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STAFF PAPER P88-32

SEPTEMBER, 1988

FARM BUSINESS AND ENTERPRISE ANALYSIS

by Kent D. Olson



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Farm Business & Enterprise Analysis

by Kent Olson

Where do we start the financial analysis of a farm? Do we start with the cash flow statement and the "times interest earned ratio"? Or do we look at the tax return first? How can we find the problems that need to be solved? This paper describes one procedure for the initial analysis of a farm and another procedure for diagnosing problems confronting the farm.

Before we start any analysis, we need to realize that its purpose is to find problems and to develop potential solutions to those problems. Alternatively, we can say our purpose is to find opportunities and to develop plans to take advantage of those opportunities. However, what we often see first (especially in financial analysis), are symptoms of the actual problems or opportunities. For example, while a low rate of return on equity is a problem in one sense; it is actually a symptom or manifestation of a problem elsewhere in the farm business. The low rate of return is not a problem that can be corrected in itself. Another example is solving a "problem" of poor returns to one enterprise, for example dairy, by selling the cows when the real problem is improper nutrition causing poor milk production which, in turn, causes the poor returns; the real solution is to feed the cows properly--not sell them. What we need to do is to find the symptoms and then explore and analyze the business in depth to find the problems that need to be solved.

Several points need to be remembered in analysis. First, the initial analysis should be used to find areas that need more analysis. We should not try to analyze everything and every part of the business in the initial analysis. Second, calculating every possible measure and ratio

will only confuse the analyst and the manager. In this paper, the list of measures and ratios is kept short on purpose. In subsequent analyses, other measures and ratios may be calculated and used to help ferret out the problem whose symptom has been found in the first step of the analysis. Third, financial statements should be interpreted in the light of the history of farm, the history of its environment, its current environment, the goals for the future, and the farm's objectives and standards.

This paper is organized into two main sections and several smaller sections. The first two sections describe the procedures for the initial analysis of a farm business and for diagnosing the problems (or opportunities) facing the farm business. Measures of profitability, solvency, liquidity, financial stress, and efficiency are described next. The remaining sections cover the steps for taking an inventory of the farm's resources, for checking the accuracy of the records, and for developing enterprise budgets from whole-farm records.

AN INITIAL PROCEDURE FOR FARM BUSINESS ANALYSIS

There are many ways to analyze the financial condition of a farm. The procedure described in this section is for a first-time analysis of a farm assuming there is no previous knowledge of this farm. This procedure is not the only procedure that will work. It is offered as a guide to be used as described or to assist the development of the reader's own analysis procedures. This procedure is designed to find the areas that have problems or opportunities so that further analysis can focus quickly on those areas.

The steps to analyze the overall financial condition of a farm are:

1. Gain an overview of the farm
2. Specify the objectives, goals, and standards of the farm
3. Check the accuracy of the records
4. Prepare the "BIG Three" financial statements
5. Evaluate profitability
6. Evaluate solvency
7. Evaluate liquidity
8. Evaluate financial stress
9. Examine prices received and paid
10. Scrutinize efficiencies
11. Analyze livestock and crop enterprises
12. Analyze internally, historically, vertically and comparatively
13. Evaluate managerial ability & personal characteristics

Let us take a closer look at each of these steps.

Gain an Overview of the Farm

What is the location of the farm and its major enterprises? How large is the farm? What is its history? What are the characteristics of the farm family(ies): size, participation, interests, etc.? What are the management abilities and risk attitudes of the principals involved in the farm business.

One step that could be taken at this time, especially if the analyst has no prior experience with the farm is to complete an inventory of resources for the farm. This step is also necessary if the financial statements are not available. The process of taking an inventory is described in a later section, "Inventory of Resources."

Specify the Objectives, Goals, and Standards of the Farm

Objectives, goals, and standards are compared against actual performance and plans. They tell us what the owners, operators, managers, and family members want to do and where they want to go. If we do not know the objectives, goals, and standards, we will not know how to evaluate or "grade" the performance and condition of the farm.

Objectives, goals, and standards are similar yet different. Usually, goals are thought of as the long-run or final items to be attained, such as retirement by 60 or the farm paid in 10 years. Objectives are the specific items that a person wants to accomplish in a shorter time period (say a year). Objectives may be items like a dairy herd average of 18,500 pounds of milk per cow, a corn yield of 180 bushels per acre, feed costs of \$35 per feeder pig (given the assumptions and practices of a farm). Standards are very similar to objectives except standards tend to be more realistic in expectations. Objectives are what we strive for knowing that

we may not be able to reach them. Standards are what we wish to be measured against because we feel that we should be able to grasp or attain those goals.

The development of objectives, goals, and standards should involve all the principals of the farm: the operator(s), other partners and equity holders, and family members. They can be developed from:

- past performance
- comparable farms
- experiments and recommendations
- requirements by a bank, the government, or other institution
- dreams and expectations
- "normal" prices, yields, efficiencies
- what the "experts" say.

Check the Accuracy of the Records

In order to trust the results of the analysis, we must trust the initial information used for the analysis. There are various accuracy and consistency checks which can be performed to assess the accuracy of those records. These are explained in the section titled, "Checking Record accuracy."

Prepare the "BIG Three" Financial Statements

Once the records are deemed accurate (that is, accurate enough), the

"BIG Three" financial statements should be prepared.¹ These are the:

- Income Statement (or profit/loss statement)
- Net Worth Statement (or balance sheet)
- Cash Flow Statement

The income statement shows the difference between the gross income and the costs incurred to produce that income. It includes both cash and noncash income and expenses, accounts for inventory changes, and is for a period of one year. It **does not** include transactions such as machinery purchases or sales and loan principal payments or receipts.

The net worth statement (or balance sheet)² shows the assets and the liabilities of a business on a particular date. Assets are valued on a cost-less-depreciation basis or a current market value basis; a double-column net worth statement will include both values. The net worth (or owner's equity) is the difference between the total assets and the total liabilities.

¹Examples of these three statements are in the appendix.

²The difference between the net worth statement and the balance sheet is only slight and comes from the accounting procedure used to develop the information. With double-entry accounting, capital accounts are used to keep a separate balance for the equity or net worth levels of the owners. When the financial statements are prepared, the total of the liability accounts is added to the total of the capital accounts and compared to the total of the asset accounts. The term "balance sheet" comes from the check to see if the totals do, indeed, balance with each other, thus signaling correct calculation. With other methods of accounting, the separate capital accounts are not kept. So when the financial statements are prepared, the total liabilities are subtracted from the total assets to obtain the net worth or equity of the owners. To add the net worth calculated in this manner to the total liabilities and then compare this to the total of assets and call it a "balance sheet" seems quite redundant. So if the double-entry accounting system is not used, I prefer to use the "net worth statement" title.

The cash flow statement shows the flow of cash in and out of a business usually on a monthly basis. It covers a period of one year but may include cash transactions which are not due to production within that year. For example, it may include grain sales from the previous year and prepaid expenses for the next year in addition to income and expenses for the current year. The cash flow statement includes only cash items. It **does not** include noncash items such as depreciation, milk from the farm's dairy cows fed to the farm's calves, or corn grown on the farm which is fed to livestock on the farm. However, it **does** include cash transactions such as the receipt of loans and the payment of loan principal which are not included in the income statement.

Further descriptions and explanations of these three statements can be found in Boehlje and Eidman (1984, pp. 34-80), Osburn and Schneeberger (1983, pp. 92-120), and Libbin and Catlett (1987, pp. 171-243).

Evaluate Profitability

Profitability is usually the first goal of farmers, so it is listed first in the analysis procedures.³ When analyzing profitability, we are concerned not only with the absolute amount of profit but also with the relative amount. Indirectly, it also measures the managerial ability of the farmer. We are interested in (1) whether the actual level of net farm income provides enough for family living and other commitments, and (2) whether that net farm income is adequate relative to a farmer's equity capital investment, the unpaid operator and family labor used in business,

³Under different circumstances, say when liquidity is known to be the main problem, other aspects of the farm's financial condition may be diagnosed first.

and the contribution of management ability. Important measures of profitability include gross cash income, net cash income, accrual net farm income, and the rates of return to equity and assets. For a fuller discussion of these measures, see the section titled, "Measures of Profitability."

Evaluate Solvency

Solvency evaluates the asset-liability balance at a particular point in time. It measures both the ability to repay all debts and the ability of the firm to financially withstand periods of poor profitability and, if measured with assets at market value, decreases in asset values. Solvency does not consider past or future profitability or liquidity. It only considers the farm's condition on a certain date. Important measures of solvency include the net worth, debt-to-asset ratio, and leverage ratio. These and other measures are discussed in the later section, "Measures of Solvency."

