The objective of machinery management is that it must contribute to total management in a cost effective manner. Understanding the different cost components and applying sound economical principles throughout the machinery system will contribute positively to the profit of the farm business.

BACKGROUND

PART I

1. INTRODUCTION

CHAPTER OBJECTIVES:

- ***To introduce the reader to an economical approach to agricultural machinery management;***
- ***To describe the difference between the mechanical side and the economical side of agricultural machinery management;***
- ***To discuss the importance and justification of agricultural machinery;***
- ***To explain the factors that influence machinery selection;***
- ***To describe time efficiency when using agricultural machinery.***

The ability of the farmer to select the proper machinery is a valuable function as many activities relate to it. In the final analysis, the selection must increase yields and must add value to the total farm business. This makes machinery management the most complex function for the farm manager as it involves owning and operating the machine. Owning the machine involves capital and this capital must return a profit. It will only return a profit when it is active, but operating the machine involves costs. This then, is the fine balancing act of machinery management: invest the correct amount of capital to do the farm operations in the most effective way at the lowest cost. This may sound simple but it means that the farmer must understand all the different cost components and managerial concepts to machinery management, he must know the physical side of matching tractors and implements, he must maintain and repair his machinery and calculate the cost of doing so, he should replace obsolete machinery at the appropriate time with the best financial alternative and must always strive to use his machinery more effectively. The reason for doing so is to add the most value to his profit.

Adding value to profit means that agricultural machinery management must have an economical approach. If this is not the case, the farmer doesn't have an economical approach to farming as a whole and will not survive the financial challenges of his farm business.

1.1. JUSTIFICATION OF MACHINERY

The use of agricultural machinery adds cost to the farm operation. The question is: is this extra cost worthwhile? In all cases the approach should be to determine if the additional cost adds value to the profit of the farm business.

Reduced drudgery

The use of machinery may not always increase profit directly. However, the positive effect of those machinery that reduces hard and dirty work can have an indirect improvement on the productivity of the staff and will retain their loyalty. Examples of machinery that can do this are equipment for grain handling, pallet handling and manure disposal.

Increased returns

The use of machinery can increase returns in five ways:

- An investment in, for example, irrigation will directly increase returns;
- Having available a wide range of implements for different soil conditions, will increase yields through effective operations;
- Getting the cultivation done within the optimal time frame will increase yields through improved timeliness;
- Equipment that reduce the damage to products will increase price through improved quality;
- The use of storage to make better use of market conditions can increase prices.

The ineffective use of machinery on the other hand, may have a decrease in returns.

Reduced costs

The main reason for using machinery is to reduce cost, specifically labor cost.

Replacing labor cost

The farmer may sometimes be forced to use machinery because of his inability to obtain suitable labor. He may prefer labor in these cases if it was available.

1.2. MANAGERIAL APPROACH

The main objective of overall farm management is to plan for maximum sustainable profit. Machinery management is part of overall management and this means that the managerial objective of mechanization should also be maximum sustainable profit. It must be part of forward-looking decisions on vital questions like how much of each commodity must be produced and how the various enterprises of the farm will be knit together to form an effective farm business as a whole.

Profitability is influenced by a combination of many factors. They must all be considered as important as some of the factors that may be decisive, cannot always be measured on a cash basis. Overlooking some of the indirect consequences can have a severe negative result on profit. This is definitely the case with machinery as it involves various cost components of which a number are indirect. Special attention must therefore be given to machinery management, as part of the overall managerial process.

1.3. MACHINERY MANAGEMENT

Although a mechanized system is more reliable and productive than a labor-intensive system, the farmer must always strive to make his end product, as far as pricing goes, as competitive as possible. This will determine his profit and not the convenience of one system above the other. However, farmers are giving more priority to machinery than to labor in recent years. The investment in machinery, as well as the number of tractors per farm unit, is on the increase while the amount of laborers is decreasing. Tractor size has also shown an increase and so did the size of the implements to go with the bigger tractors. These increases have contributed to more capital being invested per farm, larger farms to justify the bigger machines and more efficient use of labor.

Not only did the use of machinery in crop cultivation increased, it also did so in livestock production and the handling of materials. Physical labor requirements have been replaced by the use of small engines, electric motors, augers, elevators,

and conveyors in many places on the farm to reduce the cost of labor.

