health problems among the 25 to 30 percent of swine confinement production workers known to be experiencing problems? Conversely, what are the educational, community, social, and human character benefits of learning honesty, hard work, ingenuity, flexibility, and fairness as part of being reared in a farm environment? Why are these beneficial factors not included in calculations of efficiency? To respond that they are intangible, immeasurable, and therefore less relevant is a manifestation of a pervasive and powerful assumption of what economic efficiency and productivity are. Again, these are assumptions, not facts. As DeLind and Nickles show in their chapters, the social and community costs of corporate swine facilities are all too real. To be sure, farmers must make a profit if they are to survive. No one pays a tractor repair bill with strong character. But rural communities, policy makers, and society as a whole must understand, judge, and assess the total picture of farming and its relationship to our rural and national health.

Understanding large-scale industrial swine production facilities includes examining not only their internal operational efficiencies but also their rela-

tionship to rural communities in which they are situated and society as a whole. A number of rural development reports have been issued enthusiastically endorsing the economic benefits of large-scale and contract swine production (DiPietre 1992; DiPietre and Watson 1994; Thornsby, Kambhampaty, and Kenyon 1993). Glowing projections concerning job creation, increases in personal income, increase in tax revenue, business growth, and general increases in revenue are typical of these reports. However, the projected benefits are based on a set of assumptions, not empirical data, and factors considered in the projections are uniformly biased in favor of benefits. In fact, the economic model (IMPLAN) used for these reports was originally developed by the U.S. Forest Service and is virtually incapable of calculating negative impacts or costs. Because of this weakness, costs are relegated to a residual category at the end of such reports, and it is asserted without evidence that these costs will not be incurred. An example comes from the end of a 1994 University of Missouri Commercial Agriculture Program report on large corporate swine production in Missouri. "In addition, some people fear an environmental disaster may occur from a major accident in waste handling methods. Such an accident might pollute both surface and ground water and possibly harm wildlife, especially fish in streams or waterways affected [sic]. The probability of a major negative environmental impact beyond odor is unlikely" (DiPietre and Watson 1994: 52).

The assumption that an environmental impact is unlikely was proven false in the summer of 1995 when the large corporate swine producer described in the University of Missouri report was caught in three major manure spills killing over 178,000 fish in public waters according to the Missouri Department of Natural Resources (November, *Pork 95*: 67–68). In the fall of the same year, another corporate hog producer in northern Missouri was fined for a manure spill that traveled over eight miles down a tributary of the Grand River killing nearly ninety thousand fish (*Pork 95*: 68). These were part of a series of eight separate manure waste spills into Missouri public waters resulting in environmental fines of \$170,000. That same year, in north-central Iowa, site of the most rapid proliferation of large-scale hog production in that state, 1.5 million gallons of manure flowed from a hog lagoon into a tributary of the Iowa River (McMahon 1995: 17). And in North Carolina, the state with the most rapid expansion of corporate swine production in the country, 22 million gallons of swine feces and urine escaped an eight-acre waste holding lagoon, eventually draining into the New River where it destroyed most of the aquatic life in a seventeen-mile stretch (Satchell 1996). The mounting number of these environmental problems demonstrates that, contrary to economic development rhetoric and assumptions, they are very real costs.

As Laura Jackson details in her chapter on water quality and large-scale swine operations, our ability to understand and address environmental issues is limited by a myopic view of agricultural and environmental systems. In addition

to detailing specific issues such as swine waste handling systems, field application of swine manure, and nitrogen deposition rates, Jackson reminds us that it is the total ecology and economy that includes a reliance on monocropping that provides hog feed that must be included to understand and address environmental issues. Similarly in his chapter, John Ikerd urges us to broaden our gaze in pointing out that a large-scale corporate swine facility may indeed have economic benefits for a circumscribed geographical area. But when considered as part of wider rural and swine industry health there are measurable disadvantages and costs. This is because a fundamental part of industrialized food production is replacing labor with capital-intensive technology and reducing the amount of labor required per unit of output. Consequently, it is inherently misleading to promote job growth benefits of industrial swine facilities since by the very nature of their "efficiencies" they are intended to displace labor. As Ikerd points out, employment gains in one area are more than offset by employment losses in others. In other words, the jobs of workers in swine production factories do not compensate for losses of independent owner-operators.