Evaluate Liquidity

Liquidity is the ability of the firm to meet its financial obligations in the next twelve months. Traditionally, liquidity has been measured by the level of working capital and the current ratio. The "acid-test" ratio is very similar to the current ratio but counts only those assets which can be turned into cash very quickly. Both the current ratio and the "acid-test" ratio ignore a firm's cash inflow and outflow. So to look at a business' ability to generate cash to meet obligations, two other ratios are being used now: the debt service ratio and the debt servicing coverage ratio. These liquidity ratios and some others are discussed more fully in the section, "Measures of Liquidity."

Evaluate Financial Stress

The traditional measures of profitability, solvency, and liquidity in the agricultural sector have a major problem in being unable to measure and(or) predict future inability to service debt and other commitments, that is, financial stress. Initially, the debt-to-asset ratio was used to evaluate stress levels; but realizing that the debt-to-asset ratio ignores the flow of money, three other ratios have been proposed.⁴ These "new" ratios are the times-interest earned ratio, the debt burden ratio, and the financial leverage ratio. They are described in more detail in the section, "Measures of Financial Stress."

Examine Prices Received and Paid

The prices which a farmer receives or pays can indicate marketing ability, market timing, storage, discounts and other factors. However, any analysis of prices should be done with a good knowledge of the farmer's marketing plan. For instance, a farmer without storage cannot take advantage of large purchase discounts or pre-season sales, but the farmer may have already decided that the costs of owning storage is greater than any potential price discounts. The same reasoning needs to be applied when analyzing prices received. There are two questions which need to be answered: (1) was the best price obtained under the farmer's marketing plan, and (2) does the marketing plan need to be changed? In this analysis, we are looking for good and bad problems to find opportunities for improvement.

⁴Penson, J. "Evaluating Financial Trends in Agriculture", Agricultural Finance Review, Vol. 47, Department of Agricultural Economics, Cornell University, Ithaca, New York, 1987.

When evaluating prices received several items needed to be checked. Products marketed in a timely fashion will usually command a higher price. To be timely, a farmer needs to monitor the markets and watch for signals which indicate changes in market patterns and seasonal differences. Market strategies such as hedging, options, contracting, etc., need to be used to their best advantage and just not always used or never used. Also, inattentiveness to quality can cause price penalties at marketing time. Quality problems can be caused by many problems such as improper ventilation in grain storage or feeding livestock to weights which receive price penalties (unless market movements indicate that prices are going up faster than the price penalty). A good indicator of marketing performance is the price received rate:

$$\text{price received rate} = \frac{\text{ave. farmer's price}}{\text{ave. market price}} * 100$$

The "ave. farmer's price" is what the farmer actually received for all his/her product. The "ave. market price" is calculated from market information for the general market area where the farm is located.

The analysis of prices paid is done similarly to the analysis of prices received. Supplies purchased in a timely and orderly fashion should obtain more favorable prices for the farmer. The price paid rate is a good indicator of input purchasing ability:

$$\text{price paid rate} = \frac{\text{ave. farmer's price}}{\text{ave. market price}} * 100$$

Scrutinize Efficiencies

There are two main areas of efficiency: economic and physical. Economic measures of efficiency are in the financial, managerial,

marketing areas. Physical ratios and measures include crop yields and livestock production per animal. Efficiencies are discussed in the section "Measures of Efficiencies."

Many of these efficiency measures need to be considered simultaneously. For example, low labor efficiency may be found on farms with high machinery inefficiency because there may not be enough machinery on the farm. Another farm may have high labor efficiency and low machinery efficiency due to overcapitalization in machinery. A low asset turnover rate may also indicate overcapitalization.

Analyze Livestock and Crop Enterprises

So far the analysis has focused on the whole farm level without explicitly considering the parts of the business, that is, its crop and livestock enterprises. At this point in the analysis, the enterprises need to be analyzed individually. The need to evaluate the enterprises is due to the need to discover problems and opportunities which were hidden at the whole-farm level and to answer questions which have been generated during previous analysis, such as why prices or yields are low.

Enterprise analysis can also help answer questions such as: should I stop growing crops and specialize in dairy or vice versa?

Basically, enterprise analysis is the same as whole-farm, but limited to one enterprise. However, the process of getting enterprise information can be involved. The steps for developing enterprise budgets from whole-farm information is discussed in the section "Developing Enterprise Budgets from Whole-Farm Records."

Once enterprise budgets are prepared, the analysis of enterprises can be done in three ways.

1. Gross Margins (or contribution to overhead expenses)

The gross margin (gross income minus variable expenses) is used for short-run analysis. On a per unit basis (e.g., per acre or per dollar invested), gross margins can be used to decide what to produce and how much of each product to produce. Gross margin analysis ignores fixed and sunk costs in the short run.

2. Allocation of direct and indirect expenses and income

This type of enterprise analysis includes both variable and fixed costs to estimate the enterprise's contribution to whole-farm profit. The allocation of indirect expenses can be an arbitrary process but to evaluate the enterprises in a longer-run basis, the allocation needs to be done.

3. Allocate assets and liabilities to enterprises

This level of analysis involves more arbitrary decisions on what assets and liabilities (or share of each) "belong" to each enterprise. With this allocation, a financial analysis can be done for each enterprise including profitability, solvency, liquidity, financial stress, and efficiency analysis. While some people argue that this type of analysis can't be done because enterprises do not own assets or take on debt by themselves, how else can long run decisions be made concerning starting and quitting major enterprises?

In whatever way the enterprises are analyzed, the basic questions and subquestions to be answered are:

- (1) Is each enterprise being operated efficiently from an economic view? Does it produce the correct products? Does

it produce them with the proper mix of inputs? Is it the proper size?

- (2) Is the mix of enterprises appropriate for this farm, its management, and its economic environment? Is each enterprise of the correct size? What is the strategic position, or desired position, of the farm?

Analyze Internally, Historically, Vertically and Comparatively

Once the measures and ratios are calculated, there needs to be some point of comparison for analyzing these numbers. There are four main sources of comparative figures or methods of comparison: internal, historical, vertical, and comparative.

Internal. The goals, objectives, and standards are the first point of comparison. Are they being met? Is there sufficient income to meet the family's needs and run the business? Does the business perform up to expectations? Are the performance standards (such as crop yields, weaning rates, or debt repayment) being met or exceeded?

Historical. How has the business performed over time? What are the trends for the same farm business? Are the trends meeting plans and objectives? Is this year better or worse than previous years? (This method is sometimes called horizontal analysis.)

Vertical. Vertical analysis gets its name from its comparison of a column of numbers, say, income & expense items, and calculating each item as a percentage of the total income or expenses. Then the farmer or analyst can quickly see which item(s) dominates the other income or expense items. This provides information on which items need attention because they are a large component of the total. Vertical analysis can be

used when comparing with other farms to see how the mix of income and expense items differ or are the same.

Comparative. How does the business compare to other farms? One group of other farms should be similar in size and type to compare performance and efficiency. Another group of farms could be different to show the effect of different resource allocation and enterprise and strategy selection. These other farms should have their financial analysis done with similar methods so that comparisons are possible.

Evaluate Managerial Ability & Personal Characteristics

While evaluating people is a hard and subjective process, a financial analysis is not complete without this evaluation. Without this managerial evaluation, the probability of success can not be determined. Factors which need to be considered are: skills, knowledge, experience, capacity (to learn and to work), honesty, integrity, risk attitudes, goals, and drive. Other factors may be evaluated also depending on the geographic location, type of farm, and purpose of the financial analysis.

Final Points

Remember that one primary purpose of analysis is to identify those portions of the business which require further study for improvement or cessation. After completing a financial analysis of a farm, the opportunities and/or decisions that need to be made are:

1. Continue the farm business largely as it is.
2. Make adjustments or changes in the farming business that will result in a higher net farm income in the future or solve other problems. This requires a more thorough analysis of the business.
3. Liquidate the business, invest the capital elsewhere, and seek off-farm work.

When problems or symptoms of problems (or opportunities) are discovered in the initial analysis or are known to exist, the source of the problems need to be found. Usually this problem can be found with a more thorough analysis of the business, but having a diagnostic structure to follow can be helpful in the search for the solution. This structure or system is described in the next section.

DIAGNOSTIC ANALYSIS

Once a problem or symptom of a problem becomes evident or is evident before the analysis is started (e.g., inability to meet debt obligations), a diagnosis of the problem and its solution is needed. This is similar to the process used by a medical doctor or a veterinarian who, when confronted with symptoms, diagnoses the disease and its treatment.

