

FARMING IN THE 21ST CENTURY

by

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Preface

The U.S. agricultural industry is in the midst of major structural change — changes in product characteristics, in worldwide production and consumption, in technology, in size of operation, in geographic location. And the pace of change seems to be increasing. Production is changing from an industry dominated by family-based, small-scale, relatively independent firms to one of larger firms that are more tightly aligned across the production and distribution chain. And the input supply and product processing sectors are becoming more consolidated, more concentrated, more integrated.

Agriculture in the 21st century is likely to 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, facilities) in reducing cost and increasing responsiveness, and 5) increasing consolidation at all levels raising issues of market power and control.

These profound changes in the agricultural industry present new challenges and new opportunities that require new ideas and concepts to analyze and implement. They require new learning and thinking. Some of those new ideas and concepts are presented here, not as empirically verified truths, but as “thoughts” to stimulate different and better thinking. They have been developed based on observations, analysis and discussions with numerous managers and colleagues in agribusinesses in North America and Europe. This series focuses on Farming in the 21st Century; companion series are also available on Financing and Supplying Inputs to the 21st Century Producer (Staff Paper 99-11), and Value Chains in the Food Production and Distribution Industries (Staff Paper 99-10).

Our purpose in sharing these “thoughts” is to invite discussion, dialogue, disagreement — in general to encourage others to develop better “thoughts”.

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Concepts of Biological Manufacturing in Production Agriculture

The transition of agriculture from a commodity industry to one with differentiated products, combined with a focus on the end-user and a manufacturing approach to production, is a dramatic paradigm shift in the industry. The produce-and-then-sell mentality of the commodity business is being replaced by the strategy of first asking what end-users want, and then creating or manufacturing those attributes in the raw material. This may require changes in how the raw material is produced and what it doesn't contain (i.e. chemical residues) as well as what it does contain. This manufacturing mentality has become more predominant and has the potential to be increasingly successful as we learn more about the biological production process and have increased capacity to control and manipulate that process through genetics, fertility, equipment design, disease management programs, etc. What are some of the characteristics of this manufacturing mentality as applied to production agriculture?

Systemization and Routinization -- One of the characteristics of the manufacturing process is systemization and routinization. With increased understanding and ability to control the biological production process, routinization becomes increasingly possible. Tasks become more programmable. Routinization generally fosters more efficient use of both facilities and personnel as well as less managerial oversight and overhead. Hourly work schedules that identify specific tasks to be done at specific times on specific days is but one example. Precision crop farming is another example. In essence, agricultural production is becoming more a science and less an art.

Specialization -- An additional manufacturing mentality concept now being utilized in modern agricultural production systems is that of specialization, not only with respect to business venture and focus but also with respect to individual employee tasks or function. For example, an even larger proportion of the grain, swine, dairy, beef and poultry output is being produced by larger scale, specialized units rather than diversified farms. And within these units employees are becoming more specialized in their task or functions with some focusing on agronomic production skills, some on machinery operation and maintenance, some on marketing, etc. This specialization of function of personnel as well as business focus of the firm again is increasingly feasible because of better understanding and control of the biological process.

Scheduling and Utilization -- A further implication of the manufacturing paradigm in agricultural production is increased emphasis on facility utilization, flow scheduling, and process control. In the past, variability associated with the delays in adjustment of output to current and expected prices and inherent lags in the biological production processes have made facility use and scheduling and process control difficult if not impossible. Many production units have in essence maintained excess plant capacity as one means of accommodating the uncertainty of the output of the biological production process. Undoubtedly, rain fed crops will still be subject to weather variability, but increased knowledge of biological production should facilitate prediction as well as control of production processes. With increased ability to predict and control the biological production process, facility use can be more accurately scheduled, and process control concepts to improve efficiency and reduce cost are more applicable and useful than in the past.

Input Packages vs. Mix and Match Strategies -- With the increasing capacity to control and understand the biological process through biotechnology and genetic engineering techniques, producers will be more capable of developing optimal input combinations that match chemical

and biological attributes to obtain the optimum quality and characteristics of output. For example, crop genetics are being matched to pesticides for optimal pest control as exemplified by Synchrony STS – a seed/herbicide system. In this situation, the classic mix and match strategy of the past where producers could buy chemicals from one firm and genetic material from a second may become less effective. In some cases the grower will purchase pre-specified input packages that are optimized in terms of their biological and chemical characteristics; in other cases the grower will be warned that certain plant nutrient and genetic inputs respond better when used together and their performance may be sub-optimal if used in other combinations. But this matched inputs strategy has risks -- the risk of reduced flexibility to adjust if supplies of an input decrease and/or prices increase.

