
Farmers' Organization's Guide to

# PROFITABILITY ANALYSIS

For Small Scale Farming in Southern Africa

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*Foreword*

In southern Africa, small scale agricultural production is suffering from low productivity as well as low profitability. These are to a large extent dependent on each other, as low yield productivity gives very little to sell. However, low productivity must be carefully defined to make sense. Yield can of course be measured as output per area, or some other appropriate measurement, but one should remember that there is also another dimension to productivity –one that is related to inputs and circumstances. With very little inputs, outputs also tend to be small.

Productivity, when related to inputs, resembles profitability in many ways. Profitability is separated from any physical entity. Profitability is strictly economical; measuring how much 'out' is possible from some certain 'in'. Looking at physical productivity is counterproductive from an economical point of view, as 'lots of this' does not equal 'lots of that'. -'Lots of maize' does not equal 'lots of money'.

This may seem trivial, but looking at the small scale farming situation in southern Africa tells us that it is not. Farmers produce, and sell, totally unprofitable goods, obviously without any recognition of the fact that unprofitable is unproductive. There are several partial explanations for this behavior, including risk aversion, but one of the most prominent is definitely lack of profitability information. Profitability information is the most important factor to take into account when making a production decision, and lack thereof will inevitably lead to suboptimal allocations.

Suboptimal allocations are not always the end of the world, but in situations like what we are facing, they are very often just that. Nowhere is the need for optimal allocation greater.

That there has been a lack of profitability information is not surprising; profitability is not an altogether simple concept, and calculating and presenting such information in a digestible format is even more difficult.

The only structures that have any potential to supply the small scale farmer with relevant agricultural profitability information are Farmers' Organizations. It is a difficult task, as the validity of such information is highly localized, the information is highly complex and the target group is unable or sometimes unwilling to pay for the information. Although calculating profitability does not involve advanced mathematics, it depends on genuine and thorough knowledge of actual facts. However, the production of consistent and useful information can be simplified with the use of modern technology in the form of computers and specialized software.

The aim of the Guide is to provide representatives of farmers' organizations with general knowledge of profitability analysis as well as more detailed knowledge on the specific demands that small scale farming in southern Africa puts forth.

We introduce a measurement we call Return on Cash Cost (ROCC). We then explained in detail how ROCC is calculated as well as the reasons why ROCC should be

calculated. Furthermore, we suggest a format for presenting the results in a way that is not only clear and easy to understand, but also "selling" making farmers want to compare the profitability of possible investments! The reader should, once familiar with the concept of profitability analysis, feel comfortable in the use of the SCC ROSA Profitability Presentation Generator (PPG). The PPG is a computer program specifically developed to make production of presentations of the kind suggested simple and straightforward and as little time consuming as at all possible.

H. G. Lutz

# Introduction

Organizations and individuals keep explaining how important it is to treat farming as a business.

Unfortunately they very seldom also explain what a business is, making it very difficult to know how one should actually treat farming.

This Guide is more about finding the answer to the question "what is a business?" than anything else, and the title is only the name of the path to follow.

*A business is a venture to make money, and money you make by making profit.*

Hence, a business is a profitable venture, which appears to be clear and simple. However, profit is not an entirely straightforward concept. There is a huge difference in making 1$ an hour, or 1$ a week. There is a huge difference in making 1$ selling one bag of flour, or making 1$ selling 50 bags of flour, also when you manage to make exactly the same amount in the same time. There are, to stop beating around the bush, huge differences between the efforts you have to make to make the same amount of money in different ventures. This relationship is called profitability, and it is the most central concept in all business.

Profitability is the most important factor to be considered in directing a business venture. The only way of determining how the assets available to an entrepreneur should be put to use is evaluating the profitability of all (possible) ventures and selecting the highest paying one. There is no difference between a Wall Street broker and a one-hectare African farmer in this respect. Whatever difference there is concerns other things, like the nature of the business, the possible profit, the assets available and the risks involved. Hence, the factors to take into account when calculating profitability for different businesses differ substantially, but what we want to end up with is the same thing: a way to efficiently and correctly choose between money making opportunities.

Profitability is higher in relation to a specific input the less of the input that is needed to end up with the same result. Analogically, profitability is higher in relation to an input the more of the output you get from a specific amount of that input. This is an important concept, and it makes the whole "business" issue a bit clearer, but there is still a problem.