Problem diagnosis and solution discovery start with the question of what's the problem or, rather, what's the symptom of the problem? Problems and their symptoms are usually tied to the lack of performance towards goals and objectives. Goals and objectives can include farm earnings level, wealth or equity growth, leisure, high yields, high milk production, new pickups, and many others. So problems and/or symptoms can be such things as: low income, insufficient money to cover debt payments, no time for vacation, no cash for a new pickup, second place in the yield contest, etc. The problem can also be competing goals, so farmers and their families may need to decide which goals have higher priorities than other goals. Priorities may also change as different levels of goals are attained; for example, income may be quite important until a certain level is reached at which point, vacation time becomes more important than higher income.

Once a problem or symptom is found, a structured diagnosis procedure follows a set of steps similar to those identified below. The procedures follow the discovery of an earnings or income problem. Other problems such as lack of wealth accumulation or lack of vacation time could follow similar procedures for finding solutions.

1. Is there an earnings problem?
 - a) Calculate these measures: net farm income, rates of return on equity and assets, residual return to operator's labor and management. Do these meet expectations? If not, continue.
 - b) Is the problem absolute or relative?
 - (i) It is absolute if there is just not enough money or cash inflow to meet expenses, debt obligations, family living, and other commitments.
 - (ii) It is relative if there is enough money and cash inflow, but earnings do not meet internal goals and standards and/or other farms have better earnings.
 - (iii) It might be both absolute and relative.
 - c) An absolute problem suggests an immediate cash flow problem while a relative problem does not.
 - d) Both relative and absolute earning problems can be either permanent or temporary or either organizational or operational.
2. Is the problem temporary or permanent?
 - a) A temporary problem is caused by an event which is not controlled by the farmer and not expected again. Temporary problems can be caused by events such as: drought, flood, or market collapse. If a problem is temporary, its solution can be developed knowing that it will not likely occur again. However, the short-run problems caused by "temporary" problems still can be very serious and dangerous to business survival.

- b) A permanent problem is due to a situation which can be expected to occur again. The situation may not last forever, but it is expected to last for more than one or two years.
- (1) Has a structural change occurred? This may not be a sudden change but a realization that a change has occurred or is occurring. Examples of these changes are: closing of slaughter plants at nearby locations, new processing plants built near the farm, changes in consumer demand (e.g., decreasing red meat consumption), the entry of other countries into the world trade market.
- (2) Is it a management problem? Some problems occur due to mismanagement of the farms resources. If these problems persist, severe financial damage could occur. These problems could occur in many areas of the business: organization, operation, marketing, finance, personnel, timeliness, etc.
- c) The distinction between permanent and temporary problems may be found by comparing the current prices, yields, inputs, etc. with their normal values. These normal values come from historical data for the farm and also for the local area and national trends. With these "normals", the current year can be put in perspective relative to trends, changes, and other geographical areas. If a farm's current year's figures differ from its own "normals", the problem is most likely temporary (unless it is the beginning of a permanent change). If a farm's current year's figures and its own "normals" differ

from the local and/or national "normals", the problem is most likely permanent.

3. Is it an operational or organizational problem?

a) Operational problems

- (i) What are the practices followed in implementing the production, marketing, and financial plans? Are they specified correctly and done in a timely manner?
- (ii) What are the production costs and efficiencies?
- (iii) How do the actual results compare with standards, expected values, "normal" values, and comparable farms?
- (iv) Each enterprise and other phase of the business (e.g., financial management) needs to be analyzed separately. The basic question is whether each enterprise or phase is performing well and as expected or is improvement needed?

b) Organizational problems are due to poor use of resources or lack of sufficient resources. If the enterprises met their standards and "normals" as described in the previous section on operational problems and there is still a problem, it's an organizational problem.

- (i) To solve this problem, we can:
 - (1) select a different enterprise combination,
 - (2) add more resources (land, labor, and capital), or
 - (3) decrease resources.
- (ii) To analyze the enterprise combination, calculate the enterprise budgets and analyze them for gross margins, profit contribution, asset requirements, and debt load.

Analyze alternative mixes of current and new enterprises to find a mix which increases earnings or solves other problems. If alternative enterprise mixes do not solve the problem, the problem is most likely a size problem.

(iii) Size problems.

(1) Is the farming unit large enough to take advantage of modern technology? Or to produce a large enough volume of sales to provide sufficient income? Is the farm using current technology but just not large enough? How, where, and when can it be expanded? What are the options for owning, renting, leasing, or hiring more resources and would they help solve the problem?

(2) Is the farm too large given its management level or is one area too large (e.g., acreage) compared to another area (e.g., labor and machinery resources). What are the alternatives to solve these problems? Decreasing the size of the farm may help solve problems if the smaller resource base can be managed more efficiently and still meet other objectives. Adding labor resources to an understaffed farm may be all that is needed to improve a farm that has expanded faster in land and livestock than in labor supply.

4. If the options considered so far have not solved the problem(s), the option of putting the resources into other

uses needs to be considered. This includes other employment for the operator.

An analysis tree may be helpful in this diagnostic process. An analysis tree starts with the discovery of the problem or symptom and proceeds through a series of questions or areas to study until the actual problem and a solution is found. It includes the same points listed in the procedures outlined above except it is drawn as a tree growing from left to right. With an analysis tree, the analyst works through the "branches" looking for the source of a problem.⁵

Another method of analysis comes from general business and the area of strategic management. This method is called S.W.O.T. analysis because it analyzes: Strengths, Weaknesses, Opportunities, and Threats. Strengths are those parts of a business which perform well and are strong, such as livestock or corn production. Weaknesses are those parts which do not perform well or are weak, such as marketing or alfalfa production. Opportunities are additional resources (e.g., a neighboring farm for sale or a market news service), new enterprises which can be undertaken (e.g., vegetables or livestock), and other changes that could be done (e.g., downsizing to a more efficient operation). Threats are things like IRS requirements, increased world competition in the grain markets, changes in government programs, and other external factors which impact the business.

⁵ Osburn and Schneeberger (1983, p. 138) show an example of an analysis tree.

MEASURES OF PROFITABILITY

There are several measures and ratios which help analyze the profitability of a farm. In all of these, the nonfarm and family portion of a set of records are excluded from the analysis unless explicitly stated otherwise. The measures and ratios singled out for the initial analysis of the farm's financial condition are defined and described below. With all of these measures, a higher value is always desired over a lower value.

Gross cash income (GCI) is the sum of cash sales before expenses are deducted. In some instances, the cost of the raw material (such as feeder cattle or seed) is subtracted but this adjustment is not done as often as it once was; these expenses are now listed and subtracted with the other expenses. The one major exception to this "new" method can be seen in the tax forms where the original cost of items purchased for resale are subtracted from the sales total even if the original cost was incurred in a previous tax year.

Net cash income (NCI) is equal to the gross cash income less cash expenses. It is sometimes called "net operating profit" but that is a misnomer in that it does not account for inventory changes or for depreciation.

Net farm income (NFI) is the income left after subtracting all expenses. On the cash basis, net farm income is net cash income less depreciation. On the accrual basis, net farm income is net cash income less depreciation and adjusted for inventory change. Accrual net farm income is the return to a farmer's management, owner's equity, and unpaid operator and family labor. (The return to taking on risk could be stated

explicitly, but is usually considered to be part of the return to management, equity, and labor.) Compared to cash net farm income, accrual net farm income gives a more accurate picture of the profitability of a farm within a specific year. With inventory change defined as ending inventory minus beginning inventory,⁶ accrual net farm income (ANFI) is defined as:

$$\text{ANFI} = \text{NCI} - \text{depreciation} + \text{inventory change}$$

The residual return to operator labor and management (RROLM) is the return remaining after subtracting a cost for the owner's equity in the farm business and the value of unpaid family labor. The cost for using equity in the farm should be the return that equity could have received in another investment of similar risk; this is also called the opportunity cost of that equity. The opportunity cost usually assigned to equity capital is the interest rate that could have been obtained in a savings institution. Although it violates the "similar risk" rule, the savings rate is used because it can be determined quite objectively and is understood easily. The opportunity cost of equity is the owner's equity multiplied by the savings rate. The value of unpaid family labor is determined from the labor rates paid locally. Thus, the residual return to operator labor and management (RROLM) measures the return to the operator's investment of time and management ability. It is defined as:

$$\text{RROLM} = \text{ANFI} - \text{opp. cost of equity} - \text{unpaid family labor}$$

⁶Except for the change in accounts payable which need to be defined as beginning minus ending.

