Agricultural Industrialization: Implications for Future Policies

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ABSTRACT

Agriculture is in a period of great transformation, not only in terms of technology and production methods, but also in terms of business size, control and exploitation of resources (land), business models and linkages with people. buyers and suppliers. This article describes the underlying drivers of current structural change in Indian agriculture. The impact of the drivers is illustrated by depicting several illustrations of the types of innovation farms that are developing in agriculture, not typical farms but those that appear to be growing. leading and shaping new agriculture. Finally, the agricultural policy implications of converting agriculture to an industrial production model will be discussed.

Keywords— Agriculture, policy, resources, innovations.

# INTRODUCTION

 Agriculture is in the midst of a major transformation not only in technology and production methods, but also in business size, resource (land) management and exploitation, business model and customer relationship sand suppliers. The forces driving this transformation are numerous and widespread, including increased demands for quality, safety and traceability by processors and food consumers; introduction of information technologies and process control technologies that facilitate the biological production of crop and livestock products; adopting technologies and business practices that leverage economies of scale; greater use of leasing and other outsourcing strategies to drive growth and greater control over resources, and greater adoption of contractual, strategic alliances and operational business models to enable more efficient and effective vertical coordination in the production/distribution value chain (Boehlje, et. Al. In 2006, there were many important events that occurred. The livestock and grain sectors are both changing as the agricultural industry evolves.

**II. The Industrialization of Agriculture: Implications for Future Policy**

Agriculture is in the midst of major changes, not only in terms of technology and production practices, but also in terms of company size, resource (land) management and operations, business models, and relationships with buyers and suppliers. The forces driving this transformation are diverse and pervasive, including increased quality, safety and traceability requirements from food processors and consumers. implementation of information and process control technologies that facilitate the biological production of plant and animal products; adoption of technology and business practices that take advantage of economies of scale; Increased use of leasing and other outsourcing strategies to drive growth and increase resource management opportunities. Wider adoption of contracts, strategic alliances and joint business models will enable more effective and efficient vertical coordination in production/distribution value chains (Boehlje, et al. (2006)). Both the livestock and grain sectors are moving from industries dominated by small, humble, family-based, relatively independent firms to generally large firms following more closely linked industrial business models across the value chain. It’s changing. So what do dramatic changes in agriculture mean for agricultural policy? This manuscript first discusses the underlying drivers of structural change in agriculture. We then illustrate the impact of these factors by describing innovative farm practices emerging in U.S. agriculture. Not your typical farm, but one that seems to lead and shape the industry. Finally, we discuss the implications for agricultural policy of transforming agriculture to an industrial production model.

**A. Factors driving structural change in agriculture**

The drivers or determinants of structural change are many and varied. Below are descriptions of six of the key drivers of the transition to a more industrial agricultural model.

**Technology**

Technology drives structural change through the form or type of technology that will be used in agricultural production as well as the rate and characteristics of those adopting the technology. Types of technologies that have the potential to be part of the future of manufacturing include nutrition/biology, monitoring/measurement/communication technology and process control technology. The end result is the prospect of an industry characterized by the organic production of differentiated products for different food and non-food uses.

New technology has radically changed speed constraints that have severely limited the growth potential of many grain operations. The ability to plant and harvest crops within a certain number of suitable field days in spring and fall without yield penalty is critical to overall efficiency and profitability. The development of guidance and autopilot technology combined with larger planting and harvesting equipment (36-row seeders and 12-row combiners) has dramatically changed speed limitations. For example, by planting 2,000 acres , with a 24-row planter, starting April 1 and working 24 hours a day, there is a 70% chance of completing the planting by May 1. If navigation allows 16 hours a day and improves efficiency by 5%, the chance of completing planting by May 1 will improve to 85%. With a 36-row planting rig and automatic guidance, the chance of completing planting by May 1 increases to 90% (Boehlje and Erickson, 2007).

The more sophisticated measurement and monitoring technology that is part of precision farming is also enabling the development of farming practices. If agricultural processes can only be supervised by people with specific skills and those resources are expensive or costly to train, monitoring limits the extent of control that an individual can control. individuals (or at least a few people) can supervise the individual. However, if electronic systems could monitor the growth of plants (be it machine operation, plant growth, insect or weed infestations) , less manpower is required for this task and often on a larger scale. ability. Crop production can and will increasingly evolve in the direction of improved electronic monitoring and control systems to expand the scope of control of farmers/managers.