Mechanization in agriculture is a progressive development that began centuries ago with simple devices for harnessing the power of man himself, up to the big eight wheel tractors now in use. With the continued development of new technology, the process of mechanization will continue in the years to come and the scope for future development is limited only by the necessity for mechanization to be economic. This trend will enable fewer farmers to provide adequate food and clothing for the ever-increasing world population.

The increasing process of mechanization represents a larger investment of machinery on commercial farms. The farmer must be able to control the accompanying operating cost by four general methods:

- Avoid unnecessary machinery investment to reduce annual total fixed cost;
- Control the variable or operating costs;
- Increase annual use of machinery to reduce the average cost of ownership per unit;
- Utilize alternatives to ownership for acquiring machinery use.

Machinery management involves decision making about machinery, with the objective to increase profits. Machinery management and use are however related to enterprise combinations and the other resources applied on the farm. This makes it difficult to separate the importance of machinery from the total business and means that machinery management must always be seen in context with the rest of the farm operations.

1.4. THE MECHANICAL SIDE

The selection of farm machinery is often a blend of what the farmer thinks he needs and what the manufacturer thinks the farmer should need from the equipment they (the manufacturers) can produce at a profit. Therefore, the farmer's needs are mostly created by what the manufacturers offer and they will offer what they think the farmer will buy.

The farmer must strive to optimize the efficiency of his farm operations with the available equipment. He has to do this within the unique characteristics of agriculture, namely:

- Rather small scale operations, diversified enterprises and special local conditions on each farm;
- Seasonal production that means that most of the machinery will stand idle for most of the year;
- Operating with a shared power source, the tractor. (Changing any combinations will effect the whole system);
- The availability of farm labor;
- The timeliness of operations.

From the mechanical side, agricultural machinery is a set of available tools that can be used to produce goods. These tools must use the minimum power to perform the task as efficient as possible at the lowest cost.

1.5. AN ECONOMICAL APPROACH

The problem of managing agricultural machinery is one of adjusting the factors of implement performance, power availability, labor, timeliness, and cost until it results in an optimal economic return. Although the mechanical side plays its part, the farmer should finally approach machinery management from the economical side. The cost of doing a certain operation must be less than the eventual income it will generate.

Optimal machinery management will occur when the economic performance of the total machinery system is maximized. This means that the successful farm business, composed of several enterprises, will apply the machinery to produce goods at a profit. The performance of the machinery system from an economical approach will be profitable when it can add value to products and processes above the cost of owning and operating the machinery.

It may seem that minimum cost is the best way to increase profits. This is however not always the correct approach as profit maximization must be the true

goal of any business. On a farm it does not necessarily occur at the point where cost are at a minimum. This means that some machinery operations cannot be done at minimum cost but as a necessity, will contribute to maximum profit. Good machinery management, therefore, requires that each operation within the machinery system must be adjusted and combined in such a way that overall performance returns the biggest profit to the farm business. With a few changes in terminology, this will be the exact requirement the agricultural engineer will strive for when developing a machinery system. To achieve this, the engineer and the economist will both concentrate on the hardware, the energy, and the human labor to get machine performance, power performance, and operator performance to add value to the farm business.

Machine performance

Measures of the performance of agricultural machinery are the rate and quality at which the operations are accomplished. Rate is important because the timeliness of agricultural operations due to its sensitivity to climate can influence the effectiveness of the operation. At the same time, the operation must be done without wasting parts of the product. Most agricultural materials are fragile or perishable and the machine should not damage or reduce the quality of the product. Measuring machine performance must therefore take into account that the operation must be done as speedy and as complete as possible to maximize profit.

Power performance

The economical performance of a machine can also be measured by the effectiveness with which power is applied to accomplish the farm business's production objectives. Power is the rate of doing the work, meaning applying force over a distance. Tractor power is currently the main power source on most farms, but to apply this power cost money. Many costly factors can influence this power performance and an economical approach to it means the application of power must once again add value to the profit of the farm business.

Operator performance

The farmer may be quite knowledgeable about the machine and power performance but unless the operator's performance is also high, the total performance of the machinery system may be low. Optimizing the type, amount and value of required operator labor for an operation will add value to profit. In addition, the operator must also operate in a safe environment.

1.6. MACHINERY SELECTION

One of the more difficult problems in machinery management is to match the proper implement to a power source. It is not only the wide range of types and available sizes that complicates the process but also the availability of capital, labor requirements and the different enterprises that matters.

Selecting machinery will necessarily be based on anticipated performance and costs since future variables can never be known exactly. The most pertinent variable is the size or capacity of the machine. This will determine the working tempo and eventually the amount of work that can be done within a given time frame.