The residual return to operator labor and management (RROLM) should not be confused with the opportunity cost of operator labor and management (OCOLM). The opportunity cost is what the operator could get in a nonfarm job. The residual return is what the operator does get from the farm. Thus, the comparison between RROLM and OCOLM will show how well a farmer is doing relative to his/her opportunities elsewhere.

The rate of return on equity (ROE) is the first of two relative measures of profitability. ROE measures the return to owner's equity relative to the size of that equity. ROE is essentially the same measure as general business' ROI where I is the owner's (i.e., stockholder's) equity investment. While a higher ROE is preferred to a lower ROE, the ROE also should be compared to the opportunity cost of equity capital, that is, the rate of returns available in alternative investments, such as savings or stocks. ROE is defined as:

$$\text{ROE} = \frac{\text{ANFI} - \text{opportunity cost of unpaid labor and management}}{\text{Total Equity}}$$

If any part of the ROE equation is negative or close to zero, special care is needed when interpreting the calculated ROE. If equity is positive and ROE is negative, it can be interpreted as a very negative event. If a farm's equity is negative, ROE can not be used very well for analysis and other measures may be more important to analyze than ROE. If equity is positive but very close to zero, ROE may be overinflated and comparison with other farms is impossible with ROE. In these cases of negative equity or low equity, ROA should be used instead of ROE. (ROA is described in the next section.)

The opportunity cost of unpaid labor and management includes both the value of unpaid family labor and the opportunity cost of the operator's labor and management (OCOLM). Both values are estimated from local, nonfarm labor rates and the amount of time spent working on the farm. A typical value for the operator's labor and management used in the 1980s in southern Minnesota is \$15,000. This value can change based on a farmer's abilities and the local job market; however, when comparing across farms, each farm should use the same opportunity cost of the operator's labor and management so that the farms will be compared on a consistent basis. When analyzing multiple operator farms, the opportunity cost of operator labor and management is increased by the number of operators. The opportunity cost of a part-time operator should be a proportion of that for a full-time operator; a common proportion is one-half for an operator who also has a full-time, nonfarm job. Similarly, instead of estimating the number of hours worked by family members, their value could be expressed as a proportion of a full-time operator. For example, a teenage child who does some work during the school year and works full-time on the farm in the summer could be valued at one-fourth to one-third of a full-time operator.

The rate of return on assets (ROA) is the second relative measure of profitability. ROA measures the return to all farm assets invested in the farm business relative to the total value of those assets. It includes both equity capital and debt capital so the interest paid on debts has to be added in the equation since it has already been subtracted in the calculation of ANFI. ROA is defined as:

$$\text{ROA} = \frac{\text{ANFI} + \text{interest paid} - \text{opp. cost of unpaid labor and management}}{\text{Total Farm Assets}}$$

ROA can be compared to alternative investment returns, but most importantly, it needs to be compared to the ROE. If the ROE is less than the ROA, it shows that the farmer is paying more for debt capital than he/she is earning. Thus, a symptom of a problem has been exposed and further analysis can show the actual problem.

MEASURES OF SOLVENCY

The first solvency measure is the net worth (NW) or owner's equity of the farm. The net worth is the difference between the total assets (TA) and the total liabilities (TL). It is the absolute measure of the "cushion" between asset values and liabilities. This "cushion" can be used for increased borrowing and(or) enduring loss in asset value.

$$NW = TA - TL$$

Two solvency measures show the farm's overall financial risk of the farm to the farmer and the lender. These two measures are the debt-to-asset ratio and the leverage ratio. They both show the amount of debt pledged against the farm's equity. With each ratio, a higher value shows that creditors have a larger share of farm assets and the farmer faces a higher level of financial risk. Since these ratios are very similar, they both contain the same information; the choice between the two depends upon personal preference and experience.

The debt-to-asset ratio (D/A) measures the size of the farm's debt load relative to the total asset value. This ratio has become popular in the past ten years during the agricultural financial crisis in the early 1980s. When expressed as a percentage, the debt-to-asset ratio quickly shows the extent to which the farm's assets are financed by debt capital versus equity capital.

$$D/A = \frac{\text{Total Liabilities}}{\text{Total Assets}} * 100$$

The farm's leverage ratio measures the amount of debt relative to the net worth or owner's equity. It shows the amount of debt held by a farm

for every dollar of equity. While the debt-to-asset ratio is used extensively in the press, the leverage ratio has historical importance and is still used by many people in the financial sector.

$$\text{Leverage} = \frac{\text{Total Liabilities}}{\text{Total Equity}}$$

Other measures of solvency use different formulations of net worth, total assets, and total liabilities so they do not yield any new information about the solvency condition of the farm. However, since they are used in some analyses and may be more easily understood by some people, these ratios are described below.

The net capital ratio shows the total assets relative to total liabilities. It is defined as:

$$\text{Net Capital Ratio} = \frac{\text{Total Assets}}{\text{Total Liabilities}}$$

The equity-value ratio measures the farmer's equity relative to the value of farm assets. It is the "mirror-image" of the debt-to-asset ratio. Increases in the equity-value ratio show improvement in the financial condition of the farm. It is defined as:

$$\text{Equity-Value Ratio} = \frac{\text{Net Worth}}{\text{Total Assets}}$$

MEASURES OF LIQUIDITY

Liquidity is the ability of the firm to meet its financial obligations during the next twelve months. Liquidity can be evaluated at a point in time from the net worth statement by using the working capital level or the current ratio. Liquidity can also be measured as a flow concept by using the debt-servicing ratio, for example. These measures and others are described below.

Working capital is the amount of money that a farmer has available for use in the current and near future for production. Normally, working capital is defined as the sum of current and intermediate assets minus the sum of current and intermediate liabilities. It is called working capital because it is the amount of capital which is available for use (or work) in the near term within the business. In some instances, the measure used is the "current working capital" which is the current assets value minus the current liabilities; the current working capital measure shows how much money is estimated to be available for use in the next twelve months.

The current ratio shows the value of the current assets relative to the current liabilities. It indicates the farm's ability to meet debt obligations in the next twelve months from current assets. It is defined as:

$$\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

While interpreting the current ratio depends upon the type of business in which the farm is involved, a current ratio value equal to or greater than two generally is considered healthy for farms. This value shows that the farm could cover its current obligations and still have

some current working capital with which to work. A value of less than one obviously should cause concern because it says that the farm could not cover its obligations from current assets. A value between one and two is of concern, but requires further analysis before actions are recommended.

The acid-test ratio is essentially the same as the current ratio except only those current assets which are cash or nearly cash can be counted. All current liabilities are counted, but items such as growing crops or other assets which cannot be easily converted into cash are excluded. It is named the acid-test ratio because of the requirement of counting only cash or near cash current assets.

The debt-servicing ratio is the first of the cash flow measures of liquidity. It measures the farm's principal and interest payments as a proportion of gross farm income. In other words, it estimates the amount of production required to service a farm's debt. If this ratio is less than one, there was or will be a definite cash flow and liquidity problem since there will not be enough gross cash income to even meet debt servicing requirements. A lower ratio indicates a better ability to meet these requirements even if lower than expected income were to occur. It is defined as:

$$\text{Debt-servicing ratio} = \frac{\text{Principal} + \text{Interest Payments}}{\text{Gross Farm Income}}$$

The debt service coverage ratio shows the farms ability to meet debt servicing obligations, pay family living expenses, and pay tax obligations. While this ratio requires more information to calculate, the debt service coverage ratio considers expenses, family living, and other

demands upon gross farm income which the debt-servicing ratio does not consider. It is defined as:

$$\text{Debt Service Coverage Ratio} = \frac{(\text{Net Farm Income} - \text{Family Living} - \text{Income Taxes} + \text{Interest Payments} + \text{Land Rental})}{(\text{Annual Debt Service} + \text{Land Rental})}$$

where Annual Debt Service = interest on all loans + principal on term debt

The higher above one the debt service coverage ratio is, the more secure the farm is in its ability to service its debt and meet other obligations. A value of less than one indicates an inability to meet all obligations.

The balance between short, intermediate, and long term assets and liabilities may be of interest when assessing liquidity and potential solutions to liquidity problems (debt restructuring, for example). Debt structure and asset structure are two ratios which indicate the mix of current, intermediate, and long term holdings and the balance of those holdings between assets and liabilities.

