COST IMPLICATIONS OF MULTIPLE-PRODUCT FARM SUPPLY RETAILING

by

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Chapter 1

INTRODUCTION

Commercial agriculture has become a mass consumer of an increasing array of industrial products. Most rural communities are serviced by a series of business establishments that merchandise a large variety of feeds, fertilizers, petroleum, agricultural chemicals, building materials, and other farm supplies. These products have customarily been merchandised by specialized retailers. Diversified outlets, selling a wide range of farm inputs including services such as delivery, management aids and credit, are becoming more common, however. The task of supplying the right "product bundle" at the right time at the right place at the lowest possible cost is a difficult one, but is of crucial importance to the seller, the buyer, and to society.

Within recent years the relationship between the farmer and the farm supply industry[1] has become more complex and much more important. American farmers, in the wake of a technological revolution, have become more dependent on farm supply firms not only for the large array of products merchandised, but for information and guidance in the use of these products.

One of the more significant changes occurring in agriculture in the last three decades has been the increased use of purchased inputs in

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[1]The "agricultural supply industry" or "farm input industry" is employed as a shorthand to refer to a series of industries providing farm inputs: manufactured fertilizer, petroleum, feed, seed, agricultural chemicals, farm machinery, and others.

farm production. As a result, industries that supply purchased farm inputs have moved into a position of special importance in American agriculture. The index value of non-purchased inputs, for example, dropped 65 percentage points during the last 29 years while the purchased input index rose by 67 and the farm labor index declined by 127 percentage points (Table 1.1). Fertilizer use has increased more than that of any of the other inputs, rising from an index of 35 in 1940 to 224 in 1969. The change in inputs used by the farmer has been accompanied by an increase in productivity[2] and an increase in the concentration of consumption of inputs as farms continue to grow larger in size and fewer in number.[3]

These changes have influenced the trend toward increased concentration in the farm input industry. Higher concentration[4] is typical but not uniform for each major farm input. Feed and bulk fertilizer distribution are notable exceptions that will be covered in more detail in Chapter 2.

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[2]The productivity index increased from 85 in 1950 to 108 in 1969, see U.S. Department of Agriculture, Economic Research Service, Changes in Farm Production Efficiency: A Summary Report, 1970, Statistical Bulletin 233 (Washington: Government Printing Office, 1970), p. 17.

[3]The 1964 Census of Agriculture recorded 80,163 farms in Nebraska compared with 100,846 in 1954. This is a decline of 20.5 percent for the ten-year period. Over the same time interval, the number of farms in the U.S. declined 34.0 percent from 4,782,416 to 3,157,857 farms. The average farm in Nebraska increased from 470.9 acres to 596.2 acres, while the average U.S. farm increased from 242.2 acres to 351.6 acres.

[4]"Concentration" refers to the number of actual market rivals.

Table 1.1

Index of Farm Input Usage, United States, 1940-69 (1957-59=100)

Year	Farm Inputs					
	Non-Purchased	Purchased	Feed, Seed, and Livestock	Fertilizer and Lime	Farm Labor	All Inputs
	- percent -					
1940	140	76	55	35	191	99
1950	119	91	72	68	142	101
1960	95	105	109	111	92	101
1969	75	133	148	224	64	112

Source: U.S. Department of Agriculture, Economic Research Service, FPED, Changes in Farm Production and Efficiency, Statistical Bulletin No. 233 (Washington: Government Printing Office, 1970), p. 16.

The Problem

As local grain and farm supply markets are enlarged, increasing amounts of capital are needed to achieve minimum scale required for least-cost production and distribution of products. The result may be increased barriers to new entry. Entry of large firms vertically integrated backward in production and forward into distribution may pose an absolute cost barrier to potential rivals. A third and important entry impediment is product differentiation. It is to the seller's interest to seek a differential advantage for products over competitors. An established "name" supported by economies in sales promotion can be a formidable barrier to a potential new firm even though there may be no other production or distribution disadvantages.

Serious consideration is being directed to the competitive effect of the huge financial base of large diversified businesses. Market influence may arise from a firm's large cash flow or its superior advantage in securing financial support. Conglomerates are discussed and debated as a form of organization that, through continued growth and diversification, might ultimately gain undue political, economic, and social power. Large conglomerate firms operating on a national and regional scale have entered the farm input market by developing their own distribution organization for their own particular brands. Entry of national petro-chemical companies into the production and distribution of fertilizer is a classic example.[5]

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[5]For documentation of this revolutionary process, see R. O. Aines, "Rationale for Conglomerate Growth in the Farm Input Sector,"

With various market imperfections[6] present in the farm input industry, specialized firms in local markets are finding a single-product line may not provide enough market potential to allow growth sufficient for survival. Growth via diversification into additional markets, each having its own expansion possibilities, may be a relevant alternative. Diversification may be a profitable alternative because of complementarities of resource use or because of complementarities among products or services in a given market. Complementarity may exist among products because of the interchangeability of use of certain resources. The volume of one product may be increased as a result of handling another product or service--a result of market complementarity.