**Financial/Economic Forces**

Economic/financial forces shape a firm’s size and other structural characteristics. These include economies of scale/scope and learning, risk and risk mitigation strategies, opportunities and costs of leasing and outsourcing, capital and cost structure decisions, capital, as well as ownership and use of land resources. Along with new technologies and operating procedures to ease speed restrictions, farmers are also using new management strategies and business models to get the most out of their machines and equipment. One of these strategies is multi-site production. Growers are increasingly producing in multiple locations, and in many cases the selection of these sites is based on weather conditions, access to water, capacity, and transportation/logistics systems. They then move the equipment from one location to another, allowing them not only to increase usability and reduce machine operating costs, but also to relax speed restrictions on operating size. without the need to invest in additional machinery or equipment. The new business model is the use of operating leases or machine sharing agreements to gain profit on additional machinery services. These agreements are often individual agreements between growers and machine owners, but increasingly these have evolved through farming agreements. Get more formal or personalized with units like Machinery Link that provide combine harvesters, stripper cotton, and similar energy units as car rental agreements. load and other devices.

Precision farming combined with innovative ways to plan and sequence machine use, including round-the-clock operations, moving equipment between sites, and weather-dependent deployments, are capable of ability to increase machine efficiency and also reduce the cost of machinery and equipment per acre. Finally, more and more scale farmers today are adopting the common business strategy of mergers and acquisitions instead of property purchases as in the past. Thus, farmers buy businesses or all assets rather than buying pieces of land or pieces of equipment. And in fact, an increasingly popular growth strategy for some growers is to approach an existing operator with 1,000 to 1,500 acres of farmland, who is about to retire, to offer to buy a “business” agriculture” and keep the current operator and his machine to complete machine operations on this area. Essentially, the acquirer acquires control of not only the area owned but also the leased area from the existing operator, while increasing the ability to cultivate that additional area by subcontracting a portion of the machinery. machinery and other activities for a qualified farmer. the only person qualified to cultivate that particular area. This strategy of acquiring business instead of buying assets often involves gaining control of a larger asset base, and thus accelerating the growth and consolidation of large-scale operations.

**Human Capital**

The skill sets and competencies of industry managers/entrepreneurs drive many growth decisions, technology choices, and funding that will significantly impact many aspects of the future structure of the industry. Other aspects of human capital that will be important include the adaptation of general business management skills to agriculture, allocating time to work and community activities, and career opportunities for new entrants and existing entrants in the industry. Large agribusinesses with intensive management expertise may have more time and talent to find efficiency not only in saving input costs but also in areas of learning, risk reduction risk and resource acquisition/control.

**Business/Family Life Cycle**

The manufacturing sector is currently dominated by individual business structures, in which the life of the enterprise is profoundly influenced by the lives of those who manage and contribute labor and capital to the enterprise. there. Thus, the typical lifecycle stages of a sole proprietorship, namely entry/establishment, growth and expansion, maturity and exit, are industry-specific and demographically associated. learning of resource owners and operators, has a significant impact on the present and future structural characteristics of the industry. Furthermore, potential changes in the business model towards a more "corporate" structure, where the longevity of the business does not depend so much on the life of the entrepreneur or his heirs, means important structural meaning. As the industry moves from the current life cycle to the next, the percentage of companies using something other than the proprietary model is likely to increase.

Much discussion of structural change in agriculture has focused on the increasing age of farmers and the expectation that much larger amounts of farm assets will be passed on to other owners as farmers grow older. that retires or leaves the industry.

Unlike in the past, it is not uncommon today for a retired rancher to control an area considerably larger than he owns. As a result, a larger proportion of the total land area is available to new or existing potential farmers than is held by retired farmers alone. Although only 2-3% of farmland is transferred from current owners to new owners each year, the number available to new operators each year is significantly higher - possibly up to 4- 5% per year.

