

*Managing the Modern Farm Business:
Agricultural Investment Analysis*

Take AIM
The Annualized Incremental Method

Module 4
The Annualized Incremental Method Process

*Leonard Bauer
and
Don Bushe*

Faculty of Extension
University of Alberta

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Technical Editor

Leonard Bauer

Instructional Designer

Don Bushe

Technical Reviewer

Frank Novak

PREFACE

Most of what I think I know about the basics of investment analysis and risk assessment I learned from my friend and mentor, Len Bauer. Len's work and teaching has influenced farm managers and their advisors around the world. I consider it an honour and a privilege to write a short forward for this series of modules on investment analysis.

So, why should managers be interested in this series of investment analysis modules? The answer is because the consequences of poor capital investment decisions can directly determine the financial viability of a business enterprise. One need look no further than the North American hog industry investment boom of the 1980's and 90's and watch the fallout occurring today to see a classic example of capital investment decisions gone wrong. The failure to apply sound management principles invites the market place to solve your management problems for you. The market plays no favorites, treating both big and small businesses the same.

These self-directed learning modules demonstrate the basic tools used in the business world today; they are the language and practice of modern business. My biases on the importance of having a strong understanding of management concepts come from over a decade spent as a researcher and instructor at the University of Alberta blended more recently by several years as manager of a commodity production business.

I have worked with many excellent business managers and if there is a central theme it is this: they distinguish themselves by their knowledge and ability to apply the basic principles of economic decision making and risk management. These modules outline the basic principles and give practical insights, through illustrations and exercises, on how the material can be applied in practical situations.

The following modules lay out the process of analyzing investment decisions. Although the discussion in the modules is restricted to simplified cases, the tools can be applied to any business enterprise. Even if a manager does not use the actual detailed methods in every situation (for example some of the tools contained in the technical appendix) there is power in understanding the proper process for collecting and analyzing the information required for making sound investment decisions. It is impossible to build sound strategies without a solid foundation.

I use these principles in my day to day operations. I strongly encourage managers and those who work with and advise managers in any capacity, to make use of Dr. Len Bauer's work. Today's managers must be able to master these methods and the instructional design provided by Don Bushe makes it easy for busy managers to assimilate the ideas efficiently.

Frank Novak, Managing Director

Alberta Pig Company

Analyzing Agricultural Investments

What is financial management? What constitutes investment in agriculture? What is it that financial managers do? There are at least three topics that financial managers must deal with: acquiring assets [i.e. making investments], financing assets [raising the funds to make the investment] and exerting financial control. Financial management and financial managers are needed in old established businesses, in thriving growing businesses and in businesses just starting up. They play important roles as businesses expand or retract. This financial management requires attention to three topics:

- First of all the financial manager must make asset acquisition decisions. Decisions must be made to determine whether a particular asset should be acquired; whether an investment should be made. This means that the manager must have confidence that the asset in question will contribute towards the financial goals of the owners.
- Secondly the financial manager must make financing decisions. Decisions must be made about how funds should be raised to acquire the asset. This decision comes second in the list of duties for a very important reason. The manager needs to ration his or her time. There is no purpose wondering about how to finance an asset that is not worthwhile in the first place.
- The final task for the financial manager is financial control. The financial situation must be monitored and corrective action taken whenever actual results differ from those desired. Control is a much simpler task if sound acquisition and financing decisions are made in the first place.

Purpose and Organization of these Modules

The purpose of this set of modules is to focus attention on the above financial management topics, acquisition, financing and control. It has been our observation that while the financing and control aspects have been well attended to by public and commercial advisory services we have been negligent, as a profession, in analyzing investment prospects. Accordingly this set of modules will concentrate mostly on budgeting techniques for making informed agricultural investment decisions.

There are five modules in the set.

- **Module 1 Introduction to Investment Analysis**
The first is of an introductory nature. It examines the basic techniques, dismisses those that are inferior, namely urgency, payback period and accounting rate of return. The module then provides a comprehensive review of the tried and true systematic approach, net present value.
- **Module 2 Preparing Investment Data for Analysis**
The second module deals with the advanced topics of discount rates, cash flow estimates, and inflation in preparation for calculating the net present value.

- **Module 3 Advanced Investment Analysis**
The third module presents the topics of differential rates of inflation, risk, and income taxes within the net present value framework.
- **Module 4 The Annualized Incremental Method (a.k.a. The Partial Budget)**
The fourth module covers the topic of partial budgeting. The point is made that the partial budget process is really an annualized net present value method.
- **Module 5 The Technical Appendix**
The final module is a technical appendix organized much like a glossary of terms. Financial mathematics formulae and financial tables are an important part of this technical piece as are detailed explanations of issues thought too complex for the main modules.

Although some attention is paid in these modules to financing and control issues these topics are left to further development, for another time. As was pointed out good work has been done by the advisory professionals, government agents, bankers and accountants, and we refer the reader to those sources.

This Module

Farmers, like all business people are required to make investment decisions. And, as in all businesses, a systematic approach can add much to the ultimate success of the operation. The purpose of this module in the series on making sound investment decisions is to present the basic components of a systematic approach – the Partial Budget.

Objectives

When you have completed this module you should be able to:

1. Apply the partial budgeting procedure to a variety of farm management investment situations.
2. Identify and describe investment opportunities in terms of actions to be taken.
3. Calculate the economic advantages and disadvantages of investment opportunities.
4. Distinguish between business and financial risk.
5. Assess the affordability of investment opportunities then assess acceptability.
6. Make decisions with confidence.

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The Annualized Incremental Method (The Partial Budget)

An investment involves expending funds now expecting a return sometime in the future. The future may be a long way off. For example, making an investment like planting an orchard may not provide a return for perhaps three or four years and then yield an income each year over an extended period. Results from establishing a woodlot might not appear until twenty years have elapsed. On the other hand, investing in fertilizer and seed for a crop of wheat or barley will provide return within the year.

Because investments are made today with results expected way off sometime in the future uncertainty is ever present. Consequently an organized approach to investment analysis, to reduce the chance of error becomes very important. One such approach is the partial budget technique. The partial budget is an important and practical tool for deciding on major and minor incremental changes to the business. It only deals with changes from the status quo and differentiates from 'normal' and ongoing expenses / expenditures which are included in the 'regular budget'. It only refers to the details pertaining to the investment decision itself. Only things that are different, or those that are changed, need to be considered. That's why this is called the 'partial budget'.

We are suggesting that the term Annualized Incremental Method (AIM) is a more accurate description of the intention, process and product of the analysis. This will become clear as we examine it. Four steps are required for making organized investment decisions; these four steps are embodied in the AIM (partial budget) form and procedure. The steps appear as sections of the form.

Investment decisions are made at one point in time whereas the results of those decisions, whether they are a success or failure, will not be known until some time in the future. This underlines the need to be organized in attempting the analysis. An important and practical tool for deciding on major and minor incremental changes to the business is called the partial budget. Four steps come readily to mind for making organized investment decisions; these are embodied in the partial budget form and procedure. The four steps outlined appear as sections of the form.

Step 1: What is to be done?

The first thing to do is to define the decision. What is the problem that is to be solved? What are the alternatives that are available to solve it? What opportunity exists that is to be seized? Just what is the investment that is under consideration? These are the questions that help to focus the analysis. Specificity is the key – the better that you can define the problem, the more accurate will be the analysis and the better suited to solve the situation.

The AIM (Partial Budget) Form
Step 1: Define the Decision <ul style="list-style-type: none">• <i>What is the problem?</i>• <i>What are the alternatives?</i>• <i>What opportunity exists?</i>• <i>What is the investment?</i>

Step 2: Will it Pay?

The next step is to analyze the profit potential. Remember that investments are made for financial gain. We must quantify the economic advantages and balance them with the disadvantages presented by the investment.

To complete the task, considerable effort is expended to assess the profit potential. Added expenses have to be balanced against additional revenue. Reduced expenses have to be compared to reduction in revenues.

The Profit Potential

This section of the partial budget form is further subdivided into four quadrants named: added expense, added revenue, reduced revenue and reduced expense.

Added Expense: Many investments will cause the business added expenses: Increased fertilizer costs for example.

Added Revenue: Often investments will mean there are greater volumes of product for sale resulting in extra revenue. For example, finished cattle for sale could be a new product.

Reduced Revenue: New investments may cause the elimination of old lines of production. For example if barley is being replaced by Canola, barley revenue would be reduced.

Reduced Expense: Frequently, new investments cause certain expenses to be eliminated. Replacing an old machine with a new one would mean elimination of expenses of the old one. .

Total Economic Disadvantage: The sum of the added expenses and reduced revenue is the disadvantage.

