Vertical Coordination of Agriculture in Farming-Dependent Areas

Council for Agricultural Science and Technology
Printed in the United States of America

Cover design by Lynn Ekblad, Different Angles, Ames, Iowa
Cover photograph by Scott Bauer, Agricultural Research Service,
U.S. Department of Agriculture, Beltsville, Maryland.
Small farm near Ames, Iowa.

ISBN 1-887383-19-0
ISSN 0194-4088
04 03 02 01 4 3 2 1

Library of Congress Cataloging in Publication Data

Vertical coordination of agriculture in farming-dependent areas.
p. cm. -- (Task force report, ISSN 0194-4088 ; no. 137)
Includes bibliographical references.
1. Agricultural industries-Vertical integration-United States. 2. Rural industries-United States. 3. Agriculture and state-United States. I. Council for Agricultural Science and Technology. II. Task force report (Council for Agricultural Science and Technology) ; no. 137.
HD9005 .V47 2001
338.1'0973-dc21 00-064410
CIP

Task Force Report
No. 137 March 2001

Council for Agricultural Science and Technology

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Foreword

Following a recommendation by the CAST National Concerns Committee, the CAST Board of Directors authorized preparation of a report on vertical coordination of agriculture in farming-dependent areas of the United States.

Drs. Luther G. Tweeten, The Ohio State University, Columbus, and Cornelia B. Flora, North Central Regional Center for Rural Development, Iowa State University, Ames, served as cochairs and authors of the report. A highly qualified group of scientists served as reviewers of the document. The authors and reviewers include individuals with expertise in agricultural economics, agroecology, agronomy, animal science, human resources, monetary policy, rural sociology, and sustainable food systems.

The authors prepared an initial draft of the report, which was reviewed by the credited reviewers. The authors revised all subsequent drafts, and the authors and credited reviewers reviewed the proofs. The CAST Executive and Editorial and Publications committees reviewed the document. The CAST staff provided editorial and structural suggestions and published the report. The authors are responsible for the report's scientific content.

On behalf of CAST, we thank the cochairs and reviewers who gave of their time and expertise to prepare this report as a contribution by the scientific community to public understanding of the issue. We also thank the employers of the scientists, who made the time of these individuals available at no cost to CAST. CAST thanks all members who made additional contributions to assist in the preparation of this document. The members of CAST deserve special recognition because the unrestricted contributions they have made in support of CAST also have financed the preparation and publication of this report.

This report is being distributed widely including to members of Congress, the White House, the U.S. Department of Agriculture, the Congressional Research Service, the Food and Drug Administration, the Environmental Protection Agency, the Agency for International Development, the Office of Science and Technology Policy, and the Office of Management and Budget, and to media personnel and institutional members of CAST. Individual members of CAST may receive a complimentary copy upon request for a $3.00 postage and handling fee. The report may be reproduced in its entirety without permission. If copied in any manner, credit to the authors and to CAST would be appreciated.

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Interpretive Summary

This report analyzes how vertical coordination can change the face of rural communities in farming-dependent areas. It examines (1) the various forces driving the forms of vertical coordination, (2) their evolutions and their effects on agriculture and rural communities, and (3) policy options to help rural communities cope with change. The focus of the report is farming-dependent rural communities because they often are disproportionately troubled by depopulation, underemployment, and stagnant income.

The Changing Structure of U.S. Agriculture

Vertical coordination refers to the means used to synchronize vertical stages of the food-value chain. Recently, food-value chains have become more closely integrated as means (1) to lower costs by improving productivity, (2) to improve and to ensure quality throughout the chain, (3) to control risks associated with markets and food safety, and (4) to enhance responsiveness to demand.

Tomorrow's tightly coordinated agriculture will be characterized by a hub, spoke, and wedge configuration. A livestock-processing plant at the hub will be in close proximity to livestock-feeding operations supplied feed by mills drawing grain and oilseed through transportation and communication spokes delineating crop production "wedges" covering large areas. The nation's landscape will include few clusters. Farms in the periphery (wedges) will require less and less labor and other local inputs and thus will provide diminishing social and economic support for their own local rural communities.

The emerging food and agricultural sector will rely increasingly on negotiated/administered forms of vertical coordination. Principal forms will include marketing contracts, production contracts, and integrated ownership. Negotiated before delivery or production, marketing contracts typically specify the price (or a formula for price) to be paid by the buyer. Arrangements for production contracts differ greatly but, typically, the contractor furnishes baby pigs or chicks, feed, veterinary supplies, and organizational management, e.g., appropriate practices, and levels and schedules of placement. Under integrated ownership, a firm owns and operates in both crop and/or livestock production and farm input supply or food processing.

Consolidation is defined here as the coming together of firms producing the same thing. Consolidation results in economies of size and market power. Vertical integration is related to, but can exist independently from, consolidated firms.

Information technology supplemented by e-commerce in conjunction with contracting offers the promise of realizing economies of size to produce and to market at low cost-per-unit while dispersing economic activity among firms in the clusters described previously. Timely information exchange, enhanced by electronic communication, facilitates responsiveness of integrated value chains.

Electronic commerce also will influence farming-dependent rural communities. Yet while local rural communities with the help of federal and state governments likely will endeavor to close the rural "digital divide," at best rural communities will be only catching up with the technology already available to both urban and suburban communities. Ultimately, market cost efficiencies brought about by e-commerce will come partly at the expense of rural communities.

Effects of Change

Tighter coordination of links in the marketing chain produces efficiency that, when spread through the industry, ultimately decreases the firm's commodity supply price. All else being equal, industrywide productivity gains decrease aggregate employment and other economic activities in rural communities. Although production contracts have decreased farm-labor in aggregate, they have created new opportunities for many workers on small farms in the South and in other parts of the country. Many lenders are more willing to lend to construct production facilities for a low-income producer with a multiyear production con-

tract than to an independent producer perennially subject to market volatility. Thus, for many farming dependent areas of the nation, the most promising option for job and income expansion is through production contracts, which need not imply megafarms, factory farms, or environmental degradation.

Public Policy Responses

- Costs of odor-, waste-, and pest-control need to be charged to the producing units and not to their neighbors or to other "downstream" parties.
- Allowing operators to choose whichever form of vertical coordination they find advantageous but relying on the public sector to establish and to enforce environmental standards raises real national income while holding down food and fiber costs to consumers.
- There can be no universal formula; each community or other entity must decide which development strategy to use. State and federal governments can assist in this decision-making process by establishing environmental ground rules and regulations and by providing information.
- Research, resident instruction, and extension education can be valuable when designed to improve technology, information systems, risk management, and marketing tools that will help family farmers and owners of small rural firms.
- Labeling backed by proper standards and enforcement can serve a useful purpose. For example, consumers who prefer free-range chickens or eggs produced by independent firms "vote" by purchasing the labeled product at a price eliciting the appropriate supply. Providing education and technical assistance to private sector certifiers can enhance niche market options.
- Firms will tend to go to counties, states, and countries with the weakest environmental standards. Thus, some national standards may be appropriate. State-level regulations may differ due to differences in population density and aridity.
- A county option is sometimes useful where environmental regulations need to differ appropriately among local areas.
- The United States must continue to promote competition through antitrust and other measures, including enforcing existing antitrust laws.
- Many rural communities will find it advantageous to use their resources to help inhabitants increase their options. Local, state, and federal governments should build human capital for alternative opportunities locally or elsewhere through investment in schools, adult education, and skill building.
- Promote market transparency, competition, and efficiency by releasing terms of contracts to the public. Such information not only can improve decisions of growers and contractors, but also allows for collective action where individuals share disadvantageous terms and provides a data base to research issues of market structure, conduct, and performance.

Executive Summary

This report analyzes how vertical coordination can change the face of rural communities in farming- dependent areas. It examines (1) the various forces driving the forms of vertical coordination, (2) their evolutions and their effects on agriculture and rural communities, and (3) policy options to help rural communities cope with change. The focus of the report is farming-dependent rural communities because they often are disproportionately troubled by depopulation, underemployment, and stagnant income.

The Changing Structure of U.S. Agriculture

Vertical coordination refers to the means used to synchronize vertical stages of the food value-chain. Recently, food value-chains have become more closely integrated as means (1) to lower costs by improving economic efficiency, (2) to improve and to ensure quality throughout the chain, (3) to control risks associated with markets and food safety, and (4) to enhance a company's ability to respond to demand.

Traditionally, American agriculture was characterized by diversified crop/livestock family-farms, each of which looked much like the next farm, over broad areas of the nation. Tomorrow's tightly coordinated agriculture may be characterized more by a hub, spoke, and wedge configuration. For example, a large livestock-processing plant at the hub will be in close proximity to livestock-feeding operations (Figure S-1) supplied feed by mills drawing grain and oilseed through transportation (Figure S-2) and communication spokes delineating crop production "wedges" (Figure S-3) covering large areas. The nation's landscape

Figure S-1. A livestock feeding operation in the Great Plains. Photograph by Brian Prechtel, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Figure S-2. Aerial photograph of farming community and transportation routes in Ohio. Photograph courtesy of Ohio State University Section of Communications and Technology, Columbus, Ohio.

Figure S-3. Soybeans being harvested. Photograph courtesy of Ohio State University Section of Communications and Technology, Columbus, Ohio.

will include few clusters. Farms in the periphery (wedges) (Figure S-4) will require less and less labor and other local inputs per unit of output and thus will provide diminishing social and economic support for their own local rural communities.

The hub, spoke, and wedge system is unlikely to be coordinated mainly by traditional small, family-firms operating independently in markets at the various stages of the food value-chain. The emerging food and agricultural sector will rely increasingly on negotiated/administered forms of vertical coordination to get the right ingredient at the right time to the right place at the right price to meet the demands of ever more affluent and more demanding consumers. Principal forms of vertical coordination include marketing contracts, production contracts, and integrated ownership. These can be structured as cooperatives, investor-owned firms, or hybrids of individuals, cooperatives, and investor-owned firms.

Marketing contracts have been used widely for decades in fruit, vegetable, and dairy marketing orders. Negotiated before delivery or production, these contracts typically specify the price (or a formula for price) to be paid by the buyer. Commodity ownership usually remains with the producer until the product is delivered to the buyer, who is, often, a processor. Most production and marketing decisions before delivery are made by producers.

Production contracts have been used widely for broilers since the 1950s, and their use in recent years has expanded rapidly in swine production. Arrangements differ greatly but, typically, the contractor furnishes baby pigs (Figure S-5) or chicks (Figure S-6), feed, veterinary supplies, and organizational management, e.g., appropriate practices, and levels and schedules of placement. The grower or the producer does not own the animals but supplies equipment, buildings, labor, and day-to-day management for a fee-per-animal plus an incentive bonus or penalty.

Under integrated ownership, another form of vertical coordination, a firm owns and operates in both crop and/or livestock production and farm input supply or food processing. Integrated ownership is especially prominent in the production of eggs, turkeys (Figure S-7), and some fresh fruits and vegetables.

Farming-dependent communities in the Great Plains, where they are especially prevalent, have a strong environmental advantage as hubs for animal agriculture by virtue of low rainfall rates and sparse populations. But this will simply contribute to the existing hub and spoke pattern. New clusters will evolve. Vertical coordination will provide alternatives for some communities and farm households outside such clusters.

Different forms of vertical coordination have different economic and social effects on communities, however. Marketing contracts tend not to displace resources from farms and small rural-communities but at the same time do not provide the economies of size or returns for explicit bundles of characteristics essential to the revitalization of local communities. Integrated ownership provides economies of size and scope but also has the potential to displace resources from traditional farms and rural communities because production units tend to be very large, and ownership and control may reside in distant metropolitan centers. A farming-dependent rural community may not be able to assemble locally the necessary venture capital, management, and other headquarters services for production units. Production con-

Figure S-4. Aerial view of many small farms in the midwestern United States. Photograph courtesy of Ohio State University Section of Communications and Technology, Columbus, Ohio.

Figure S-5. Baby piglet. Photo by Scott Bauer, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

tracts offer the promise of economies of size but with less threat to small farms and communities than integrated ownership poses.

Electronic Commerce

Electronic commerce, or *e-commerce* (market buying and selling transactions through the Internet), an emerging means for coordinating vertical links in the food value-chain, also will influence farming-dependent rural communities. E-commerce could make any rural community the site for the headquarters of an efficient global firm. By bringing together large numbers of buyers and sellers over a very extensive and even global area, e-commerce promises a highly competitive and efficient market.

Disadvantages could outweigh advantages of e-commerce for rural farm communities, however. Rural communities have lagged in their access to the broadband fiber optics facilitating e-commerce. While local rural communities with the help of federal and state governments likely will strive to close the rural "digital divide," at best rural communities will be only catching up with the technology already available to both urban and suburban communities. But information technology will not necessarily help small communities and small firms more than urban areas and large firms, which are already highly connected. Rural communities cannot afford to neglect telecommunications, even though it will be a challenge to catch up with urban areas.

And catching up will not necessarily be enough. Decreasing transaction costs and increasing competition in farm input and product markets mean shrinking marketing margins. This in turn means decreasing the number of intermediaries, many of whom are located in rural communities and serve local markets. In short, efficiencies in decreasing market costs will come partly at the expense of existing firms in rural communities.

Information technology supplemented by e-commerce in conjunction with contracting offers the promise of realizing economies of size to produce and to market at low cost-per-unit while dispersing economic activity among firms in the clusters described previously. Modern production contract efficiencies often can be enhanced by spreading production and processing activities among communities of different sizes.

Effects of Change

Production contracts and integrated ownership often can increase information flow and responsiveness, save inputs, improve productivity, and enhance total profits. Tighter coordination of links in the marketing chain decreases the firm's commodity supply price by reducing transaction costs. All else being equal, industrywide productivity gains decrease aggregate employment and other economic activities in rural communities.

Figure S-6. Baby chicks. Photo by Keith Weller, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Figure S-7. Turkey production facility. Photo by Scott Bauer, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Although production contracts have decreased farm labor in aggregate, they have created new opportunities for many workers on small farms in the South and in other parts of the country. Many lenders are more willing to lend to construct production facilities for a low-income producer with a multiyear production contract than to an independent producer perennially subject to market volatility. Thus, for many farming dependent areas of the nation, the most promising option for job and income expansion is through production contracts. A comparison of two counties in Ohio (see text) illustrates how production contracts can help small-acreage family-farms stay competitive. The example illustrates how production contracts need not imply megafarms, factory farms, or environmental degradation. Production contracting can combine the economies of size needed to compete in modern agriculture with the social advantages of family-size farms.