**Value Chain Forces**

Several forces are currently affecting the agricultural sector that have the potential to challenge the traditional open market-based coordination system with buyers and suppliers and replace it with a coherent system of vertical coordination. than. These forces include the need for more unique and differentiated products from the manufacturing sector, concerns about traceability and maintaining identity across the entire production and distribution channel, strategies to leverage efficiency, better flow planning, the benefits of better and more accurate information flow between users and manufacturers , concerns about the quality and quantity availability of processors and others in the distribution channel, etc. As agricultural production becomes less commoditized and there is a need to be more precise about the attributes it produces and in recording how and when the product is produced, changes structurally in the form of different mechanisms, there is the possibility of coordination between suppliers, producers and buyers. These business arrangements are often less expensive to make because of the larger scale ventures that have the size and ability to attract the attention of potential partners in the downstream business.

**The Leading Edge of Structural Change: Some Illustrations**

The structural changes taking place in Indian agriculture represent a shift to an industrial model much like the Industrial Revolution that took place in the manufacturing sector in the India more than a century ago. This shift is not so new to agriculture as poultry has essentially been an industry model for decades. The pork industry also went through a similar transition in the late 1990s. Much of the fruit and vegetable industry can also be described as an industrial model. Traditional cash crops and dairy farming have been slower to transition to an industrial model, but are increasingly moving in that direction. For example, the potato industry is currently dominated by a number of very large potato farms in several states and even some countries. Figure 1 summarizes thirteen elements that characterize the management practices of agribusinesses actively pursuing the industrial model.

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| * Quickly adapt to new technology to reduce costs or increase value.
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| * Find the best technology and develop it into a standardized management system.
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| * Develop standard command and control systems or standard operating procedures.
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| * Use alliances with “partners” to learn from them and expand the scope of your business.
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| * Look for supply chain management strategies that maximize the value of agricultural inputs at the dinner table.
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| * Create solutions to reduce costs or increase value with supply chain partners.
 |
| * Pursue all the way to save size.
 |
| * Perfect the technology/management/scale structure, then replicate it in other locations or other companies.
 |
| * Use debt and equity effectively to continuously grow the business.
 |
| * Use automation and information technology to improve accuracy and systematically control production processes.
 |
| * Focus on product quality and consistency of production process.
 |
| * Acknowledge and emphasize the expectations of buyers in their product selection and manufacturing practices.
 |
| * Develop closed-loop systems that use all resources, including waste, as efficiently as possible.
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**Figure 1. Management Practices of the Industrial Farming Model**

The following descriptions illustrate the growing number and importance of large “advanced” agricultural organizations that embody the industrial agriculture model. The four farm organizations were purposefully selected from the horticulture and dairy industries, as these are considered the least influenced by today’s industrial model. To be sure, these agricultural organizations do not represent mainstream Indian agriculture today. To be sure, the majority of agribusinesses in the India continue to be modestly owned companies of 1-2 people. However, the case studies below give an idea of ​​the potential future structure of agriculture in the India as the industrial model becomes more common.

**III. IMPLICATIONS OF STRUCTURAL CHANGE FOR AGRICULTURAL POLICY**

Significant changes are currently taking place in productive agriculture, transforming it from the small and modest Jeffersonian family farm model to an industry characterized by larger production units exhibiting characteristics of industrial models and organic production, has profound implications for the future appropriate agricultural policy debate. This change in the characteristics of the manufacturing industry, combined with increased production and global competition, environmental concerns and other external impacts associated with agricultural production, and the Consumers’ growing interest in safe and healthy food is likely to profoundly change the focus of debates about agricultural policy.

 The primary goals of agricultural policy are to improve or reduce the risk of low income for farmers; prevent agriculture from accumulating unmanageable surpluses; protect land and other resources from degradation; and provide Indian consumers with complete and nutritious food at reasonable prices and essentially eliminate the prospect of food shortages in the India. Collectively, these goals were achieved through a series of agricultural programs that protected agricultural production from market forces and essentially attempted to minimize the flow or dispersion of both human resources and capital from the industry.