The AIM (Partial Budget) Form
<p>Step 1: Define the Decision</p> <ul style="list-style-type: none"> • <i>What is the problem?</i> • <i>What are the alternatives?</i> • <i>What opportunity exists?</i> • <i>What is the investment?</i>
<p>Step 2: Will it pay?</p> <ul style="list-style-type: none"> • <i>Will the investment be profitable?</i> • <i>What are the economic advantages?</i> • <i>What are the disadvantages?</i>

The AIM (Partial Budget) Form	
<p>Step 1: Define the Decision</p> <ul style="list-style-type: none"> • <i>What is the problem?</i> • <i>What are the alternatives?</i> • <i>What opportunity exists?</i> • <i>What is the investment?</i> 	
<p>Step 2: Will it pay?</p> <ul style="list-style-type: none"> • <i>Will the investment be profitable?</i> • <i>What are the economic advantages?</i> • <i>What are the disadvantages?</i> 	
Added Expense	Added Revenue
Reduced Revenue	Reduced Expense
Total Economic Disadvantage	Total Economic Advantages
Net Disadvantage	Net Advantage

Total Economic Advantages: Sum the added revenue and reduced expenses.

Net Disadvantage: Subtract the disadvantages from the advantages. If the disadvantages outweigh the advantages the investment does not have a profit potential.

Net Advantage: Subtract the disadvantages from the advantages. If the advantages outweigh the disadvantages the investment has an expectation of profit.

Step 3: Analyze the Financing Implications

Now it is necessary to answer the question, Can I afford it?

Will the investment jeopardize the financial health of the business?

How will the financial ratios be affected?

Will the overall leverage be unduly increased?

Will the business come under financial stress?

Is the investment feasible?

These are the questions that have to be answered in this third step in the analysis.

The AIM (Partial Budget) Form	
Step 1: Define the Decision	
<ul style="list-style-type: none"> • <i>What is the problem?</i> • <i>What are the alternatives?</i> • <i>What opportunity exists?</i> • <i>What is the investment?</i> 	
Step 2: Will it pay?	
<ul style="list-style-type: none"> • <i>Will the investment be profitable?</i> • <i>What are the economic advantages?</i> • <i>What are the disadvantages?</i> 	
Added Expense	Added Revenue
Reduced Revenue	Reduced Expense
Total Economic Disadvantage	Total Economic Advantages
Net Disadvantage	Net Advantage
Step 3: Analyze the Financial Implications	
Can I afford it?	
<i>Effect on financial health</i>	
<i>Affect on financial ratios</i>	
<i>Leverage increased?</i>	
<i>Cause financial stress?</i>	
<i>Is it feasible?</i>	

Step 4: Make the Decision

The last step is to decide on a course of action.

Do you want to do it?

Is it compatible with your personal and business goals?

Obviously there was some interest in the investment; otherwise you would not have done the analysis. But now that you have seriously considered profit potential and affordability, what is your decision?

The step-by-step analysis recorded on this Partial Budget Form should allow you to reach your decision with greater confidence.

The AIM (Partial Budget) Form	
Step 1: Define the Decision <ul style="list-style-type: none"> • <i>What is the problem?</i> • <i>What are the alternatives?</i> • <i>What opportunity exists?</i> • <i>What is the investment?</i> 	
Step 2: Will it pay? <ul style="list-style-type: none"> • <i>Will the investment be profitable?</i> • <i>What are the economic advantages?</i> • <i>What are the disadvantages?</i> 	
Added Expense	Added Revenue
Reduced Revenue	Reduced Expense
Total Economic Disadvantage	Total Economic Advantages
Net Disadvantage	Net Advantage
Step 3: Analyze the Financial Implications Can I afford it? <i>Effect on financial health</i> <i>Affect on financial ratios</i> <i>Leverage increased?</i> <i>Cause financial stress? Is it feasible?</i>	
Step 4: Do I want to do it? Make the decision. <i>Is the alternative acceptable? Is this investment compatible with your personal and business goals?</i> <i>Considering profit potential and affordability what is your decision?</i>	

Question

Complete the payoff chart by circling the correct response.

	Winner	Loser
Chosen	[Correct/Incorrect] Full Steam Ahead	[Correct/Incorrect] Choice Money Thrown Away
Rejected	[Incorrect/Correct] Too bad – Lost Opportunity	[Correct /Incorrect] Choice Loss Avoided

Answer

Compare your answers. Correct any errors.

	Winner	Loser
Chosen	[Correct/Incorrect] Choice Full Steam Ahead	[Correct/Incorrect] Choice Money Thrown Away
Rejected	[Incorrect/Correct] Choice Too bad – Lost Opportunity	[Correct /Incorrect] Choice Loss Avoided

Remember that rejecting a winner can be just as serious as choosing a loser. The ‘correct’ choice is dependant on the situation. The same choice that is correct in one scenario could be deadly in another.

What Is To Be Done?

It is difficult to stress too strongly the need to clearly specify the problem to be solved; even so, it is a step that is not infrequently glossed over. Time spent in analyzing a situation saves time in directing the manager’s effort into solving the underlying problem; it saves time and avoids chasing after non-existing problems. The manager’s attention must be directed to those things that matter.

The things within your control are the only things about which you can make decisions and take direct action. For example, as a farm manager you can decide whether to market your barley directly or feed it to a pen of beef steers. Being able to identify those things which are controllable is a major managerial task.

Once the problem has been identified alternative solutions must be specified. Very few problems have only a single correct solution. It is an important function of the manager to determine potential solutions to the problem. Brainstorming for possible solutions with business partners, management team colleagues or others who have faced similar problems can often be a valuable exercise. Professional help may also be available in identifying alternative solutions to a problem.

Sometimes the solution is immediately recognizable as correct and can be implemented without further analysis. In other cases a suggested solution can be dismissed quickly after only cursory examination because it is so obviously undesirable. Most of the time, especially where large amounts of money or effort are at stake a thorough analysis of the likely consequences must be undertaken.

Especially in these latter cases, care should be taken to clearly write out the alternative solution to be examined. This ensures that the correct information will be gathered and that it will be analyzed properly. The “What Can Be Done” section of the partial budget form provides a space for identifying the potential solution.

In specifying alternative solutions to a problem be as specific as possible; preferably do it in writing. For example, expressing the alternative as “Should I take 160 acres out of barley production and put it into wheat?” is more clearly stated than is “Should I grow

wheat or barley?” “Should I own a combine?” is not as focused as “Should I buy a combine to replace the custom operator I have been using?”

Will it Pay?

The ‘will it pay’ question is one of profitability; you are trying to determine if an alternative course of action will have a favourable economic outcome. And it is a question that must be answered about the future, [i.e. before all the needed information is completely known]. Because of the futuristic setting in an uncertain environment an organized approach is called for. The profitability question on the partial budget form is divided into four quadrants; any situation will involve some combination of added expenses, added revenue, reduced revenue or reduced expenses. An important set of decision rules guides the manager in three production categories.

How much to produce: a frequently encountered set of problems is the resource intensity question. How much fertilizer should be used in producing barley? How much milk should be produced from a given cow? To what weight category should a steer be fed? How heavily should the pasture be grazed? These are called input/output problems in that we have an input [e.g. fertilizer] and an output [e.g. barley]. The manager must decide how much fertilizer to apply thereby determining the amount of barley to produce. Problems of this sort involve added expenses and added revenues.

These decision rules come from an earlier set of modules in *Managing the Modern Farm Business* that deal with Production Management. Readers are encouraged to find the answers to the questions of How Much, How, and What to Produce there.

Decision Rule I

Increase the use of an input, [e.g. fertilizer], as long as the added cost associated with its use is more than compensated for by the added revenue from the extra output produced, [e.g. barley]. Stated another way, the alternative is profitable if added revenue exceeds added expenses.

How to produce: another set of problems involves resource trade-off issues. Should we feed a high energy low roughage diet to beef cattle? Should we be highly mechanized or should we rely more on manual labour? These are called input/input problems in that we have one resource (such as mechanization) that we might substitute for another resource (such as labour). The manager must decide what combination of mechanization and labour to use; should he invest in machinery or labour? Problems of this sort involve added expenses and reduced expenses.

Decision Rule II

Increase the use of one input, [e.g. mechanization], as long as the added expense associated with its use is more than compensated for by the reduced expense of the input being replaced, [e.g. labour]. Stated another way, the alternative is profitable if reduced expenses exceed added expenses.

What to produce: the final set of problems deals with product trade off situations. Should we follow a low forage high grain crop rotation? Should we increase the production of Canola at the expense of barley? These are called output/output in that we

have one output (such as forage) that we might produce in place of another (such as grain). The manager must decide what combination of products to produce. Problems of this sort involve reduced revenue and added revenue.

Decision Rule III

Increase the amount of one output, [e.g. grain], as long as the added revenue associated with its production more than compensates for the reduced revenue associated with the output being replaced, [e.g. forage].” Stated another way, the alternative is profitable if added revenue exceeds reduced revenue.

In practical situations we often encounter alternatives where dimensions of all three problems are involved. For example increasing grain production at the expense of forage output will also cause a shifting of costs. Although the added revenue and reduced revenue quadrants play the major roles there will also be added expenses and reduced expenses. As the form shows the sum of added expenses and reduced revenues represent economic disadvantages. In like manner the sum of added revenue and reduced expenses accounts for economic advantages. This results in the general decision rule.

General Decision Rule

Accept only those alternatives where the economic advantages exceed the economic disadvantages.”

Can I Afford It?

