Investment Analysis Guidance Document

This guidance document presents a process for making decisions about investing in farm equipment, farm infrastructure and other assets that you'll use for multiple seasons.

When you're evaluating an investment in farm equipment or farm infrastructure, you're probably considering it because you expect it will reduce your labor needs, allow you to increase production and sales, address a bottleneck in your operation, or enhance your quality of life in some way – either by saving your body or by making a task that is currently less than enjoyable a little more fun. If these benefits were the only factors to consider, making the investment would be a no-brainer. The reality is that there are likely going to be some costs to take into account. The investment decision comes down to comparing the benefits of making an investment to the costs to determine if the benefits outweigh the costs enough to make the investment worthwhile.

The process presented in this document starts with evaluating whether the investment you're considering makes economic sense. In other words, if you buy the equipment or infrastructure can you expect to generate more revenues and/or produce more cost savings than the additional costs that result from making the investment? If the answer is yes, then the investment will contribute to the profitability of your business. From a purely economic perspective, buying the equipment or infrastructure makes sense. On the other hand, if the additional costs related to buying the equipment or infrastructure are greater than the additional revenues and cost savings, then you can expect to lose money by making the investment. In this case making the investment does not contribute to the profitability of your business and does not make economic sense.

Along with evaluating whether the investment will contribute to the profitability of your business, you will also want to consider any non-economic factors that might influence your investment decision. In some cases, you might decide not to make an investment that makes sense from an economic perspective because you identify that the non-economic costs are just too high. While it's not advisable to make investments that you will clearly lose money on, you might be swayed to purchase equipment or infrastructure that will not contribute to profitability but will deliver plenty of non-economic benefit.

This document covers both economic and non-economic evaluation, explaining each part of the process in more detail. An example is provided to demonstrate the process. Once you understand the process that is presented in this document, you can use this process to aid in making decisions about investments for your farm business.

Economic Evaluation: Will making this investment contribute to the profitability of your business?

Net Present Value (NPV) is a method that is used to evaluate whether or not an investment will contribute to the profitability of your business. The NPV method does two things: It compares the economic benefits of making the investment to the economic costs *and* it accounts for the time value of money.

What is the Time Value of Money?

The time value of money is a concept that recognizes that a dollar you have today has more value than a dollar you'll get in the future because that dollar you have today has earning potential. A dollar you have today can be invested, thereby increasing its value over time. In other words, you can start making more money with money that you have today.

As a farmer, you might not be interested in investing your money for the sole purpose of making more money. You're likely farming because you want to grow good food for your family and your community and hope to make a living while doing so. That said, if you're considering spending some of your hard-earned profits on purchasing a piece of equipment or infrastructure, unless the only other thing you'd do with those profits is hide them under your mattress (where they'd likely lose value because of inflation), the reality is that those dollars are going to be earning at least a small amount of interest, even if they're just sitting in your savings account.

The NPV method takes the time value of money into account by factoring in what you would give up earning by making the investment you're considering and not making another investment.

The NPV Method

Step One: Identify the Economic Benefits and Economic Costs

The first step in the NPV method is to identify the economic benefits and the economic costs that are expected as a result of making the investment. Economic benefits include any additional revenues and cost savings that result from making the investment. Economic costs include any revenue loses and additional costs that result from making the investment, including the initial cost of purchasing the equipment or infrastructure.

In addition to identifying the amounts of additional revenues and cost savings and additional costs and revenues you expect, you will also need to identify *when* you expect these revenue and costs to occur. The profitability of your investment depends on both the amount of any revenues and costs *and* the timing of these cash flows. The further into the future you have to wait for positive returns, the less they will be worth.

To identify the timing of the cash flows you expect as a result of making the investment, first identify the entire period of time (in years) that you expect to be able to use the equipment or infrastructure you are considering purchasing. Depending on your experience with the equipment or infrastructure, you might need to do some research to determine its expected life. You can't know for sure how many years of life

you will get out of a piece of farm equipment or infrastructure, but you do need to identify a timeframe that you think is reasonable in order to analyze the investment.

Next, refer to the following questions to help you identify the changes to revenues and costs that you expect as a result of making the investment. Really focus on thinking about how your operation will be different if you make the investment you are considering. The revenues and costs that will change as a result of making the investment are the only ones that are relevant to your analysis. As you answer the questions below, identify the relevant revenues and costs for *each year* you expect to use the equipment or infrastructure.

What additional revenues do you expect as a result of owning and using the equipment or infrastructure?

Revenue increases might come from increasing the amount you produce and sell, from raising your prices, or both. Equipment or infrastructure that improves yields or extends the season for a crop can increase production and sales volume. Equipment or infrastructure that enhances the quality of a product or increases its value might allow you to raise your prices and thereby increase your revenues. Equipment or infrastructure that is used to produce value-added products could result in both increasing the amount of product you sell and increasing the product's value.