*Which input should we measure this profitability in relation to?*

There are numerous measurements for profitability with exotic names and abbreviations, highlighting the fact that there is not one way to express profitability. You need to consider what the measurement you are calculating is going to be used for! In this Guide, the idea is that the most important thing for a small scale farmer in southern Africa is to be able to discriminate between possible production lines.

This basic assumption determines how we shall look at the measurements and which measurement we will advocate.

Hence, the question that shall be answered in this Guide is: "How do you calculate a profitability measurement that is sufficient for a small scale farmer to select what to produce at the same time as it is as uncomplicated as possible to calculate?"

# Background

## Profit

Profit is the difference between the total gross income from a venture and how much it has cost to produce and market the product. Profit could of course be measured using any scale, for example weight, in which case we would get a profit expressed in kg. However, profit is more commonly measured using a monetary scale, as money is more easily compared across applications.

*Profit is usually expressed in monetary terms, e.g. Dollars.*

Profit is sometimes called"Return", and on other occasions it is referred to as"Margin". Margin is however more commonly used for a ratio than for an amount.

When we speak of profit like this, we are considering the"true" profit, that is, we include all costs incurred in the production, and to make things even more complicated but also more relevant, marketing costs. These are many and sometimes difficult to estimate, which is the reason why it is very often not done. However, the dangers in omitting information without knowing what is omitted and why it is omitted are big. Simplifications may be incredibly useful if you only know that it is a simplification and what the side-effects can be. We will therefore discuss all production costs in this Guide.

## Profitability

Profitability differs from profit in a very important way. Profitability is not measured in terms of money, but in terms of return on some asset. This means that a profit of 100$ has nothing to do with profitability. Profitability measures how much output you can get from employing a certain amount of an asset.

*Profitability is usually expressed as a ratio, e.g. Percent.*

Profitability is calculated using the exact same information as that used to calculate profit, but in a slightly different way.

Profitability is a very useful measure, insofar that it can make it easy and straightforward to choose between possible actions or ventures. As a matter of fact, in a perfect business world profitability is the only measurement that is needed for any economic being; obviously not so in the real world, where all sorts of other considerations must be made. Even if one has to be cautious at all times when it comes to risking assets, profitability is a far better tool to determine which venture to choose than profit.

## Factors of production

In this guide we use a very common and useful simplification. We cluster assets into groups with similar characteristics. In general we will have three groups:

- Technology
- Labor

- Capital

Let's take a look at these:

*Technology*
Technology is a way of producing something, including all things that can possibly be included. Technology consists of "production knowledge", which of course includes things like "how much of this and that". Technology will usually have a "technique"-component, such as "conservation farming in tomato production", or even a "technical" component such as "tractor", but it is not identical to these concepts. A technology describes how you should use certain assets to produce a certain thing. As we have seen above, one technology is not always better than another. It all comes down to pairing technology with other assets. And most certainly there are differences in quality of what might be considered one and the same technology, depending on how detailed the specification is. Production knowledge (skill) is one of those factors in a technology that tends to fluctuate even on an individual basis.

*Labor*
There are many reasons to spend some time on considering what labor really is. Of course you could say that it is how many man-hours you put into production. This would then imply that it doesn't really matter whose hours you use, which is quite obviously wrong. A big physically strong person is better at carrying heavy things than a small, sick and weak person, and hence can produce much more carrying over any specified period. The same reasoning can

be applied to any situation, and will cover things like education, health (AIDS, malaria etc) or any other quality of the labor force.

The labor force is you and I, and our "quality" is measured as "human capital". Now, one should not forget that although it on average should be better to be healthy, it is not anything near certain that healthier is more productive. A philosopher will not need strong arms and legs, a boxer will not need the sharpest mathematical mind. This applies to all situations, and hence "human capital" is not a straightforward concept.

If we consider small scale farming in southern Africa a rather heavy physical job, there is however no question as to whether physical health is important or not, which contributes to making malaria and AIDS so utterly devastating. Even though malaria is seldom (in comparison to the total number of infected people) lethal, infection can severely limit working capacity for long periods of time, and the same of course goes for HIV/AIDS.

The use of labor, just as the use of any other factor of production, always has a cost attached to it. This may be an actual cost, such as salary, or an opportunity cost.

*Capital*

Capital is anything that is not Labor or Technology. Money is one form of capital, but other forms are much more common. Land, tools, tractors, clothes, hoes, hats, shoes, airplanes, houses and so forth are all "capital", which clearly shows that money is only a small part of the total capital.