The form of vertical coordination influences the rural community through the number of workers, the conditions of work, and the degrees of specialization, skill, and income of each worker. Vertically coordinated systems require a variety of workers, ranging from highly trained engineers and scientists to unskilled laborers. Compared with independent family-farms, firms under integrated ownership and production contracts tend to employ individuals skilled in compiling, managing, analyzing, maintaining, and applying the results of information technology.

Public Policy Responses

With the farming-dependent communities especially prevalent in the Great Plains being in a unique position to become agricultural hubs, at issue are the appropriate public-policy responses.

- Of the many available policy options, a first critical component is to internalize externalities consistent with the characteristics of farms and the needs of communities. In other words, **costs of odor-, waste-, and pest-control need to be charged to the producing units and not to their neighbors or to other "downstream" parties.** Control measures and requirements can be tailored to circumstances and will depend on whether enterprises are small or large, areas sparsely or densely settled, and regions warm and humid or cool and dry. Appropriate policies entail a mix of national regulation and/or taxes and subsides, along with local options to internalize externalities while protecting property rights.
- As a general rule, **allowing operators to choose whichever form of vertical coordination they find advantageous but relying on the public sector to establish and to enforce environmental standards raises real national income while holding down food and fiber costs to consumers.** Low cost, sustainable practices have been shown to greatly reduce environmental impacts of hog and beef production. But when a policy speeds substitution of capital for labor, it will result in displacement of family farms and, hence, will erode the social and economic bases of many farming-dependent rural communities. Vertical coordination can move entrepreneurship from rural communities to urban places, along with the gains and losses that attend risk-taking.
- There can be no universal formula; each community or other entity must decide which development strategy to use. **State and federal governments can assist in this decision-making process by establishing environmental ground rules and regulations and by providing information.** The Cooperative Extension Service can help communities assemble information for the public and organize it to make sound decisions. The federal/state extension service and other state and local organizations can (1) promote entrepreneurship and innovation, e.g., with business incubators; (2) encourage farmer/producer groups, e.g., cooperatives, to operate in food-supply chains; (3) facilitate application of knowledge to producing, processing, and distributing food and other products as means of decreasing costs and increasing responsiveness to consumers and other end users; and (4) improve community members' understanding of their economic and social assets as the basis for their options in terms of business expansion, retention, and acquisition. These strategies, which can help transform rural communities, are sometimes most effectively carried out not only through alliances of farmers but also through alliances of communities to achieve economic and political influence along with efficient information-flow.
- **Another public-policy option is the support of research, resident instruction, and extension education that are designed to improve technology, information systems, risk management, and marketing tools that will help family farmers and owners of small rural firms**, who together constitute the economic base of rural farm communities. An example is development of improved waste-, odor-, and pest-control

technologies suited to family farms.

- If the political process deems that aspects of vertical coordination in agriculture are inappropriate in some instances, **another useful policy option is labeling backed by proper standards and enforcement.** For example, consumers who prefer free-range chickens or eggs produced by independent firms "vote" by purchasing the labeled product at a price eliciting the appropriate supply.
- Although regulations are unavoidable, questions remain regarding the proper jurisdictional level for regulation and control. For practices deemed unacceptable to the nation, labeling and local or state options alone will not suffice. **Firms will tend to go to counties, states, and countries with the weakest environmental standards. Thus, some national standards may be appropriate.** State-level regulations may differ due to differences in population density and aridity. A state proscribing contract production may deny many local family-farmers the production contract operations that have sustained their farms.
- **A county option is sometimes useful where environmental regulations need to differ appropriately among local areas.** People in a local jurisdiction can vote whether to accept or to reject a proposed economic activity. For instance, communities with dense populations or sensitive environments (or noses) may be unsuitable for large livestock-operations. Whereas a local option allows communities to express their choices, local livestock-operations seek safeguards against arbitrary and capricious populist judgments.
- The strategy proposed herein of letting markets work after internalizing externalities presumes workable competition in markets. **It is essential that the United States continue to promote competition in the food industry through antitrust and other measures.**
- Relatively few rural communities can become future livestock production and processing hubs generating substantial local employment and income. Many communities either will be unable to compete for the privilege or will decline it in favor of preserving their environments and heritages. Of course, rural residents would like more control over their own destinies. Using their own initiative, with the help of the Cooperative Extension Service and other agencies, communities *can* influence outcomes and generate alternative employment. But **many rural communities will find it advantageous to use their resources to help inhabitants increase their options to maintain and improve their quality of life.** Human resource investments can improve living standards whether rural residents remain in their local communities or migrate elsewhere.
- Education and technical assistance to make small food processors ISO 2000 compliant will increase the diversity of value chains in rural areas. Training in appropriate record keeping among farm enterprises and small businesses will facilitate their ability to negotiate contracts.
- Invest in leadership development through cooperative extension and nonprofit organizations so that rural communities can make better decisions in how they invest their collective resources.
- The public sector can help to ensure that contract terms are transparent (language understandable and terms of contract publicly available).
- The public sector needs to offer mediation and technical assistance to help individuals or groups of farmers gain recourse if the contract terms are broken.
- Markets work best where buyers and sellers are informed. Terms of production contracts can be made available to the public so that growers and contractors will possess similar information. Information is a public good, hence proper gathering of this information requires a government role.

1 Introduction

This report analyzes how the synchronization of vertical stages of a production/marketing system, a process known as *vertical coordination* (Martinez 1999, p. iv), may change the face of rural communities in farming-dependent areas in the United States. It examines (1) the impetuses behind the various forms of vertical coordination — their evolutions and impacts on agriculture generally and rural communities specifically and (2) potential policies that may enhance the options of rural communities. Because they often are beset by depopulation, underemployment, and stagnant income[1], farming-dependent rural communities, which are especially prominent in the Great Plains, are the focus of this report. Vertical coordination in agriculture will affect these communities substantially but will have less of an effect on rural communities with nonagricultural economic bases.

Traditionally, means of coordination have been open-market pricing among private firms operating independently in the areas of farm input supply, farm production, and food processing and marketing. Increasingly, however, operators hoping to achieve closer coordination between production input suppliers "upstream" and consumers "downstream"[2] are turning to contracting or owning links in the food production and marketing chain. Drabenstott (1999, p. 69) notes that new "supply chains redraw the rural economic landscape" and "point to a strikingly different future for parts of rural America." Among the changes he foresees are production concentration in fewer places, input sourcing farther from production, and "communities that choose to remain tied to commodities [having] fewer farms, banks, and other businesses" to sustain them. Rural communities will be challenged to provide the economic bases needed to support infrastructure and public services.

Evolving over time through interactions among buyers and sellers, more-integrated food-value chains are a means (1) to improve economic efficiency through refinements of input-flow scheduling and resource utilization; (2) to improve management and quality control throughout the chain; (3) to decrease

[1]On the whole, *nonmetropolitan counties* (counties excluding *metropolitan counties*, which contain 50,000 or more residents in addition to surrounding commuting counties) are maintaining if not increasing in population. Nearly 75% of the 2,304 counties classified as nonmetropolitan in 1993 gained population between 1990 and 1996 (Johnson and Beal 1999). Counties classified as nonmetropolitan increased in population 5.9% from 1990 to 1996, just behind the 6.9% population gain in metropolitan counties during the same period. Nonmetropolitan areas underwent a net inflow of 1.83 million people, or a 3.6% rate of population growth, a net migration rate twice that of metropolitan areas (Johnson and Beal 1999, p. 4).

Nonmetropolitan migration and population gains were smallest in the Great Plains and the Mississippi Delta — regions whose economic bases are agricultural. Nonmetropolitan areas near metropolitan areas experienced the most rapid growth. Nonmetro population growth increasingly is tied to net immigration rather than the natural increase. Thus, the economic, social, and environmental conditions in nonmetro areas that attract residents will heavily influence future growth.

[2]Vertical coordination is not synonymous with consolidation. *Consolidation*, or horizontal integration, occurs when firms producing the same thing at the same stage of the food marketing chain join, usually through mergers or acquisitions. Consolidation was extensive at the end of the 1990s in all industries, from automobiles and oil to food processing and marketing. In production agriculture, for example, consolidation has been especially evident in the increasing number of farmers buying or renting real estate from each other. Although often associated with consolidation, vertical coordination, by allowing communities to achieve *economies of size* (or advantageous relationships of production cost/unit with firm size) and *economies of scope* (or advantageous relationships of production with output as the number of activities or enterprises within the firm increases) may in fact serve as an alternative to consolidation in certain rural communities.

This report focuses on vertical coordination, but vertical and horizontal integration in tandem can decrease redundancies and achieve economies of size and scope by increasing efficiencies related to size, *ceteris paribus* (Azzam 1999). Consolidation also can increase the market power of consolidating firms at the expense of food producers, consumers, and taxpayers. A number of studies indicate that increasing concentration in the marketing sector has, on balance, decreased marketing margins — with most savings passed to consumers (Azzam 1999; Persaud 2000). Consolidation means fewer potential sources of inputs and fewer potential markets for products. For example, in a highly consolidated market, vegetable growers can no longer sell directly to local supermarkets, for central purchasing makes such growers "inefficient" partners for the supermarket chain even if not necessarily for individual stores.

risks, especially those associated with food safety and contamination, through *identity preservation* (or identification of sources of ingredients in a product all along its production and marketing chain, as is sometimes necessary, for instance, in the trace back of pathogenic organisms); (4) to improve the ability of agricultural industries to respond rapidly to changes in consumer demand for certain food attributes (Boehlje, Hofing, and Schroeder 1999); (5) to increase the two-way flow of communication as to attributes desired and constraints to producing them; and, of course, (6) to increase earnings through market control. New forms of vertical coordination among stages of the food production marketing chain are designed to respond to consumers, or, roughly, to any economic entity beyond the farm gate — not to respond to rural communities or producers.

Vertical coordination is itself the product of powerful forces currently reshaping both food and nonfood industries (Boehlje 1996; Thu and Durrenberger 1998). These forces include advances in science and technology, human ingenuity, education, globalization policies (such as export subsidies and lowered trade barriers), research, and the inexpensive capital accompanying economic expansion (Figure 1.1). Moreover, these forces are favored by market-place rules and regulations. In earlier decades, mechanical (tractors, combines), chemical (fertilizers, pesticides), genetic (hybrid seeds), and transportation (roads, vehicles) technologies were introduced as results of these forces, thereby increasing productivity and transforming the structures of food systems and rural communities. By being implemented widely and by encouraging production of a few crops and animals, technologies transformed traditional farms and their communities. Coordination came about largely through market allocation of undifferentiated products. As information flows have increased through changes in technology and organization and products have become more user-specific, it has become possible and profitable to enhance, through ownership or contract, the vertical coordination of food-value chains.

Figure 1.1. In her laboratory, plant physiologist Katrina Cornish checks seedlings produced for use in experiments to improve guayule plants. The experimental, allergen-free latex products shown were made from guayule. Photo by Jack Dykinga, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Forces Pressing for Closer Food-Value Chain Coordination

The forces motivating closer coordination among stages of the food chain will now be addressed in detail. These forces arise among both producers and consumers.

Specific Qualities in Production

In many instances, the traditional system of independent family-farmers and processors responding to prices established in wholesale and retail markets has proved insufficiently cost competitive, timely, and responsive to consumers. The postindustrial forces of knowledge creation, information technology, competition, and affluence are revolutionizing rural America as more information is potentially available to producers and firms about technology and the demands of specific end users(Tweeten and Zulauf 1998). Ever-more affluent consumers world-wide are demanding foods tailored to their needs and desires. Previously, specialized *designer foods*[3], or foods spe-

[3]Designer foods present a bundle of characteristics, including who grows them and how they are grown.

cially produced and prepared to meet the specific needs of individual consumers or groups of consumers, were processed and sold in ethnic neighborhoods, gourmet retail outlets, or health-food stores; but now consumers all over the country expect to be able to purchase rare and specialized products (Figure 1.2). Consumers may demand a low-fat, high-protein, nutritionally complete nonbioengineered food, and food providers are ever better equipped technologically to respond to these needs. Universal product codes and computers track what consumers are buying; this information is relayed quickly upstream in the food-marketing chain so that food providers and processors can respond to demand. Yet farmers and rural communities in *spot market* situations often receive too little information that could trigger adaptive strategies.

Figure 1.2. Small-fruit geneticist Stan Hokanson displays several elite wild strawberries collected by collaborators. The small, highly aromatic berries (left) are from plants collected in Alberta, Canada. The larger berries are from a type collected in Alaska that may prove to be cold hardy. Photo by Scott Bauer, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Modern forms of vertical coordination featuring *administered or negotiated arrangements* (or economic and other terms of a production or marketing contract negotiated between the commodity grower/producer, and the integrator/contractor) coupled with improved means of communication and transportation allow farming-dependent communities far from population centers to respond rapidly to changes in demand. For instance, carcasses of meat traditionally were sent by packers to retail stores that cut, trimmed, and packaged the meat for consumers. Increasingly, however, the packer provides case-ready, prepackaged cuts. This shifts a considerable workforce from supermarkets to processing plants — an increasing number of which are or could be in farming-dependent rural areas.

Supply-Chain Efficiencies

Efforts continue to improve coordination of the food chain — from input suppliers to producers, processors, and marketers — and to increase food-system abilities to meet more exacting food demand. Applying the exact amount of fertilizer, seed, and irrigation water to produce the precise soybean variety desired by the specific processor requires modern technology and attention to detail if profit and consumer satisfaction are to be ensured. Many firms are finding that transaction costs of coordinating production by means of precision application of inputs upstream to fulfill the exacting needs of ever-more-affluent consumers downstream are decreased through production contracts and *integrated ownership*. Under the latter, one firm owns and operates crop and/or livestock production in at least one stage of the food production chain in addition to input supply or food processing and marketing. It also depends on ability to isolate its product to preserve characteristics and quality while avoiding contamination of products of other producers throughout the food chain. Such identity preservation can be expensive and management-intensive if managed well, and even more expensive if mismanaged, as in the case of StarLink corn.