‘Can I afford it’ poses the affordability question. Affordability refers to the ability of the business to actually raise the funds to make the investment and to bear the additional financial risk. Funds typically come from one of two sources, namely equity or debt.

Equity Sources: Businesses that have generated profits over the years may have retained some of their earnings in the business; after all this is how a business grows. Retained earnings may be held in different forms, e.g. in various kinds of assets like land, buildings, machinery or cash. Assets can be converted to cash thus providing funds to finance the investment.

Business owners may also contribute additional capital into the business thus providing the necessary equity funds for investment.

Debt Sources: Businesses have the ability to borrow funds, i.e. to go into debt; they can raise debt capital. Liquidating assets to raise cash may prove disruptive to the business so borrowing may turn out to be a practical solution. A word of caution is appropriate. Using debt capital increases the leverage of the business and thereby the financial risk exposure.

How do you evaluate affordability? Obviously affordability is a non-issue for a business with lots of cash and few investment opportunities; does such a business exist? In a more typical situation the manager should look at the balance sheet of the business as it will appear after the investment has been made, especially if debt capital is to be involved. Calculate the basic financial ratios; the capital ratio, the current ratio, the leverage ratio.

Is the business moving into a financially stressed situation? Does the new leverage ratio, [that is, after the potential investment will have been made], forewarn of difficult or unmanageable financial risk? Is your banker nervous about your financial condition as he assesses how your business will look after the investment is in place? If he is, maybe that's your answer?

You must also look at the investment itself, especially at the size and timing of cash flows. Will there be sufficient cash generated in a timely fashion to retire the debt? Will you have to dig into other parts of the business to raise enough cash to remain liquid?

When should you evaluate affordability? Strictly speaking you need to evaluate the affordability of only those investment alternatives that show the potential of profit. In normal circumstances only paying investment alternatives would be implemented. In other words don't waste time on those alternatives that do not pay.

It is unfortunate but sometimes only the affordability analysis is done; the profitability question can easily be overlooked if one concentrates on the ability to pay back the loan to the exclusion of other factors, especially those dealing with profit.

Do I Want To Do It?

The decision embodied in the 'do I want to do it' component answers the question of acceptability. Is the investment desirable? Do we want to make the investment? Ideally we want investments that are profitable, affordable and desirable.

We might run into situations where something is affordable and acceptable, but not profitable. Would we do it? We might, but in the knowledge that we were subsidizing the investment from somewhere else in the business. Obviously, in a competitive world we can't make too many unprofitable investments with out economic consequences.

We might encounter another situation where something is profitable in the long run and otherwise acceptable. But, because of the long run nature of the investment there would be difficulty in generating sufficient cash flow to pay back the loan. Should this investment be made? Probably not, the financial risk is just too great. If it's not affordable its best avoided.

Finally, does the investment fit our personal, family and business goals? Even though an investment might be both profitable and affordable, we might chose to reject it if it doesn't move us toward our long-term goals.

A Spirited Community

We will look in on a rather close knit community where the locals gather at Katie's Kaffee Klatsch; locally it's just called the Klatsch. Katie's patrons include neighbourhood farmers as well as local business folks. It's a great place to generate new ideas and talk over problems. She got tired of tablecloths being ruined by the doodlers so she put up a blackboard for the gang to use when it gets into heavy discussion. In fact Katie has a mission for the Klatsch – to provide a place for dispensing knowledge, stamping out ignorance or just wasting time. She lets her patrons choose the option of the day.

An AIM (Partial Budget) Example

Pierre Engrais is a wheat farmer; in total he plants 960 acres of wheat each year. This spring he was encouraged by Nels Kjeldahl, an analyst with the soil and feed testing laboratory, to have his soil tested for its nutrient content. As Nels said, "Your available nitrogen is deficient so we recommend you apply 50 pounds of nitrogen per acre at seeding time. With prevailing moisture conditions you should see a 10 bushel per acre increase in wheat yield over the base yield." "That should take my yield from 30 bushels to 40 bushels per acre," was Pierre's response. A few of the fellows around the table at the Klatsch had similar concerns about their cropping programs and so a spirited discussion ensued as to the economic wisdom of applying this level of fertilizer.

"How sure are you, Nels that the yield will increase by 10 bushels?" Pierre wanted to know. Nels responded, "It's an average that takes a number of factors into account, especially growing conditions like spring soil moisture and growing season precipitation." "We know soil moisture is pretty good this spring but precipitation is an unknown, so the yield prediction is not a sure thing!" Pierre observed thoughtfully; with this he began to think about the economics of the situation.

John Farmer, who faced a similar situation on his farm, noted "Nitrogen fertilizer costs \$0.50 per pound plus an application cost of \$2.00 per acre." "Indications are that wheat will sell for \$5.00 per bushel, and we should be able to move the crop into the market within the year," Jake Rindfleisch added to the conversation. "But the price is not totally for sure either, is it?" Pierre reflected.

Because the yield of wheat is somewhat uncertain, i.e. there may be more or less than a 10 bushel increase, and because the price might also vary from the \$5.00 level Pierre needs to explore ways to deal with the inherent business risk. Ben Argent, local bank manager made a suggestion. "Why don't you insist that the investment return at least a certain rate, say at least 10% on your money. That way you are compensated for two things: for waiting because you won't get your money back until the wheat is harvested and sold, and for the risk of low yields and prices."

Pierre has been keeping detailed records of his farming operation and has a five-year average summary of his wheat growing enterprise. It costs him \$75.25 per acre for growing the crop comprising fertilizer at \$7.25, seed at \$10.00, weed control at \$24.50, crop insurance at \$3.50, labour at \$14.00 and machinery operating expenses at \$16.00.

Pierre must decide whether the additional fertilizer is a good investment. The cost analysis for wheat production on his farm is in the table.

Let's look in on Pierre and the gang at Katie's Kaffee Klatsch as they follow the steps of the partial budget form to make the decision.

What is to be done? The important question to be answered is this. Pierre asks, "Should I apply 50 pounds of nitrogen per acre to my wheat crop?" Stating the problem clearly and concisely, as Pierre has done, is a big help to him in setting the stage for analysis. For example he might have simply mused, "Should I fertilize this spring?" That would not have set up the situation very well for finding the answer.

Will it pay? To answer this question Pierre must assess the economic disadvantages and advantages of the situation. Because he stated the problem concisely he can readily identify the relevant cost and revenue items.

Only the expenses and revenues incremental to the fertilizer decision are relevant. Other costs, such as seed, machinery operating and weed control are being borne already whether or not fertilizer is used. The same can be said for real estate taxes and crop insurance. On the revenue side the base 25 bushels per acre are not relevant to the fertilizer decision either since this amount will be harvested anyway, with or without the application of nitrogen.

This case involves added expenses and added revenues only. There are no reduced revenues or reduced expenses from the addition of fertilizer.

Added Expense: Pierre sized up the situation and proceeded to calculate the added costs of the fertilizer. "Obviously applying 50 pounds of nitrogen will increase expenses, by \$25.00 per acre to be exact, [i.e. $50 \times \$0.50 = \25.00]."

Question

Complete Pierre's calculations in the following statement. Refer to the information in the table above.

"Next there is the matter of the \$2.00 cost of application. All told added costs are [\$_____] per acre (that is [\$_____ + \$_____ = \$_____]) or [\$_____] for the whole farm.

Total fertilizer material costs are [\$_____ (that is [\$_____ x _____ acres = \$_____] , and [\$_____] for application (that is [\$_____ x _____ acres = \$_____)]."

Wheat Enterprise Analysis (Pierre Engrais)	
Five Year Average Costs and Returns	
Item	Wheat
Yield (bushels per acre)	25 bu
Price (dollars per bushel)	\$5.00
Revenue (per acre)	
Crop Sales	\$125.00
Direct Expenses (per acre):	
Fertilizer	7.25
Seed	10.00
Weed Control	24.50
Crop Insurance	3.50
Machine Operating	16.00
Labour	14.00
Total Direct Expenses	\$75.25
Contribution Margin	\$49.75

Answer

Compare your work to Pierre's answers. Correct any errors.

"Next there is the matter of the \$2.00 cost of application. All told added costs are [\$27.00] per acre (that is [\$25.00 + \$2.00 = \$27.00]) or [\$25,920] for the whole farm.

Total fertilizer material costs are [\$24,000 (that is [\$25.00 x 960 acres = \$24,000], and [\$1,920] for application (that is [\$2.00 x 960 acres = \$1,920)]." Continuing to analyze the situation, Pierre made note of the correct added expenses.

Reduced Revenue: "You won't be giving up any sales of product as a result of fertilizer use so there are no reduced revenues in this situation," John Farmer was quick to notice.

Total Economic Disadvantage: Pierre went on to notice that, "Since there are no reduced revenues for this situation, only added expenses, the total disadvantages of the investment are \$25,920. As a matter of fact this is the amount I would be investing in the project."

Added Revenue: John quickly calculated, "the added revenue would be made up from the sale of wheat." He went on to explain, "an extra 10 bushels per acre at \$5.00 per bushel amounts to \$50.00 per acre; that's \$48,000 in total over the 960 acres, [i.e. \$50.00 x 960 = \$48,000]."