Generally, capital can be

- acquired through production
- acquired by selling something (a product or a service such as labor, in which case it is called salary) at a profit
- accumulated through saving such produce or profits,
- acquired through borrowing

The use of capital, just as the use of any other factor of production, always has a cost attached to it. This may be an actual cost, such as repairs or interest, or an opportunity cost, which we will discuss below.

The average small scale farmer in sub Saharan Africa faces a price of capital that is extremely high in comparison to the price of labor, which could be expressed as that"the marginal return is much higher on capital than on labor".

*Opportunity Cost*

The opportunity cost concept is sometimes confusing, and it has certainly messed up a lot of good intentions. Opportunity cost simply describes what the value of an asset would be in the best possible other employment. The opportunity cost measurement can be used basically to do two things: to put a value on something that does not have a price tag, and/or to determine whether an asset is put to good use by deducting the opportunity cost from the profit actually made. In the first of these uses it has caused a lot of

problems for people in agricultural economics and farm business planning (especially in sub Saharan Africa, where such a large proportion of the population is self employed in the small scale farming sector and no, or very little, formal labor market exists). In cases like this it is not only difficult to understand the concept, but it is also very difficult to attach a relevant value to labor. In particular one that makes economical sense at the same time as it is logical and intuitively appealing to the farmers concerned.

## Income

As stated above, both profit and profitability are calculated using two basic measurements, income and cost. As income is the first half of the equation, we start by discussing what income is. This is luckily uncomplicated. Income is simply the total sum a seller manages to get for whatever she is selling. A farmer will usually sell some product at a price per kg or piece, and the income is then the product of that price and the amount she manages to sell. Sometimes the total income from a product is compounded from a number of prices and traded units. Taking cassava as an example, this one crop yields three marketable goods; the tuber, sold in kg; the stem, sold in pieces; and the leaves, again sold in kg, although this is not usually the way neither the seller nor the buyer view it, as the traded unit is more commonly "bags" or "bundles". These three goods are priced differently, measured differently and sometimes sold not only in different places but also to different types of buyers. The complexity of the product makes the calculation of income (or potential income) a bit more time consuming, but it does not mean that it is any more complicated.

## Costs

The other half of the equation is unfortunately more complicated. Costs cover so much more than income. Costs are often clustered in groups, according to some common denominator. This is what we will deal with on the next few pages.

*Input costs*

Relate to the things directly used in production. Mostly, these are tangibles, but not necessarily so. Seeds, fertilizers, pesticides, herbicides etc are all input costs, and most likely the most important, but there may also be many more. In even more general terms, input costs can be classified as a capital cost.

*Labor costs*

When labor costs must be correctly calculated there are a number of things to consider. One of these is the fact that family members can produce different things getting different returns. This means that we have to take the opportunity cost into account if we want to create a correct profit measure. The opportunity cost of labor is the income that that labor could generate in another occupation. Of course, most farmers do not have much opportunity to get a job outside the farm, which could be taken to mean that opportunity cost is zero, but then we must think again. It can be argued that labor costs are zero when only family members are engaged in production, and hence no salaries paid. From some perspectives, depending on what the calculated measure is to be used for, this is quite correct, though from others it is not.

*Capital costs*
are all costs that arise from the use of capital. These are not the costs of buying inputs, which have been handled above, but the costs of using money to buy those inputs, e.g. interest. Capital costs also cover for example the cost of having a tractor, which does not only include costs to repair the tractor, but also depreciation (the fact that the value of assets often decreases over time) and the opportunity cost: whatever money was used to buy the tractor cannot be put to any other use, such as generate interest in a bank account. In most places, such costs are very high for small scale farmers, although they may not be very high for other groups.

*Marketing costs*
These are basically all costs which are not directly attributable to the production of goods. There is some confusion as to which costs should be included in marketing costs and which rather belong to production costs. To simplify as much as possible, and to create measures that are as relevant for the small scale farmer as possible, marketing costs in this paper shall include

- Costs of collecting information
- Costs of transporting
- Costs of storing
- Costs of cooperating
- Costs of selling

With the exception of Transport costs most people find this classification straightforward. When the transport costs arise from transport of produce to a buyer, it is obvious why they belong to transport costs, but when they arise from transporting inputs to the farm, they could well be considered production costs (meaning that input costs are higher for someone far from the market). The reasons why we shall treat all transport costs as Marketing costs are twofold:

- Firstly, all transport costs are closely connected to trade;

- Secondly, many of the marketing efforts to increase profitability aim at reducing transport costs, which makes it relevant to sum up all such costs.