The debt structure shows the percentage of total debt held as current debt. It shows the proportion of the debt which is due in the next twelve months. This ratio is also called the "current debt ratio". It is defined as:

$$\text{Debt structure} = \frac{\text{Current Liabilities}}{\text{Total Liabilities}} * 100$$

The asset structure shows the percentage of total assets held as current assets. It is defined as:

$$\text{Asset Structure} = \frac{\text{Current Assets}}{\text{Total Assets}} * 100$$

Reviewed together, the debt and asset structures can help determine potential solutions to some problems, particularly questions regarding the potential for debt restructuring. For instance, suppose a farm has a low debt service coverage ratio and one proposed solution is to restructure the debt in order to decrease current obligations (at the expense of higher long term obligations). The debt structure would indicate whether the farm has the potential to move current debt to long term debt or if the structure is already relatively low in current debt and restructuring is not a possibility. The asset structure will show whether there is and would be enough balance between the types of assets and debts to permit restructuring as a possible solution.

The cash flow coverage ratio is the gross cash income expressed as a proportion of the principal and interest paid. It is the inverse of the debt-servicing ratio and it has the same problem of not considering other business expenses. It is defined as:

$$\text{Cash flow coverage ratio} = \frac{\text{Gross Cash Income}}{\text{Principal Paid} + \text{Interest}}$$

MEASURES OF FINANCIAL STRESS

The traditional measures of profitability, solvency, and liquidity have a major problem in being unable to measure and/or predict future financial stress, that is, the inability to service debt and other commitments. The three ratios which have been proposed⁷ to measure financial stress are described below.

The financial leverage ratio evaluates how well the business used debt capital versus equity capital. It measures this by taking the ratio of the rate of return to equity (ROE) to the rate of return to assets (ROA) which are defined in the "Measures of Profitability" section. The financial leverage ratio should not be confused with the leverage ratio used as an indicator of solvency. The financial leverage ratio is defined as:

$$\text{Financial Leverage Ratio} = \frac{\text{ROE}}{\text{ROA}}$$

If debt capital is used effectively, the return to that capital will be greater than its cost, thus ROE will be greater than ROA and the financial leverage ratio will be greater than one. However, if debt capital is not used effectively, its cost will be greater than its return and the ratio will be less than one. Hence, the financial leverage ratio identifies potential problems by signalling when debt capital is not being used effectively.

The times-interest earned ratio, also called the interest coverage

⁷Penson, J. "Evaluating Financial Trends in Agriculture", Agricultural Finance Review, Vol. 47, Department of Agricultural Economics, Cornell University, Ithaca, New York, 1987.

ratio, shows the degree to which annual earnings before interest and taxes (EBIT) are sufficient to pay annual interest commitments:

$$\text{Times-Interest Earned Ratio} = \frac{\text{EBIT}}{\text{Interest Paid}}$$

Preliminary evidence shows that a ratio of greater than two indicates a financially healthy farm and one that is easily capable of meeting its interest obligations. A value of less than one definitely indicates trouble and a value between one and two indicates potential trouble and the need to further evaluate the business.

The debt burden ratio measures the net cash income as a percentage of the total debt burden of the farm. It shows the size of the total debt burden relative to the annual net cash income of the farm. Pictorially, this ratio can be viewed as measuring the size of the river trying to erode the mountain. It is defined as:

$$\text{Debt Burden Ratio} = \frac{\text{Net Cash Income}}{\text{Total Liabilities}} * 100$$

Preliminary evidence indicates that a debt burden ratio of 25% or more is healthy. A ratio of less than 15 may signal trouble and the need for further analysis.

The times-earnings ratio is also used at times. It measures the burden of outstanding debt relative to the farm's earnings after interest (but before taxes). It calculates the number of years needed to repay outstanding debt. It is almost the inverse of the debt burden ratio. It is defined as:

$$\text{Times-Earnings Ratio} = \frac{\text{Total Debt}}{\text{Earnings After Interest}}$$

MEASURING EFFICIENCY

There are three areas of efficiency to be evaluated: financial, marketing, and physical. Often several efficiency measures need to be considered simultaneously. For example, low labor efficiency may be found on farms with high machinery inefficiency because there may not be enough machinery on the farm. Another farm may have high labor efficiency and low machinery efficiency due to overcapitalization in machinery.

Financial Efficiency

There are three major financial efficiencies: the gross ratio, the asset turnover rate, and the expense structure. The value of production is used instead of sales in these measures because sales may be misleading due to tax planning under the cash income basis causing swings in sales. Thus, there can appear to be differences between farms and between years, when, in fact, there are no production differences only differences in how the farms responded to the tax laws and their economic environment. The value of production is defined as the total sales minus purchases of feed and feeders and adjustments for changes in inventories.

The gross ratio measures the cost of producing one dollar of production, that is, the efficiency of production. It is defined as:

$$\text{Gross Ratio} = \frac{\text{Total Expenses}}{\text{Value of Production}}$$

The asset turnover rate measures how fast the assets of the farm are "turned over" annually. It indicates how efficiently assets are used. Typical asset turnover rates in farming are between 40 and 50% with some variation between types of farms. For example, a dairy farm typically has a lower asset turnover rate than a fresh vegetable farm because the dairy

farm has a more stable income flow and is able to operate with a thinner margin while the vegetable farm operates at a higher risk level so requires a faster rate of asset payment. The asset turnover rate is defined as:

$$\text{Asset Turnover Rate} = \frac{\text{Value of Production}}{\text{Total Assets}}$$

This ratio can cause problems when comparing farms which have different mixes of owned and rented assets even though other measures of size are similar. Without adjusting the equation, the farms with more rented assets will have a falsely higher asset turnover rate because their value of assets owned is less than a farm which owns all of the assets it uses. So, at times, the value of rented assets are counted in the total assets for this ratio, in order to provide a more accurate comparison between farms. Then the asset turnover rate is defined as:

$$\text{Asset Turnover Rate} = \frac{\text{Value of Production}}{\text{Total Productive Assets}}$$

The expense structure measures the inflexibility of a farm's expenses by the proportion of those expenses which are fixed. It indicates how well a farm can respond to changes in its economic and physical environments. It is used to analyze a farm's opportunities or problems after an initial analysis has been completed. The expense structure is defined as:

$$\text{Expense Structure} = \frac{\text{Fixed Cash Expenses}}{\text{Total Cash Expenses}}$$

Different types of farms will have different standards for the expense structure. A fruit orchard is expected to have a higher expense structure because it will have more capital tied up in fixed assets than an annual crop farm. Farms which have made recent major capital purchases will have a higher expense structure than farms which are nearly debt free. These differences are to be expected; they do not say that one type of farm is worse or better than another type.

Controlling costs of production can be critical to a farm's success. The efficiency with which costs are controlled relative to production levels can be seen in several cost measures. The total cost per unit (bushel, head, cwt., etc.) can be compared with other farmers and other years. The total costs per unit can be divided between direct operational costs per unit (i.e., variable) and overhead costs per unit (i.e., fixed). Feed costs per livestock production unit are especially important for dairy operations. Comparing the investment per acre or per livestock unit can explain differences between farms and changes over time. For more detailed analysis, the total investment could be divided into building investment (especially for livestock) and machinery investment (especially for crops). Cost measures can be used for (1) efficiency comparisons, (2) comparison of operational differences between farms (e.g., labor-intensive versus capital-intensive farms), (3) determination of whether a cash flow problem is due to a production problem or a marketing problem (or both) and (4) breakeven and marketing analysis.

Marketing Efficiency

Marketing efficiency can be measured in economic terms by the price received (or paid) rate and in physical terms by the storage and handling losses. The price received and paid rates are discussed in an earlier section (pages 9-10) and are presented here again to complete this section.

$$\text{Price received rate} = \frac{\text{Ave. price received by farmer}}{\text{Ave. market price}} * 100\%$$

$$\text{Price paid rate} = \frac{\text{Ave. price paid by farmer}}{\text{Ave. market price}} * 100\%$$

Physical Efficiencies

There are many measures of physical efficiency. Some of them are listed below. These and other measures are used to compare actual performance with the farm's internal standards and goals, the farm's historical performance trends, and the performance of comparable farms. When these measures are calculated and compared, the same rules and procedures should be used. For instance, the weaning rate (number of young weaned per adult female) can be altered drastically by different methods of counting the numbers of breeding adults; are only those which have young counted or are those which were bred but never kept for birthing counted also? The question is not really which way is right but is the same method being used for all calculations. Examples of physical efficiencies include:

- yields per acre
- average daily gain
- livestock production per head (e.g., eggs/hen, milk/cow)
- food efficiencies

- calving and weaning percentages and death loss percentages
- pigs per litter, pigs per sow, litters per sow per year
- output per labor hour and per dollar invested

INVENTORY OF RESOURCES

The farm inventory of resources is a list of all the farm assets a farmer has at a given time with a value established for each item. In the sense that it is a tool for planning, the inventory of resources should include more than the usual list of physical and financial assets; it should also include such items as the available line of credit, managerial abilities, land and buildings which could be rented or purchased, etc.