"But is this really worth \$48,000 to Pierre?" Ben enquired. "Remember that the \$48,000 is a 'promised' amount, subject to uncertainty. Pierre argues that, "for an investment of this risk level I need to be compensated at a rate of 10%." The question now arises, what is an uncertain \$48,000 to be received in one year's time worth today if money is worth 10% per year?

Pierre, having picked up on Ben's point, explained it to the folks. "If I had \$43,636 today I could invest it at 10% for a year, in an investment as risky as the fertilizer situation and have the \$48,000 at the end of the period; subject to the uncertainty of it of course.

Question

Help Pierre explain the calculation by filling in the blanks in the following statement.

The interest on [\$ _____] at 10% is [\$ _____] which when added to the original \$43,636 amounts to [\$ _____]. This is to say that [\$ _____] x 1.10 = [\$ _____]." The gang at the Klatsch nodded in agreement with Pierre's cogent reasoning.

Stated another way, the present value of \$48,000 is [\$ _____ (that is \$48,000 / 1.10 = [\$ _____]. The \$48,000 to be received in one year is then really only worth [\$ _____] to Pierre today.

Answer

Compare your work to Pierre's. Correct any errors.

The interest on [\$ 43,636] at 10% is [\$ 4,364] which when added to the original \$43,636 amounts to [\$ 48,000]. This is to say that [\$ 43,636] x 1.10 = [\$ 48,000].” The gang at the Klatsch nodded in agreement with Pierre's cogent reasoning.

Stated another way, the present value of \$48,000 is [\$ 43,636 (that is $\$48,000 / 1.10 =$ [\$ 43,636]. The \$48,000 to be received in one year is then really only worth [\$ 43,636] to Pierre today.

Reduced Expenses: As a number of the participants noted, there are no reduced expenses in this situation.

Total Economic Advantage: Since there are no reduced expenses in this situation, only added revenues, total economic advantages of the investment are \$43,636.

Net Advantage: “The net advantage I can expect,” Pierre continued, “is therefore, in present value terms, \$17,716, [that is $\$43,636 - \$25,920 = \$17,716$]. Will it pay? Yes, it will!”

Can I afford it? Pierre has already allowed for the business risk in the profitability analysis, by discounting the revenues to their present values. However there is the matter of financial risk. Will he need to borrow the extra \$28,800 needed to finance the fertilizer and application? What will be the impact of borrowing on his leverage ratio? What will be the impact on his current ratio? These become important issues for Pierre to wrestle with.

Suppose that the Engrais farm business is well established with sufficient current assets to justify the extra pressure on its line of credit at the bank. Also, Pierre has been using crop insurance, as a matter of course to transfer some of his business risk, and consequently his financial risk. With the insurance in place he can count his growing crop as security against the line of credit making the fertilizer investment affordable.

Do I want to do it? Now is the time for decision. The investment is profitable and affordable. Unless Pierre has an aversion to using chemical fertilizers he will likely decide in favour of the investment. If Pierre had such an aversion, i.e. perhaps he had an organic wheat growing operation he would probably have investigated alternative means to solve his crop nutrition problems. Pierre decides to make the fertilizer investment.

Business Risk: An important point to remember: all expenses and revenues must be at the same point in time, at their present values for the analysis to be valid. In the example all expenses and revenues have been brought to the point in time at which the decision is made, that is the present time. Furthermore, using a risk-adjusted discount rate is the acceptable way for dealing with the business risk inherent in the investment. Please refer to the section, ‘Allowing for Risk.’

Financial Risk: It is important to recognize that, even though an investment shows profit potential certain vulnerabilities may exist in the business such that the financial risk could become excessive. Consequently an analysis of the investment's impact on the financial health of the business becomes vital. Please refer to the section ‘Allowing for Risk.’

Later at home, Pierre summarized his analysis and decision using the AIM (partial budget) form.

The AIM (Partial Budget) Form	
What is to be done? <i>Should I apply 50 pounds of nitrogen per acre to my wheat crop?</i>	
Will it pay? <i>Yes, as the following analysis shows it appears to be a profitable investment.</i>	
Added Expense: <i>Cost of Nitrogen \$24,000</i> <i>Cost of Application \$1,920</i>	Added Revenue: <i>Present Value of Wheat Sales \$43,636</i>
Reduced Revenue: <i>nil</i>	Reduced Expense: <i>nil</i>
Total Economic Disadvantage: \$25,920	Total Economic Advantage: \$43,636
	Net Advantage: \$17,716
Can I afford it? <i>The line of credit is adequate to finance the fertilizer purchase without an undue increase in financial risk. Yes, I can afford it!</i>	
Do I want to do it? <i>Yes, since there is a net advantage of \$17,716 and there are no financial feasibility limitations, it will be implemented.</i>	

Using the AIM form helped Pierre systematically lay out the problem and follow the steps to its solution.

Allowing For Risk

Pierre recognized that the fertilizer was not a riskless investment. He needed to purchase the fertilizer at planting time and would not see the results until harvest. This delay in receiving income until harvest for an outlay of cash today imposes a risk. There are two kinds of risk that must be accommodated, business risk and financial risk.

Business Risk

Business risk refers to the risk embodied in the project itself without regard to how the project is financed. It refers to the ups and downs of yields, prices and costs that Pierre faces, much in the same way that all of his neighbours also experience. Jacques, a wheat farmer down the road is exposed to almost the same business risk as is Pierre even though Jacques carries a much heavier debt load on his farm.

It is very important to recognize that in analyzing profit potential that projections are being made. The decision maker should base his projections on what he or she expects to happen. Overly optimistic or pessimistic forecasts should be avoided. Think in terms, on average this or that will happen. A ten bushel yield increase was expected in the above fertilizer example. In reality it may turn out that there is a drought and the increase is only five bushels. On the other hand it may be a bumper year with an increase of fifteen bushels. The rule is ‘stick with the expected or average value and adjust for the risk in the discount rate.’

Recall that Pierre, on the suggestion of bank manager Ben Argent, discounted the added revenue thereby bringing all of the flows of cash back to the same time period, i.e. to the time of the decision. It was argued that there was some risk in the yield and price forecasts and he would need a 10% return on his money to justify the investment. Let's explore his reasoning a bit further. Why would he not be happy with the rate paid on guaranteed investment certificates or government bonds? Suppose these are paying 3%. Obviously the risk inherent in these financial instruments is low compared to what Pierre assesses for the fertilizer project. He needs a risk premium over and above what a safe investment would be earning. The risk premium he needs is 7% bringing discount rate to 10% [i.e. $3\% + 7\% = 10\%$].

Financial Risk

Even though a project shows good profit potential it is wise to also think about its affordability. Will the risk exposure of the business become excessive? What are the financial risk implications? What is financial risk?

It was pointed out that Pierre and his neighbour Jacques had farms of similar size and productivity and experienced the same level of business risk. Jacques however carries a

There are a set of modules in the Managing the Modern Farm Business series dealing with risk. The design of risk management strategies and identifying sources of business and financial risk are explained in greater detail there. More about selecting discount rates is found in the technical glossary.

much heavier debt load than does Pierre. Because of his higher debt-equity or leverage ratio Jacques' business risk gets magnified into greater financial risk. Generally speaking, investments into operating expenses, like fertilizer, are self liquidating, [i.e. such investments are of such a short term nature that if they pay they are also affordable]. It may well be however that longer term investments, even though they might be profitable would not be affordable to Jacques because of his already high debt load.

The Time Horizon

The length of time involved in an investment is of crucial importance in the analysis, especially in the profitability analysis. For this reason, the time when cash flows occur becomes an important factor. When will the investment begin? When will it terminate? For convenience we will divide the problem into two categories.

Single period investments are those that begin within the production period and end within the same period. For example fertilizer is applied at the start of the crop production cycle and the barley is harvested and sold at the end. All of this happens within the year.

Multi-period investments run over extended periods of time. For example a beef breeding herd is established and may be productive for generations to come. Machinery is purchased and buildings built with the intention that services will be provided for many years. When using the partial budgeting procedure it is usual to express the profit analysis on an annual basis even for multi period situations.

We will discuss the investment topic under these two categories, namely single period and multi period analysis.

Single Period Investments

Single period investments run their course in one production period. To illustrate the technique we will use two examples of short run investments in a farm business. The first example involves changing the cropping program. The second example involves an alternative use for the barley crop. Instead of direct marketing, the alternative of feeding the crop to beef cattle is tested.

Example 1: A Question of What to Produce

Substituting Edible Peas for Feed Barley

John Farmer is planning his crop program for the coming year. He had planned on growing 640 acres of feed barley but is now wondering if planting edible peas on 160 acres, still leaving 480 acres for barley, might not be a better choice for the investment of crop inputs.

John had kept detailed records of feed barley production operation over the last five years. He reported to the group that, “my five year average costs were \$31.25, \$10.00 and \$22.50 respectively for fertilizer, seed and weed control chemicals. Crop insurance was another \$3.00, machinery operating costs were \$16.00 and labour added another \$14.00.” He went on to say “my barley yields have run at 50 bushels per acre for the level of fertilizer used.” “What do you guys think the price will be? I think \$3.00 per bushel seems to be a reasonable estimate considering all things.” There was a murmur signifying general agreement.