Ikerd's findings confirm for the swine industry what established research has shown for agriculture generally, that the emergence of industrial agriculture is a significant precipitating factor for the decline of rural social and economic conditions, particularly in areas dependent on agriculture (Barnes and Blevins 1992; Goldschmidt 1978; Lobao 1990). This research includes a number of regional and nationwide assessments examining various measures of industrialized agriculture, for example, scale, extent of hired labor, and its effects on various indices of social and economic health, such as, poverty rates and food stamp usage. Our study in Iowa similarly showed a measurable relationship between large-scale swine production and measures of declining economic well-being in rural Iowa (Durrenberger and Thu 1996). Our analysis indicated that having more hog farms was better for rural health than producing more hogs. Despite this evidence, the dominant criterion of industry health continues to be the absolute number of hogs produced and a state's proportion of national production.

In addition to traditional economic considerations such as employment, there are a number of other social and community costs. Susan Schiffman, an expert in odor research, demonstrates in her chapter that people living in the vicinity of large-scale swine facilities experience clear and measurable declines in psychological health. The gases and corresponding odors emitted from these facilities have been widely reported by people experiencing them as atrocious, repugnant, and unbearable. Subsequent research suggests neighbors may be experiencing physical health problems similar in kind, though less intense, than well-documented health problems among swine confinement workers (Thu et al. 1997). Unfortunately, swine-generated odor and gases and people's responses to them are all too frequently treated by officials and many researchers

as a matter of individual perception and subjective experience (Thu and Durrenberger 1994). Considerable research funds are being channeled into developing odor control technologies. Strangely, the availability of research funds indicates a clear recognition of a problem, but when problems are experienced by neighbors they are deemed too elusive or subjective to address. The burden of proof then falls on the neighbors to demonstrate the reality of their problems. Schiffman's work clearly shows that these problems are real and that they have a physiological basis.

In her contribution, Laura DeLind provides perhaps the only relatively complete case study of the community consequences of a large-scale corporate swine facility. She traces an agonizing cycle from the arrival of a facility in a Michigan community, to the community's response to its eventual departure. In contrast to most cases, this Michigan community "successfully" rid itself of the corporate swine facility. However, the human cost of the battle to purge itself of the facility exhausted the community to the extent that it was forever changed. DeLind describes in detail the human dimensions of this battle and how the human social costs that are excluded as intangible externalities in economic development models are in fact the all-too-vivid realities of actual people. These are facts, not assumptions.

As Iowa family farm hog producers for over twenty years, Jim Braun and his wife Pam discuss the myths and realities of industry change in their chapter. Increasingly surrounded by corporate hog operations in north-central Iowa where their hog farmer neighbors have all but disappeared, the Brauns face a daunting challenge in trying to forge a farming future for their children and resist the transformation of their small community into a company town. With the realization that industry changes are not simply the result of so-called natural market forces, Jim Braun saw the absurdity of industry rhetoric focusing on increasing operational efficiency as a survival strategy for his farm. No longer wedded to his father's admonition to stay on the farm and work hard, he is now working to keep his family hog operation by sowing and tending the political fields of the state legislature and farm organizations where he works relentlessly for an equal chance to survive.

Robert Morgan, a former U.S. senator and state attorney general from North Carolina, and Blaine Nickles and Jim Braun—farmers in north-central Iowa, describe the legal and political dimensions of industrial swine production in North Carolina and Iowa. As a farmer, Blaine Nickles describes his experiences with the consequences of large-scale swine production in his community. Odor, water quality, economic impact, and changing social relationships are among the problems he discusses. In addition, he traces his grassroots efforts to have the problems of his community redressed through political processes. A disconcerting picture emerges of what happens when industry power becomes concentrated, blocking political channels for getting the real problems

of rural citizens addressed. From a different vantage point, Senator Morgan describes the political and legal dimensions of corporate swine production in North Carolina. North Carolina is home to the greatest concentration of corporate swine production in the United States, purposefully courting pork production to replace its troubled tobacco industry. As Senator Morgan points out, large-scale corporate hog producers wield political and legal power that puts typical rural residents at a distinct disadvantage when they seek redress for problems they experience. Both chapters illustrate how the concentration of political power that accompanies the growth of corporate swine production works against the principles of a democratic society. These costs are among the most disturbing and have perhaps the most fundamental consequences for the rural health of the United States.