While all of these are important issues, most must be deferred for later study. The present study is concerned only with possible operational efficiencies from increased size, utilization and diversification of country elevators and retail farm supply businesses.

Economics of Conglomerate Growth, ed. Leon Garoian (San Francisco: Recorder-Sunset Press, 1969), pp. 63-68; Arlo J. Minden, "Changing Structure of Farm Input Industry," American Journal of Agricultural Economics, Vol. 52, No. 5 (December 1970), pp. 678-685; Dale C. Dahl, "Structure of Input Supplying Industries and Techniques of Analysis," American Journal of Agricultural Economics, Vol. 51, No. 5 (December 1969), pp. 1046-1054; and Kenneth R. Farrell, "A Look Ahead for the Agri-business Industries" (speech presented at the National Agricultural Outlook Conference, February 1969, Washington, D. C.).

[6]Many firms in the farm input industry are not operating or may not be in a position to operate at an output level that yields minimum long- or short-run average costs. Fluctuating volume caused by seasonality in demand for the product, level of technology, imperfect knowledge, degree of competition, and managerial ability are some of the reasons why firms do not operate at the low point on their short-run average cost curve. Firms marketing products used seasonally in farm production appear particularly susceptible to problems of inefficient resource use.

The major purpose for focusing on multi-product firm costs was two-fold. First, only limited research has been directed toward investigating the internal cost structure of multi-product firms. No studies were found that rigorously evaluated the internal cost structure of multi-product firms engaged in farm product marketing and farm input retailing activities. Research in the past has centered almost exclusively on analyzing the cost and demand problems of single-product plants. The economic-engineering framework typically employed for measurement and evaluation of costs of marketing a single homogeneous product provides a useful base, but cannot be applied without modification to specific questions and problems of a multi-product marketing operation. Secondly, specification of cost-volume relationships between the single- and multi-product firms is needed to provide guides for predicting possible merits of firm expansion and merger policies. The economic implications of larger and more highly diversified firms are of prime interest to the firms themselves, to farmers and to society.

Substantial emphasis has been placed upon research and extension to assist the farmer in organizing and operating his business efficiently. Less attention has been given to the organization and efficiency of agricultural suppliers and the impact their costs have upon the agricultural producer. With today's commercial farmer substituting purchased farm inputs for land and labor, it becomes highly important to both farmers and society that production and distribution costs of farm inputs be as low as possible and that the price of these inputs to the farmer be in accordance with costs.

The trend toward enlarged scale of farm supply retailing to match the increased scale of producer operations may force some single-product firms to diversify into related product lines to protect their market position and insure their own growth and survival. A need exists for an economic evaluation of structural changes taking place. A particularly neglected need is the evaluation of cost structures of highly diversified farm input organizations retailing directly to the farmer. Only through such an analysis can cost comparisons be made between more traditional highly specialized retail outlets and the newer more highly diversified establishments.

Failure to make efficient adjustments in the farm supply sector may be reflected as higher farm production costs. Consequently, untimely or improper adjustments made in the farm input sector can lead to an inefficient allocation of resources in the agricultural industry generally. Higher costs of food production would lead ultimately to higher costs of food. The consumer too has an interest in promotion of economic efficiency in this sector.

Objectives

The broad objective of this study is to investigate the nature of the internal cost structure of multi-product farm supply retailing firms and to make comparisons with the internal cost structures of single-product firms.

The specific objectives of the study are:

I. Examine the nature and extent of structural changes in

the grain, feed, petroleum, and fertilizer industries.

II. Develop multi- and single-product models that will:

A. Measure the relationship between plant size and average cost.

B. Measure the relationship between different levels of plant utilization and average costs.

C. Measure the relationship between product diversification and average costs.

III. Suggest possible implications of diversified input merchandising for input industry firms and farmers.

Procedure

Costs of three different plant sizes were synthesized for grain, custom mix feed, bulk petroleum, and liquid fertilizer multi- and single-product firms. Multi-product firm plants were structured to fit a multi-product linear programming model. The four products were chosen on the basis of: 1) staggered temporal demand pattern, 2) observed actual diversification trends, 3) relative importance in terms of total sales, and 4) availability of empirical cost evidence. Each product line is composed of a group of related products. The bulk petroleum department, for example, sells two grades of gasoline, two grades of diesel fuel, tractor fuel, kerosene and lubricants. Programming was simplified by establishing a gross sales

margin coefficient, weighted according to each product's margin and contribution to sales.