An inventory should be taken or updated (1) at the beginning of each fiscal year, (2) when applying for a loan, and (3) when considering or making a major change in the business such as new rentals, partners, and other changes in the business. Other reasons for having an up-to-date inventory include:

- a. providing a basis for determining the extent to which resources are available or lacking,
- b. indicating the condition of machinery, equipment, and improvements,
- c. providing a basis for selling a value on the farm business
- d. aiding in the preparation for a financial statement
- e. applying for a loan
- f. providing information needed for the preparation of income tax statements, insurance claims, or rental agreements.

Steps in Taking an Inventory

The inventory of resources is a large and valuable piece of knowledge for a manager. The job of preparing the inventory can be made significantly easier if it is done in an orderly process. The steps outlined below are based in large part on the unpublished notes of Bruce Jensen⁸ and on Libbin and Catlett (1987).

1. Start with the land
 - a. Proceed from field to field until the entire farm is covered.
 - b. Identify the fields and building sites on a map.
 - c. Note in each field:
 - (1) Size of the field, soil type, topography, condition
 - (2) Crop planted, if any, and its stage, condition, expected yield
 - (3) Improvements such as fences, tiles, irrigation systems, bridges, etc. (Be sure these improvements are entered in the farmer's depreciation schedule.)
2. Buildings should be listed next after the land
 - a. Note the type of structure, size, use and condition. (Be sure these are entered in the farmer's depreciation schedule.)
 - b. While at each building, record its contents: grain, hay, other feedstuffs, livestock, machinery, chemicals, and other supplies. Also, record the information noted below for each type of asset found in the building.

⁸Professor (retired), College of the Sequoias, Visalia, California, 1985.

3. Livestock should be listed by kind, age, sex, weight, condition, and location. (Breeding and working livestock should be entered in the depreciation schedule.)
4. Machinery, equipment, implements and tools should be identified by manufacturer, use, capacity or size, serial or identification number, condition, and location. (These should be entered in the farmer's depreciation schedule.)
5. Operating inputs (seed, feed, fuel, fertilizer, spare parts, etc.) should be listed by type, kind, amount, condition, and location.
6. Harvested crops
 - a. Both on-farm & off-farm storage sites.
 - b. Note the type, amount, condition and location.
 - c. If needed, note the weight of the units (e.g., 60 bags of barley seed @ 80# each)
7. Financial assets
 - a. Cash on hand and in "liquid" accounts
 - b. Other capital accounts
 - c. Stocks, bonds
 - d. Deferred patronage dividends
 - e. Accounts receivable
 - f. Other - (e.g., line of credit available)
8. Managerial knowledge, experience, skill, and ability.
9. While they are not resources, a record of liabilities is needed in order to determine the financial condition of the farm and its

working capital and other abilities to obtain capital. These records include:

- a. Loan Information: date, from, for what, amount, length, rate
(and other specifications if it's a non-traditional loan)
- b. Current portions of the principal and interest payments
- c. Unpaid, accrued interest
- d. Delinquent principal and interest payments
- e. Charge and credit card account information

10. Family records are another type of record which is not a resource but are needed to provide complete information for business analysis and planning. These records include:

- a. Personal expenses
- b. Off-farm income & expenditures
- c. Investments & other assets
- d. Farm products used by family
- e. Personal liabilities

11. Availability of other resources that could be purchased, rented, or hired. This list should cover land, buildings, machinery, labor, custom work services, etc. This list is very useful to planning the operation and growth of a farm.

CHECKING RECORD ACCURACY

There are several ways to check the accuracy of a set of records besides the visual impression of a neat, precise set of records kept in a timely and orderly manner. These methods or procedures are outlined below.

1. Does cash-in equal cash-out?

Does all the cash spent, saved, or otherwise used account for all the sources of cash? A record of personal and nonfarm expenses and income is needed to make this check accurate on farms which do not keep separate personal and business checking accounts.

2. Liabilities check:

a. Ending debt = beginning debt - principal payments

+ new debt - debt forgiveness

b. If accounts payable are included add:

+ beg. A/P - end A/P

c. Partners and corporations may cause discrepancies if

individuals hold some debt and it is not recorded properly in the accounts.

3. Income/Net Worth Check

a. Does the change in net worth balance with the money left after expenses, debt servicing, family living, etc.?

b. For farms which do not have separate business and personal accounts, nonfarm income, expenses and investments need to be included in this calculation.

4. Livestock head count by month
 - a. Ending count = beginning count + purchases + transfers in
- sales - deaths + births - transfers out
 - b. This needs to be done each month not all at the end of the year.
 - c. The monthly check helps maintain schedules, record sales and purchases, and keeps the manager on top of the operation. It may also help in the crop/feed check.
5. Production record for both crop & livestock
 - a. Does the reported production check with the acreage or number of breeding livestock?
 - b. Do the yields and production levels seem reasonable?
 - c. These records may force recall of other production and resources, such as: storage, sales, and other land/animals.
6. Crop/feed check
 - a. Does the crop production estimates balance with feed fed, crops bought, crops sold, and crops stored?
 - b. The quality of this check depends upon quality of the estimates of crop production, feed fed, and storage amounts.
 - c. The crop/feed check may never balance completely due to having to use estimates, but the process of working through the check may stimulate memories and records to provide better records.

7. Average sales price and weight or yield

- a. Does the calculated average yield seem reasonable compared to the reported market average price?

$$\text{Calculated average price} = \frac{\text{Total sales \$}}{\text{Total prod wt. or volume sold}}$$

- b. Estimate total production by using the market average price and the actual farm sales. How well does this "backwards" estimate compare with the actual production?

$$\text{Estimated Total Production} = \frac{\text{Total Sales}}{\text{Mkt. Ave. Price}}$$

- c. Estimate average yield or production per animal from total farm sales, average market prices, and the number of acres or animals. How well do these estimates compare with actual yields and productivities?

$$\text{Estimated Yield} = \frac{\text{Total Sales}}{\text{Market ave. price} * \text{acres}}$$

$$\text{Estimated Production} = \frac{\text{Total Sales}}{\text{Market ave. price} * \text{head}}$$

- d. These "backwards" estimates are useful for discovering missing information or other mistakes. Since market averages are used, there will be some small deviations between the estimates and the actual numbers. These small deviations are to be expected; we are interested in finding large deviations which indicate major problems.

DEVELOPING ENTERPRISE BUDGETS FROM WHOLE-FARM RECORDS

When enterprise budgets are developed for the first time, many managers will start with records for the whole farm. Whole-farm costs and returns can be allocated to individual enterprises by using the following steps.

1. Determine the costs of separate items for the whole farm.

If your whole-farm records are in good order, they should indicate expense figures by individual item (i.e., seed corn, fertilizer for soybeans, feed for the dairy calves, etc.). If these records are not up to date or individual items are not specified, this data will have to be gathered and organized before costs can be allocated to specific enterprises.

2. Identify the enterprises on the farm.

Most farms grow more than one crop and/or raise more than one category of livestock. If only one crop is grown, allocation is very easy. If the farm business involves more than one crop or livestock enterprise, these enterprises have to be identified and listed. At this time, the farmer should decide whether to separate some enterprises into its parts. For example, the dairy herd could be divided into two sub-enterprises: the milking herd and all other dairy cattle, such as calves and replacement heifers. The farrow-to-finish hog enterprise could be split into feeder pig production and hog finishing. Corn production could be split into different land types or different tenure

arrangements. These divisions are done to have a better idea of how each part of the business is performing. The divisions can be made even though all of the activity takes place on the same farm.

3. Classify the costs as direct or indirect.

The costs on the farm can be classified as either direct or indirect costs. Direct costs are those costs that can be attributed to a specific enterprise. Examples of direct costs are fertilizer applied to wheat and feed fed to dairy cows. Indirect costs are those costs that cannot be associated with a specific enterprise. These would include, for example, costs for a truck which is used for several crops (or general farm duties), and fencing which is used for several types of livestock.

4. Allocate the direct costs and returns.

Direct costs and returns are easily allocated to enterprises because they are defined as used or produced by that enterprise directly. Corn harvesting costs are allocated to corn. Weed control for wheat is allocated to wheat. Veterinary expenses for dairy cows are allocated to dairy.

5. Determine the best way to allocate indirect costs.

Indirect costs can be allocated to enterprises by determining how they are related to those enterprises. There are three main ways to allocate indirect costs:

a. On the basis of use.

Machinery-use hours can be used to allocate fuel, repairs, and other machine costs to the appropriate enterprise. Factors such as total crop acreage, total herd value, number of head, etc., may be used as the basis for allocating costs such as insurance or erosion control to the various enterprises which benefit from them. General farm liability insurance may be allocated to crops on the basis of an average cost per acre.

b. On the share of gross income.