Successful two-way flows of information are also evident in the new forms of direct marketing, where discussion and negotiation allow the producers to alter what they produce, and they produce in response to the preferences of specific consumers. In such cases, trust substitutes for contacts. Since face- to-face interactions are not always possible or desired, contracts can substitute for personal feedback. Spot market attempts at feedback have met with limited suc-

cess due to problems of coordination and timeliness.

Hog producers had relatively open access to production technology, genetics, and slaughter facilities through the 1980s (Ginder 1998). The emergence of systems based on uniform genetics, phased feeding, all in/all out occupancy, and integration or forward contracting of the animal on the one hand limits access and on the other hand cuts transaction costs (Ginder 1998).

Intellectual Property

In an agricultural and food system now dominated by knowledge creation and dissemination (see Tweeten and Zulauf 1998), development costs of technological breakthroughs in information systems and bioengineering often are staggering; increasingly, these costs are originating in the private sector and, thus, an increasing portion of agricultural technology is proprietary. Firms supplying technologies are eager to control them closely, for, once created, technologies have relatively low marginal-costs of dissemination. Extremely high fixed-costs relative to variable-costs place a premium on market size — that is, on the ability to spread fixed costs over a large output in order to decrease total cost/unit. Yet, designer foods are aimed at segmented, not mass, markets. Because new technologies often can be reproduced easily and then used by competing firms, a successful firm controls access to its technologies sufficiently to ensure that the millions (or billions) of dollars needed to support new research can be generated along with stockholder dividends. The ability of a firm to profit from knowledge creation to an extent that will support future product development often depends on its being a business large enough to sell enough, at a high enough price, of an already developed product or service.

Achieving economies of size and investing in development by contractually sharing technology with other firms can be successful business strategies. Furthermore, given the increasing importance of rights of *intellectual property*, or patents, copyrights, and rights to information, it may be easier and less expensive for a firm to buy or to merge with a company owning a sought-after deoxyribonucleic acid process than to attempt to obtain all required licenses.

Risk Management

Another major impetus behind closer vertical coordination is risk management, which can be achieved in several ways. Tighter coordination, including better information flow, between stages of production can decrease risks associated with product quality, quantity, and variety. The highly competitive food industry limits the profits and the market shares of firms unable to respond to changing consumer demand. Food-chain shocks occur that might have been avoided or diminished with improved coordination.

Commodity cycles featuring high (low) returns in farm production are often attended by low (high) returns in processing and marketing — hence, the stream of returns over all links over time is less variable than that over individual firms operating independently.[4] A crucial risk-related consideration is that consolidation and size tend to be accompanied by deep financial pockets, that is, by access to extensive financing. All else being equal, a firm with extensive access to capital will survive competition better than a firm with limited access will. In producing a genetically enhanced new crop, a farmer may, for example, choose to contract with a deep-pocketed agribusiness firm that is better able than he or she to cope with the risk of consumers' rejecting the product. And because the management of such a firm is likely to be aware of consumer concerns, it may redirect farmers into less controversial means of production, as McDonalds recently did its potato producers by declining to buy genetically modified potatoes.

Consolidation affects the ability of small producers to respond to shifting demand by entering or leaving markets. Large, modern livestock-production facilities tend to have higher overhead costs (for facilities and equipment) than operating costs (for labor and feed). In hog production, large buildings must be kept full in order to minimize cost/unit. This strategy works best when production is at or near capacity. Low variable-cost/unit keeps large operations producing at low product prices; hence, the burden of adjusting supply to weak demand falls heavily on small producers. Vertical coordination of large-scale producers leaves small-scale, independent producers as residual suppliers selling in cash markets. If the barriers to trade and capital flow continue to fall, many nonintegrated producers who do not use forward markets could be left selling, at prices greatly influenced by wide fluctuations in the world market, undifferentiated commodities in *thin markets*, or markets with few buyers or sellers.

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[4]Administered/negotiated coordination among vertical links in the food-value chain does not necessarily avoid industry-wide strategic risk attending price and quantity fluctuation due to movements in aggregate supply and demand balances for food.

The institutions of undifferentiated markets, such as grain elevators and sales barns, tend to be community based. These institutions once defined many agriculturally dependent rural communities. Vertical coordination provides better flow of information from producer to end user — and removes these local links in the value chain. Entrepreneurs in some small communities have responded through establishing tightly linked value chains, which require constant exchange of information (Flora et al. 2000). These coordinated value chains do not necessarily bypass local institutions, but they will not be the traditional institutions.

Food Safety and Quality

Consumers quickly change purchasing behavior in response to perceived threats to food safety. Consequently, an outbreak of illness from foodborne pathogens can devastate a firm's finances. Carefully handling and processing food so as to lower pathogenic contamination requires strict quality-control facilitated by hazard analysis and critical control point processes, identity preservation, and sensitive-product irradiation, especially when food travels long distances or is held for long periods in storage or on the shelf. While large, closely linked operations often can perform at the lowest cost/unit the essential task of ensuring quality by controlling the environment at every stage of the production-marketing process, once systems are in place, well-coordinated smaller units, in which pathogens are less likely to be spread, can more easily maintain quality. To a degree, therefore, vertical coordination through contracts with widely dispersed growers can overcome the scale advantages of a few large, consolidated production facilities under a single ownership.

Product identity preservation and precision input application require careful monitoring. A processor may wish to trace the source of a pathogen, or a consumer may wish for proof that he/she is receiving the organic, nongenetically modified, range-fed product specified. A challenge, especially for many farming-dependent rural communities, is how to be competitive in the food-value chain by responding to demand while using the latest technologies and management systems to ensure quality.

Information Availability

Traditionally, local dealers knew best and could respond best to the habits and the needs of local customers. But because markets have become global, such an information system no longer suffices. Sophisticated new information systems using universal product codes and computers are able to link specific customers to past purchases. In New Zealand, each piece of meat is given an edible brand to increase traceability to a specific animal. These data usually are shared among all parts of the input chain (except, perhaps, with the farmer), thereby allowing custom packaging of inputs assembled from corporate headquarters.

Transaction Costs

Considerable direct and indirect costs are incurred to coordinate production and marketing among stages of the food chain. Direct transaction costs are incurred in negotiating, signing, and administering contracts and in bargaining over prices and other terms of sale. Indirect transaction costs accrue from failure to achieve efficient coordination. At issue is what kinds of vertical coordination minimize transaction costs. Currently, markets tend to make that decision: the business arrangement with the lowest cost survives and multiplies.[5]

Cluster Configuration

Traditional U.S. agriculture was characterized by diversified, crop/livestock family-farms, and each farm looked much like the next, over broad areas of the nation. Tomorrow's tightly coordinated agriculture will be characterized more by a hub, spokes, and wedge configuration. That is, a livestock processing plant, or "hub," will be in close proximity to livestock feeding operations supplied feed by mills drawing grain through the transportation and communication "spokes" delimiting a production "wedge," which can constitute a large, often distant area. Farms in the wedges will require less labor or other local inputs/unit of output than the same farms require now and thus will provide diminishing social and economic

[5]Farmer-controlled value chains can utilize trust to become more competitive. Blabach (1998) compared increase in efficiency over time in two sugar beet factories. The investor-owned firm and the cooperative began with the same production of sugar per ton of sugar beet. Both paid by weight. The cooperative added bonuses for quality with specific feedback to each producer on the quality of each load of beets. The producers then sought information to utilize to improve beet quality. Productivity at the cooperative increased dramatically, while that of the investor-owned firm remained static. The investor- owned processor attempted to add incentives for quality. But productivity remained flat. The better growers did not believe the information on quality delivered by the firm. The reason trust existed is because of the transparency of the relationship. Such transparency can be cultivated in private firms as well–and can be ignored by cooperatives.

support for local rural communities.

Clusters could be quite few, as evident from a statement by Benjamin (1997):

> The standards set by the target hog producers now suggest that some 50 producers could account for all the hogs needed in the United States. Moreover, the standards set by new, state-of-the-art packing plants suggest that fewer than 12 plants could process the country's hogs.

In the competitions for hubs in the most dynamic areas of agriculture, i.e., value-added poultry, beef, and hog-feeding, the farming-dependent rural communities especially prominent in the Great Plains have a strong environmental advantage by virtue of low rainfall and sparse populations. Yet meat processing and feed growing are water intensive; and, ultimately, ground water availability in these rural communities may not be able to support the new intensive food processing and production infrastructure just described. More-limited opportunities to compete in niche/specialty crop production will exist for the Great Plains, as well.

Concluding Comments

The preceding list indicates substantive benefits from effective vertical linkages in the food-value chain, along which new forms of vertical linkages such as contracting are likely to increase in number. As modern vertical linkages emerge, traditional linkages, often prominent in rural farming communities, may disappear. New linkages such as those for high-oil corn may require on-farm storage and trucking to facilitate "just-in-time" delivery to the processing plant and thus may bypass the local elevator as intermediary. Food, along with inputs ensuring quality, may be provided by processors located in other communities. As a result, traditional local linkages may be further attenuated. As demand for identity preservation and segregation increases and as processing and production wedges appear in rural communities, many of the firms designed to serve the markets of earlier decades may disappear. In other communities, new firms and organizations may emerge to provide the coordination required of ever-more-complex food-value chains. Promising opportunities therefore exist in farming-dependent rural communities.

2 Alternative Food-Value Chains

Food production and marketing system institutions are quite diverse and range from traditional, private family-farms, to cooperatives, to vertically integrated ownership arrangements, e.g., Buckeye Egg Farm or Seaboard Corporation. Each system exhibits unique efficiencies in food production and marketing or in coordinating among food-chain links, and each has a unique effect on rural communities. This section addresses the advantages and disadvantages of several options.

Independent Private Firms Coordinated by Market Prices

In the United States, production agriculture traditionally has been characterized by family farms of a modest size (by nonfarm, firm standards) and by numerous supply and marketing firms. This system has served the nation well by providing plentiful, reasonably priced, high-quality food. At the same time, small-business firms have been the backbone of rural communities. The impressive productivity record of individual private farmers and agribusiness firms — supplemented by public inputs in terms of education, research, information, and infrastructure — is well documented (Figure 2.1).

Family farms and small agribusiness firms have been receptive to new technology. Local firms have close ties with and are nourished by local communities. Independent, middle-class family operations preserve the cultural heritage of the community, provide a social and economic base and, in turn, are appreciated by local residents.

But in recent decades, traditional, small family-farms or small businesses coordinated by markets have been at a competitive disadvantage and have had difficulty sustaining rural farm communities while providing the local entrepreneurial, technical, and communication skills, as well as the workforce, financing, and transportation resources, needed to support an industry competing in a global marketplace.[6] Compared with large farms, small farms make less use of innovations such as computers, carcass-merit marketing, futures and options marketing, storing and injecting animal waste, and conservation tillage (Tweeten 1995; Tweeten, Harmon, and Feng 1999). Few traditional farms are large enough to realize economies of size, i.e., to produce at the lowest cost/unit or gain bulk marketing and purchasing advantages (U.S. Department of Agriculture 1999a., Table 1; for economies of size, see Tweeten 1989, Ch. 4).

Farming-dependent rural communities, which tend to be distant from urban centers, frequently face bleak prospects for generating nonfarm jobs essential to sustain the livelihoods of small-farm families requiring off-farm income for survival. Outlaw (1998) concluded, based on a review of 16 industries, that the major determinants of location were accessibility to industry infrastructure (water, industrial sites), population (markets, labor), transportation (commercial airports, railroads, and highways), and business environment (high-income areas receptive to business). Of the six most important factors, only the presence of a community-development group and the provision of an industrial site could be controlled by local communities; these factors, however, were overshadowed by others. The presence of a community-development

[6]Many rural communities suffer from, along with other problems, equity capital shortcomings curtailing economic prospects in a postindustrial economy. Moncrief (See Drabenstott and Meeker 1999, p. 79) noted the success of the much-heralded Kentucky Highland Corporation (KHIC), which has helped start up numerous small plants in eastern Kentucky. A trait shared by KHIC and by many venture capitalists is that they earn lower rates of return — typically, 8 to 12% annually — than more urban-oriented venture capital funds, which earn 35% or more (Drabenstott and Meeker 1999, p. 79). Duncan (See Drabenstott and Meeker 1999, p. 80) noted that rural businesspeople often do not want someone else owning part of their businesses, telling them how to run their businesses, or cashing out the businesses once they are successful. Yet because these are precisely the goals of equity investors, rural development and business development are at cross purposes. Some communities, however, have found that outside investors provide important new sources of information that is as important as their capital for business success. Others have stressed the "double bottom line" to keep local investment capital in rural areas. This approach encourages investors to enhance both social capital and financial capital in a particular place or region to enhance the quality of life.

group may have been important because it signaled to existing or prospective firms that they would be appreciated in the community. Outlaw (1998) noted, however, that "financial assistance and tax incentives have not been found to be quantitatively important in determining development in rural areas" (p. 40) and observed that industrial parks in rural areas have been overbuilt. As firms expand, they may leave rural areas to be nearer larger labor and other input markets, or product markets found mainly in metropolitan areas.

Narrow profit-margins pressure firms to grow in assets, output, and labor income to remain competitive with firms in other industries. One of the reasons that many small farms and agribusiness firms in farming-dependent areas find themselves with inadequate resources to realize economies of size is that they rely on family capital rather than on public equity, or venture capital, which is more available in more-populous locations.

Additionally, operators of family businesses often are chosen for reasons besides their abilities to take calculated risks or their technological or managerial expertise. Farm operators raised on farms have, historically, enjoyed advantages from on-the-job training and from detailed knowledge of local resource systems both natural and social. But today's efficient, large, risky, managerially intensive, and technologically advanced operations demand operators and owners suited by training and temperament to cope with uncertainties and complex managerial tasks. Financing problems, and especially cash flow to service debt and to maintain living standards, frequently overwhelm family operations that must be refinanced each generation.

Figure 2.1. Agriculture Research Service entomologist Brad Higbee (left) explains the benefits of areawide insect pest suppression to Jerry Wattman, manager of this apple orchard near West Parker Heights, Washington. Photo by Scott Bauer, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Small independent operations frequently lack market power to countervail the power of firms from which they purchase inputs and to which they sell outputs. Small farms and agribusiness firms may be poorly positioned to initiate the strategic alliances that are increasingly vital to business success. Rural communities often do not provide the institutional base for the formation of such alliances. Strengthened intellectual property rights result in more resources' being devoted to intellectual property management, e.g., to creating and licensing technology and to forming strategic alliances. Sporleder (1999) argues that rivalries within agriculture and the global food system will shift away from tangible assets such as land and machinery and toward intangible assets such as knowledge, brand loyalty, worker skills, and managerial capabilities. With rivalry centered on intangible assets, value-creating networks will emerge. The search for complementarities is evident in, for instance, the alliances and mergers among genetic engineering, seed, and chemical firms. Alternative food chains also are based on intangible assets, including relationships among farmers, specialty processors, and specific consumer groups.