John Morrison, executive director of the National Contract Poultry Growers Association, outlines disturbing parallels between current changes in the swine industry and those leading to the complete vertical integration of the poultry industry some thirty years ago. He discusses the inherent power imbalance between the handful of poultry contractors who now control production and the growers who must accept contracts with them if they want to stay in business. A number of legal battles have raged over corporate contractors' exploitation of individual growers. As Morrison points out, current state and national pork producer organizations have a clear historical record from the poultry industry from which they can base decisions for the future of the swine industry.

In contrast to the fatalistic rhetoric of economic inevitability, a basic point of this collection is that we do have choices over the type of food production we want in this country. If the industrialization of food production were simply a matter of free market economics, then why does agriculture and the food industry have so many public and private agencies and organizations spending so much time and money attempting to influence policies and the politics of food production? If the market were the only reality, none of these would be necessary. The fact that more of these organizations exist now than ever before in the face of record small numbers of food producers is a testament to whom the beneficiaries of industrialized agriculture are and belies the rhetoric of free market forces. As discussed earlier, industrial agriculture has its beneficiaries, and it goes without saying that those that benefit will attempt to protect their interests. The notion that economics is an isolated sphere of activity into which politics does not intrude is a myth. Almost all state governments intervene to regulate systems of food production (Clunies-Ross and Hildyard 1992; Friedmann and McMichael 1989; Lindert 1991; Michelmann, Stabler, and Storey 1990; Timmer 1991). Assumptions that define and promote ideas of productivity and efficiency as inevitable and natural economic processes resulting in industrialized swine production convinces those who suffer its costs that there is nothing they can do about it. While this rhetoric is repeated in small town coffee shops, cafes, and grain elevators, the largest agribusinesses and food proces-

sors in the world are busy in the corridors of Washington, D.C., contradicting their free market rhetoric merely by participating in political processes. The predictable response is that their participation in political processes is simply to ensure fair and equitable markets and conditions. We leave it to the reader to decide by casting aside assumptions and weighing the facts.

Recent strides in a “movement” known as sustainable agriculture have succeeded in establishing a foothold relative to the dominant industrial agricultural paradigm. Sustainable agriculture is often perceived to be associated with specific farm practices to deal with issues such as soil erosion or decreasing fertilizer use while maintaining profitability (Keeney 1990). It may also include features such as farmer health and safety as Donham and Thu (1993) advocate. Criticism often is leveled at sustainable agriculture that it is nebulous and ill-defined, and that it has no pragmatic program or mechanism for ensuring profitability among farmers who make the transition. However, any newly emerging system of adaptation requires a range of variation to increase its likelihood of success. Sustainable agriculture would be doomed to failure if its tenets were clearly defined and rigidly practiced at the outset. The underlying point of sustainable agriculture is not precisely what it is, but what it means (Duffy 1994) and why it is emerging. It is emerging because of defects in the industrial paradigm of farming, and whatever its resultant forms, they should be developed in response to clearly identified problems inherent in the industrial paradigm. The chapters in this book help to crystallize problems associated with the industrial paradigm in order to remedy them.

In the volume’s Conclusion, Walter Goldschmidt reminds us of the human meaning and cultural evolutionary significance of changes in the way we produce our food. As a leading anthropological scholar schooled and experienced in studying the ways of human adaptation, Goldschmidt points to the waves of consequential changes that occur when we fundamentally alter a basic infrastructure of society—our food production system. Goldschmidt reminds us that this is not an issue of technological reticence or advocating a return to a simpler romantic past. Rather, it is an issue of cultural evolutionary cognizance, of learning what changes in food production mean for the social, economic, and political health of a society and the lessons that we ought to be wise enough to learn and courageous enough to apply. It is an anthropological lesson born of understanding the ways of human existence and adaptation, a lesson that reminds us that the challenge of today’s prairie frontier is taming the all-consuming economic dragon that lays waste the fertile soils of human dignity and community.

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