What cost savings do you expect as a result of owning and using the equipment or infrastructure?

Reduced labor is probably the main place that cost savings from investments in equipment and infrastructure will show up. Quantifying these labor costs savings requires coming up with an estimate of how much labor is currently needed without the equipment or infrastructure you're considering purchasing AND estimating how much labor will be needed with the new equipment or infrastructure. Subtract your estimate for your labor costs with the new equipment or infrastructure from your current labor costs to identify your labor cost savings. If your result is a negative number then there are no cost savings, the new equipment or infrastructure will cost you more in labor than you you're currently spending.

Cost savings for other non-labor inputs like fuel, electricity, seed, feed and soil amendments are also possible and need to be taken into account. Just like with labor costs, determine your expected costs savings by subtracting the costs you expect as a result of using the equipment or infrastructure as offsets to your current costs.

What additional costs do you expect as a result of owning and using the equipment?

You will likely be taking on additional costs when you buy equipment or infrastructure, such as maintenance and repair costs, increases to property insurance or increases to property taxes. You may have already captured some additional costs as part of your analysis of your cost savings. Be sure you also take any costs that do not offset your current costs into account.

Obviously, the initial cost of the equipment and infrastructure itself will be an additional cost if you decide to make an investment. Since the initial investment will happen before any of the other revenues or costs can occur, these costs are considered to occur in Year 0. If you expect that the equipment or

infrastructure will have any value at the end of its useful life, you'll include this amount, known as the "salvage value", as a positive cash flow in the equipment or infrastructure's final year of useful life.

What revenue loses do you expect as a result of owning and using the equipment and infrastructure?

If the additional revenue streams you except from your investment will displace any current revenues, the revenues you are giving up need to be taken into account. For example, if you are currently growing mixed vegetables on a quarter acre of land and you decide to invest in a high tunnel and produce strawberries on that quarter acre instead, the revenues you would have brought in from growing and selling mixed vegetable crops need to be taken into account. When accounting for lost revenues, be sure you also account for any costs that will be avoided as a result of giving up these revenues.

Calculate the Annual Net Cash Flows

Once you've identified the additional revenues, cost savings, additional costs and lost revenues for each year you expect to use the equipment or infrastructure, you will do some simple addition and subtraction to determine the net cash flow for each year. First, add together the additional revenues and the costs savings for each year. Next add together the additional costs and lost revenues. Then, subtract the sum of the additional costs and lost revenues from the sum of the additional revenues and the costs savings to get the net cash flows for each year of the investment.

Step Two: Account for the Time Value of Money

After you've determined the net cash flows for each year of the investment, your next step will be to take into account what you'll be giving up by not investing the dollars that you are using to purchase equipment and infrastructure in an alternative investment. This is done using a process called discounting. Discounting reduces future cash flows to what they would be worth in today's dollars if they were invested in an alternative investment to the equipment or infrastructure investment you are considering. This gives you a way to compare the amount you are investing in equipment or infrastructure to the cash flows you expect from the investment after accounting for the opportunity cost of not investing those dollars elsewhere.

The process for discounting involves estimating the cash flows you expect in the future, which we've already done in the first step, and choosing a discount rate. The discount rate is the minimum rate of return that is required for having your funds tied up in the investment. If you will be using your own money to purchase the equipment or infrastructure, you'll want to use a discount rate that is at least equal to the rate of return you could earn by investing your money elsewhere. If you are borrowing money to purchase the equipment or infrastructure, the discount rate is the rate of return the bank requires for allowing you to use their money. These are both simplified explanations for how to come up with a discount rate. For a more detailed explanation, see Capital Investment and Project Analysis.

Once you've determined the net cash flows for each year of your investment, the next step is to find the discount factor for each year of cash flows. The discount factor can be looked up on present value

tables[1]. Simply select the discount factor that corresponds with the year the cash flows are expected and the discount rate that is being used to analyze the investment. Once you've identified the discount factor for each year of cash flows, multiply the discount factor by the cash flows for the corresponding year.

> *The discount factors you'll find on present value tables are calculated using the following formula:*
>
> *Present Value of $1 = Future Value of $1 ÷ $(1+r)^n$*
>
> *In this formula "r" is the discount rate and "n" is the year the cash flows you are discounting are expected.*

Once you have the discounted cash flows for each year, add them up to get the present value of the cash flows from the investment. This is the total value of cash flows from the investment after taking into account the earnings that will be given up by not investing elsewhere.

Finally, subtract the initial cost of the equipment you are considering purchasing from the present value of the cash flows from the investment. Notice that the initial cost of the investment is not discounted. This is because you are paying for the investment now, in today's dollars, meaning that these dollars are already reflected at their present value. What you have left when you subtract the present value of the initial cost of the investment from the present value of the cash flows you expect to generate from the investment is the net present value of the investment[2].