The magnitude of office expenses (e.g., telephone, accountant, etc.) may be related to the farm's total expected income. Thus, an enterprise's contribution to total gross income for the farm may be the best basis for allocating those costs. For example, office expenses can be allocated between enterprises on the basis of each enterprise's share of total expected gross income.

c. On the share of variable costs.

Some costs may be allocated on the basis of that enterprise's share of total variable costs for the whole farm. For example, an employee may spend more time on those enterprises which have the largest costs. Thus, the employee's salary should be allocated on the basis of each enterprise's share in total variable costs -- rather than gross income. The share in costs more accurately reflects each enterprise's share of the employee's salary.

d. With a combination

Choosing between the three main methods is an arbitrary decision. The goal is to obtain accurate enterprise budgets for analysis and planning. In some cases, a combination of the three methods will provide the most accurate allocation between enterprises.

6. Calculate the percentage of total use, gross income, and variable costs for each enterprise.

a. After the best allocation method has been chosen, the shares (or percentages) to be used for allocating those costs need to be calculated.

b. Shares of gross income are calculated by:

- (1) determining the actual (or expected) acreage, production, and price for each enterprise;
- (2) calculating the gross income for each enterprise; and
- (3) calculating each enterprise's share in the gross income for the whole farm.

c. Shares of variable costs are calculated by:

- (1) determining the actual (or expected) variable costs for each enterprise;
- (2) calculating the total variable costs for the whole farm; and
- (3) calculating each enterprise's share in the total variable costs.

7. Allocate the indirect costs.

Now, whole-farm indirect costs can be allocated to the enterprises. The whole-farm cost is multiplied by each enterprise's shares of use, gross income, or variable costs.

8. Calculate the per unit costs

The per unit cost in each enterprise is calculated by dividing the enterprises share of the total costs by the number of units of that enterprise (e.g., the number of corn acres or cows in the milking herd).

Allocation Example

As an example of allocating indirect, whole-farm costs, consider how a dairy-corn-alfalfa farm in Minnesota will allocate general office expenses (\$15,436) and an employee's salary and benefits (\$24,878).

Most of the office expenses are used for marketing or for those enterprises which have the higher potential income, the farmer decides these expenses should be allocated on the basis of gross income shares. The farmer calculates the potential gross income for each enterprise, the share of total, and allocates the office expenses on the basis of that share (Table 1). The allocated office expenses are \$154.36 per dairy cow and \$20.58, and \$18.52 per acre for corn and alfalfa. These costs can be used in the respective enterprise budgets.

Table 1. Allocation of General Office Expenses

<u>Enterprise</u>	<u>Size</u>	<u>Total Gross Income</u>		<u>Enterprise's Share</u>	
Dairy	70 cows	\$ 126,300	70%	\$10,085	\$154.36/cow
Corn	180 acres	43,560	24	3,705	20.58/acre
Alfalfa	50 acres	<u>11,000</u>	<u>6</u>	<u>926</u>	18.52/acre
		180,860	100	15,436	

While the employee's time is also related to the potential income, the farmer has decided that the share in variable production costs is a more accurate method to allocate the employee's salary and benefits between the enterprises. The farmer calculates the costs are \$252.33 per dairy cow and \$34.55 and \$19.90 per acre for corn and alfalfa. These costs can be used to itemize the employee's salary and benefits in the respective enterprise budgets.

Table 2. Allocation of Employee's Salary and Benefits

<u>Enterprise</u>	<u>Size</u>	<u>Total Variable Costs</u>		<u>Enterprise's Share</u>	
Dairy	70 cows	\$ 73,640	71%	\$17,663	\$252.33/cow
Corn	180 acres	25,560	25	6,220	34.55/ac
Alfalfa	50 acres	<u>4,000</u>	<u>4</u>	<u>995</u>	19.90/ac
		\$103,200	100	\$24,878	

SUMMARY

In this paper, I have presented two procedures: one to analyze a farm's financial condition, and another to diagnose problems and develop solutions to those problems. I have also described the important measures of profitability, solvency, liquidity, financial stress, and efficiency. The traditional measures have been expanded to include the cash flow concepts of liquidity and financial stress. Other sections of the paper are included to complement the analysis process: taking an inventory of the farm, checking the accuracy of the records, and developing enterprise budgets from whole-farm records.

These procedures and ideas have been developed over the years by myself and others. I hope they help the reader develop, refine and understand his/her own financial analysis procedures.

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APPENDIX
EXAMPLES OF FINANCIAL STATEMENTS

Table A-1	An Example Income Statement for 1987
Table A-2	An Example Net Worth Statement for 1987
Table A-3	An Example Cash Flow Statement for 1987
Table A-4	Example Measures and Ratios for 1987

Table A-1. An Example Income Statement for 1987.

CASH FARM INCOME		
Soybeans - cash sales	695 bushels	\$3,306
Oats - cash sales	921 bushels	1,059
Corn - gov't loan	12,966 bushels	22,085
Soybeans - gov't loan	3,122 bushels	13,890
Soybeans - net gov't sale	3,153 bushels	161
Finished hogs	663 head	84,021
Feeder pigs	385 pigs	21,555
Cull breeding stock		5,067
Deficiency and diversion payments		12,286
Other farm income		1,655
TOTAL GROSS CASH INCOME		165,085
CASH OPERATING EXPENSES		
Seed		5,288
Fertilizer		2,468
Crop chemicals		2,068
Crop insurance		321
Misc. crop expense		217
Purchased feed		54,550
Veterinary and medicine		1,677
Livestock supplies		1,803
Gasoline, fuel, and oil		3,084
Repairs		10,968
Hired labor		300
Machine hire		1,135
Real estate taxes		230
Land rent		0
Farm insurance		1,109
Utilities		2,717
Interest		5,672
Misc. expenses		1,427
TOTAL CASH OPERATING EXPENSES		95,034

NET CASH FARM INCOME		70,051
INVENTORY CHANGES		
Feed and grain		560
Market livestock		2,590
Receivables and other income items		14,219
Prepaid expenses and supplies		501
Payables and accrued expenses		0
TOTAL INVENTORY CHANGES		17,870
DEPRECIATION AND OTHER CAPITAL ADJUSTMENTS		
Breeding livestock		(2,341)
Machinery and equipment		(6,666)
Buildings and improvements		(32,722)
Stock and other investments		0
TOTAL DEPRECIATION AND OTHER CAPITAL ADJ.		(41,730)
		=====
ACCURAL NET FARM INCOME		46,191

Table A-2. An Example Net Worth Statement for December 31, 1987.

ASSETS		LIABILITIES	
CURRENT FARM ASSETS		CURRENT FARM LIABILITIES	
Cash	3,306	Accounts payable	1,657
Prepaid expenses and supplies	6,657	Current notes	0
Cash in growing crops	0		
Accounts receivable	18,989	Current portion of term-debt principal	8,710
Hedging accounts	0	Accrued interest	0
Crops for sale and feed	41,264	Taxes	0
Livestock held for sale	32,269	Rent	0
Other current farm assets	0		
	-----		-----
TOTAL CURRENT FARM ASSETS	102,485	TOTAL CURRENT FARM LIABILITIES	10,367
INTERMEDIATE FARM ASSETS		INTERMEDIATE FARM LIABILITIES	
Breeding livestock	13,381	Breeding livestock loans	0
Machinery and equipment	18,171	Machinery and equipment loans	10,347
Other intermediate assets	0		
	-----		-----
TOTAL INTERMEDIATE FARM ASSETS	31,552	TOTAL INTERMEDIATE FARM LIABILITIES	10,347
LONG TERM FARM ASSETS		LONG TERM FARM LIABILITIES	
Buildings and improvements	43,019	Deferred principal on real estate loans	37,170
Farmland	31,500		
Other long term farm assets	0		
	-----		-----
TOTAL LONG TERM FARM ASSETS	74,519	TOTAL LONG TERM FARM LIABILITIES	37,170
TOTAL FARM ASSETS	208,556	TOTAL FARM LIABILITIES	57,884
	-----		-----
TOTAL NONFARM ASSETS	61,521	TOTAL NONFARM LIABILITIES	8,392
	=====		=====
TOTAL ASSETS	270,076	TOTAL LIABILITIES	66,276
		NET WORTH	203,800