 The current farm law continues to focus heavily on the same goals and objectives as the previous farm law. However, as the structure of the agricultural sector continues to evolve towards an industrial model, some of these policies may be challenged. For example, much of the farming in industrialized agriculture, such as Tom Farms, is based primarily on the concept of property control rather than property ownership. Current agricultural programs that rely on income transfers based on past crop and production records will inevitably be included in the value and rent of the land. For activities that pursue the economically rational goal of asset control rather than ownership, these policies represent an impediment rather than an agent because they raise resource prices. in an “artificial” manner. Payment limits, which limit the amount of benefits received, and/or the amount of qualified production force businesses to look for trade structures that are not economically viable but necessary to maintain access to government support mechanisms. Finally, government interventions such as milk marketing orders, designed for the increasingly archaic dairy industry, create market distortions that can sometimes turn to the advantage of dairy producers. industrial dairy firms , but can also impede the ability of industries to transition to a business model that will remain internationally competitive.

Looking to the future from the perspective of globally competitive industrialized agriculture, additional sector-related public policy objectives may become relatively more important than those that have been central to policy in the past. These goals may include:

 1. Enabling producers to manage their growing risk and volatility

 facing a more market-oriented industry,

 2. Maintain or protect the productive capacity of land, capital and human resources

 basis in short-run surpluses for long-term global food security,

 3. Facilitating the permanent transition of surplus human resources out of agriculture through vocational training and other transitional support,

 4. Maintain producers' access to input and product markets,

 5. Protect farmers from potential exploitation by processors and input suppliers,

 6. Create favourable conditions for skilled workforce and career paths for employees.

 7. Maintain and facilitate access to a seasonal workforce able to work in a safe and productive work environment,

 8. Maintain an adequate food supply to minimize the possibility of food shortages or significant food price increases,

 9. Protect consumers from all forms of food contamination during production/distribution,

 10. Reduce environmental, olfactory and other external conflicts between farmers and other members of society,

 11. Improve agricultural productivity, creativity and innovation,

 12. Help farmers and residents of rural communities adapt to change and adapt to the new economic and social environment.

Our goal here is not to define specifically the details of a policy choice or institutional structure to implement a particular agricultural program, but to identify seven key issues that Future agricultural policies must address to achieve all of the previously defined goals. These questions or alternatives are generally not part of the current political debate and are presented not because they are fully developed and analysed, but to stimulate new ideas and new thinking in political discussions that were previously dominated by changes in agricultural prices and income support systems. and resource conservation and protection programs.

 **A. Transition Support Programs**

As noted earlier, the market sometimes causes hardship in the form of low resource rewards. One of the roles of public policy is to alleviate this pain through temporary relief. But if these resources are frequently in surplus, public programs to facilitate the conversion of these resources to other uses are appropriate. For example, a program that helps farmers who can find permanently lower prices and incomes due to international competition or other forces could provide job training and relocation assistance to relocate. change from farming to other activities. This transition-supporting approach could be a logical follow-up to legislation that offers little protection to farmers against market forces.

**B. Institutional structure around vertical market systems and supply chains**

The development of closer vertical alliances in agriculture and the formation of supply chains has raised many questions about the issue market power and exploitation potential of those with limited market size or power, especially manufacturers. Such a policy can not only be difficult to implement, but also robs opportunities for developing a more efficient and responsive food production and distribution system. An alternative policy approach is to develop an institutional structure around vertical supply chains that addresses public policy concerns. Such a structure could include open access to pricing information and commercial terms of all transactions, whether within a vertically linked chain or not. This could include redefining antitrust laws to address market power concerns regarding vertical chain placement as well as concentration and market size. It may include provisions to mitigate opportunistic and exploitative practices by imposing compensation, for example, if contractual obligations in a vertical chain are not met. Another policy response is to change the bargaining potential between producers and others in the vertical chain by increasing the bargaining power of producers. And new arrangements and institutional structures to more equitably share risks and rewards in vertical alliances as an alternative to fixed-price contracts that can be mandated or incentivized, including different profit and loss sharing arrangements. The basic principle here is to develop a new institutional structure around vertical systems of economic activity that eliminates the potential for power or exploitation in order to achieve the same goal that the institutional structure is complete in the market environment.

