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Economic Efficiencies in Seed Processing

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ECONOMIC EFFICIENCIES IN SEED PROCESSING

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The title of this paper is not overly descriptive of the types of information I will present. In fact, some of you probably wondered "What is meant by that title?" The key word in the title is "Efficiencies". Thus, I will discuss an economist's view of some efficiency concepts. Several definitions will be presented and referred to later in the discussion.

Let's start with the word efficiency. Broadly defined, efficiency is the ratio of output to inputs. For example, the number of bushels of soybeans cleaned per hour of operation. Let's look at some terminology that may be a bit more restrictive. These include: technical efficiency and economic efficiency, operational efficiency and pricing efficiency, micro efficiency and macro efficiency.

Technical and Economic Efficiency

Technical efficiency is concerned with the ratio of physically measurable units of inputs and outputs. For example, a motor may be technically efficient and designed to have a high horsepower output relative to the potential energy available per gallon of fuel used. Economic efficiency is concerned with the cost of obtaining a given level of output from a system or operation. The most economically efficient system would produce the desired number of horsepower for the lowest dollar expended. The values of inputs and outputs are measured under this concept. It is possible for an operation to be the most efficient from both a technical and economic standpoint, however, a diachotomy often exists between the two. For example, a solar energy system of drying seed would be an efficient method of drying beans if the criterion were to minimize fuel used. However, the cost of such a system per unit of beans dried may far exceed cost of using conventional methods. Interest payments on increased investment required to dry beans with a solar energy system may exceed fuel cost required to dry the beans by conventional drying methods. Changes in input costs often affect relative economic efficiencies of systems. Using the sun as an energy source is receiving much more attention today than when fuel costs were much lower. The reason is two-fold: (1) higher cost of fuel to be transformed into energy to operate equipment and, (2) technological advances that have lowered the costs of transferring the sun's energy to energy in a form suitable to operate equipment.

Operational and Pricing Efficiency

Operational efficiency is concerned with the physical operations of a system. An operationally efficient system would be one that provides

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a given level of output at the lowest possible cost, given the existing level of technology. Stated differently it is having machinery and equipment synchronized to achieve desired levels of output at the lowest cost possible.

Pricing efficiency is concerned with the accuracy, rapidity and effectiveness with which information is generated and disseminated in the marketing process (4). Simply stated: products are priced according to their value -- Grade 1 soybeans should command higher prices than Grade 2 soybeans. This concept is beyond the scope of this paper. The next two concepts will have more bearing on our topic.

Micro and Macro Efficiency

Micro efficiency is concerned with intrafirm (within the firm) efficiency. Micro efficiency has to do with the inter-relationship of stages of a firm's activities where all stages are combined to produce given levels of output at the lowest possible cost, given the level of technology.

Macro efficiency is concerned with interfirm (among firms) efficiency. Macro efficiency is essentially the same concept as micro efficiency except that the stages are firms. Thus, from a macro standpoint the most efficient system would be one that would provide the goods and services required at the lowest cost, given the level of technology and goals of society. "Goals of Society" is mentioned because system inefficiencies are often tolerated in preference to relinquishing certain freedoms, reducing employment, decreasing price competition, or allowing of greater concentration of economic power (3, p. 195).

The micro-macro concepts, as presented, often do not fit the industry as neatly as we would like. If seed processing is the only activity of an organization, we have no problem from a definitional standpoint; however, if the seed processing plant is part of a larger organization then the plant is only a stage in a firm, thus confusing the issue.

Costs

Thus far, we have delved into definitions of efficiency but have not given much thought to efficiency measures. Economic efficiencies are not as easily measured as technical efficiencies. The complexibility of firms and the ranges of activities that are carried on by different firms within the industry makes this issue even more complex. Hopefully, however, I will be able to touch on some points that should be common to all types of firms.