Table A-3. An Example Cash Flow Statement for 1987

Item	Month-->	January	February	March	April	May	June	July	August	September	October	November	December	Total
BEGINNING CASH BALANCE		4,298	12,515	17,838	7,446	9,172	6,755	1,000	5,568	16,333	18,333	28,933	16,442	4,298
CASH INFLOWS:														
CASH FARM INCOME		3,306												
Soybeans - cash sales														3,306
Oats - cash sales											1,059			1,059
Corn - gov't loan												15,500	6,585	22,085
Soybeans - gov't loan											13,890			13,890
Soybeans - net gov't sale			161											161
Finished hogs		5,634	8,273	7,034	5,724	5,538	8,736	9,387	7,639	5,893	4,387	7,752	8,024	84,021
Feeder pigs			4,736	3,621	4,623			1,683	2,964	3,928				21,555
Cull breeding stock		235	307	251	387	279	473	389	452	408	376	634	876	5,067
Deficiency and diversion payments		6,359							5,927					12,286
Other farm income							592			773		290		1,655
CAPITAL ASSET SALES														0
TOTAL CASH INFLOW		19,832	25,992	28,744	18,180	14,989	16,556	12,459	22,550	27,335	38,045	53,109	31,927	169,383
CASH OUTFLOWS:														
CASH OPERATING EXPENSES														
Seed							5,288							5,288
Fertilizer							2,468							2,468
Crop chemicals							2,068							2,068
Crop insurance										321				321
Misc. crop expense						217								217
Purchased feed		4,546	5,087	4,370	4,571	5,620	4,023	4,782	4,308	3,027	4,307	4,380	5,529	54,550
Veterinary and medicine		173	181	174	148	117	106	89	109	124	130	157	169	1,677
Livestock supplies		145	160	135	150	125	119	67	128	158	187	212	217	1,803
Gasoline, fuel, and oil		131	128	197	247	418	253	145	267	492	516	187	103	3,084
Repairs		623		379	260	99				2,794	1,549	3,741	1,523	10,968
Hired labor								300						300
Machine hire				630								505		1,135
Real estate taxes					115						115			230
Land rent														0
Farm insurance				1,109										1,109
Utilities		338	350	237	187	103	87	89	103	127	286	383	427	2,717
Interest			941		863						630	1,378	573	4,385
Misc. expenses		86	57	267	217	285	35	26	52	133	142	85	42	1,427

Table A-3 continued

Item	Month-->	January	February	March	April	May	June	July	August	September	October	November	December	Total
CAPITAL ASSET PURCHASES				12,550	1,000							7,958	6,294	27,802
LOAN PRINCIPAL PAYMENTS												12,784		12,784
LOAN INTEREST PAYMENTS												1,285		1,285
PROPRIETOR WITHDRAWALS		1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	15,000
CORPORATE DISBURSEMENTS														0
INCOME TAXES														0
TOTAL CASH OUTFLOWS		7,292	8,154	21,298	9,008	8,234	15,697	6,748	6,217	8,426	9,112	34,305	16,127	150,618
CASH POSITION (min. balance 1,000)		12,540	17,838	7,446	9,172	6,755	859	5,711	16,333	18,909	29,509	19,381	18,739	18,766
NEW BORROWINGS		0	0	0	0	0	141	0	0	0	0	0	0	141
PAYMENT OF CURRENT BORROWINGS:														
INTEREST: (at 12 %)		0	0	0	0	0	0	1	0	0	0	0	0	2
PRINCIPAL:		25	0	0	0	0	0	141	0	0	0	0	0	166
ENDING CASH BALANCE		12,515	17,838	7,446	9,172	6,755	1,000	5,568	16,333	18,909	29,509	19,381	18,739	18,739

Table A-4. Example Measures and Ratios for 1987.

MEASURES OF PROFITABILITY

Ending farm net worth (equity) = 150,672

Opportunity interest rate on equity = 7.0%
(chosen from financial market data)

Opportunity cost of equity = 7% of Net Worth = 10,547

Unpaid family labor cost = 0
(chosen from records and labor market information)

Residual return to operator labor and management = RROLM = \$35,644

$$\begin{aligned} \text{RROLM} &= \text{accrual net farm income} \\ &\quad - \text{opportunity cost of equity} \\ &\quad - \text{unpaid family labor cost} \\ &= 46,191 - 10,547 - 0 = 35,644 \end{aligned}$$

Opportunity cost of unpaid labor and mgt. = 15,000
(chosen from labor market information)

Rate of return on equity = ROE = 20.7%

$$\begin{aligned} \text{ROE} &= \frac{\text{Accrual net farm income} - \text{opp. cost of labor \& mgt.}}{\text{Net worth}} \\ &= (46,191 - 15,000) / 150,672 = 20.7\% \end{aligned}$$

Rate of return on assets = ROA = 17.7%

$$\begin{aligned} \text{ROA} &= \frac{\text{Accrual net farm income} + \text{interest paid} - \text{opp. cost of L\&M}}{\text{Total farm assets}} \\ &= (46,191 + 5,672 - 15,000) / 208,556 = 17.7\% \end{aligned}$$

MEASURES OF SOLVENCY

Farm Net worth (or equity) = NW = \$150,672

Debt-to-asset ratio = D/A = $\frac{\text{Total Farm Liabilities}}{\text{Total Farm Assets}} = \frac{57,884}{208,556} = 27.8\%$

Leverage ratio = $\frac{\text{Total Farm Liabilities}}{\text{Farm Net Worth}} = \frac{57,884}{150,672} = .38$

Net capital ratio = $\frac{\text{Total Farm Assets}}{\text{Total Farm Liabilities}} = \frac{208,556}{57,884} = 3.60$

Equity-Value ratio = $\frac{\text{Farm Net Worth}}{\text{Total Farm Assets}} = \frac{150,672}{208,556} = .72$

Table A-4 Continued

MEASURES OF LIQUIDITY

Working capital = \$113,323
 = Current assets = 102,485
 + Intermediate assets = + 31,552
 - Current liabilities = - 10,367
 - Intermediate liab. = - 10,347

 113,323

Current working capital = \$92,118
 = Current assets - current liabilities
 = 102,485 - 10,367 = 92,118

Current ratio = $\frac{\text{Current Assets}}{\text{Current Liabilities}}$ = $\frac{102,485}{10,367}$ = 9.89

Acid-test ratio = $\frac{\text{Cash or nearly cash current assets}}{\text{Current Liabilities}}$ = $\frac{76,839}{10,367}$ = 7.41

Debt-servicing ratio = $\frac{\text{Principal} + \text{interest payments}}{\text{Gross cash income}}$ = $\frac{12,950 + 5672}{165,085}$ = .11

Cash flow coverage ratio = 8.86
 = $\frac{\text{Gross cash income}}{\text{Principal} + \text{interest payments}}$ = $\frac{165,085}{12,950 + 5,672}$ = 8.86

Debt service coverage ratio = 2.24
 = $\frac{\text{Accrual net farm income} - \text{family living} - \text{income taxes} + \text{interest payments} + \text{land rent}}{\text{Term principal payments} + \text{interest payments} + \text{land rent}}$
 = $(46,191 - 15,000 - 0 + 5,672 + 0) / (12,784 + 5,672 + 0) = 2.00$

Debt Structure = $\frac{\text{Current Liabilities}}{\text{Total Farm Liabilities}}$ = $\frac{10,367}{57,884}$ = 17.9%

Asset structure = $\frac{\text{Current Assets}}{\text{Total Farm Assets}}$ = $\frac{102,485}{208,556}$ = 49.1%

Table A-4 Continued

MEASURES OF FINANCIAL STRESS

$$\text{Financial leverage ratio} = \text{ROE/ROA} = 20.7/17.7 = 1.17$$

$$\text{Times-interest earned ratio} = 9.14$$

$$= \frac{\text{Earnings before interest and taxes}}{\text{Interest paid}}$$

$$= \frac{\text{Accural net farm income} + \text{interest paid}}{\text{Interest paid}} = \frac{46,191 + 5,672}{5,672} = 9.14$$

$$\text{Debt burden ratio} = \frac{\text{Net Cash Income}}{\text{Total Farm liabilities}} * 100 = \frac{70,051}{57,804} = 121.2$$

$$\text{Times-earnings ratio} = \frac{\text{Total debt}}{\text{Earnings before interest}} = \frac{57,804}{46,191 + 5,672} = 1.11$$

FINANCIAL MEASURES OF EFFICIENCY

Value of production = total sales	165,085
- feed costs	(54,550)
- feeder purchases	0
+ inventory changes	17,870

	128,405

$$\text{Gross ratio} = \frac{\text{Total expenses}}{\text{Value of production}} = \frac{95,034}{128,405} = .74$$

$$\text{Asset Turnover ratio} = \frac{\text{Value of production}}{\text{Total Farm Assets}} = \frac{128,405}{208,556} = .62$$