This discussion, in light of conclusions from the previous section, has provided compelling evidence that a smaller share of farm products for processing and marketing will be supplied in bulk form at current market prices to agribusiness firms. Agribusiness firms will seek closer integration of the food chain from seed to supermarket and will prefer to work with larger farm operators so as to minimize transaction costs.

Certain small, private farms and family-operated agribusinesses have found linkages to consumers through niche/specialty organic food and farmers' markets. And the need to isolate the designer products of GMOs from bulk commodities and non-GMOs could offer opportunities for small firms to produce, to store, and to market products. But, as with organ-

ic foods, farmers' markets, and niche opportunities generally, favorable economic outcomes will attract competition, thereby driving down returns on resources. Many small firms are labor intensive in an economy favoring capital-intensive activities facilitating low-cost production. After many firms have time to enter an emerging industry in response to high returns, large-scale commercialization follows, driving returns down. Thus, the trend is to larger-scale, private companies, whether family- or publicly-owned. Recognizing this situation, many members of farming-dependent rural communities will look to contracting or to other means of realizing the economies of large firms while preserving family farms. The alternative is constant — and risky — innovation.

Cooperatives

Cooperatives offer another means of preserving the vitality of farming-dependent rural communities in an age calling for tight vertical linkages along the food-value chain. The patron-owned cooperative movement began in 1810, when dairy producers in Connecticut banded together to churn and to market butter cooperatively (Taylor 1953, p. 472). Over nearly two centuries, cooperatives have become a vital component of the U.S. agricultural and rural landscape. Today, approximately one-third of farm commodities are marketed through cooperatives. A like proportion of farm inputs are supplied by cooperatives (Table 2.1). Nearly 90% of milk and related dairy products and approximately 40% of grains, soybeans, and cotton are marketed cooperatively. Approximately one-fifth of fruits and vegetables are marketed by cooperatives. Forty-five percent of fertilizer, lime, and petroleum products are supplied to farmers by cooperatives.

Most agricultural cooperatives are producer cooperatives owned by farmer patrons. A dividend is rebated to each patron from surplus earnings of the cooperative in proportion to his or her input purchases or product sales. Ordinarily, each patron, regardless of his or her volume of business with the cooperative, casts one vote for its board of directors.

The shares shown in Table 2.1 are first-handler, farm gate transactions. Although cooperatives are less well-represented at the processing and the retailing levels, mergers (Merio 1998) will increase the cooperative's role in adding value to food (Miller 1999). Certain large cooperatives are active in almost every major type of agribusiness activity: supplying inputs, exporting, processing, contracting for the market, contracting for production, and integrating ownership.

Cooperatives provide competition and a yardstick of performance for investor-owned companies. They help ensure that neither producers nor rural communities will be exploited by private agribusinesses, whether independents or vertically integrated private firms.

The Capper-Volstead Act of 1922 — also known as the "Magna Carta" of cooperatives — exempted cooperatives from the antitrust provisions of the Sherman and Clayton Acts and placed with the more-sympathetic Secretary of Agriculture instead of with the Federal Trade Commission and the U.S. Department of Justice the jurisdiction over and the oversight of pricing by cooperatives.

But even with antitrust advantages, cooperatives have been unable to control commodity supplies so as to raise farming industry prices. Cooperatives have successfully pursued more modest goals by more modest means, however; and some are achieving economies of size by enlarging operations through growth and consolidation. Many large operations are owned by other cooperatives instead of directly by farmer patrons.

And, like private firms, cooperatives are merging. For example, two farmer-owned cooperatives in Ohio merged to form the Countrymark Cooperative in 1985. Countrymark subsequently merged with Michigan and Indiana cooperatives. In the late 1990s, the merged cooperative became part of the Land O' Lakes Cooperative, whose operations range from input supply to retail food sales. Also in the late 1990s, the giant cooperative Farmland Industries explored a merg-

Table 2.1. Cooperatives' share of farm supplies purchased and products marketed, 1973, 1983, and 1997 (adapted from Kraenzie [1998, pp. 5–6] and Wissman [1985, pp. 18–19])

	Share of market (%)		
Item	1973	1983	1997
Marketing			
All farm products	23	30	31
Milk and dairy products	76	77	87
Grain and soybeans	29	38	42
Cotton and products	21	31	38
Fruits, vegetables, and products	23	19	19
Dry beans and peas	23	18	NA
Livestock and wool	9	11	12
Poultry and eggs	7	8	NA
Supplies purchased			
All major farm supplies	23	27	30
Fertilizer and lime	36	38	45
Petroleum and products	38	38	45
Farm chemicals	19	35	34
Feed	18	19	23
Seed	17	14	10

NA = Not available.

er with the Cenex Harvest States cooperative, itself the product of mergers. The proposed merger would have formed one of the largest agricultural cooperatives in the world (Merio 1998, p. 20), but the vote failed narrowly. It may win acceptance yet. To date, the mergers increase consolidation in bulk commodities, but do not necessarily increase vertical integration of designer foods.

In the effort to coordinate the food-value chain and to compete successfully in global markets, cooperatives confront issues of size and scope similar to those confronted by private firms. Because small cooperatives are owned mainly by local patrons and thus control and profits remain largely in the community, small cooperatives can give members a sense of involvement, control over firm decisions, and confidence that they are not being exploited. By creating jobs, income, and a tax base to support community services, cooperatives can help unite citizens to work for a better community. Small cooperatives can serve niche markets that more profit-driven firms bypass. Specialty grains or soybeans, for example, need to be isolated from conventional varieties, and small cooperatives sometimes are in a better position to perform this process than large firms that handle only bulk commodities in large storage and transport systems are. In many communities, the market is so small that only one firm, e.g., a local elevator, can supply feed and chemical (e.g., fertilizer and pesticide) inputs and market farm commodities at low cost/unit. Such natural monopolies often are best served by cooperatives.

Producers' fears of exploitation by private firms are less justified than in former times, for several reasons. Transportation and communication have improved, giving producers a broader knowledge of markets elsewhere, along with the paved roads and large trucks (often owned by producers) needed to deliver commodities to distant markets. Today's complex private and cooperative markets compete over a wide geographic area; and so opportunities for exploitation by any one firm are diminished unless there are only a few firms nationwide.

Small patron-owned cooperatives, like small private-firms, have difficulty competing in the global economy.[7] Cooperatives governed by boards chosen by patrons to serve patrons may not respond to consumers rapidly enough to survive and to prosper. Compared with private firms able to offer stock options, cooperatives are disadvantaged in the competition for top managers. Moreover, cooperatives lack access to the venture capital available to many private firms.

The trend among cooperatives and private firms is toward expansion and consolidation, in order to realize economies of scale, to underwrite research, to decrease coordination cost/unit, and otherwise to remain competitive. Woeste's (1998) historical legal analysis suggests that as cooperatives increasingly gained special legal privileges enhancing their competitiveness relative to that of private corporations, they simultaneously became more and more like those corporations. To be sure, alliances now are common between private firms and cooperatives. Certain large cooperatives serving at several levels of the food-value chain, including those cooperatives contracting with farmers, are owned mostly by other cooperatives and behave much like private conglomerates. They also are treated, legally, much like nonfamily corporations — for example, Amendment E in South Dakota allows local cooperatives and family corporations, but not large cooperatives such as Cenex Harvest States, which is owned by other cooperatives, to own or to operate farms in the state.

The conclusion is that small cooperatives can preserve jobs and income and serve the needs of certain farm communities. Certain small cooperatives have successfully pursued niche production and marketing, often in local markets. Yet local cooperatives responsive to rural community needs have difficulty competing in today's global markets, whereas giant cooperatives dealing vertically, from seed to supermarket stages of the food chain, are nearly indistinguishable in their behavior from private firms. Such drawbacks suggest that although cooperatives will continue to be one of the vehicles for improving the well-being of residents of rural farm communities, they will not likely be the principal one.

Administered/Negotiated Vertical Coordination

Administered or negotiated vertical coordination, here referred to simply as vertical coordination, is

[7]Local initiatives to form cooperatives, to create jobs, and to add value to crops and to livestock remain strong even as consolidation is decreasing the number of cooperatives. Numerous community groups have formed small business incubators to generate local jobs and income, often through farm product value-added processing and marketing. Examples include the Kearney Area Producers Association in Kearney, Nebraska; the Alliance for the Twenty-First Century in Manhattan, Kansas; and the Producer's Alliance of Illinois, the latter sponsored by the Illinois Farm Bureau (Miller 1999, p. 18). The National Pork Producers Council is serving as a catalyst to organize, as a way of maintaining markets for independent swine producers, a national producer-owned cooperative for slaughtering, processing, and marketing pork.

rapidly displacing the markets that traditionally set prices at each stage of the food chain. Under vertical coordination, a firm coordinates production and marketing over two or more stages of the food chain by means of marketing contracts, production contracts, or integrated ownership/operations, as will be described. Vertical coordination can be achieved by cooperatives, sole proprietorships, partnerships, corporations, or local or distant firms and in its various forms may affect farm structure and rural communities in several important ways.

Marketing Contracts

For decades, marketing contracts have been used widely in fruit, vegetable, and dairy marketing orders (See Table 2.2). Negotiated before delivery or production, contracts typically specify grade and price (or formula for price).[8] Commodity ownership usually remains with the producer until the product is delivered to the buyer, who is usually a processor. Although certain contracts specify time, volume, and pricing formula for payment on delivery of product by producers to processors, most production and marketing decisions before delivery are made by producers.

By means of forward pricing, which decreases variations in prices and outputs, marketing contracts can benefit producers and consumers. Forward pricing allows producers to combine inputs with comparative efficiency to produce output. Because contracts do not ordinarily control industry production, they do not raise long-run prices to producers or consumers although they *do* tend to decrease short-term market instability. Overall, the effect of marketing contracts on rural communities is small.

Production Contracts

Since the 1950s, production contracts have been

[8]For example, the formula may be based on the futures' market or on a specific premium above the *spot*, or cash, market; alternatively, well in advance of product delivery to market, a price may be negotiated by buyers and sellers.

[9]Production and marketing contracts may be complementary. A firm providing contracts to farm producers also may have marketing contracts with feed suppliers and food processors and may specify a formula for pricing of feed inputs used by producers and by livestock delivered by producers.

Table 2.2. Nonprice vertical coordination as percent of commodity output: production and marketing contracts, e.g., contracts and marketing orders, and vertical integration, e.g., integrated ownership/operation of input supply or product marketing and farm production by one firm, U.S., 1970 and 1990 (adapted from Drury and Tweeten, 1995, p. 20. Original data from Economic Research Service, USDA)

	Production and marketing contracts		Vertical integration (ownership/operation)		Total	
Commodity	1970	1990	1970	1990	1970	1990
Livestock						
Broilers	92	92	7	8	99	100
Turkeys	60	65	12	28	72	93
Hatching eggs	70	70	30	30	100	100
Market eggs	35	43	20	50	55	93
Mfg. grade milk	25	25	1	1	26	26
Fluid grade milk	95	95	0	0	95	95
Hogs	1	18	1	3	2	21
Fed cattle	18	12	7	4	25	16
Sheep/lamb	7	7	12	33	19	40
Field Crops						
Food grains	2	7	1	1	3	8
Feed grains	1	7	1	1	2	8
Cotton	11	12	1	1	12	13
Specialty Crops						
Processed vegetables	85	83	10	15	95	98
Fresh vegetables	21	25	30	40	51	65
Potatoes	45	55	25	40	70	95
Citrus	55	65	30	35	85	100
Other fruit	20	40	20	25	40	65

used widely for broilers; in recent years, their use has expanded rapidly for swine (see Table 2.2).[9] Arrangements differ widely (Martinez 1999), but the contractor typically furnishes baby pigs or chicks, feed, veterinary supplies, and organizational management, e.g., appropriate practices, and number and timing of placements. The grower or producer does not own the animals but supplies equipment, buildings, labor, and day-to-day management for a fee/animal and an incentive bonus or penalty.[10]

Advantages to growers under production contracts include decreased operating cost and risk, coupled with improved breeding and feed rations. Contractors may advise growers on the latest management practices and technology for production and environmental protection and may guarantee a market. Many contracts are up to ten years in length and guarantee a minimum number of animal placements over that period if production standards are met. In this way, producers and lenders have assurances at hand if they need to obtain financing to construct facilities or to buy equipment. Advantages to contractors include (1) economies of size and market power in purchasing inputs and selling products; (2) production of standardized products at the time, quality, and quantity specified by processors; (3) diminished capital requirements; (4) opportunity to extend innovative management over a large output; and (5) low fixed-costs for buildings and other overhead items, so that production can be altered at relatively low expense.

But production contracts also have disadvantages for growers/producers. The "down side" of a fixed return protecting a producer from a market price drop is not being able to reap gains from a market price rise. Once growers have constructed buildings and purchased equipment, they need a steady source of income to service debt and to decrease overhead cost/unit of output. Thus, contractors gain bargaining power once grower facilities are in place, for growers may be willing to produce at a lower fee/animal to keep facilities occupied and to pay overhead.

Surveys provide mixed evidence of grower/producer/feeder dissatisfaction with contract enterprises (Heffernan 1984; Ilvento and Watson 1997).[11] Even those studies finding that growers have negative reactions to production contracts have reported generally favorable economic benefits of these contracts. Reviewing results from a Louisiana broiler production study in 1969 and a follow-up study in 1981, Heffernan (1984) concluded that growers under contracts had done quite well financially and that their numbers in the study area had doubled. Most new growers would not have been attracted to contracts if returns had been unfavorable or if contractors had earned reputations for contracting renewals on unfavorable terms. Studies of grower response to broiler contract design suggest that in some cases the contracts favor the integrators over the growers. However, with more information flow and negotiation, more mutually optimal solutions could be reached (Vukina and Foster 1998; Timmons and Gates 1986).