- ⇒ If the net present value of the investment is negative, the money you will make from investing in this equipment is not enough to cover the initial cost of the investment and the cost of having your money (or the bank's) tied up in this investment and not getting it back until some future point. The investment is not economically viable. You are projected to lose money by making the investment.
- ⇒ If the net present value of the investment is $0, the money you will make from the investment is exactly enough to cover the initial cost of the investment and the cost of having your money (or the bank's) tied up in this investment. You will not lose money or make a profit from this investment. You are projected to break-even.
- ⇒ If the net present value of the investment is greater than $0, the money you will make from the investment is enough to cover the initial cost of the investment and the cost of having your money (or the bank's) tied up in this investment AND on top of that, there is an additional profit projected. You are projected to make a profit by making the investment.

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[1] See the Appendix of Capital Investment and Project Analysis for present value tables.

[2] The net present value of an investment can also be calculated using the NPV function in Excel.

Part Two: What non-economic factors might influence your investment decision?

Often making a change to one aspect of your farming system can have ripple effects on other aspects of your operation. The set of questions below will help you consider some of the non-economic factors that might be impacted by making the investment you're considering. As you give these questions some thought, take note of any benefits and/or drawbacks to making the investment that are important to you.

Worker Health/Well-being: Does using the equipment or infrastructure help save your body, prevent fatigue and decrease potential for injury? Or is it a tool that is hard on the body to use?

Cultural and Work Enjoyment: How will using the equipment or infrastructure on your farm impact the people that work there? Will it change how people interact and communicate? Will you enjoy using it? Is it loud or awkward? Does it make you smile?

Learning Curve: Is there a big learning curve involved in using the equipment or infrastructure? Will only a few trained people be able to use the equipment?

Volume/Scale Requirements: Does investing in the equipment or infrastructure require you to change your production scale?

Flexibility: Will having this equipment or infrastructure make you nimbler? Will it be restrictive or cause a bottleneck in your operation?

Life Cycle Analysis: What resources were used in the manufacturing of the equipment or infrastructure? What resources were used to get it to you? What is the environmental impact of using the equipment or infrastructure? How will you dispose of it at the end of its useful life? Conducting an actual life cycle assessment is a very complex process that is beyond the scope of this document, however, considering some of these questions can be a good start to recognizing if equipment or infrastructure will have negative environmental impacts. For more information about how to evaluate the full environmental impact of an investment, check out this Guide to Life Cycle Assessment.

After giving these questions some thought, are there any non-economic factors that influence your decision either in favor of, or against investing in the equipment or infrastructure? Are there benefits you've identified that make an investment that you already expect to be profitable even more worthwhile? Are there enough drawbacks to make an otherwise profitable investment worth re-thinking? Are there enough non-economic benefits to warrant making an investment that will return little to no profits?

How you end up interpreting these results is up to you. The important point here is that while the factors above might not be ones that you can quantify, they still can, and should, be considered in your investment decision.

Example: Investing in a Brush Conveyor for Bin Washing[3]

In this example the process that's been presented for making decisions about investing in farm equipment, farm infrastructure and other assets is applied to a decision about purchasing a brush conveyor for bin washing.

Background: Washing bins that are used for harvest and crop storage can take a significant amount of labor. An investment in a brush conveyor for bin washing is being considered because it is expected that it will speed up the bin washing process and reduce labor costs.

Economic Evaluation: Will making this investment contribute to the profitability of your business?

How many years do you expect to be able to use the equipment or infrastructure you are considering purchasing?

- The brush conveyor has an estimated useful life of 10 years.

What additional revenues do you expect as a result of owning and using the equipment or infrastructure?

- There are no additional revenues expected as a result of this investment.

What cost savings do you expect as a result of owning and using the equipment or infrastructure?

- The current labor cost related to bin washing is estimated to be $5143 per year.
$18{,}000\ bins/year \div 70\ bins/abor\ hour = 257\ hours \times \$20/labor\ hour = \$5143/year$

- The expected labor cost with the new brush conveyor is estimated to be $3000 per year.
$18{,}000\ bins/year \div 120\ bins/labor\ hour = 150\ hours \times \$20/labor\ hour = \$3000/year$

- Subtracting the new labor cost from the current cost gives a cost savings of $2143 per year.

What additional costs do you expect as a result of owning and using the equipment or infrastructure

- The brush conveyor will require 1 hour a week of maintenance for each week of the 30-week season. At a labor cost of $20 per hour, this comes to $600 per year.

What revenue loses do you expect as a result of owning and using the equipment and infrastructure?

- There are no revenue loses expected as a result of this investment.

The sum of the additional costs and lost revenues is subtracted from the sum of the additional revenues and the costs savings to get the net cash flows for each year of useful life of the investment.