The object of machinery selection is to purchase the machine that will perform the required operation within the time available at the lowest possible cost. This purchase will not necessarily results in the smallest machine because labor and timeliness cost must also be considered.

Selecting machinery for a farm business involves a mechanical as well as an economical approach. As this selection is one of the pillars of agricultural machinery management, a whole chapter will be used to describe this process.

1.7. TIME EFFICIENCY

The time a machine is not actually processing the field is calculated as wasted time. It is impossible for a machine to be 100% efficient due to the following:

- Machine preparation time at the homestead;
- Travel time to and from the field;
- Machine preparation time at the field before and after the operation;
- Turning time and time crossing waterways;
- Time to load or unload the machine;
- Time to adjust the machine;

- Maintenance time (refuelling and lubrication);
- Repair time (replacing certain spare parts);
- Operator's personal time.

These elements increase machinery cost and the more efficient it can be managed, the more productive time the machine spends on the field. The latter is the activity that adds value to profit.

1.8. MACHINERY EFFICIENCY

The efficiency of machinery can be measured in financial terms. Two aspects must be measured namely the efficiency of the invested capital and the efficiency of the operating cost.

Invested capital

Invested capital can be measured as *investment per tillable hectare*, which is calculated by dividing the current market value of crop machinery by the number of tillable hectares. The lower the value of this result, the more effective is the invested capital if there is no timeliness cost.

Operating cost

The operating cost can be measured as *operating cost per tillable hectare*, which is calculated by dividing the total annual machinery cost (ownership and operating cost) by the tillable hectares. The optimal use of machinery is that point where the difference between the cost of owning and operating the machine and the value it adds to the profit is the highest.

1.9. EXCESSIVE MACHINERY COST

When the efficiency measures indicates an excessive level of machinery cost, some of the following factors may have contributed to the high cost:

- Over-mechanization with no compensation for cost savings;
- Correct mechanization but with no saving in labor cost;
- Mechanization without the necessary ancillary equipment;
- Excess capacity: too many or too large machines;
- Insufficient specialisation: too many and too small enterprises with a full complement of machines for each;
- Small buyers buying new instead of reliable second-hand machines;
- Too early replacement;
- Too much machinery purchased for tax-reducing purposes;
- Too little use made of contractors;
- Excessive repair cost through too little maintenance, ill-usage or inadequate skills;
- Excessive fuel cost;
- Wasteful mechanisation.

There is a fine balance between excessive machinery cost and just the correct amount of mechanization. When the machinery is costing more than the value it adds to the profit, mechanization is not economical.

1.10. IMPROVING EFFICIENCY

A number of techniques can be employed to improve machinery efficiency. Choosing the optimum size of machinery and comparing alternatives for acquiring machinery services have already been referred to. Three other areas that have an impact on machinery efficiency are maintenance and operation, extending machinery use and the replacement policy.

Maintenance

The farmer must distinguish between maintenance and repairs. The less precautionary maintenance the farmer will do, the more unexpected repairs he will have to do. Constant attention and proper training of machine operators can correct excessive repair cost.

Operation

The way in which the machine is operated will affect both repair cost and field efficiency. Speed should be adjusted to load a machine to capacity without overloading it or lowering the quality of work being done.

Extending machinery use

Low annual use of expensive specialized machinery contributes to high machinery cost. Some owners exchange the use of this kind of machinery or perform custom work to reduce the fixed cost of these machines.

Replacement

One of the most difficult decisions in machinery management to make is to replace a machine at exactly the right time. This aspect will be discussed in more detail in Part IV. For the moment it is sufficient to say that a moment too soon or a moment too late will make a difference in cost.

1.11. CONCLUSION

For several decades now, mechanization showed a continued increase on farms all around the world. As long as it reduces costs directly or indirectly in the farm business, it can be justified.

An economical approach to machinery management means that the machinery system must add value to profit. It is however a continuing and complex process involving owning the machine and operating it while keeping the cost as low as possible and generating the highest return on investment. This must all be done at the appropriate time within the correct time period.

Getting the best efficiency from the invested capital means that the matching of power source and equipment must be optimised. These combinations must then

be maintained through a thorough maintenance and repair program and the regular replacement of obsolete machinery.

Knowledge of the different cost components involved in machinery management and knowing how to manage them will help the farmer to optimise his investment in machinery.

1.12. REFERENCES

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