Poultry (Ilvento and Watson 1997) and swine (Tweeten, Harmon, and Feng 1999) producers under production contracts indicated general satisfaction with this arrangement. Nearly three-fourths of poultry growers surveyed in the Delmarva Peninsula in the 1990s indicated satisfaction with "my business as a poultry grower," and a similar proportion was satisfied with "my relationship with my present company" (Ilvento and Watson 1997, p. 7). Only half the respondents were satisfied with the income they received from poultry, however; and many expressed a desire for better communication, longer contracts, and earlier notice of termination by contractors.

The Ilvento-Watson results need to be kept in perspective. A survey of Ohio swine producers in late 1998–early 1999 revealed that only 4% of contract producers — compared with 63% of independent producers — were dissatisfied with the economic payoff from their enterprises (Tweeten, Harmon, and Feng 1999)[12]. Sixty-three percent of contract producers reported no favoritism to new or to established producers, and 74% of contract producers said that they believed they could find another contractor if necessary. In Ohio, larger independent and contract producers were much more likely to use computers, keep swine records, sell on a carcass-merit basis, store manure, and inject manure — all efficient management practices (Tweeten, Harmon, and Feng 1999) — than smaller independents were.

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[10]The structure of contract farming differs greatly across enterprises. In cattle, for example, a *custom feedlot feeder* (a contract producer under contracts negotiated and perhaps renewed annually who finishes feeder calves) is supplied and paid by ranchers or other owners.

[11]States have adopted measures to protect contract producers. Minnesota, for example, requires contractors to compensate producers if a contract is terminated before a building constructed for contract production is depreciated. The constitutionality of the measure remains in doubt. Certain states also require public disclosure of prices paid for livestock by producers. Nationally, efforts are underway to make contract terms more transparent in wording and publicly available.

[12]The results might have been different in a time of higher hog prices.

Additional empirical data regarding growers' and contractors' attitudes, problems, and opportunities are needed. Information would be helpful from a wide range of contracts and arrangements for various commodities, regions, and firms. A critical issue may be the opportunity to change from one contractor to another. Consolidation in the meat industry may decrease producer satisfaction with contract growing.

Vertical Integration/Integrated Ownership

Martinez (1999) defines *vertical integration* as "coordination of two or more stages in the food chain under common ownership via management directive." Vertical integration may involve one firm's operating a business spanning two or more links in the food marketing chain but leasing some or all facilities. The major form of vertical integration is *integrated ownership*, whereby a firm owns and operates crop and/or livestock production in addition to input supply or food processing. In 1990, integrated ownership was especially prominent in eggs, turkeys, and fresh produce such as potatoes and fruit (Table 2.2). The trend has been toward integrated ownership as with Buckeye Egg Farm, which owns and operates feed mills and which supplies pullets to its egg-laying operations. Although it sells most of its eggs to supermarkets that subsequently sell them under private labels, Buckeye also sells eggs under its own brand. Its Ohio inventory was projected at 15 million hens for the year 2000.

Figure 2.2. Technician Jeff Nichols collects a water sample from the Walnut Creek watershed in Ames, Iowa. Samples are collected weekly from this area and surrounding watersheds to study the effects farming practices have on water quality. Photo by Keith Weller, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Vertical integration has many variants. For example, some firms supply feed, produce and process animals, and sell under their own brand names while contracting with growers and/or purchasing in open markets the remainder of animals needed for their own processing plants.

In summary, integrated ownership offers economic advantages, including the highest possible degree of control one firm can achieve over the vertical stages of the food-value chain. Certain integrated ownership operators think that food safety is enhanced through identity preservation. And financial risks are decreased when stages of the food chain are combined to smooth profit over commodity cycles. Some integrated ownership firms seek competitive advantages over rivals by maintaining an operation large enough to reap payoffs from its intellectual property without releasing patents, copyrights, or secret innovations to other firms, which could conceivably steal them.[13]

Compared with typical operations of independent, local family-farms, integrated ownership operations as well as production contract operations are able to draw management, labor, and debt and equity capital from larger markets outside the local community. For local communities, advantages of such operations are that they face less risk; draw on a larger pool of entrepreneurial, technological, and managerial skills; and share employment in growing segments of agriculture. Integrated firms often employ laborers who

[13]With well-functioning markets, the general rule is that benefits of innovation and productivity gains go to society, mostly by way of consumers. Competitive market producers receive extra rewards for innovation in the short run but their rewards are only sufficient for them to retain resources in the sector, given time for adjustments of resources to the highest paying use. Thus, large integrated ownership firms may invest more in research and development than small competitive firms do because integrated firms can capture more of the revenue from innovation. Profits from innovations depend not only on selecting the right technology or organizational relationship, but on implementing it in a timely fashion.

do not have the resources to operate farms or the skills to be employed as remuneratively elsewhere. But with concentration to gain market power and consolidation to gain economies of size, fewer firms with fewer plants are available to locate in rural or urban communities (Kim et al. 2001).

If entities are to operate at multiple market-levels with efficiently sized plants at each level, capital and managerial requirements are high. Efficiency can be defined as units produced per dollar of fixed costs, units produced per unit of variable costs, or units produced by the two combined. In its quest to be of sufficient size, a firm can find itself to be (1) too small to realize low costs and remain competitive if it relies mainly on internal financing or (2) too dependent on funding and management from outside sources. But capital and managerial requirements may be diminished and made manageable by developing production contracts with other firms in the marketing chain or by obtaining, for example, for a packing plant, inputs from independent markets.

Integrated ownership firms have other disadvantages. Profits and top salaries may go to owners and managers in distant communities. Thus, decisions regarding plant closings, mergers, sales, and the like may be made by individuals outside the local community who are less sensitive than local citizens to the needs and customs of the community.

All large livestock- or poultry-operations, whether under production contract or integrated or private ownership, pose major waste-disposal problems (Figure 2.2). Without superior management, insect, odor, and water-quality problems can be overwhelming and will be especially transparent because large operations invite intensive public scrutiny.

Another disadvantage of integrated ownership (vertical integration) is that it provides less market power than does horizontal integration for a given investment of capital. For a given investment, vertical integration usually imparts less market power than does horizontal integration (consolidation), which raises market share. Large livestock operations usually are consolidated and vertically integrated. A firm's *market power*, or power to influence prices and wages, tends to rise with its market share. Of particular concern to farmers and rural communities is the situation where there is only one buyer, who then has the leeway to set prices. A higher market share makes for a more inelastic demand for product so that restraint on output disproportionally raises prices and profits. Firms vertically integrated over several stages of the marketing chain may have limited market shares or power. Less market power for firms sometimes is advantageous for farmers, workers, communities, and /or society, as the competition and free flow of information enhances efficiency outside the firm.

Electronic Commerce

Because it is a recent development cutting across issues of private versus cooperative and price versus negotiated coordination, electronic commerce, or *e-commerce*, that is, the buying and selling of products over the Internet, is discussed last in this section on institutions involved in the coordination of vertical links in the food value-chain. At issue is how e-commerce will influence farming-dependent rural communities, especially through vertical coordination.

E-commerce makes any rural community the potential site for the headquarters of an efficient global firm. By bringing together large numbers of buyers and sellers over a very extensive, even global, area, e-commerce promises a highly competitive and efficient market. To date, e-commerce has featured sales mostly between businesses; but it has the potential to feature sales between consumers or between businesses and consumers. E-commerce can help both integrated and independent firms in rural communities buy and sell more competitively among themselves and with firms outside their own communities. Thus, e-commerce could extend to local independent firms the advantages of purchasing in the large market heretofore available primarily to large and/or integrated firms and of receiving more information about the particular characteristics desired by specific end-users.

E-commerce extends to commerce the low communication costs made possible by computer and information technologies. Farming is tied by high transportation costs to the location of natural resources, but other industries and many farm services are comparatively footloose. Thus, the underemployed in farming-dependent areas will find opportunities to telecommute and in other ways to transact e-commerce with both urban and rural residents. Earnings can supplement farm income.

Together with continuing improvements in transportation, e-commerce promises to diminish further the "frictions of space" that have isolated rural farm communities. Local monopolies will be less feasible, and rural residents may feel more confident of buying and selling in what they consider fair, competitive markets with little potential for exploitation. In short, e-commerce allows an enterprising individual or firm in any "connected" rural farm community access to a global market.

For rural farm communities, however, the advantages of e-commerce may ultimately be outweighed by its disadvantages. Rural communities have lagged in their accessibility to the broadband fiber optic technology facilitating e-commerce.[14] New wireless technologies provide a less expensive alternative for broad band access but require local investment and are still more expensive than urban fiber optic connections.

Even increased connectivity will not maintain Main Street businesses as they are today. Decreasing transaction costs and increasing competition in farm input and product markets means lower marketing margins and thus fewer intermediary buyers and sellers to serve local markets. Many of those intermediaries are now located in rural communities. Efficiencies in containing market costs will come partly at the expense of traditional businesses in rural communities.

E-commerce may be the contemporary equivalent of the Sears Roebuck catalogue, which was introduced in 1889. The impact of the catalogue along with improved transportation and free rural postal delivery was to bring competitively priced goods to rural households — a system that often resulted in financial losses to local merchants. E-commerce certainly will offer a larger bazaar of goods and services to consumers and businesses than the Sears catalogue or even Wal-Mart ever did. It is likely to displace a considerable number of existing local businesses although some local showrooms and warehouses will be needed to make available goods and services that cannot be digitized. The deeper impact of e-commerce is likely to be the loss of sales tax revenue on which many rural communities directly or indirectly depend.

Many local farm and other firms serve local markets, extracting a price advantage by virtue of the high transportation costs and other marketing costs incurred in bringing in competing products from distant markets. E-commerce and information technology will diminish the power of such local monopolies; this change will benefit consumers but not necessarily local producers or the retail bases of rural communities. Main Streets as a result will shift from the provision of goods to the provision of services, with lower gross sales but the possibility of higher local retention of the sales dollar.

E-commerce has other drawbacks in the revitalization of rural communities and the replacement of agricultural vertical coordination through contracts and ownership. Farm commodities and most farm inputs are bulky and high-touch and cannot be shipped over fiber optic channels. *High-touch* means that quality and management must be appraised at least in part through hands-on, face-to-face contact. For example, it is not unusual for representatives of contractors to visit contract producers personally each week to review conditions and to propose herd health and management improvements. Such contacts cannot be replaced by e-commerce.

Vertical coordination that is negotiated/administered through contracts and ownership and that has evolved to bring the right product at the right cost to the right customer at the right time may face competition from e-commerce, for both vertical coordination and e-commerce are means of improving communication and lowering transaction costs. But e-commerce requires specialized skills in setting up "virtual stores" in merchandising, finance, inventory control, delivery, and customer service. E-commerce also requires substantial infrastructure, as has been noted. Infrastructure and specialized skills give rise to economies of size that are often realized more easily by contractors or by firms with integrated ownership than by independent family-farms or agribusiness firms in farming-dependent communities. It may come as no surprise that an early major initiative in agricultural e-commerce, http://www.rooster.com, is a joint venture of large firms — Cargill, DuPont, and the cooperative Cenex Harvest States. Whether that venture will succeed and if so to what extent are yet unknown.

Independent family farms lacking formal ties to input suppliers and output processors would seem to especially benefit from Internet markets for inputs such as feeder calves and pigs, and marketing of finished products to processors. But electronic marketing technologies are not new for either animal or cotton production. Though heavily promoted, electronic markets have had limited success, in part because of the difficulties surrounding judgment of input or output quality. E-commerce may fare no better. Of course, improved grading and other means provided by the public sector to facilitate distance trading might help markets function more efficiently. Certification, by the private sector or public sector, is an important part of effective e-commerce.

Information technology and e-commerce will not necessarily improve the competitive advantage of rural, farm communities in a global market-place

[14]Rural America seems on the wrong side of a *digital divide*, or the gap between those who have and do not have modern digital technology. Trujillo (See Drabenstott and Meeker 1999, p. 93) noted that 82% of urban residents have access to the Internet, compared with only 31% of rural residents. Trujillo observed that the current communication regulatory framework may prevent a bridging of that divide.

unless accompanied by free flow of information and certification institutions to ensure information accuracy. In the past, improvements in communication have generally not made rural communities more competitive. Because of the economies of size necessary for success in e-commerce, this new technology is more likely to enhance than to inhibit the advantages of firms of large size and scope. In other words, vertically coordinated and larger independent firms are likely to receive a greater boost from e-commerce in rural, farm communities than small family-firms are.

Comments

Regrettably, timely data are unavailable with which to update Table 2.2. Recent data for certain enterprises suggest that the use of contracts continues to expand. Approximately 42% of swine are produced under production contracts and 57% of swine were sold under marketing contracts in 1997 (Lawrence, Grimes, and Hayenga 1999, Tables 10–13).

Despite continued growth in vertical coordination, pluralistic marketing systems will dominate tomorrow's agriculture, which likely will reflect (1) coexistence of traditional competitive mass markets setting spot prices on relatively homogenous commodities; (2) multi-attribute product and minor niche-product markets selling under forward prices established between either a single buyer and seller in advance of production or tied to the prices of a central market, e.g., Chicago, at time of delivery contract; (3) producers under production contracts negotiated before production is initiated, paid a fee to raise crops or livestock for the owner; and (4) marketing contracts negotiated, before production begins, between producers or contractors on the one hand and processors on the other. This list is incomplete. The important point is that market system diversity will offer farming-dependent communities unprecedented flexibility in tailoring arrangements to meet emerging market requirements at the lowest cost to consumers while offering efficient producers a fair return on investment over the long run although not every year. Public provision for information, grades, standards, contract enforcement, and competition will enhance market efficiency.

3 Economic Impact of Vertical Coordination on Communities

This section will bring together information from previous sections and elsewhere to illustrate how vertical coordination affects the economy of rural communities by influencing

1. resource demands to produce food and fiber,
2. firm size and income,
3. distribution of employment among and within firms, and
4. location of ownership and management decisions.

Discussion will be limited to vertical coordination in farm and agribusiness industries.

Resource Demands

Economies of size characterize most agricultural and rural firms and drive the trend to fewer, larger firms in rural areas (Hallam 1993). Economies of size depend on firm activities, however. Even given the activity clustering already described, efficiencies often can be enhanced by spreading production and processing activities among communities of various sizes. With the aid of modern information and communication technologies, close coordination can be achieved among, for example, swine firm units, by featuring larger-scale breeding-birthing units at one rural site, a large-scale nursery unit at another rural site, smaller finishing units at dispersed rural sites, and an administration and packing facility in an urban site.