## Risk

Risk is one of the most important issues for small scale farmers. It has frequently been argued that small scale farmers do not behave like you would expect from market players, that they do not take advantage of competitive advantages, or adapt production to demand. In short; that small scale farmers do not maximize profit! But it seems that this analysis is all a matter of attaching the correct weights to risks. Risk is something that can be handled in very many different ways, to a large extent depending on how much money, or other reserves, you have. If you cannot afford to fail, you cannot afford to take chances. That is the rule of the game. Small scale farmers in southern Africa can very seldom afford to fail, and hence have to be very careful when it comes to change. If there is a way of making a living that has proven to work many

generations, albeit not very secure or "successful", it would be extremely careless to abandon it for something else, without an acceptable level of certainty guaranteed. Changing crops or production methods is not something you would do in a rush. Novelties will have to prove themselves bit by bit. This is only natural. Another way of securing food and income, such as a donor providing some kind of income guarantee, would make it possible to change production patterns rapidly, provided the guarantee can be trusted.

On the other hand, professional marketers can convince almost anyone of anything. If, for example, a professional marketer finds that she could make a huge pile of dollars in case a lot of farmers would grow a particular crop, and sell it to or through her, she could probably convince them to do so. There are numerous examples of where this has happened, with disastrous results.

Sources of risk in agriculture can be

- **Production** –yield/quality variability
- **Market** –changes in price/external conditions
- **Financial** –variability in debt/equity capital and ability to meet cash demands
- **Legal** –responsibilities for contracts, statutory compliance, tort liability and business structure
- **Human** –managing people

However, risk for a small scale farmer normally means either

- Meteorological risk and other "natural risks" such as famines or deceases.

or

- Market risk

of which the impact of the former often is devastating, whereas the latter can be troublesome, but usually not devastating. Risk assessments are used to evaluate the different possible outcomes of any undertaking.

Managing risk can be defined as "choosing between alternatives to reduce the effect of risk". One of the most commonly used ways to handle risk with unknown probability (also commonly know as"uncertainty") is diversification, which is a way to make sure that if one thing goes wrong, it doesn't necessarily mean that all things go wrong.

*Risk vs. expectations*
Expectations are the results of analyzing probabilities of different outcomes and attaching the proper payoffs to those outcomes. Hence, expected outcome is the total payoff you can expect to get from any undertaking, taken the chances for"failure"and unexpectedly good results into account.

**Example:**
Assume that the chances of getting a good yield are just as good as the chances of getting a bad yield (the good old "50/50"), and that a good yield is 2 tons, and a bad yield is 1 ton. The expected harvest would then be:

**(Expected outcome) = ? x (2 tons) + ? x (1 ton) = (1.5 tons)**

One possible reason that economists so often misjudge the small scale farmers' capacity to handle risk calculations is that they view the farmers' activities as "purely economic", which is to say profit maximizing in a very simple way. The problem is then that they fail to understand that the fact that maximizing "expected profit", in accordance with economic theory, does not guarantee a "lowest profit" results in immense problems for some people. The problem for a small scale farmer is that if profits drop too low, starvation, or worse, is a very likely outcome. This is of course not acceptable, and hence "simple expected profit" is not good enough measure. For someone with reserves as small as a small scale farmer there is need for a better tool to calculate which option is the most profitable, given her special situation. There is, in short, a need for weighting of the possible outcomes. Such weighting must take into consideration the cost of failure, not only the loss of potential income that failure represents.

**Example:**
Attaching the right values to risks:
Assume that the chances of getting a good yield are just as good as the chances of getting a bad yield (the good old "50/50"), and that a good yield is 2 tons, and a bad yield is 1 ton, which is too little to survive on. In this case, the cost to the farmer of a low yield would be life, which some tend to value quite highly.
We could write it like this:

**(Expected outcome) = ? x (2 tons) + ? x (1 ton) + ? x (loss of life) = (a very bad thing)**

It must also be emphasized that the only expectations that matter are those that result from perceived probabilities, or risks, which means that there is need for not only accurate but also trustworthy information. Trustworthiness is sadly not an easy concept, and it is fairly common that people and institutions that far from deserve trust are the ones that are given it. As we know, rhetoric ability is often more important than fact.