Several times today the word cost has been mentioned in the definitions. Which costs should we consider and why? We will divide costs into four classifications for this presentation. Other economists may use different categories and different classifications. Cost categories I would like to consider are: fixed costs, variable costs, joint costs, and administrative costs. Often all costs are placed in the first two categories. Fixed costs (or ownership costs) are the cost incurred regardless of the processing level or the amount of time the plant

operates. Depreciation, taxes, insurance, maintenance, and interest on investment are components of fixed costs. Variable Costs (or operating costs) are the costs incurred in processing. These costs would vary with the processing level and amount of time the plant operates. Components of variable costs in processing are: fuel and power costs, maintenance and repairs to equipment, supplies and equipment, and production worker labor. As stated above, most analytical work would classify costs into these categories only. I will define two additional categories now, and the reason for using them will become clearer after the next section. Joint Costs are the annual ownership costs associated with land, buildings, and improvements (1, p.6). Administrative Costs are associated with management, supervision, and general office operations (1, p.6).

Stages

By now it should be obvious that one of the "keys" to efficiency is "knowing your costs". As a means of reference, I will use information from a study recently completed in the Agricultural Economics Department at Mississippi State University (2). The objective of this study was to provide cost estimates associated with operating alternatives sizes of seed processing firms. The sizes of plants selected were: Plant I; 150,000 bushel capacity; Plant II; 300,000 bushel capacity; and Plant III; 600,000 bushel capacity.

The product mix considered for these plants was: soybeans, 60 percent; wheat, 20 percent; and rice, 20 percent. The Seed Technology Laboratory of Mississippi State University furnished the plant designs. Operational characteristics were derived by case observations and consultations with professional workers. To facilitate cost estimation, this study divided plants into stages. The stages selected were: receiving, drying and bulk storage, processing, bagging and bag storage. The joint and administrative costs were specified separately. It was also assumed that the plant was the firm's only operation.

Some firms may have the added stages of acquisition and/or distribution of the products, while still others may have operations where the plant itself is considered as a stage or minor part of a larger organization. For example, labor used in the seed plant may have its duties in other segments of the business operation just as a plant superintendant would have duties with all of the aforementioned stages of the operation. For purposes of our discussion the 300,000 bushel capacity facility will be used. Total annual costs as a percentage of total cost by stage and by cost component are shown in Table 1. The total cost (1973 figures) for this plant was $230,031.50 or .77 cents per bushel capacity (2). Calculating plant costs by stages permits inefficiencies to be easily observed. In addition, one could better evaluate the effects of changes in the system or plant.[2/] These data would also enable one to consider alternatives to the current operations such as "in and out" custom cleaning.

2/If cost data were kept over several time periods inefficiencies and/or the efficiency of changes could more easily be evaluated.

Table 1. Annual cost as a percent of total cost, by cost component, three model seed processing plants, Mississippi, 1973.

Plant and cost components	Annual Cost				
	Fixed	Variable	Other	Total	Per Bu.
	------Percent of total cost-------				Cents
Plant I (150,000 bu. capacity)					
Stage I: Receiving	5.5	3.4		8.9	8.3
Stage II: Drying and Bulk Storage	9.5	10.0		19.5	18.1
Stage III: Processing	7.9	19.4		27.3	25.4
Stage IV: Bagging	0.4	16.9		17.3	16.1
Stage V: Bag Storage	7.5	10.0		17.5	16.3
Joint Cost			2.7	2.7	2.5
Administrative Cost			6.8	6.8	6.3
Total	30.8	59.7	9.5	100.0	93.0
Plant II (300,000 bu. capacity)					
Stage I: Receiving	3.7	3.0		6.7	5.2
Stage II: Drying and Bulk Storage	7.7	11.2		18.9	14.5
Stage III: Processing	6.3	15.3		21.6	16.6
Stage IV: Bagging	1.5	21.1		22.6	17.4
Stage V: Bag Storage	7.4	11.5		18.9	14.6
Joint Cost			2.0	2.0	1.5
Administrative Cost			9.3	9.3	7.2
Total	26.6	62.1	11.3	100.0	77.0
Plant III (600,000 bu. capacity)					
Stage I: Receiving	3.2	4.3		7.5	5.2
Stage II: Drying and Bulk Storage	8.0	12.0		20.0	14.0
Stage III: Processing	5.1	14.7		19.8	13.8
Stage IV: Bagging	0.8	21.1		21.9	15.3
Stage V: Bag Storage	6.1	15.8		21.9	15.3
Joint Cost			1.4	1.4	1.0
Administrative Cost			7.5	7.5	5.2
Total	23.2	67.9	8.9	100.0	70.0

Improving Efficiency

Let's turn our attention to some "keys" to efficiency improvement. We will discuss several factors that may aid in improving efficiency. First, one should be sure that technical organization of his plant is such that it is operating efficiently. The firm's men and equipment should be organized to achieve maximum technical efficiency at the lowest possible cost. Care should be taken, however, not to sacrifice quality. The lowest cost operation does not necessarily mean maximum profits.