Such a scenario has two implications for rural communities. First, newer forms of vertical coordination often save inputs, increase productivity, and enhance profits. Tighter coordination of links in the marketing chain conserves inputs and decreases supply price. Most farm and food products face inelastic demand in the short and the intermediate runs; hence, quantity increases less than price decreases, so that receipts and total input use fall as quantity supplied rises.[15] All else being equal, such industry-wide productivity gains decrease aggregate employment and other economic activities in rural communities.

The forms of vertical coordination have unique effects on employment. Marketing contracts probably displace few resources from farms and small rural communities. Integrated ownership, especially, has the potential to displace resources from farms and rural communities because production units tend to be large and because ownership and control may reside in distant metropolitan centers. A farming-dependent rural community may be unable to assemble locally the venture capital and the management and other headquarters services required.

It has been noted already that although a "cluster" structure in poultry and livestock feeding and processing will offer immense opportunities to add value in agriculture, few rural communities will benefit from such a restructuring because there will be few clusters. Communities that are successful in developing or attracting processing facilities and independent or contract growers will tend to prosper more than communities that are not. Vertically coordinated firms may be sole proprietorships, partnerships, corporations, or cooperatives; key are the level, the economic and environmental sustainability, and the type of activity generated. Some communities may generate activity through local entrepreneurs or cooperatives; others, by attracting firms from elsewhere.

Might contract farming be undesirable for rural communities because contract producers tend to be large and to crowd out smaller farmers? The answer is complex. Value of crop and livestock production on the average U.S. production contract farm averaged $406,017 in 1993, or five times that on the average U.S. farm (U.S. Department of Agriculture 1996). In the absence of substantial off-farm income, the average U.S. farm, producing $72,938 in crops and livestock, was too small to achieve economies of size or to support a farm family. Because many farming-dependent counties do not have access to off-farm income,

[15]Most nonhobby farms in the farm and food systems are attempting to increase profits or to cut losses. Early innovators often reap profits, but later adopters often suffer losses. Profits of successful innovation are decreased over time as output expands, competition intensifies, and product prices fall. Thus, over time, benefits of innovation accrue mainly to consumers.

the increased average size of contract producers was not necessarily undesirable.

An important related point is that efficiencies provided by technologies used as a result of contracts create substantial production value from family-farm sized resources. For example, one hour (hr) of labor/day can service a 1,000-hog house finishing 2.5 generations, or 2,500 hogs/year (yr). At 8 hr/day, plus seasonal help, one worker can provide labor for up to eight 1,000-head units, thus finishing 20,000 hogs/yr.[16] At 225 pounds/hog and $40/hundredweight, gross value of one worker's production is $1.8 million. A typical contract producer payment for finishing 20,000 hogs is $240,000 plus bonuses. Thus gross receipts and payments are large as measured by capital/labor requirements, but the operation is the size of a traditional family farm.

Respondents in an Ohio study were much more concerned about megafarms than about contract production as threats to family farms (Tweeten, Harmon, and Feng 1999). Most farms using production and/or marketing contracts are not megafarms, but family farms whose labor is provided mainly by the operator and his or her family (Figure 3.1). Although broiler production, as measured by gross sales, is especially concentrated on large farms, Perry and colleagues (1999) concluded that "broiler operations more closely resemble small to midsized farms in the income generated." In 1995, the average U.S. farm producing poultry and eggs operated 134 acres (a.) compared with 400 a. for the average U.S. farm (Perry, Banker, and Green 1999). Household income of the average poultry-farm operator, who was younger and less educated than the average operator and who inhabited a region with fewer economic opportunities, averaged 79% of U.S. household income (Perry, Banker, and Green 1999). Hard evidence is needed with which to analyze whether production contracts detracted from the economic vitality of rural communities by shifting production to other locales.

On average, vertically integrated ownership farms are probably larger than other farms. Compared with small farms with an equivalent composite production value, a large farm tends to buy a smaller share of consumption and production inputs in nearby small towns (Chism and Levins 1994; Henderson, Tweeten, and Schreiner 1989). To achieve market economies, industrialized farms buy and sell in large volumes and often require specialized inputs and sell specialized outputs to markets in larger communities. Hence, even without decreased aggregate input purchases, an agricultural structure consisting primarily of larger farms would buy and sell less in local, small, rural towns than the current, more mixed structure does.

Less-efficient smaller operations producing today's output by means of traditional technologies require many more inputs of labor and other resources, many of which come from local communities. It is, therefore, tempting to conclude that small traditional livestock operations best serve rural communities. The problem is that small, inefficient producers cannot compete effectively and thus will struggle to remain in production. Hence, the option facing rural communities is not (1) large numbers of small livestock farms purchasing inputs locally versus (2) few farms having greater sales and purchasing more competitively and thus less in local communities. The first option is unlikely to be a viable alternative.

It should be recalled, as well, that communities can sacrifice public services and future growth by subsidizing job creation heavily.

[16]An operation of this size is included for the purpose of illustration but could have serious waste disposal problems. It is, therefore, sometimes desirable to combine other sources of income with income from fewer hog houses.

Figure 3.1. Multigenerational family farm operation. Photograph courtesy of Ohio State University Section of Communications and Technology, Columbus, Ohio.

Firm Size and Income

Major forces of change in rural farm communities include improved communication and transportation, e.g., motor vehicles and roads. These, in turn, depend on cheap fossil fuel. As transportation and communication costs/unit have fallen, rural residents have elected to travel to and to shop in vicinities offering a wider selection of goods at lower prices, and workers have chosen to travel to sometimes-distant employment offering more attractive wages, benefits, and working conditions. Thus, the economic structure of

rural communities would have changed in the absence of vertical coordination and other evolutions in farm structure.

Modes of vertical coordination such as contract production and integrated ownership have been associated closely with growth of the broiler industry in the South, cattle feeding on the Great Plains, and hog production in North Carolina. Meanwhile, small-scale livestock-feeding enterprises on family farms producing feed in the Corn Belt are becoming a thing of the past. But although production contracts and integrated ownership have hastened the growth in farm size and have influenced the geographic location of farm activities, these newer forms of vertical coordination, per se, do not cause farms to become large. Integrators, however, have found the transaction costs in writing a contract for a large or small amount is the same, encouraging fewer contracts with larger producers per contract.

Although production contracts have decreased farm labor in aggregate, they also have created new opportunities for many workers on small farms in the South and in other parts of the country. Many lenders are more willing to lend to a low-income producer who has a multiyear production contract and who wishes to construct production facilities than to a larger independent producer perennially subject to market volatility.

A comparison of two counties in Ohio illustrates how production contracts can help make small-acreage family farms viable. Mercer County, Ohio is characterized by a large number of vertically integrated production contract enterprises for swine, turkeys, broilers, and laying hens. Van Wert County, which borders Mercer County, is mainly a cash-grain area of independent producers. Area and quality of agricultural lands are similar, as were crop receipts from the two counties in 1998 (Ohio Agricultural Statistics Service 1999). But livestock receipts and total agricultural receipts differed sharply, as noted in Table 3.1.

With only 10% less land in farms, Van Wert County had 37% fewer farms than Mercer County. Mercer County farms numbered 1,460 and averaged 189 a./farm. Van Wert County farms numbered 830 and averaged 302 a./farm.

Contract-intensive Mercer County farm receipts averaging $202,740 were much nearer the receipts necessary to constitute an *economic unit* (defined as an operation large enough to support a farm family and realize economies of size essential to low, competitive production costs) than Van Wert farm receipts averaging $108,193 were. Farm receipts averaged $1,072/a. in contract-intensive Mercer County, but only $358/a. — or two-thirds less — in cash-crop intensive Van Wert County.

Net receipts and payments from farming averaged $53,629/farm in livestock-intensive Mercer County and $49,926/farm in crop-intensive Van Wert county in 1997. Data were unavailable regarding the off-farm income of farm households, but with 46.2% of Mercer County farm operators compared with 35.4% of Van Wert County operators working at least 200 days off farm, addition of off-farm income likely would widen the income advantage of Mercer County over Van Wert County farm households.

In short, production contracting can combine the economies of size essential to compete in modern agriculture with the social advantages of family-size farms. Because of the numerous forces for change affecting Mercer and Van Wert counties, differences in community economic activity and associated social vitality cannot be identified using statistically reliable multivariate measures of economic activity beyond

Table 3.1. Comparison of farm receipts and of farm numbers between livestock intensive Mercer County and cash-grain intensive Van Wert County, Ohio, 1998 (adapted from Ohio Agricultural Statistics Service, 1999, pp. 115, 129; U.S. Department of Agriculture, 1999b)

Characteristics	Mercer County (Livestock intensive, contract intensive agriculture)	Van Wert County (Crop intensive, cash intensive agriculture)
Area (acres of land in farms)	276,000	251,000
Acres per farm	189	302
Number of farms	1,460	830
Crop receipts ($ mil)	67.7	77.3
Livestock receipts ($ mil)	228.3	12.5
Total receipts ($ mil)	296.0	89.8
Total receipts per farm ($)	202,740	108,193
Net farm receipts, govt pmts, farm related income per farm, 1997 ($)	53,629	49,926
Share of farm operators working 200 or more days off farm, 1997 (%)	46.2	35.4

the farm gate. Input-output analysis (See Sporleder 1997, p. 9) indicates, however, this rule of thumb: each farm job adds another job in local communities and another in the state outside the local communities. Similarly, each $1,000 of farm income adds another $1,000 to local communities and another $1,000 to the state outside the local communities, for a total multiplier of nearly 3.0 (See Sporleder 1997, p. 9). Those benefiting are local merchants of consumer goods, of farm input supplies, and of food transportation, processing, and storage. Resulting higher tax revenues can better support educational and other local services. Other estimates of area economic impacts of livestock operations are found in Thornsbury, Kambhampaty, and Kenyon (1999), DiPietre and Watson (1994), and North Central Regional Center for Rural Development (1998).

The choice facing rural communities seems not to be whether to maintain the status quo or to accept more modern methods of production. Those who elect to maintain the status quo find themselves inevitably losing market share (Figure 3.2). The production contract operations invigorating family farms and local communities in areas like Mercer County, Ohio have detracted from the social and economic vitality

Figure 3.2. Example of abandoned small-farm barn. Photograph courtesy of Ohio State University Section of Communications and Technology, Columbus, Ohio.

of rural communities in other areas by lowering commodity prices for all producers, including those who change nothing.

The Environment

Contract production continues to give rise to controversy over issues such as the legal provisions in production contracts and the effects of such production on real estate values and the environment. Large, concentrated animal-feeding operations can generate flies, odors, and other *externalities* (or divergences between private and social costs/benefits) that decrease land values near production facilities. A Michigan study by Abeles-Allison and Connor (1990) estimated that house values decreased $0.43 for each additional hog within a five-mile radius. The study probably overestimated the loss in real estate value because home sale observations were recorded only near hog farms having received multiple complaints. Palmquist, Roka, and Vukina (1995) estimated, based on 237 home sales in 1992 and 1993 in North Carolina, that housing values were decreased 7.9% one-half mile away, and 3.5% two miles away from a new 2,400-head swine-finishing facility. But because hog facilities provide a market for local feed producers, a low-cost source of soil nutrients from swine waste (except when the waste must be transported long distances because of high animal/cropland ratios), and employment generating income and demand for housing, farmland values locally and housing values at greater distances from swine facilitates may rise.

If they create environmental problems, newly developed or arrived agribusinesses may undermine a community's opportunities to expand its economic base. Market incentives bring about efficient social and economic outcomes only if the environmental problems of waste disposal, odor, pests, and water quality are addressed effectively.

Environmental standards appropriate to the United States need to be reflected in national regulations so that states inappropriately lowering standards do not gain an unfair advantage in the competition to generate increased economic activity. Often the most effective approach to environmental policy is to set overall standards, allowing firms flexibility in meeting them.[17] It should not be forgotten that standards must be tailored to different regions and must be enforced to be effective.

Distribution of Employment Among and Within Firms

Through numbers of workers and their specializations, skills, and incomes, the form of vertical coordination influences rural communities. Large, integrated-ownership farms efficiently using vertically

[17]Negotiable, tradable emissions permits have been used with success in the case of sulfur dioxide, for example. Such permits allow overall industry emission quotas to be met by decreasing emissions most among those firms with the lowest costs/unit of control.

coordinated systems may require a variety of workers, ranging from highly trained engineers and scientists to unskilled laborers. Compared with independent family-farms, integrated ownership and production contract firms tend to employ individuals specialized and skilled in compiling, managing, analyzing, maintaining, and applying results of information technology. Information systems often substitute for unskilled labor, but the number of unskilled laborers on large farms is greater than that of skilled laborers because the more complex components of local jobs may be performed by computers or by skilled workers at distant locations. In contrast, the operator of an independent family-farm is more likely to need diversified skills and to spend time on a range of activities — from analyzing computer data to cleaning hog pens.

At least since the Goldschmidt (1946) study of Arvin and Dinuba, California, debate has raged over the merits of a community's having an economic base of middle-class family farms or a base of larger farms necessitating a highly differentiated set of skilled workers and reflecting a variety of ownership arrangements. It seems that although economically and socially vibrant rural communities often contain midsized, middle-class family-farms, a one-size farm policy has drawbacks. Writing in 1984, Tweeten (p. 53) made this observation:

> Moderate-size farms are consistent with the well-being of rural communities because middle-class families support churches, schools, clubs, and commercial businesses. Although optimal size of farm, *if there is one*, varies widely and no one size fits all conditions, the size of the farm consistent with increased well-being of society, as best measured with our crude tools, is neither a small nor a very large farm but rather is a moderate-size family operation.
>
> Not all persons possess the human and material resources to be family farmers; some must begin as hired laborers, renters, and part-time owner-operators. The well-being of society is enhanced when people with off-farm incomes are able to exercise their preferences to operate a small farm for consumptive purposes — at least if they are not subsidized to do so. There is much value in a heterogenous economy that keeps options and opportunities open to all classes as individuals and society strive to improve human and material resources. Because each family and farming situation is unique, it is not clear that public policy could do a good job in determining which farms should be restrained in growth to benefit society.