Furthermore, the simple profit maximizing model does not really take into account that perfect information is something that is very common in fairytales, but rarely elsewhere. As a result, the expected outcome, which relies on probabilities for different outcomes, is very inexact, and everybody knows it. Although it may be really awkward to make decisions without access to proper data you still have

to make the decisions relying on the data you have. And the data most farmers have access to is based on a very limited experience. As we have discussed, uncertainty is considered very dangerous by small scale farmers, as any unknown factor may result in death. Thus, the room for experimentation is small, and farmers stick with known factors, no matter what.

*Sensitivity analysis*

One way of trying to handle the problem of applying correct weights to risk is providing the user with a "sensitivity analysis". In short, this allows the producer of information to avoid calculating probabilities that are more or less dubious by creating "scenarios". The scenarios cover at least a couple of possible outcomes, usually including a "worst case" scenario, a "normal" scenario and a "best case" scenario. The more difficult it is to accurately estimate probabilities, the more attractive the sensitivity analysis alternative becomes, as it allows for exclusion of "expected" outcomes.

# What and why; concepts, assumptions and simplifications

As we want to thoroughly investigate and explain which profitability measures should be calculated and why, we must become a little bit theoretical. It is strongly recommended that you read through this section, as it explains why a very important simplification can be made. Understanding of the underlying concepts and assumptions will equip you with means to determine when the simplifications we have made are less accurate and will generate incorrect and potentially destructive results. It is also likely that this understanding will give you quite a bit of new spirit.
We start with one of the few concepts in economics that is not altogether simple.

*Comparative advantage*
In economics, the theory of comparative advantage explains why it can be beneficial for two countries to trade, even though one of them may be able to produce every kind of item more cheaply than the other. What matters is not the absolute

cost of production, but rather the ratio between how easily the two countries can produce different kinds of things. It was first described by Robert Torrens in 1815 in an essay on the corn trade. He concluded that it was to England's advantage to trade various goods with Poland in return for corn, even though it might be possible to produce that corn more cheaply in England than Poland. However, it is usually attributed to David Ricardo who explained it clearly in his 1817 book The Principles of Political Economy and Taxation in an example involving England and Portugal. In Portugal it is possible to produce both wine and cloth with less work than it takes in England. However, the relative costs of producing those two goods are different in the two countries. In England it is very hard to produce wine, and only moderately difficult to produce cloth. In Portugal both are easy to produce. Therefore, while it is cheaper to produce cloth in Portugal than England, it is cheaper still for Portugal to produce excess wine, and trade that for English cloth. And conversely England benefits from this trade because its cost for producing cloth has not changed but it can now get wine at closer to the cost of cloth.

When one entity (be it a firm or a country) is able to produce more efficiently than another entity it has an absolute advantage; that is, assuming equal inputs, the entity with an absolute advantage will have a greater output. This notwithstanding, a producer with an absolute disadvantage in production of everything can still be a successful producer, supplier and trader, providing the more advantageous with goods and making a better living than would be possible if she would produce and consume only for herself. The thing that matters is there are differences in relative productivity.

Because the theory produces a counter-intuitive result, it may be useful to consider the following:

**Example:**
Suppose there are two countries, Northland and Southland. Both have a wine-making industry and a clothing industry.

In Northland, it takes a worker 3 days to make a suit of clothes, and 5 days to make a bottle of wine.

Southland is more efficient in both industries – a Southlander can make a suit of clothes in 1 day or a bottle of wine in 1 day.

Southland has an "absolute advantage" in both industries – it is more productive at making both wine and clothes. However, it is 5 times more productive than Northland in wine making and only 3 times more productive than Northland in Clothes making. That is, it has a comparative advantage in wine making. While Northland is worse at making either kind of goods, it is least deficient at making clothes.

The price of goods must reflect the cost of making them, so it is likely that in Northland, a bottle of wine (takes 5 days work for a Northlander to make) costs more than a suit of clothes (takes only 3 days). As the Southlanders can make either wine or clothes at the same production cost, it is rational to export wine to Northland, and take the higher profit. Wine will be a better export than clothes for Southland as long as this is true, and it would be rational to

deploy more resources into the wine industry at the expense of the clothes industry.