Secondly, plant efficiency may be improved by the addition of new kinds of seeds and/or new varieties which extend the period of operation. For example, adding wheat and rice to a plant cleaning only soybeans or adding a later maturing soybean variety to those already being cleaned. Care should be taken to be sure that one has the proper facilities to handle the additional.

Thirdly, one may want to expand the size of his operation. In the study previously cited, per bushel annual cost estimates were as follows: Plant I (150,000 bushel capacity), 93 cents; Plant II (300,000 bushel capacity), 77 cents; and Plant III (600,000 bushel capacity), 70 cents (2). Several factors should be given consideration when expanding. Questions to be asked are: (1) What will be the effects of my expansion on the total industry? (2) What will be the effects on the local industry? (3) What organizational changes will have to be made within the firm due to expansion? (5) Is there a market for the added kinds and/or varieties of seed processed?

Fourthly, one may consider adding a custom cleaning operation. Custom cleaning may improve efficiency by helping "spread fixed costs", improving labor utilization, and adding revenue to the firm. Let's look a little closer at Table 1, to evaluate the alternative of custom cleaning. In the 300,000 bushel plant, total costs were estimated to be 77 cents per bushel operating at 100 percent of capacity. As stated, fixed costs would not be relevant; the bag storage stage variable cost would not be relevant either, and possibly a portion of both joint and administrative cost could be omitted. Omitting the fixed costs and bag storage segments from the cost components would reduce the cost by 38.1 percent or 29 cents per bushel. Therefore, any returns above 49 cents per bushel could help to make the operation more efficient. This type of decision would have to be made on an individual plant basis. In some cases this may not be a viable alternative since labor may be fully utilized in other segments of the firm's operation.

Lastly, but surely not least, "know your costs". Plant costs should be estimated at each stage of the operation. Dividing the plant and calculating costs this way helps to point out inefficiencies and also enables one to more adequately evaluate prospective changes. The stage designations and number of stages used are arbitrary; however, I feel that this is a valuable technique. In most cases the manager and/or accountant should be able to reasonably allocate cost items to their respective stages.

Now, I would like to reflect on the micro efficiency macro efficiency concept discussed earlier. In all cases it is imperative that we have optimum plant organization and that we know our costs. However, decisions may be different for some plants depending on whether the processing plant is the firm's only activity or whether it is part of the larger organization. To clarify the point, a few examples are offered. Let's first look at a seed processing plant as the total firm in order to determine ways to make the operation more efficient. Alternatives are to add new seed (varieties or kinds) to the line to more fully utilize labor at different times during the year. In-out custom work and/or increasing the size of the operation are other alternatives that may help a plant become more efficient.

In another type firm the seed processing plant may only be a portion of the enterprise. Managers and/or labor may have other duties in addition to those assigned in the seed processing plant. In fact, in some cases the seed processing segment of the firm may be a means of more fully utilizing excess labor from its major functions. Thus, there is an added dimension to the "efficiency improvers" presented for the firm where the seed processing plant was an end in itself. Adding in-out custom work may require extra men to perform duties previously being performed by workers from another of the firm's operations. The question is whether the overall system becomes more efficient or will only the seed operation become more efficient? If there is not an overall gain to the firm, management may decide to live with inefficiencies in the seed processing operation.

In some cases, changes in a particular firm may have a significant effect on the industry in a particular locale. If the efficiency move were to come in the form of expansion these effects would need to be considered explicitly. Throughout we have not talked about acquisition and distribution of seed not have we discussed quality. All of these factors need to be considered when major changes are to take place in an operation.

I have enjoyed talking to you and I hope that I have given you some food for thought. I'm sure that some people here work in firms where the techniques and thought processes for decision making may be far more elaborate than those presented, and others may be in firms where decisions are made with much less information than would be generated by some of the techniques proposed. I cannot stress enough that one would need to "know his costs" at any level if proper decisions are to be made.

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