Joe Reaper had some experience with edible pea production and was willing to share his knowledge. He suggested that, “Fertilizer expense would be around \$7.25, much less than for barley since peas are a nitrogen fixing legume. Seed, on the other hand is a major item at \$30.00. Weed control is a bit more than for barley, coming in at another \$30.00. Crop insurance will run at \$4.50.

Machine operating costs and labour should be the same as for barley; \$16.00 and \$14.00 respectively should cover these items.” He concluded, “You can expect a yield of 35 bushels per acre and a price of \$5.00 per bushel.”

Costs and Returns for Feed Barley and Edible Peas		
For John Farmer		
Item	Feed Barley	Edible Peas
Yield (bushels per acre)	50 bu	35 bu
Price (dollars per bushel)	\$3.00	\$5.00
Revenue (per acre)		
Crop Sales	\$150.00	\$175.00
Direct Expenses (per acre):		
Fertilizer	31.25	7.25
Seed	10.00	30.00
Weed Control	22.50	30.00
Crop Insurance	3.00	4.50
Machine Operating	16.00	16.00
Labour	14.00	14.00
Total Direct Expenses	\$96.75	\$101.25
Contribution Margin	\$53.25	\$73.75

John's assessment of the two crops was that the edible peas are marginally more risky than is feed barley. "I think I'm willing to accept a 10% cost of capital for the investment in feed barley but I think an extra two points of risk premium on the peas might be prudent," he argued. The insurance company apparently agrees with this assessment in that it is charging a higher premium for covering the peas as opposed to the barley, [i.e. \$4.50 vs. \$3.00]. Consequently a 12% cost of capital for the pea enterprise seems reasonable.

Would John's profit increase by switching 160 acres out of barley and into peas? By how much would it increase? Should he do it?

What is to be done? The alternative is clearly stated by John's question, "Should I take 160 acres out of fed barley production and put these acres into edible pea production?"

Will it pay? This is mainly a situation of substituting one crop for another. The major components will be increased pea revenue offset by a reduction in barley revenue. However, because direct costs of production between the two crops also differ there will be some added and reduced revenues.

Added expense: Putting land into edible pea production will result in added expenses of \$101.25 per acre [i.e. the direct costs from the table]. For the 160 acres this totals to \$16,200.

Reduced revenue: Eliminating barley production on 160 acres will reduce revenue by \$24,000, [i.e. 50 bushels per acre at \$3.00 per bushels for 160 acres]. To allow for business risk and to bring all cash flows into the same time period this amount is discounted by 10% for a present value of \$21,818, [i.e. $\$24,000 / 1.10 = \$21,818$].

Total economic disadvantage: The total economic disadvantage amounts to \$38,018 comprised of \$16,200 in added expense because of wheat production and \$21,818 in reduced revenue due to the elimination of barley.

Added revenue: Adding edible pea production on the 160 acres taken out of barley will increase revenue by \$28,000, [i.e. 35 bushels per acre at \$5.00 per bushel for 160 acres]. To allow for business risk and to bring all cash flows into the same time period this amount is discounted by 12% for a present value of \$25,000, [i.e. $\$28,000 / 1.12 = \$25,000$].

Reduced expense: Taking land out of barley production will result in reduced expenses of \$96.75 per acre [i.e. the direct costs from the table]. For the 160 acres this totals to \$15,480.

Total economic advantage: The total economic advantage comes to \$40,480 made up of added revenue in the amount of \$25,000 for edible pea sales and \$15,480 for the elimination of barley production costs.

Net economic advantage: There is a net economic advantage of \$2,762 indicating that the transfer of acreage from feed barley to edible peas is profitable.

Can I afford it? There is no affordability issue since there are no major differences in the magnitude or timing of cash flows. Business risk has been accommodated through the discounting procedure and by the potential diversification effect of introducing another crop into the mix. Furthermore there will be an agronomic advantage in improved soil

condition and nutrient content because of a legume into the rotation. “Yes”, John concludes, “This is quite affordable”.

Question

Help John Farmer summarize his analysis by completing the AIM (partial budget) form. Refer to the information above to complete an Annualized Incremental Method (AIM) form then select the appropriate decision.

The AIM (Partial Budget) Form	
What is to be done?	
Will it pay?	
Added Expense:	Added Revenue:
Reduced Revenue:	Reduced Expense:
Total Economic Disadvantage:	Total Economic Advantage:
	Net Advantage:
Can I afford it?	
<p>Do I want to do it?</p> <p><i>Yes, since the alternative is both profitable and affordable I will implement it!</i></p> <p><i>No. Even though the alternative is profitable I can not afford the cost. I will not implement it!</i></p> <p><i>No. The alternative is not profitable even though I can afford the cost. I will not implement it!</i></p> <p><i>No. The alternative is both unprofitable and unaffordable. I would be foolish to implement it!</i></p>	

Answer

Compare your work to John Farmer's. Correct any errors.

The AIM (Partial Budget) Form	
What is to be done? <i>Should I take 160 acres out of feed barley production and put these acres into edible pea production?</i>	
Will it pay? <i>Yes, the analysis shows that the alternative has the potential for profit.</i>	
Added Expense: <i>Cost of Pea Inputs \$16,200</i>	Added Revenue: <i>Present Value Peas Produced \$25,000</i>
Reduced Revenue: <i>Present Value Barley Eliminated \$21,818</i>	Reduced Expense: <i>Cost of Barley Inputs \$15,480</i>
Total Economic Disadvantage: \$38,018	Total Economic Advantage: \$40,480
Net Disadvantage:	Net Advantage: \$2,462
Can I afford it? <i>The change is quite affordable. There is no cash flow or financial risk issue; business risk is mitigated in a small way by diversification.</i>	
Do I want to do it? <i>Yes, since the alternative is both profitable and affordable I will implement it!</i> <i>No. Even though the alternative is profitable I can not afford the cost. I will not implement it!</i> <i>No. The alternative is not profitable even though I can afford the cost. I will not implement it!</i> <i>No. The alternative is both unprofitable and unaffordable. I would be foolish to implement it!</i>	

Do I want to do it? John Farmer was able to answer the question in the affirmative. The substitution of peas for barley on 160 acres proves to be both profitable and affordable. John decides: "Yes, I will certainly transfer 160 acres out of feed barley production into edible peas."

Example 2: A Question of How Much to Produce

Feeding Barley to Cattle

Jacob Rindfleisch has 6,000 bushels of barley on hand which he could sell for \$3.50 per bushel. Recently he has been considering the wisdom of feeding the barley to beef cattle instead. He can purchase 100 head of 850 pound feeder steers and sell them as 1,300 pound animals in 120 days. Jake expects it to take about 2 hours of extra time per day to look after the project, but he has lots of spare time in the winter months anyway. He also has adequate facilities to carry on the small feeding operation. These facilities were built five years ago and have been depreciated at \$1,500 per year. As an aside, the business has assets of \$750,000 with outstanding debt of \$150,000.

Jake, as his friends call him, expects it will cost \$30.00 per steer for veterinary bills, feed supplements, transportation charges and marketing charges. He will need 24 tons of hay worth \$50.00 per ton in the venture; he has been growing a bit of hay on some of the rougher land and has an adequate supply.

Experience suggests a 1% death loss of cattle in a project of this sort. Feeder steers can be purchased for \$110.00 per hundredweight and market analysts predict that finished cattle will be selling for \$100.00 per hundredweight when these hit the market. Having assessed the risk in this project, Jake thinks he needs a return of at least 18% per annum on his investment.

Should Jake feed the barley to the steers, or should he sell it directly? If he decides on the feeding option what will his profit be? How low could the expected price of finished cattle be before Jake would be indifferent between feeding and selling the barley directly at \$3.00 per bushel? With feeder cattle at \$110.00 per hundred weight and finished beef at \$100.00 per hundredweight, what would the price per bushel of barley need to be for Jake to be indifferent between the two options?

Jake just received his results from a survey on the cost of producing barley; it cost him \$3.50 per bushel. Would this new information affect his feeding decision? In what way would his decision change?

What is to be done? Jake stated the alternative clearly: “Should I feed 5,000 bushels of my own barley to 100 head of feeder steers instead of selling it directly?”

Will it pay? This is mainly a situation of using barley as an input in the production of beef. The purchase of feeder cattle and incidentals represent added expenses. Since the barley is already on hand, its use will represent reduced revenue because it would have been sold otherwise. The added revenue from beef sales will be a major item in the analysis. There are no elements of reduced expenses in this situation.

Added Expenses: The \$93,500 for the purchase of feeder cattle, [i.e. 100 head at 850 pounds at \$1.10 per pound] and the \$3,000 incidental costs represent added expenses. The \$1,500 cost of depreciation and the 2 hours of labour per day are not relevant to the decision. The depreciation is already being borne by the business. Jake said that the 2 hours are spare time that would not have been paid. In this case depreciation and labour are not incremental costs. Jake’s added expenses will total \$96,500, [\$93,500 + \$3,000].