Suppose that the Southland clothes industry now collapses due to a labour (or capital) shortage caused by the boom in the wine industry. This might not worry the Southland Treasury – the Northlanders should be willing to pay more for wine than for clothes: until the price rises above 5:3, it will not be economic to reopen the Northland vineyards. Therefore a Southland worker can make wine, buy clothes and still be in profit. Provided the profit margin is enough, it is worth Southland trading wine for clothes with Northland, even though Southland imports goods that it could manufacture more efficiently itself. If Northland's clothes were to rise to more than the price fetched by wine, it would be time to re-open the Southland clothes factories.

Clearly this theoretical model omits several factors that sometimes apply in the real world: Workers and capital may not be able to be transferred painlessly from one industry to another. The clothing industry (in Southland) and wine-making industry (in Northland) may therefore exert political pressure (through industry associations and trades unions) to protect their industries. Governments also sometimes decide to provide subsidies or to erect import barriers to preserve domestic industries. Reasons other than political needs might include national prestige, or the wish to avoid being dependent on imports in case trade is disrupted – for example by war.

The theory of comparative advantage is not only applicable on macroeconomic examples. The same basic principles apply for people, companies, families or any other producing unit. By producing whatever I have a comparative advantage in, and trading with others, I will probably be far better off than if I produce what I have an absolute advantage in.

*Most limiting factor*

The "comparative advantage" shows how important it is to use the assets available as efficiently as possible! It is simply not true that there is one technology that is much better than other technologies, as the efficiency of any technology is relative to the availability (price) of inputs (assets). Technology is to be understood as "a way of producing things" rather than "use of a certain kind of machinery.

In fact, theoretically it is quite simple to determine which technology should be used: the one that most efficiently utilizes the inputs is the technology demanding the same "mix" or "combination" of inputs as the producer has "access" to. This simply means that if we have a lot of one asset, we should try to use a lot of that asset. A lot, in this context, is a lot in relation to how much we need of other assets, and is an economic concept, not a physical ditto, although the two often go hand in hand.

In real life this is not so simple though. It is not always certain which factor you have "a lot" of, as this is defined by what others have, which other assets you have and what

production technologies you can use. One efficient way of dealing with this problem is by ambushing it. Instead of trying to map the whole scenery you use some pieces of crucial information to attack the most sensitive parts of the problem.

*The ambush*

Let us consider a situation where we have a number of assets, whereof some are available in abundance, some not. What then determines what we can produce is first of all the choice of technology. If we now also make the rather realistic assumption that there are, at large, only a couple of technologies, whereof one more or less makes use of the "asset mix" that we happen to have access to the problem is already smaller, and allows us to consider which factor actually determines how much we can produce. The answer is straightforward and simple. Using the most appropriate technology, the asset that we have least of in relation to other things needed for efficient use of the technology determines how much we can produce. This is the most limiting factor.

Exclusion of costs will not generate a measurement that reflects actual profit in terms of "net generated income". If our intention is to is to calculate how much real income a business venture generates, we need to take all costs into account, and if the intention is to calculate a possible future income we need to take also have to include risks and expectations in the equation. There is however strong evidence that attempting to calculate such measurements is often unnecessary, and that it is also potentially counterproductive.

**The essence:**

The mix of assets we have access to determines which technology should be used

If we know which technology to use, the most limiting factor determines how much we will be able to produce.

Using the most limiting factor as basis for profitability calculations therefore simplifies generation of a measurement that is useful in selection of production

*The big simplification*

Now it's time to make a very important assumption. It is an assumption that will have great implications for the calculations recommended later on, and one that will make life a lot easier as long as it holds correct, but very troublesome if it doesn't.

**Assumption:**

Small scale farmers in southern Africa have very little access to capital. They find it very difficult to buy inputs, and are prone to accept pretty much any form of credit or input provision, regardless of the expected profitability thereof. Hence, they should concentrate on production of goods that need very little cash.

This, as long as it holds true, has implications on the calculations we should make, and in fact make them a lot simpler! The conclusion that it is the use of cash that is the most limiting factor for most small scale farmers justifies

Inclusion of only cash costs in profitability calculations!

For example, only those labor costs that must be paid with cash should be included in calculations, as this is where the limitation is.

In the following chapters, we shall examine how this can be done in practice, and further discuss why it makes such perfect sense.

# Profitability measures –description and discussion

In order to get the full picture, we should take a step back and examine the most common measures used to determine the profitability of a crop or another business venture:

- Gross Margin Analysis (GMA)
- Return on Investment (ROI)
- Return on Capital (ROC)

Of these, GMA is by far the most popular with small scale farmers and their organizations in the area, and we shall therefore begin by explaining the construction, strengths, shortcomings and shortfalls of GMA. We shall then continue to explore the other measurements and explain why and

when they for some reason must be preferred before GMA.