Not everyone can be a midsized, middle-class farm operator, because a great deal of capital, managerial skill, and technical expertise is required for the position. Less-qualified individuals may prefer hourly or salaried employment on a farm, and hired workers have greater employment opportunities on larger farms; on the largest of these, working conditions evidently are most favorable. Hurley, Kliebenstein, and Orazem (1999) reported, based on a 1995 mail survey of U.S. pork producers (1,538, or 17%, of the 9,000 questionnaires were returned), that "salaries are also highest in the largest firms, with 42% of employees earning over $30,000 annually. Only 12.9% of the employees in the smallest firms earn salaries above $30,000." The authors concluded that "on average, larger farms provide more-generous benefit packages and work conditions, suggesting that larger firms may also enjoy returns to scale in the provision of benefits and investments in workplace safety."

Location of Ownership and Management

The rise of vertically-integrated conglomerates undertaking operations from seed development to food processing and marketing moves ownership and control far from local family-firms, and often to urban centers. Equity capital markets in New York City and elsewhere are likely to be tapped for financing. Thus, firm management and financial success or failure are likely to take place far from rural communities. Likewise, the farmer under a production contract shifts many managerial, marketing, and financial decisions, along with many of the effects of attendant successes and failures, to the contractor.

4 Public Policy Options

Boehlje, Hofing, and Schroeder (1999, p. 1) predict that agriculture in the twenty-first century will likely ". . . be characterized by (1) adoption of manufacturing processes in production as well as processing; (2) a systems or food supply chain approach to production and distribution; (3) negotiated coordination replacing market coordination of the system; (4) a more important role for information, knowledge, and other soft assets (in contrast to hard assets of machinery, equipment, and facilities) in decreasing cost and increasing responsiveness; and (5) increasing consolidation at all levels, raising issues of market power and control."

Technological and economic forces are moving agriculture and rural industries toward production contracts and integrated ownership, both of which are, on the whole, less supportive of businesses in farming-dependent rural communities. Few rural communities in the United States can be the livestock production and processing hubs that have been predicted to generate substantial local employment and income in the coming century. Most communities either cannot compete successfully for such a leading role or respectfully decline the honor in favor of preserving their environments and cultural heritages.

Production contracts do not necessarily imply megafarms, factory farms, or environmental degradation. If properly managed, vertical coordination through contracting, as illustrated by the data from Mercer County, Ohio, is a means of achieving critical economies of size in production and marketing while permitting family-size farms to perform those functions that can be decentralized efficiently.

Because they offer the benefits of low rainfall and open spaces — characteristics that will mitigate, for instance, waste management problems arising from intensive animal production, and because they offer underutilized labor and institutions — characteristics that will support job growth, a few farming-dependent communities especially prevalent in the Great Plains are in a unique position to seize the opportunity to become agricultural hubs. At issue are appropriate public policy responses to agriculture's changing structure, which depend in part on the socioeconomic costs and benefits of these changes.

A principal policy option is to allow companies to use the form of vertical coordination they find most advantageous but to rely on the public sector to establish and to enforce environmental standards and to encourage competition. Such an approach to policy would raise real national income while holding down food and fiber costs.

In general, technological and economic forces for change can be expected to improve the well-being of

Figure 4.1. At Florida A&M University, landscape design and management student Johnnene Addison helps sort aquatic insects to be used in biological monitoring of water quality. Photo by Keith Weller, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

society if the incremental social benefits exceed the incremental social costs of that change, where *social* costs or benefits accrue to society, and *private* costs or benefits accrue to firms or to individuals party to a transaction. In agriculture, externalities are likely to arise from soil erosion; water degradation from chemicals; odors and flies from livestock production; slow-moving vehicles on highways; and pesticide spray drift occurring downwind of the originating farm (Figures 4.1 and 4.2). Employee health impairments caused by working conditions and neither paid for in wages or health premiums nor corrected by employers are also externalities.

The federal government has passed the Clean Air Act and the Clean Water Act and has established

Figure 4.2. To measure nitrogen runoff in the Pacific Northwest, plant physiologist Steve Griffith collects water samples from a monitor well inside the riparian zone near the Calapooya River. Photo by Brian Prechtel, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

agencies such as the U.S. Food and Drug Administration, the U.S. Occupational Safety and Health Administration, and the U.S. Environmental Protection Agency to correct externalities by bringing private costs (benefits) in line with social costs (benefits). By aligning incremental private costs (benefits) with social costs (benefits), such efforts have had mixed success in *internalizing externalities*. In the case of concentrated animal-feeding operations, public agencies often have required larger livestock-farms to submit environmental plans and to obtain approval before beginning operation. These operations are subject to periodic inspections for compliance. Failure to follow proper practices, or a breakdown such as a waste lagoon spill, can result in sanctions, including fines.

The market responds to private costs and benefits. But if all social costs and benefits were included, would large farms continue to display greater efficiencies and to displace other farms? Although data are not available, Martin and Zering (1997, p. 20) have concluded that small farms would be more disadvantaged than large farms if environmental regulations were enforced rigorously, for "economies of size result in a greater cost/head of regulatory compliance for smaller operations — consequently, the movement to regulate large farms seems to accelerate the rate of change [to fewer and larger livestock and poultry farms]." Boehlje, Hofing, and Schroeder (1999) arrived at a similar conclusion: "As in most other industries," they write, "most environmental regulation will likely increase costs, and smaller scale units will find compliance with environmental rules both difficult and higher cost compared to larger scale units."

A disadvantage of leaving markets alone while using the public sector to provide public goods is that this strategy speeds substitution of capital for labor and causes displacement of family farms, thereby eroding the social and economic bases of many farming-dependent rural communities. The public must decide how important preserving small family-farms and rural community social and economic vitality is in comparison with lowering food costs for consumers or enhancing international competitiveness.

Many communities will seek to attract contractors or integrated owners from elsewhere. It may be useful here to view vertical coordination metaphorically, as the institution of marriage. Although the institution (vertical coordination) is basically sound, not every prospective spouse (outside firm) will have the potential for a sound marriage with the community. Some integrated owner-contractors are "footloose" (will go to another community offering greater tax concessions), are "poor housekeepers" (will bring odors, flies, water pollution), are "poor providers" (will pay low wages), or "decrease local social control" (will increase crime rates) (see North Central Regional Center for Rural Development 1998). No single formula works for all; each community or other entity must decide which strategy to follow. State and federal governments can assist in this decision-making process by establishing ground rules and regulations regarding the environment and by providing information. The Cooperative Extension Service can help communities assemble information and develop procedures for making sound decisions.

Several questions arising in the pursuit of this key policy goal of "internalizing externalities" will now be addressed.

1. **Is preserving rural communities an externality the markets do not or cannot address?** Is it appropriate to use federal tax dollars or regulations to preserve rural communities lacking viable economic bases? The public has sometimes intervened to preserve historic sites that are not sound investments for the private sector. In other instances, the public cost has been judged too great to justify preserving a historic but noneconomically viable site. With few exceptions, the public has not intervened to save towns with outmoded bases in the lumber, oil, mining, or military industry. For instance, although communities have lobbied actively to keep redundant military bases open, efficiency considerations sometimes have prevailed in time, and bases have been closed. However, public investments helped to smooth the transition.
2. **Is a public policy to influence vertical coordination an effective means of preserving rural communities — if such preservation is the goal?** Analysts such as Carlin and Saupe (1993) and Lobao (1990) have concluded that rural communities influence farm structure more than farm structure influences rural communities. Small family-farms with crop and livestock sales below $100,000/year dominate farm demographics (Figure 4.3); such households obtain income largely from off-farm sources. Creating nonfarm jobs in rural communities may be more cost effective, therefore, than adjusting vertical coordination incentives to preserve small family-farms and local jobs. Whatever the policy outcome, residents are likely to travel to larger towns and cities, not to local rural communities, to do more and more of their shopping.
3. **Is the preferred goal to create jobs in rural America or to improve the well-being of rural people wherever they may, eventually, reside?** To what degree is it cost-effective for society to maintain a rural option? Rural communities on the whole are growing. But should every rural community grow? Is the public cost of maintaining the population and the income of some rural farming-communities so great that these communities should be encouraged to undergo a graceful decline in population? Who pays those costs? Do they offset the public costs of urban sprawl? Public outlays for better schools and health care may provide more options for rural residents than rural-prosperity programs promoting vertical integration of agriculture or attracting nonfarm and industry jobs. Certain rural communities are so distant from markets and so lacking a diversified, skilled labor force and infrastructure, e.g., a major airport, medical facilities, financing, and transportation, that payoffs from costly and perhaps unsuccessful efforts to direct jobs there are likely to be low.

Understandably, residents of rural communities would like to feel that they have control over their own destinies. By using initiative and by seeking the assistance of the Cooperative Extension Service and other agencies, communities can help shape their own futures (Figure 4.4). Notwithstanding, many rural communities will find

Figure 4.3. A small dairy farm in western Maryland. The U.S. Department of Agriculture defines "small farms" as those averaging $50,000 in gross sales annually—which net, on average, around $23,159. Photo by Scott Bauer, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Figure 4.4. ARS lab technician Debra Williams and Kennedy high school student Sean Gros label cotton bolls for identification. Photo by Scott Bauer, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

it more advantageous to maximize their personal alternative through education, organization, and skill building.

4. **What are the appropriate roles for regulations and markets?** Livestock operation externalities such as water, air, and soil quality degradation can be dealt with, for example, by requiring setbacks from populated areas and properly treating water discharge. Preventing waste from seeping into ground water aquifers and prohibiting the spread of waste on frozen fields and the field deposit of waste nutrients above levels unusable by plants prevents excess nitrogen and phosphate runoff into streams and lakes. Sometimes, however, the social cost of correcting exceeds the social costs of ignoring externalities. To use international examples, government attempts to correct externalities by dictating an "optimal" firm size often have created farms that are, in terms of efficiency, too small, e.g., those in East Asia, or too large, e.g., those in the former Soviet Union.

   Markets work best in a supportive institutional environment. One regulatory concern is the lack of transparency in production contracts. The terms of these contracts can be made comprehensible, and information promoting competition and fair treatment of contract growers can be made public.

   Another issue is the use of public regulation versus public financial incentives to encourage protection of the environment when markets do not. Agriculture has a long tradition of public financial inducements to promote conservation of soil, for example. The public also has elected to subsidize environmental measures on small farms, as under the Environmental Quality Improvement Program (See also Innes 1999). These incentives, however, still reward "bad actions" by subsidizing means to control undesirable emissions, instead of rewarding "good actions" (low emissions) with "green payments." *Green payments* is the term applied to payments for the production of such environment goods and services such as clean water, clean air, biodiversity, and carbon sequestration.

   If the political process deems that certain aspects of vertical coordination in agriculture are inappropriate, an alternative to regulating firms is product labeling backed by standardization and enforcement (see Council of Agricultural Science and Technology 1994). Consumers who prefer to purchase free-range chickens, or eggs produced by independent operators can "vote" by purchasing the labeled product at a price bringing forth the optimal supply.

5. **What is the proper jurisdictional level for regulation and control?** Labeling and local or state options will not suffice for practices deemed unacceptable on a national level. Firms will tend to go to the communities, counties, and states with the weakest environmental standards. For example, a state that makes swine operations above a certain size illegal will see swine operations move elsewhere and thus may find itself with very few swine operations because small operations usually cannot make a profit. A state that proscribes contract production may deny many local family-farmers the production contract operations that have sustained their farms. These are empirical questions and the data to date are mixed. Thus, practices deemed widely unacceptable need to be identified and regulations established on the national level.

   National environmental rules do not account for differences in population density and climates among states. Thus, national environmental rules need to have sufficient flexibility to be tailored to the unique circumstances of individual states and communities.

   To enhance the vitality of farming-dependent rural communities, the federal/state extension service and other state and local organizations can (1) promote entrepreneurship and innovation, e.g., business incubators; (2) encourage farmer-producer groups, e.g., cooperatives, to operate in food-supply chains; (3) facilitate application of knowledge to production, processing, and distributing, as a means of decreasing costs and increasing responsiveness; and (4) increase resident understanding of economic and social strengths and weaknesses, e.g., business expansion, retention, and acquisition options. These strategies, all of which can help transform rural communities, are sometimes best carried out not only through alliances of farmers but also through alliances of communities to achieve economic and political influence along with efficient information flow.

   A county option sometimes is useful when environmental regulations must differ among local areas. People in a local jurisdiction can vote whether to accept or to reject a proposed

economic activity. Communities with dense populations or sensitive environments (or noses) may be unsuitable for large livestock operations. Whereas a *local option*, or a local citizens' vote to accept or to reject a proposal, allows communities to express their choices, local livestock operators rightly fear capricious populist judgments. Without proper legal protection, established farmers who have been good citizens and have invested heavily in safeguards for workers and proper waste disposal and odor control measures may be required to shut down their operations. To avoid this type of injustice, communities may choose to apply a local option solely to new operations.

6. **What is the role of public versus private research in vertical coordination?** Private firms are performing more research in part because they have the resources to do so and in part because they face increasing pressure to be competitive and to contain costs while addressing externalities. Public research will be especially helpful to smaller firms. Measures to address externalities and to dispose of animal waste properly are detailed in *Integrated Animal Waste Management* (Council for Agricultural Science and Technology 1996). Perhaps the most intractable externality is odor. Through public and private research, technologies such as building manure pits or covered lagoons, using additives, composting, and converting animal waste to solids before injecting it into farm fields have been developed to address this last issue. Raising animals in smaller, more scattered production units can also reduce odor and the noxious gases it represents.

   Innovative technologies and negotiable discharge permits can decrease environmental regulation costs materially. Much public research is being conducted to decrease the externalities associated with large, confined-animal operations; when these externalities are dealt with effectively, one of the main advantages of smaller operations will disappear. Nonetheless, the public and farmers of all types and sizes can benefit immensely from more public and private research developing technology that cost-effectively improves animal welfare and water quality while addressing such environmental problems as odors and flies.

7. **If externalities are internalized, will the trend to production contracts and vertical integration be stopped or slowed?** The answer is probably "no," but this likelihood does not detract from the need for a national policy (1) augmenting existing taxes, subsidies, and regulations, when worthwhile, to internalize externalities; that is, using taxes, subsidies, or other means to bring private costs (benefits) at the margin in line with social costs (benefits) to society, and then (2) allowing the market to decide which size and type of economic units will thrive and expand.