The linear programming model was used to evaluate resulting profits and average costs for each of several sizes and levels of utilization of each department. Profit and cost estimates were developed for both single- and multi-product operations. Comparison of multi-product model plant cost results were made with single-product model firm plant costs at 50, 75, and 100 percent of plant utilization for three plant sizes, multi- and single-product firms.

Uniform assumptions were made regarding plant characteristics and location, customer and use density, physical transformation coefficients, and factor prices. Resulting cost differences can, therefore, be attributed to size, utilization, or diversification. Additional assumptions considered operationally useful in making the transition from a single-product cost analysis to a multi-product cost construct are presented in Chapter 5.

The data used for developing both the multi- and single-product model plants were taken extensively from prior studies of single-product plant operations. Costs reported in these studies were synthesized primarily from engineering estimates. Information from studies was supplemented with other data secured from interviews with farm input managers, equipment manufacturers, accounting, insurance and credit institution personnel, and other primary and secondary sources.

The next chapter reviews the structural setting of the four farm input industries under investigation in the present study.

The account of structural changes serves as a guide for comparison of the synthetic cost findings with the likely cost structure of "typical" present-day firms.

Chapter 2

STRUCTURAL TRENDS IN FARM INPUT INDUSTRIES

The purpose of this chapter is to present consumption and structural changes occurring in grain marketing and in selected farm input industries for Nebraska, the North Central Region, and the United States. The specific purchased farm input industries discussed are feed, fertilizer, and petroleum.[1]

Firms comprising the purchased farm input industries have been undergoing important structural changes and have attained a position of great importance in American agriculture. The variation in form and grade of purchased farm inputs and changes in farming practices have contributed to the quantity of inputs used, particularly in recent years. The value of total farm inputs used in the United States increased 3 percent from 1950 to 1965, and 11 percent by 1969.[2]

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[1]Changes have not been confined to these three selected farm inputs. The pesticide industry (insecticides, fungicides, rodenticides, and herbicides), for example, the fourth largest in terms of farm expenditures, has grown as fast as any of the farm input industries. Over 100 firms are involved in basic pesticide production today, with farm pesticide expenditures in the United States increasing by nearly 250 percent, from $179 million in 1950 to $619 million in 1966. At the retail level, pesticides are frequently sold in combination with other farm inputs. See Brian G. Gnauch, "An Economic Analysis of Market Conduct in Five Agricultural Input Industries" (unpublished Ph.D. dissertation, University of Minnesota, 1968), pp. 74-78. The present study is concerned with only the three major farm inputs (major in terms of total farm expenditures) and grain marketing.

[2]U.S. Department of Agriculture, Economic Research Service, "Handbook of Agricultural Charts," Agriculture Handbook No. 359 (Washington: Government Printing Office, November 1969), p. 16.

In 1968, farm expenditures for feed, seed, fertilizer and "operational capital items" amounted to $534 million in Nebraska, almost $6 billion in the North Central Region and nearly $14 billion in the United States (Table 2.1). These four major expense categories have generally constituted at least 50 percent of total current farm operating expenses. In 1968, for example, these four categories accounted for 52.4 percent of total current farm operating expenses for Nebraska and 59 and 56 percent for the North Central Region and the United States respectively.

Consumption changes and related structural trends for the fertilizer, feed, petroleum, and grain assembly industries are described separately in this chapter. Additional attention is also directed at farmer-owned organizations (cooperatives) since a significant proportion of farm supplies, particularly fertilizer and petroleum products, are purchased through these organizations (Table 2.2).

Fertilizer

Consumption

Fertilizer has been one of the most rapidly growing farm supply markets. The decade of the 1960's saw the use of fertilizer increase substantially, both in the world and domestic markets. Total fertilizer materials consumed in the United States more than doubled between 1950 and 1968, while plant nutrient consumption was nearly four times as great (Table 2.3). Fertilizer consumed in Nebraska increased 20 times from 43,667 tons in 1950 to 878,309 tons in 1967.

Fertilizer expenditures in the United States increased 96 percent, from $975 million in 1950 to $1,914 million in 1966, while Nebraska