## Gross Margin Analysis (GMA)

GMA is probably one of the most widely used processed market data. Gross margin is frequently used to calculate the profitability of different farm enterprises and technologies. It is often, but incorrectly, said that:

- GMA can be used to compare the performance of a single enterprise using different farming practices and technologies

- GMA can be used to calculate the profitability of growing an entirely new crop if a farmer wishes to diversify production

- GMA can be used to analyze the performance of an existing enterprise

- GMA can be used to project future profitability as part of the farmers' planning

In the following we shall explain what gross margin is, and why one should be very careful when it comes to using it.

**Gross Margin (GM) is calculated as:**

| |
|---|
| Gross Income |
| - Variable Cost |
| = Gross Margin |

Where
Gross Income is the total value of production
(Amount Sold) x (Price)
and
Variable Costs are costs that vary according to the level of production (see below)

*Gross Margin* is the gross income (i.e., value of production) minus variable costs, expressed in terms of an input. For example, in the case of crops it is often expressed in per hectare terms. Gross margins are calculated for specific enterprises.

*Gross Income* or Value of Production is production expressed in monetary terms (e.g., Kwacha, Meticais or Dollars). This therefore consists of not only the product (i.e., the main crop) that has been sold, but also an estimated value of that product that has been consumed, given away (e.g., ceremonial gifts) or bartered, and also the value of the product produced on that plot that is still in the farm household store. It also includes the value of by-products, if they have value and the value of production of other minor crops in the mixture (if it is a crop mixture).

*Fixed Costs* are costs that have to be paid whether production takes place or not. This means that they are types of expenses that cannot be avoided, no matter what is grown or raised and cannot easily be allocated directly to any particular enterprise. The services that fixed inputs provide

last for more than one production cycle (e.g., one main crop of taro or some other main crop is a production cycle).

Fixed costs can be divided into three broad categories:

- land, buildings and finance costs;
- machinery depreciation;
- other costs that have to be met whether or not production takes place

*Variable Costs* are costs that vary according to the level of production (i.e., increase as production increases and decrease as production decreases), and can be easily associated with specific enterprises. The services variable inputs provide usually only last for one production cycle. Some variable inputs are paid for (i.e., are cash inputs) and some are not paid for (i.e., are non-cash inputs). Valuing non-cash inputs requires use of the opportunity cost principle. The cost of any choice (e.g., of using some resource for a given purpose) is given by the value of the best alternative use forgone. For example, in our analysis, the cost of family labor on the farm is what it could have earned if it was used in some way off the farm (e.g., as hired labor).

*Examples of variable costs of a crop enterprise would be:*

- Hired Labor: This can be physical or mechanical. It covers labor brought in from outside the farm. It is used for tasks that require doing at times when there is insufficient

family labor available (e.g., special weeding operations, assistance with pineapple harvesting, banana sorting before marketing).

- Seed and Other Planting Materials: This is usually bought but may be a mixture of purchased and home-grown seed and planting materials. Home-grown seed will have been kept since the previous production cycle and will need to be valued at the value it could have been sold for.

- Fertilizer: Inorganic artificial fertilizer is normally bought. Animal or farmyard manure, compost, green manure, and seaweed may also be used and could have a value because of the nutrients in it replaces some or all of those in artificial or inorganic fertilizer. However, if there is no market for it, it can be valued at zero.

- Sprays: This includes any chemicals or biological agents used to control weeds, pests or diseases affecting the crop.

- Sundry Crop Expenses: This covers any miscellaneous costs. For example, packing materials and marketing group membership fees.

*The variable costs of a livestock enterprise may be:*

- Hired Labor

- Feed: This includes feed whether bought or transferred from other enterprises on the farm (e.g., maize produced in the farm and used in preparing a ration for animal feed).

- Veterinary Fees and Medicines: This covers all expenditures for animal health, mainly veterinary practitioner's fees and medicines. Prophylactic doses of mineral or vitamins intended to ensure health of intensively reared stock (e.g., pigs or poultry) would also be included here.

- Livestock Transport: If the amount of produce to be transported is considerable, a transportation company may need to be contracted. Often for small amounts, farmers prefer to take their own animals to market.

- Sundry Livestock Expenses: This would include items such as ear tags for animals' identification and bedding.