8. **Is there healthy competition in markets?** If not, the proposed public policy of letting markets work after internalizing externalities cannot achieve its end. Although there is no evidence that farmers are exploited systematically by agribusiness and although there is much evidence that food and fiber markets are reasonably free, it is essential, nonetheless, that the United States continue to promote competition through antitrust and other measures (Tweeten 1989, Ch. 8). Increasing concentration (horizontal integration) in all sectors of the economy has a more negative impact on rural communities in negotiating power than vertical coordination.

   Public and private decision-making can be enhanced by greater transparency of information in integrated markets. For example, terms of production contracts can be made publicly available. Data therefrom promotes symmetry of information between growers and contractors and thereby promotes greater competition and economic efficiency. It also provides a data base to research issues of market structure, conduct, and performance.

   Many dimensions of the impact on rural communities and farms of fewer and larger vertically coordinated agribusiness firms cannot be predicted. Of course, predatory and exclusionary anticompetitive conduct by firms is unacceptable and must be addressed by regulatory agencies. But precise rules for judging the competitive merits of mergers and acquisitions are difficult to describe a priori. Fewer and larger firms may increase well-being of society by realizing economies of size or may decrease well-being by exercising market power. Fewer and larger firms can bring fewer (or more) plants to rural communities and can bring lower (or higher) prices to food producers and consumers. Continuing in-depth study of market structure, conduct, and performance is neces-

sary, but designing regulatory responses for any particular merger or acquisition requires case-by-case analysis.

Whatever the number of firms at the national level, many local communities will be unable to provide economic opportunity for more than one contractor operating locally at minimal cost while being nationally and internationally competitive. Such so-called "natural monopolies" will be addressed by contract transparency (enabling comparisons of contract terms to those of contractors elsewhere), the formation of cooperatives, long-term contract arrangements, improved transportation by growers to markets elsewhere, and by human resource investments so that resources can find the best opportunities locally or elsewhere.

It should be noted that excessive market power in farm input supply and product marketing firms will not cause low returns to farm labor and capital resources if those resources remain as mobile as they are today, and that improved agribusiness competition and efficiency may not mean an increase in farms or more-prosperous rural communities.

Appendix A: Glossary

Administered/negotiated arrangement. Economic and other terms of a production or marketing contract are negotiated between the commodity grower/producer and the integrator/contractor rather than established in cash market.

Consolidation. Horizontal integration, or the process whereby firms producing the same thing at the same stage of the food marketing chain join through mergers or acquisitions.

Custom feedlot feeder. The contract producer under contracts negotiated and perhaps renewed annually, who finishes animals.

Designer foods. Foods specially produced and prepared to meet the specific demands of individual consumers or groups of consumers. They represent a bundle of specific qualities.

Digital divide. The gap between those who have and those who do not have modern digital technology.

E-commerce. The buying and selling of products over the Internet.

Economies of scope. Advantageous relationships of cost/unit of production with output as the number of activities or enterprises within the firm increases.

Economies of size. Advantageous relationships of cost/unit of production with firm size (number of units produced). If unit costs rise as size of firm expands, *diseconomies of size* prevail.

Externality. A divergence between private and social costs/benefits.

Green payments. Payments for the production of such environment goods and services such as clean water, clean air, biodiversity, and carbon sequestration.

High-touch inputs. Quality and management must be appraised at least in part through hands-on, face-to-face contact.

Identity preservation. Maintaining the ability to identify the sources of ingredients in a product all along its production and marketing chain. Facilitates trace back to pathogenic and other sources.

Integrated ownership. The major form of vertical integration, whereby a firm owns and operates, in addition to input supply or food processing and marketing, crop and/or livestock production in at least one stage of the food production chain.

Intellectual property. Patents, copyrights, rights to information.

Internalize externalities. To use taxes, subsides, or other means to bring private costs (benefits) at the margin in line with social costs (benefits) to society.

Local option. Local citizens vote to accept or to reject a proposal.

Market power. Ability of a firm or other entity to influence prices and wages in the market.

Metropolitan counties. Counties containing 50,000 or more residents in addition to surrounding commuting counties.

Nonmetropolitan counties. Counties excluding metropolitan counties.

Nonprice vertical coordination. Production and distribution of a good or service through administered or negotiated allocation rather than through price allocation.

Spot market. Cash market.

Thin markets. Markets with few buyers or sellers.

Vertical coordination. Synchronization of the vertical stages of a production/marketing system.

Vertical integration. "Coordination of two or more stages in the food-chain under common ownership via management directive" (Martinez 1999, p. iv.).

Literature Cited

Abeles–Allison, M. and L. J. Connor. 1990. *An analysis of local benefits and costs of Michigan hog operations experiencing environmental conflicts*. Agricultural Economics Report No. 536. Department of Agricultural Economics, Michigan State University, East Lansing.

Azzam, A. 1999. Asymmetry and rigidity in farm-retail price transmission. *Am J Agric Econ* 81:525–533.

Balbach, J. K. 1998. The effect of ownership on contract structure, costs, and quality: The case of the U.S. sugar beet industry. Pp. 155–184 . In J. S. Royer and R. T. Rogers (Eds.). *The Industrialization of Agriculture: Vertical Coordination in the U.S. Food System*. Ashgate, Brookfield, Vermont.

Benjamin, G. 1997. Industrialization in hog production: Implications for midwest agriculture. Pp. 2–13. *Economic Perspectives*. Federal Reserve Bank, Chicago, Illinois.

Boehlje, M. 1996. Industrialization of agriculture: What are the implications? *Choices* (1st quarter):30–33.

Boehlje, M., S. L. Hofing, and C. Schroeder. 1999. *Farming in the 21st century*. Staff Paper 99–9. Department of Agricultural Economics, Purdue University, West Lafayette, Indiana.

Carlin, T. and W. Saupe. 1993. Structural change in farming and its relationship to rural communities. Pp. 538–560. In A. Hallam (Ed.). *Size, Structure, and the Changing Face of American Agriculture*. Westview Press, Boulder, Colorado.

Chism, J. and R. Levins. 1994. Farms spending and local selling: How much do they match up? *Minn Agric Econ* 676:1–4.

Council for Agricultural Science and Technology. 1994. *Labeling of Food-Plant Biotechnology Products*. Issue Paper 4. Council for Agricultural Science and Technology, Ames, Iowa.

Council for Agricultural Science and Technology. 1996. *Integrated Animal Waste Management*. Task Force Report No. 128. Council for Agricultural Science and Technology, Ames, Iowa.

DiPietre, D. and C. Watson. 1994. *The economic effect of premium standard farms on Missouri*. CA144. University Extension, University of Missouri, Columbia.

Drabenstott, M. 1999. Consolidation in U.S. agriculture: The new rural landscape and public policy. *Econ Rev* 84:63–71.

Drabenstott, M. and L. G. Meeker. 1999. Equity for rural America: From Wall Street to Main Street: A conference summary. *Econ Rev* 84:77–85.

Drury, R. and L. Tweeten. 1995. *Farm structure graphics*. Publication No. ESO 2256. Department of Agricultural, Environmental, and Development Economics, The Ohio State University, Columbus.

Flora, C. B., G. McIsaac, S. Gasteyer, and M. Kroma. 2000. Farm community entrepreneurial partnerships in the Midwest. Pp. 115–130. In C. Flora (Ed.). *Interactions between Agroecosystems and Rural Communities*. CRC Press, Boca Raton, Florida.

Ginder, R. 1998. Alternative models for the future of pork production. Pp. 247–263. In J. S. Royer and R. T. Rogers (Eds.). *The Industrialization of Agriculture: Vertical Coordination in the U.S. Food System*. Ashgate, Brookfield, Vermont.

Goldschmidt, W. 1946. *Small business and the community, a study in the Central Valley of California on effects of scale on farm operations*. Report of the Special Committee to Study Problems of American Small Business. U.S. Senate, Washington, D.C.

Hallam, A. (Ed.). 1993. *Size, Structure, and the Changing Face of American Agriculture*. Westview Press, Boulder, Colorado.

Heffernan, W. 1984. Constraints in the U.S. poultry industry. Pp. 237–260. *Research in Rural Sociology and Development*. Vol. 1. JAI Press, Stamford, Connecticut.

Henderson, D., L. Tweeten, and D. Schreiner. 1989. Community ties to the farm. *Rural Dev Perspect* 5(3):31–35.

Hurley, T., J. Kliebenstein, and P. Orazem. 1999. The structure of wages and benefits in the U.S. pork industry. *Am J Agric Econ* 81:144–163.

Ilvento, T. and A. Watson. 1997. *Poultry growers speak out! A survey of Delmarva Poultry growers*. Cooperative Extension Service, the University of Delaware, Newark.

Innes, R. 1999. Regulating livestock waste: An economic perspective. *Choices* (2nd quarter):14–19.

Johnson, K. and C. Beale. 1999. The continuing population rebound in nonmetro America. *Rural Dev Perspect* 13(3):2–10.

Kim, C. S., C. Hallahan, G. Schaible, and G. Schulter. 2001. Economic analysis of the changing structure of the U.S. flour milling industry. *Agribusiness: An International Journal* 17(1):1–11.

Kraenzie, C. 1998. Coops break supply records. *Rural Cooperative* (Nov.–Dec.):4–6.

Lawrence, J., G. Grimes, and M. Hayenga. 1999. *Production and marketing characteristics of U.S. pork producers, 1997–1998*. Department of Economics, Iowa State University, Ames.

Lobao, L. 1990. *Locality and Inequality: Farm Industry Structure and Socioeconomic Conditions*. State University of New York Press, Albany.

Martin, L. and K. Zering. 1997. *Relationships between industrialized agriculture and environmental consequences: The case of vertical coordination in broilers and hogs*. Staff paper 97–6. Department of Agricultural Economics, Michigan State University, East Lansing.

Martinez, S. 1999. *Vertical coordination in the park and broiler industries*. Agricultural Economic Report No. 777. Economic Research Service, U.S. Department of Agriculture, Washington, D.C.

Merio, C. 1998. When cooperatives combine. *Rural Cooperatives* (September/October):18–23.

Miller, D. 1999. Finding a way to move up the food chain. *Progressive Farmer* (July):18.

North Central Regional Center for Rural Development. 1998. *Bringing home the bacon: The myth of the role of corporate hog farming in rural revitalization*. A Report to the Kerr Center for Sustainable Agriculture. North Central Regional Center for Rural Development, Ames, Iowa.

Ohio Agricultural Statistics Service. 1999. *1998 Ohio agricultur-*

al statistics annual report. Ohio Department of Agriculture, Columbus.

Outlaw, J. 1998. A framework for identifying rural agribusiness centers. M.S. thesis, Texas A&M University, College Station.

Palmquist R., F. Roka, and T. Vukina. 1995. *Hog operations, environmental effects, and residential property values*. Department of Agricultural and Resource Economics, North Carolina State University, Raleigh.

Perry, J., D. Banker, and R. Green. 1999. *Broiler farms' organization, management, and performance*. Agricultural Information Bulletin No. 748. Economic Research Service, U.S. Department of Agriculture, Washington, D.C.

Persaud, S. 2000. Investigating market power and asymmetries in retail–to–food and farm–to–retail–food transmission effects. Ph.D. diss., Ohio State University, Columbus.

Sporleder, T. 1997. *Ohfood. Income enhancement program*. Agricultural, Environmental, and Development Economics Department, Ohio State University, Columbus.

Sporleder, T. 1999. Vertical network alliances within the global food system with emphasis on the role of trust. (Mimeo). Presented at Building Trust in the Agro–food System: Trade, Technology, and Competitiveness, *World Congress of the International Food and Agribusiness Management Association*, Florence, Italy, June 13–16, 1999.

Taylor, C. 1953. *The Farmer's Movement*. American Book Company, New York.

Thornsbury, S., S. Kambhampaty, and D. Kenyon. 1999. *Economic impact of a swine complex in Southside Virginia*. Department of Agricultural and Applied Economics, Virginia Tech University, Blacksburg.

Thu, K. and E. P. Durrenberger (Eds.). 1998. *Pigs, Profits, and Rural Communities*. State University of New York Press, Albany.

Timmons, M. B. and R. S. Gates. 1986. Economic optimization of broiler production. *Trans Amer Soc Agric Eng* 29:1373–1378, 1384.

Tweeten, L. 1984. *Causes and consequences of structural change in the farming industry*. Report No. 207. National Planning Association, Washington, D.C.

Tweeten, L. 1989. *Farm Policy Analysis*. Westview Press, Boulder, Colorado.

Tweeten, L. 1995. The structure of agriculture: Implications for soil and water conservation. *J Soil Water Conserv* 50:347–351.

Tweeten, L. and C. Zulauf. 1998. Post-industrial agriculture. *Choices* (2nd quarter):30–33.

Tweeten, L., C. Harmon, and X. Feng. 1999. *Independent and contract producers' attitudes towards industrialization and economic change*. Occasional Paper ESO 2553. Department of Agricultural, Environmental, and Development Economics, Ohio State University, Columbus.

U.S. Department of Agriculture. 1996. *Farmers' use of production of marketing contracts*. Agricultural Economic Report No. 747. Economic Research Service, U.S. Department of Agriculture, Washington, D.C.

U.S. Department of Agriculture. 1999a. *1997 Census of Agriculture. United States Summary and State Data*. AC97–A–51. Vol. 1, Part 51. National Agricultural Statistics Service, U.S. Department of Agriculture, Washington, D.C.

U.S. Department of Agriculture. 1999b. *1997 Census of Agriculture: Ohio*. AC97–A–35. Vol. 1, part 35. National Agricultural Statistics Service, U.S. Department of Agriculture, Washington, D.C.

Vukina, T. and W. E. Foster. 1998. Grower response to broiler production contract design. Pp. 133–154. In J. S. Royer and R. T. Rogers (Eds.). *The Industrialization of Agriculture: Vertical Coordination in the U.S. Food System*. Ashgate, Brookfield, Vermont.

Wissman, R. 1985. *Coop share of marketing, purchasing stabilizes after period of growth*. Farmer cooperative. Agricultural Cooperative Service, U.S. Department of Agriculture, Washington, D.C.

Woeste, V. S. 1998. *The Farmers' Benevolent Trust: Law and Agricultural Cooperation in Industrial America, 1865–1945*. University of North Carolina Press, Chapel Hill.

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