 **C. Intellectual property rights**

Private sector companies are creating innovation and new information and capitalizing on this activity by charging technology fees to farmers and generally limiting access to those who can and cannot afford it. willing to pay for information and technology. Existing copyright and patent laws were developed at a time when markets were open and played an important role for the public sector in providing information and new R&D. These rules and regulations regarding intellectual property rights and information dissemination need to be revisited, as the market is currently characterized by alliances and vertical linkages, global competition and role The private sector plays an important role in developing new technologies and disseminating information. .

**D. Support for Public Sector R&D**

As mentioned earlier, the private sector is playing an increasing role in the technology and information markets, and many are concerned about the distributive consequences of marketing. limited or closed access to the latest and better information and technology. An important public policy issue is the appropriate level of funding for R&D, technology and information system transfer, and the appropriate level of funding for these activities. Current funding sources are unlikely to be sufficient to expand support for R&D programs and open information. New and innovative ways to fund such programs are a major public policy concern. Innovative structures and joint ventures between the public and private sectors should be part of this discussion, including the possibility of taxing private sector intellectual property profits and the allocation of these revenues. directly to the public sector, free access research and information programs geared towards those who cannot access the latest technology and information from the private sector.

 **E. Worker health, safety and immigration**

Modern agriculture will need to compete to attract skilled labor. Public policy on health care costs and coverage as well as occupational safety rules that balance private and public costs and provide reasonable working conditions will be important in attract this workforce. Immigration policy is particularly important for the agricultural industry, as evidenced by the recent debate in the India about appropriate immigration and labor policy. Agriculture is increasingly dependent on foreign-born labor, not only in the production of vegetables and specialty crops as in the past, but also in livestock and, increasingly, in agricultural sectors such as potatoes. Many of these workers are undocumented, which causes costs as well as uncertainty about availability for planting, harvesting and other pressing tasks. In addition, undocumented workers may be reluctant to challenge unsafe working conditions and may therefore be treated unfairly. Addressing this uncertainty through immigration policy reform is critical to the economic opportunity and security of this workforce, as well as cost competitiveness and long-term viability. of the agricultural industries that rely on this workforce.

**F. Food Safety, Traceability and Additive Use**

 Some argue that large-scale industrialized agriculture, especially the increased concentration of livestock in confined spaces, combined with the use of antibiotics for treatment, increases the risk of food contamination. . Others argue that an industrialized production system has the potential to increase the deployment of monitoring and control systems to detect and reduce food safety and animal health risks. Regulation of antibiotics and additives in food production, processing and storage will be critical to maintaining a cost-competitive industry, but also to maintaining and building Consumer confidence in food products and access to markets in countries or regions limit the use of these technologies.

 Traceability systems play an important role in both preventing food safety problems and minimizing exposure if they occur. In the livestock sector in particular, An important future policy issue is the role of the public in developing, facilitating, or implementing identification and traceability systems in response to natural disease outbreaks and purposefully, improving food safety and assuring consumers of the attributes and quality of their food. some products.

 **G. Next Generation Farm Leaders**

A popular Indian policy approach to attracting new generations into agriculture is through low-interest loans and loan guarantees. The design of these programs is to reduce barriers to entry into agriculture. Unfortunately, they also promote the notion that young farmers plunge into debt to acquire fixed assets, including land and machinery. The changing agricultural sector structure creates an alternative method for young farmers to enter the agricultural production sector. Today’s industrialized farms, like those described above, often offer entry-level management opportunities with well-defined career paths for young people. These opportunities can serve as a ‘learning’ for future agricultural leaders, where they have the opportunity to learn how to operate what will likely be the farms of the future. An agricultural policy that encourages this agricultural career path can be realized through grants, scholarships, and low-interest loans for the opportunity to go to college in related fields. Management and agricultural production, and tax incentives for agricultural organizations to hire young people graduating from college with career orientation.

**IV. CONCLUSION**

The seven public policy areas identified here have not been the focus of past agricultural policy debates and discussions. But they can be just as important, if not more, than traditional agricultural price and income support programs and resource conservation programs in shaping the efficiency and opportunities of production systems. and distribution of agricultural products in an increasingly stronger global competition in the future. Future agricultural policy debates need to be much broader in focus and concept in order to address the important public policy questions facing food production and distribution systems.

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