Reduced Revenue: Jake is deciding whether to use 6,000 bushels of barley for feeding to beef cattle. Since he could sell this for \$3.50 per bushel the total \$21,000 is reduced revenue. In a similar vein the 24 tons of hay worth \$1,200, (it could be sold at \$50.00 per ton) is also a reduction. Reduced revenue totals \$22,200, [$\$21,000 + \$1,200 = \$22,200$].

Total Economic Disadvantage: The total economic disadvantage for Jake's cattle feeding venture is \$118,700, [$\$96,500$ added expenses plus $\$22,200$ reduced revenue].

Added Revenue: Jake will have 99 head of finished cattle for sale (remember the one per cent death loss). He will receive \$128,700, [99 head at 1,300 pounds at \$1.00 per pound]. Jake realizes that the \$128,700 is 120 days in the future and subject to risk; the amount is an expected amount. Consequently Jake will discount the gross by 18% per annum to bring things into the correct time frame and risk perspective. An 18% rate per annum would be 5.67% for the 120 day period, [one-third of a year]. The \$128,700 expected in 120 days is worth only \$121,794 in present value terms, [$\$128,700 / 1.0567 = \$121,794$].

Reduced Expenses: There are no reduced expenses.

Total Economic Advantage: The total economic advantage amounts to \$121,794, the discounted added revenue from cattle sales.

Net Economic Advantage: The net economic advantage is \$3,094, [i.e. $\$121,794 - \$118,700 = \$3,094$], indicating that the alternative promises profit.

Can I afford it? Jake reasons, "We will have to come up with \$96,500 of cash to finance the venture." He went on to argue, "We have enough equity in the business so we can extend our line of credit to cover the amount. The business risk is accounted for by the discount rate so we are able to bear the added financial risk. The project is affordable."

Question

Help Jake to make his decision by completing the AIM (partial budget) form then select the appropriate decision.

The AIM (Partial Budget) Form	
What is to be done?	
Will it pay?	
Added Expense:	Added Revenue:
Reduced Revenue:	Reduced Expense:
Total Economic Disadvantage	Total Economic Advantage
	Net Advantage
Can I afford it?	
Do I want to do it? <i>No, even though the venture is profitable, I cannot afford the reduction in revenue. We will continue to sell the barley directly.</i> <i>Yes, since it is both profitable and affordable to do so we will feed the cattle instead of selling the barley directly.</i> <i>No, even though it is profitable there is no economic advantage. We will continue to sell the barley.</i>	

Answer

Compare your work to Jake's. Correct any errors. Did you reach the same conclusion?

The AIM (Partial Budget) Form	
What is to be done? <i>Should I feed 6,000 bushels of my own barley to 100 head of feeder steers instead of selling it directly?</i>	
Will it pay? <i>Yes, the project has the potential of making a profit.</i>	
Added Expense: <i>Purchase 100 Steers \$93,500 Incidental Expenses \$3,000</i>	Added Revenue: <i>Present Value of 99 Steers Sold \$121,794</i>
Reduced Revenue: <i>6,000 bushels of barley fed \$21,000 24 tons of hay fed \$1,200</i>	Reduced Expense: <i>nil</i>
Total Economic Disadvantage: \$118,700	Total Economic Advantage: \$121,794
	Net Advantage: \$3,094
Can I afford it? <i>We will have to come up with \$96,500 of cash to finance the venture but we have enough equity in the business so we can extend our line of credit to cover the amount. The business risk is accounted for by the discount rate so we are able to bear the added financial risk. The project is affordable.</i>	
Do I want to do it? <i>No, even though the venture is profitable, I cannot afford the reduction in revenue. We will continue to sell the barley directly.</i> <i>Yes, since it is both profitable and affordable to do so we will feed the cattle instead of selling the barley directly.</i> <i>No, even though it is profitable there is no economic advantage. We will continue to sell the barley.</i>	

Do I want to do it? Now that both the profitability and affordability tests have passed it is time for the decision. Jake decided, "We will feed the cattle instead of selling the barley directly."

Multi-Period Investments

Multi-period investments run their course over more than one production period. To illustrate the technique we will use two examples of longer-run investments in a farm business. The first example involves replacing a custom harvesting operator by purchasing a combine. The second involves adding a supplementary cow-calf enterprise to an existing grain farm.

Example 3: A Question of How to Do It.

Buying a Combine Instead of Hiring Custom Work

The local machinery dealer is over stocked with combines and has offered to sell Joe Reaper a new model for \$100,000. Joe expects the machine to last seven years; currently seven-year old used models of this combine are selling for \$20,000. The combine has a capacity of 12 acres per hour at an operating cost of \$60.00 per hour. Joe values money tied up in a machinery investment of this sort at 10% per annum.

To this point he has been using a custom operator at a rate of \$20.00 per acre to harvest 1,200 acres. Under the custom contract Joe hauled the grain in his own truck. Joanne, Joe's daughter, has just passed her test for a driver's license and is willing to haul the grain for \$5.00 per hour while Joe runs the combine. Should the Reapers purchase the combine or should they continue with the custom operator?

What is to be done? The situation is expressed by Joe when he states, "Should we replace the custom operator by purchasing our own combine?"

Will it pay? In this situation Joe is contemplating the exchange of one harvesting method with another: custom hiring vs. owning the combine. This will involve added expenses and reduced expenses. The interesting part of the problem will be the capital costs associated with purchasing and owning the combine.

Added Expenses: The combine can be purchased for \$100,000 and will have a salvage value of \$20,000 in seven years. The first thing Joe asks is, "What is the net amount we need to spend here?" On a quick and dirty basis we can conclude that we spend a net of \$80,000; we will get \$20,000 back in seven years, so that's depreciation of \$11,429 per year [$\$80,000 / 7 = \$11,429$]. "In addition to the loss in value we also have money tied up in the combine and so we should account for that too", Joe is quick to point out. In the average year we have an investment of \$60,000, [$(\$100,000 + \$20,000) / 2 = \$60,000$]. The interest on \$60,000 at 10% would be \$6,000 per year. A cost of capital at 10% seemed reasonable to Joe under the circumstances. In total that would be \$17,429 for the annual cost of the capital investment, [$\$11,429 + \$6,000 = \$17,429$].

That looked OK on the surface but Joe was uneasy. “What about the fact that we lay out \$100,000 now and won’t see the salvage value for seven years” he asked “Don’t we need to account for that?” “Yes,” Ben Argent, the banker, interjected. “It is important that we do. Remember we want everything converted to the same time period; the period of choice is of course the present.” Ben had his financial tables with him.

First we need to know what the present value of the net capital outlay is. Ben had to refer to a set of financial tables in his pocket [Module 5 The Technical Glossary, Table A2, page 22] from which he determined that with a 10% interest rate the present value of \$1.00 received in seven years was worth \$0.5132, hence \$20,000 in seven years is worth \$10,264, [$\$20,000 \times 0.5132 = \$10,264$]. That means our net capital outlay is actually \$89,736 not \$80,000, [$\$100,000 - \$10,264 = \$89,736$]. “Now how can we express this as an annual amount?” Joe was interested in knowing. “Well, we could amortize

Financial Table at 10.0% Interest Rate		
Year	Present Value	Amortization Factor
1	0.9091	1.1000
2	0.8264	0.5762
3	0.7513	0.4021
4	0.6830	0.3155
5	0.6209	0.2638
6	0.5645	0.2296
7	0.5132	0.2054
8	0.4665	0.1874
9	0.4241	0.1736
10	0.3855	0.1627

it just like my loans officer at the bank would do if you wanted the option of paying back a loan with equal annual payments,” Ben went on. “I see,” said Joe as he looked up the amortization factor [table A6 page 26 Module 5 Technical Glossary] for \$1.00 over seven years at 10% per annum and found it to be \$0.2054. “Then that means the annual cost, depreciation and interest comes to \$18,432 not \$17,429 like we had with the other rather crude method,” Joe observed.

That other method is called the ‘accounting rate of return method.’ It is biased and always understates the true capital cost. “That’s like setting your table saw to cut a right angle at 89 degrees,” Joe chuckled “I think we’ll use the better method, after all it’s no harder to apply and it makes a great deal more sense.” The crude accounting rate of return method understates the cost by more than 5.0%, [$1 - \$17,429 / \$18,432 = 0.0544$ or 5.44%].

In addition to the capital costs, Joe will have to pay operating costs as well. He will have to operate the combine for 100 hours at \$60.00 per hour in fuel and maintenance expenses totaling \$6,000. Then there’s his deal with Joanne who must be paid \$500 for grain hauling, [100 hours of labour at \$5.00 per hour.

Added expenses amount to a total of \$24,932, [$\$18,432 + \$6,000 + \$500 = \$24,932$].

Reduced Revenue: There are no reduced revenues.

Total Economic Disadvantage: Total economic disadvantages add to \$24,932, the total of added expenses.

Added Revenue: There are no items of added revenue.

Reduced Expense: Since the custom operator’s services will no longer be required the associated expenses will disappear as well. The custom hire charges of \$24,000 will disappear, [1,200 acres at \$20.00 per acre amounts to \$24,000].