Systems/Process Flow -- The manufacturing mentality places increasing emphasis on the entire production and distribution chain from raw materials supplier to end-user. This total system rather than stage or segment focus reduces the chances for sub-optimization within a stage or sector and inefficiency or losses because stages are not well matched in terms of product flow, product characteristics, quality, or other critical attributes. These losses can be particularly large in biological production processes where variation in many attributes is naturally wide because of variation in genetic and other inputs as well as growing conditions. Thus, there is the potential for a very high payoff if manufacturing processes can be used to reduce these losses in the system.

Purchasing Agent -- Part of the manufacturing mentality is a purchasing agent or specification buying approach to acquiring inputs or services. This approach involves the specification of input requirements and in many cases requesting alternative suppliers to bid for the business based on the contract specifications. This purchasing agent approach puts more emphasis on ability to fulfill contract specifications at a competitive price than the personal relationship based purchasing behavior of many of today's agricultural producers. Note that the relationship is not unimportant in a purchasing agent approach to acquiring inputs; instead the relationship is more explicitly defined in the context of meeting and enhancing the features and characteristics the buyer wants as reflected in the contract specifications.

System Cost Control -- Although cost control is critical in any production process, the manufacturing approach focused on end-user products recognizes total production and distribution systems cost as being more critical than the cost in each stage of the chain. As noted earlier, this approach has the potential to eliminate some of the significant inefficiencies in the chain. And as more resources are purchased from others, the cost structure of the business changes with a higher proportion of the cost being variable (i.e. costs change directly as a function of output) and a lower proportion fixed (i.e. do not vary with output). With this changing proportion of fixed and variable cost, each stage becomes more responsive to changing end-user demands and competitive pressures. In the short-run the costs that influence production adjustment decisions are variable costs -- the smaller proportion that variable costs are of total costs, the more prices must decline before firms reduce output. Consequently firms with a high proportion of fixed costs are slower to adjust to lower prices than they are to expand when prices increase. In essence, an industry in which more firms have a higher proportion of their total costs that are variable is more responsive to changing market conditions.

New Venture Expansions -- Much of the expansion of agriculture in the past can be described as that of incremental expansions -- producers would add an additional 40 acres to their 240 base acreage. But increasingly expansion is of the large-scale new venture variety. These new venture projects require substantial capital investments (often in excess of a million dollars) and frequently require significant labor and managerial resources as well to be successful. This new venture approach to production agriculture is a dramatic change in the way of doing business compared to the incremental expansions of the past.

Partnering/Alliances to Reduce Investment and Leverage Volume -- The traditional approach to agricultural production has been that of an independent producer who purchases inputs and sells products through various market mechanisms to other independent businessmen. Increasingly, producers are joining or partnering with other resource suppliers in various ways to expand volume with limited capital outlays. In crop production this is occurring through the growing use of contracting for machinery services, leasing of land, and custom farming. In essence, the grower is leveraging volume by investing his funds in only part of the total fixed assets needed to produce the crop while maintaining a high degree of control of the other phases through the ownership of the crop and the specification of the growing conditions. The critical dimension of such partnering or alliances is that more resources and services are obtained from others if that is a less expensive technique for acquiring production inputs, and more linkages along the chain to the food or industrial product end-user are used to capture value in additional stages of that chain.

Stage Coordination through Negotiation -- As noted earlier, production agriculture in the past has focused primarily on commodity products with coordination through impersonal spot markets. The increased specificity in raw material requirements combined with the potential for producing specific attributes in those raw materials is transforming part of the agricultural market to a differentiated product market rather than a commodity product market. This trend combined with the trend to geographic as well as ownership separation of the various stages of production suggests that personal negotiation is a more effective mechanism of systems coordination than impersonal spot markets. Increasingly, impersonal spot markets find it difficult to convey the full set of information about product attributes that characterize these differentiated products. Contract or ownership coordination will become more dominant in differentiated product markets with impersonal price coordination continuing to dominate the commodity markets.