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[3] This example is presented for the sole purpose of demonstrating the process. Do your own analysis using data from your own farm to evaluate any investment you're considering.

The net cash flows for each year are discounted to their present value by multiplying them by the discount factor corresponding to a discount rate of 5% and the year the cash flows occur. The 5% discount rate is the rate of return that the farm in this example would earn by investing the $7100 that they are considering spending on the brush conveyor in a retirement fund.

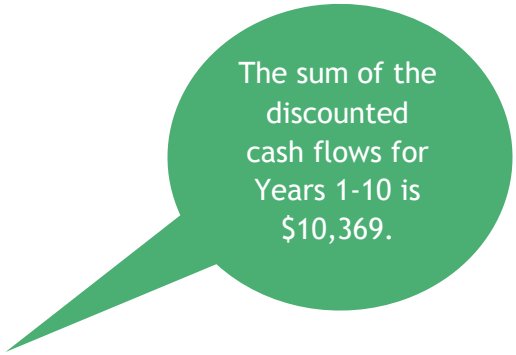
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Additional Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cost Savings	$ 2,143	$ 2,143	$ 2,143	$ 2,143	$ 2,143	$ 2,143	$ 2,143	$ 2,143	$ 2,143	$ 2,143
Additional Costs	$ 800	$ 800	$ 800	$ 800	$ 800	$ 800	$ 800	$ 800	$ 800	$ 800
Revenue Losses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flows	$ 1,343	$ 1,343	$ 1,343	$ 1,343	$ 1,343	$ 1,343	$ 1,343	$ 1,343	$ 1,343	$ 1,343
Discount Factor	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139
Discounted Cash Flows	$ 1,279	$ 1,218	$ 1,160	$ 1,105	$ 1,052	$ 1,002	$ 954	$ 909	$ 866	$ 824

The sum of the discounted cash flows is $ 10,369. This is the present value of the cash flows that are expected from the investment in the brush conveyor.

The present value of the cost of the brush conveyor is $7,100.

Subtracting the present value of the cost of the brush conveyer from the present value of the cash flows that are expected from the investment in the brush conveyor gives the net present value of the investment: $ 3,269

Year 1 Discounted Cash Flows	$	1,279
Year 2 Discounted Cash Flows	$	1,218
Year 3 Discounted Cash Flows	$	1,160
Year 4 Discounted Cash Flows	$	1,105
Year 5 Discounted Cash Flows	$	1,052
Year 6 Discounted Cash Flows	$	1,002
Year 7 Discounted Cash Flows	$	954
Year 8 Discounted Cash Flows	$	909
Year 9 Discounted Cash Flows	$	866
Year 10 Discounted Cash Flows	$	824
Present Value of the Cash Flows from the Brush Conveyor	$	10,369
Present Value of the Cost of the Brush Conveyor	$	7,100
Net Present Value of the Investment	$	3,269



Based on this analysis, the economic benefits of making the investment outweigh the economic costs. The returns from the investment are enough to cover the initial $7100 cost of the investment along with the foregone benefits of not investing those dollars elsewhere at a 5% rate of return. In fact, after covering the initial cost of the investment and the opportunity cost of having money tied up in this investment, there is $3269 in projected profit. Based on this analysis, investing in the brush conveyor makes economic sense.

What non-economic factors might influence your investment decision?

In this case there are no non-economic factors that stand out as reasons not to make the investment. In fact, there are several non-economic benefits that make the investment even more worthwhile.

Worker Health/Well-being: The brush conveyer operation is fairly ergonomic. Although it does require repetition of the same motion, some of the repetitive motions required in the manually bin washing process are eliminated, making it easier on the body to use overall.

Cultural and Work Enjoyment: Bin washing tends to me a rather menial task. Because the brush conveyer gets bin washing done more quickly, more time is expected to be freed up for other more enjoyable work.

Learning Curve: The tool requires minimal training to use safely and effectively.

Volume/Scale Requirements: At the current scale of the farm, the tool will only be in use for approximately 5 hours per week, meaning that there will be unused capacity. Finding ways to utilize the available capacity would increase the economic viability of the investment.

Flexibility: The tool operates most efficiently with two people working together (one loading dirty bins and the other removing cleaned bins)

Life Cycle Analysis: A comprehensive life cycle assessment has not been completed. The brush conveyer is made by a company that is located in Pennsylvania using materials and parts that are likely sourced from all over the world. The brush conveyer will be shipped to the farm by truck. The brush conveyer runs on electricity. The design of the brush conveyer makes it easy to repair and parts can be replaced as they wear out. Though a 10-year useful life was used for the economic analysis, it is expected that the brush conveyer will be in use well beyond this time frame. When the machine does need to be disposed of, the steel will be sold for scrap.

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