Total Economic Advantage: The total economic advantage is \$24,000; since there are no 'added revenue' items this is equivalent to reduced expenses.

Net Economic Disadvantage: The net economic disadvantage is \$932. The profitability test fails.

Can I afford it? The question of affordability becomes irrelevant since the profitability test has failed. There is no point in investigating financing options since the project is rejected.

Do I want to do it? Joe decides to remain with the custom operator since owning the combine option is more expensive.

Later at home, Joe summarized his analysis and decision in the AIM (partial budget) form. Just for curiosity Joe decided to check out the crude accounting rate of return method to see what his decision might have been. He filled out another AIM form using the information from the crude rate of return method to compare them.

Question

Complete the two AIM (partial budget) forms to help Joe Reaper make his comparison. First the AIM form for the accurate accounting method of calculating capital costs.

The AIM (Partial Budget) Form	
What is to be done? <i>Should we replace the custom operator by purchasing our own combine?</i>	
Will it pay? <i>No, it does not pay.</i>	
Added Expense: <i>Capital Costs of Combine</i> <i>\$89,736 over 7 years @ 10% \$18,432</i> <i>Operating Costs</i> <i>Fuel and Maintenance \$6,000</i> <i>Labour \$500</i>	Added Revenue: <i>nil</i>
Reduced Revenue: <i>nil</i>	Reduced Expense: <i>Custom Charges \$24,000</i>
Total Economic Disadvantage: <i>\$24,932</i>	Total Economic Advantage: <i>\$24,000</i>
Net Disadvantage: <i>\$932</i>	
Can I afford it? <i>The question of affordability becomes irrelevant since the profitability test has failed.</i> <i>There is no point in investigating financing options.</i>	
Do I want to do it? <i>No. Joe will remain using the services of the custom operator since the option of owning the combine is more expensive.</i>	

Feeling comfortable with his decision, Joe turned to a new AIM form.

Answer

Compare your work to Joe Reaper's. Correct any errors. First Form One:

The AIM (Partial Budget) Form	
What is to be done? <i>Replace the custom operator by purchasing our own combine?</i>	
Will it pay? <i>No, it does not pay.</i>	
Added Expense: <i>Capital Costs of Combine</i> \$89,736 over 7 years @ 10% \$18,432 <i>Operating Costs</i> <i>Fuel and Maintenance</i> \$6,000 <i>Labour</i> \$500	Added Revenue: <i>nil</i>
Reduced Revenue: <i>nil</i>	Reduced Expense: <i>Custom Charges</i> \$24,000
Total Economic Disadvantage: \$24,932	Total Economic Advantage: \$24,000
Net Disadvantage: \$932	
Can I afford it? <i>The question of affordability becomes irrelevant since the profitability test has failed. There is no point in investigating financing options.</i>	
Do I want to do it? <i>No. Joe will remain using the services of the custom operator since the option of owning the combine is more expensive.</i>	

Example 4: A Question of How Much To Produce

Adding a Supplementary Beef Enterprise

Sam Coulee's main farming enterprise is grain. Recently he bought some additional land including 160 acres of land unsuitable for cultivation. Now he is wondering whether to add a supplemental beef herd. He muses in front of his comrades at the Klatch, "That quarter section is rough and hilly but productive enough to pasture 25 cow-calf pairs plus replacement heifers." "Oh, sure!" his friends chided him; "even back in grade school you always wanted to play cowboy."

On a more serious note, Jake Rindfleisch ventured, "I saw an ad in the paper for a herd being offered for sale. They were asking \$1,000 per head for good bred cows and \$900 for bred two-year old replacement heifers. Calves are selling for around \$550 each."

Sam commented, "I'd expect to raise 21 calves per year of which 17 would be sold after weaning in October; the remaining 4 calves would be held back in the herd as replacement heifers. We'd breed these next June or July when they were about 15 months old. They'd calve as two-year olds. I'd expect one cow to die each year and three others will be culled from the herd." Jake, being up on the cattle market interjected, "Cull cows are selling for around \$750 per head." "I think I would use artificial insemination for breeding the herd," Sam continued. "That would run around \$40.00 per head and seems practical under your circumstances, Sam," was Jake's response.

While Sam and Jake were discussing the situation someone put the table on the blackboard Katie had so kindly provided. It shows the number of head on hand at the beginning and end of the year as well as the births, deaths, purchases and sales occurring each year to maintain the herd

Cattle Herd Dynamics					
Description	Beginning Balance	Born	Sold	Died	Ending Balance
Cows	25		3	1	25
Replacement Heifers	4				4
Calves		21	17		
Total head	29	21	20	1	29

composition in a steady state. This means that the herd size will remain at 29 head for as long as Sam wishes it to remain so.

John Farmer chimed in with an important question, "I don't know much about livestock being a grain farmer and all, but what besides pasture are you going to feed these critters?" Sam responded, "I'll need to buy 30 tons of hay for the winter plus 400 bushels of oats that I grow on the place. I expect the hay will come in at around \$50.00 per ton and I could get maybe \$2.00 per bushel for the oats." In addition these critters as you call them will need health care so I'll have annual expense for the veterinarian. Then there will be feed supplements and incidentals. This could be around \$500 for the three items."

"What do you guys think of the risk involved in this venture?" Sam wanted to know from his comrades. Ben Argent, the banker, had the chance to see quite a few cow-calf operations over the years and suggested the rate to be moderate. "You're going into a long term project here so your risk is definitely less than the short term feeding venture that Jake is trying out. What discount rate did you factor into your project, Jake?" I figured 18% per annum or 5.67% for the 120 days," was Jakes answer. After the

discussion was concluded Sam said, “I think the risk in this project is moderate and so I’ll value the capital tied up in the beef herd and the cash flows at 10% per annum”.

“Well Sam, are you going to be a cowboy, or what?” the gang wanted to know. As an individual interested in profit should Sam establish the beef herd?

What is to be done? Sam phrases the question succinctly, “Should I add a supplementary 25 head cow-calf enterprise to my existing grain farm?”

Will it pay? This investment opportunity will involve mainly added expenses and added revenue; however there will also be some reduced revenue by virtue of grain, which heretofore has been sold, is now being fed.

Added Expense: Added expenses can be broken down into two kinds, namely capital costs and operating costs.

The capital costs involve the investment in the herd itself. Sam was able to construct the ‘Cattle Herd Dynamics’ table which shows the movement of cattle through time. We assume that he has purchased the herd as a going concern and that he will continue to replace aging cows with replacement heifers raised from female calves kept back from the market; replacement heifers will be bred at 15 months of age to calve when they are two years old.

As such he will always have 25 cows worth a total of \$25,000, [25 head x \$1,000 = \$25,000] and 4 replacement heifers worth a total of \$3,600, [4 head x \$900 = \$3,600]. Because of this replacement method, and under the assumption of a stable economy, the female breeding herd will maintain a total value \$28,600 for an indefinite period of time. This represents an annual investment cost of \$2,860 at a rate of 10% per annum.

The operating costs consist of hay plus veterinary expenses, feed supplements and incidentals. He will purchase 30 tons of hay at \$50.00 per ton for a total of \$1,500. Artificial insemination will run at \$40.00 per cow for a total of \$1,000, and he will spend another \$500 on veterinary expenses, feed supplements and incidentals. Total added expenses amount to \$5,860, [\$2,860 + \$3,000 = \$5,860].

Reduced Revenue: Reduced revenue consists of 400 bushels of grain which normally would have been sold at \$2.00 per bushel for a total of \$800.

Total Economic Disadvantage: The economic disadvantage of the proposed cattle enterprise adds to \$6,660, [\$5,860 + \$800 = \$6,660].

Added Revenue: The added revenues arise from the sale of calves and cull cows. He will have 17 calves for sale at \$550 per head for a total of \$9,350. Recall that the best 4 heifer calves will be retained as replacements. He will also have 3 cull cows for sale each year at \$750 per head for a total of \$2,250.

Sam was impressed with Pierre’s account, the other day at the Klatsch, of discounting the revenue to bring things onto an equivalent time basis and to allow for risk. Using the method described by Pierre means that the present value of calf sales is \$8,500, [\$9,350 / 1.10 = \$8,500]. The 3 cows sold for \$2,250 are worth \$2,045 in present value terms. Total added revenue comes to \$10,545, [\$8,500 + \$2,045 = \$10,545].

Reduced Expense: There are no reduced expenses in this situation.

Total Economic Advantage: Since there are no reduced expenses the total economic advantage of this proposal is equivalent to the added revenue of \$10,545.

Net Economic Advantage: The net economic advantage comes to \$4,260, [$\$10,545 - \$6,285 = \$4,260$]. The project shows the potential for profit.

Can I afford it? Since the profit test passes, Sam proceeds to the affordability question. He does have adequate borrowing room so that there should not be any financial risk problems. As a matter of fact there are some diversification benefits which might reduce business risk and thereby mitigate any financial risk concerns.

Do I want to do it? “This cow-calf enterprise would be a useful supplemental addition to my grain farm,” Sam remarked. “And you can start wearing your cowboy hat again too,” the gang at the Klatsch chimed in.

Later at home, Sam summarized his analysis in the AIM (partial budget) Form to confirm his decision.

Question

Help Sam confirm his decision by completing the AIM form.

The AIM (Partial Budget) Form	
What is to be done? <i>Should I add a supplementary 25 head cow-calf enterprise to my existing grain farm?</i>	
Will it pay? <i>Yes, the venture will pay.</i>	
Added Expense: <i>Capital Costs</i> <i>Opportunity cost of herd @ 10% \$2,860</i> <i>Operating Costs</i> <i>Hay 30 tons @ \$50 per ton \$1,500</i> <i>Vet, feed and incidentals \$500</i> <i>Artificial insemination \$1,000</i>	Added Revenue: <i>Present value of calf sales \$8,500</i> <i>Present value of cull cow sales \$2,045</i>
Reduced Revenue: <i>400 bushels grain @ \$2.00 per bu. \$800</i>	Reduced Expense: <i>nil</i>
Total Economic Disadvantage: <i>\$6,660</i>	Total Economic Advantage: <i>\$10,545</i>
	Net Advantage: <i>\$3,885</i>
Can I afford it? <i>I have adequate borrowing room so that there should not be any extra financial risk problems. As a matter of fact there are some diversification benefits that might reduce business risk and thereby mitigate any financial risk concerns.</i>	
Do I want to do it? <i>This cow-calf enterprise would be useful supplemental addition to my grain farm. It is both profitable and affordable. Yes, I will do it.</i>	

Answer

Compare your work to Sam Coulee's. Correct any errors.

The AIM (Partial Budget) Form	
What is to be done? <i>Should I add a supplementary 25 head cow-calf enterprise to my existing grain farm?</i>	
Will it pay? <i>Yes, the venture will pay.</i>	
Added Expense: <i>Capital Costs</i> <i>Opportunity cost of herd @ 10% \$2,860</i> <i>Operating Costs</i> <i>Hay 30 tons @ \$50 per ton \$1,500</i> <i>Vet, feed and incidentals \$500</i> <i>Artificial insemination \$1,000</i>	Added Revenue: <i>Present value of calf sales \$8,500</i> <i>Present value of cull cow sales \$2,045</i>
Reduced Revenue: <i>400 bushels grain @ \$2.00 per bu. \$800</i>	Reduced Expense: <i>nil</i>
Total Economic Disadvantage: <i>\$6,660</i>	Total Economic Advantage: <i>\$10,545</i>
	Net Advantage: <i>\$3,885</i>
Can I afford it? <i>I have adequate borrowing room so that there should not be any extra financial risk problems. As a matter of fact there are some diversification benefits that might reduce business risk and thereby mitigate any financial risk concerns.</i>	
Do I want to do it? <i>This cow-calf enterprise would be useful supplemental addition to my grain farm. It is both profitable and affordable. Yes, I will do it.</i>	

Comfortable that this is the correct decision, Sam went to the hall closet to look for his Stetson.

Conclusion

In this module we learned how to apply the basic principles of the Annualized Incremental Method (AIM), a technique for evaluating the impact of incremental changes in a business enterprise.

The first step in applying the technique was to define the management problem being solved. It is important to identify and clearly describe investment opportunities to be considered because this sets the stage for analysis. We learned that focusing our attention on those issues over which we have control improves our chances of solving the right problem; it improves our efficiency.

The second step was to calculate the economic advantages and disadvantages of investment opportunities. In this step we estimated the added expense, added revenue, reduced revenue and reduced expense associated with a number of practical farm business investment opportunities. Two types of examples were chosen: single-period and multi-period analyses. Because considerable spans of time can be involved in investments it was necessary to learn about the time value of money. The present value concept, we discovered, allows us to bring cash flows to a common point in time and simultaneously allow us to adjust for business risk. We developed the simple but powerful decision rule: accept only those alternatives where the economic advantages exceed the economic disadvantages.

The third step was to assess the affordability of investment opportunities. Under usual circumstances an affordability assessment only needs to be done for investment alternatives showing potential profit; there may be instances where the manager might, for personal reasons, proceed with an unprofitable investment. Affordability analysis involved examining the balance sheet and its ratios as they might appear after the new investment was in place. High leverage ratios and unmanageable financial risk were taken as signals that an investment was not affordable. In addition to balance sheet analysis we also examined the magnitude and timing of cash flows to determine whether debts taken on to finance the investment could be paid back in an orderly fashion.

The fourth and final step was to make the decision. This meant assessing the ultimate acceptability of investment opportunities so that the decision could be made with greater confidence. Ideally only those investment opportunities that are both profitable and affordable would be acceptable to the manager. On the other hand acceptability may have a personal dimension as well as a business one. Consequently a manager may, for personal reasons, decide in favour of an investment that is affordable although unprofitable. A word of caution: the business is then called upon to subsidize unprofitable ventures. Under no circumstances can unaffordable investments be justified, no matter how much the manager might be personally disposed towards it.

About the Authors

Leonard Bauer

Len Bauer joined the University of Alberta in 1977 to assume research and teaching duties in agricultural business management, finance, and production economics. He was instrumental in creating the Agricultural Business Management Program at the University and was its first director.

He was guest professor at the University of Hohenheim in West Germany and guest lecturer at FINAFRICA in Milan, Italy, and at Curtin University of Technology in Perth, Australia. In 1995 he was workshop leader for agricultural economics instructors in Ukraine.

After retiring in 1996, Len continued developing instructional materials in Agricultural Business Management. Len, the Professor Emeritus of Agricultural Business Management in the Department of Rural Economy was dedicated to stamping out ignorance – wherever it was found. This set ‘Agricultural Investment Analysis’ was virtually complete prior to his death in 2004.

Don Bushe

Don Bushe is a consultant, writer, teacher, and designer of interactive instructional materials. His products and publications have received recognition from the European Broadcasting Union, Ohio State Awards of Excellence, National Educational Broadcasters' Association, and the Japan Prize. Pipeline operators from Rio de Janeiro to Norman Wells have benefited from the training curriculum he analyzed and designed. His interactive DVD display systems operate in museums from the Royal Tyrrell to Arviat in Nunavut. He is most proud of his role in assisting college instructors and university faculty in Ukraine as they struggled to re-define their economics curriculum in the post-soviet era.

Don and Len have developed a number of self-instruction modules in farm management for the University of Alberta, Faculty of Extension. Together, they prepared what has become the standard textbook for agricultural economics in Ukraine. Their work has been reviewed and checked by Len’s colleagues and former students.

About the Collaborating Reviewers

Ted Darling

Ted Darling has been with Alberta Agriculture, Food and Rural Development since the mid-1970's, first as District Agriculturist and later as Farm Management Specialist. In 1990 he returned to the U of A for a Masters degree in Ag. Economics and he is currently an Agricultural Risk Specialist for the department based in Airdrie. Ted's interests lie in the area of individual firm management, and include risk, strategic planning, and innovative business arrangements.

Dean Dyck

Dean is the Financial Business Analyst - New Ventures with Alberta Agriculture, Food and Rural Development. Dean graduated with a Bachelor of Science in Agriculture in 1982 from the University of Saskatchewan with a major in Agricultural Economics. He has over 20 years of experience in farm business management, including positions as a Production Economist and Farm Management Agrologist with Saskatchewan Agriculture, and Farm Management Specialist with Alberta Agriculture. Dean's main interest is in financial, economic and risk analysis and production costs for new agricultural ventures.

Dale A. Kaliel

Dale's life is firmly rooted in agriculture. Harkening from a mixed farm in northern Alberta, Dale received his B.Sc. Agric. (Animal Science) in 1977 followed by a M. Sc. Agric. (Ag. Econ.) in 1982 under the tutelage of Dr. Len Bauer. He has worked with Alberta Agriculture, Food and Rural Development in a number of capacities since 1980 advancing to his current position of Sr. Economist: Production Economics.

The focus of Dale's career has revolved around creating economics, financial and business management information for Alberta producers and then striving to take them to the next, critical step ... showing them how to utilize their own "on-farm" information, applying fundamental economics principles and procedures, to make better business management decisions.

Frank Novak

Born and raised in Southern Alberta, Frank obtained his B. Sc. in Ag, and M. Sc. in Ag. Economics from the University of Alberta. Len Bauer was his advisor and mentor who urged him to continue to complete his Ph. D. in Ag. Econ. at the University of Illinois specializing in agricultural finance, farm management, and risk management. Frank taught at the U of A's Department of Rural Economy from 1989 to 1999. He was a founding partner of Alberta Pig Company in 1995 and left the U of A to work full time in the industry in 1999. He is currently the managing director of Alberta Pig Company.

Brian Radke

Following graduation from the Western College of Veterinary Medicine in 1989, Brian practiced large animal medicine for 5 years, first in Ontario and then in BC's Fraser Valley. He completed a Ph.D. in Agricultural Economics at Michigan State University in 1998. Brian is currently a Research Economist in the Economics and Competitiveness Division of Alberta Agriculture, Food and Rural Development, and previously held the position of Dairy Cattle Research Veterinarian with the Animal Industry Division. He is also an Adjunct Professor in the Department of Rural Economy, University of Alberta.