*The problem with GMA*
is that it does not take the use of assets into account. Looking at the example in table 1, the implications should become clear.

**Table 1**

| | | PRODUCTION | | | |
|---|---|---|---|---|---|
| | Per hectare | A | B | C | D |
| TVC | Total Variable Production Cost (Investment) | 700 | 700 | 1300 | 700 |
| GI | Gross Income | 1250 | 3000 | 5000 | 3000 |
| GM | **Gross Margin** | **550** | **2300** | **3700** | **2300** |

Facing a choice between four product lines; A, B, C and D, it seems very attractive to go for option C, as this gives the highest possible Gross Margin. However, considering that the input costs are also very high, this option might not be viable for someone with limited access to production factors! And even if the assets are available, it is really difficult to tell whether C is really the most profitable us of the available assets.

Not until the use of assets is taken into account will the producer be able to determine if this choice is the best one, maximizing her profit. In this example, which is uncommonly detailed despite providing far too little information, we immediately see that unless the farmer has access to a total of 1300 worth of inputs, it is not certain that option C is the best.

One other thing should be obvious, namely that the GMA in this case does not give us any help in choosing between B and D, as their total production costs as well as incomes and therefore gross margins are identical. The only thing that seems certain is that A is a really bad choice, as the production costs are equal to those of products B and D, but the Gross Margin is only a fraction. As we shall see, accounting for access to, and need of, assets, greatly changes this. For now, we shall just have to conclude that GMA does not answer some very important questions.

## Return on Investment (ROI)

Recall that measuring profitability is to measure profit in relation to costs. This is usually called "Return on [some]

Investment", RoI, and is calculated by dividing Profit by Investment. The "investment" normally includes fixed as well as variable costs.

**Return on Investment (ROI) is calculated as:**

$$\frac{\textbf{Return}}{\textbf{Investment}}$$

Where *Return* is the actual net profit:

| | |
|---|---|
| | Gross Income |
| - | Variable Cost |
| = | Gross Margin |

| | |
|---|---|
| - | Fixed Costs |
| = | Return |

and

*Investment* is the total cost associated with generation of the Return, i.e. the Total Cost

| | |
|---|---|
| | Variable Cost |
| + | Fixed Cost |
| = | Investment |

The good thing about measures like ROI is that they make it so much simpler to compare different prospects. Profit can

be expressed as gross or net, as yield, in monetary terms (nickels and dimes, or whichever currency you feel like using) and so on; -all very good and important measures, true, but not easily comparable!

Return on Investment calculations give you simple numbers that are"the same"for all products, and comparing them tells you which production decision will allow you to make the highest profit, taking costs into consideration. As always, it is not wise to overemphasize the usefulness and accuracy of any single measure: ROI is not foolproof, and to make it as correct, accurate and applicable as possible takes a bit of work and knowledge.

**Table 2**

| | | PRODUCTION | | | |
|---|---|---|---|---|---|
| | Per hectare | A | B | C | D |
| TVC | Total Variable Production Cost (Investment) | 700 | 700 | 1300 | 700 |
| GI | Gross Income | 1250 | 3000 | 5000 | 3000 |
| | Profit | 550 | 2300 | 3700 | 2300 |
| ROI | **Return on Investment** | **79%** | **329%** | **285%** | **329%** |

In this example the returns on investment in production of B and D are higher than the return on an investment in the production of C. The Gross Margin Analysis of the same projects (above) suggested that production of C would be the

most profitable. Although the conclusion from the GMA cannot be said to be incorrect, it is definitely insufficient. The ROI analysis tells us that using assets to produce C is inefficient, in the sense that it is not the most lucrative use of the assets (the investment). Any of the products B or C would give a higher return on the investment, i.e. more money.

*The problems with ROI*

The investment is normally assumed to be the total investment, which is the total monetary valuation of all assets employed, and the profitability is measured in percent. If you invest 1$ and make a profit of 1$, the Return on Investment is 100%. The total monetary valuation of all the assets employed includes measures like opportunity costs, depreciation and the share of fixed costs that is attributable to the product or project in question, all of them very difficult to estimate correctly. Furthermore, ROC in its standard form does not take differences in project duration into account. Duration of a project can be highly relevant, and omitting the timeframe can therefore be detrimental.

The bottom line is that it is questionable whether the different ROI are comparable, and even more whether it is possible to create ROI calculations that are useful for more than a few producers with very similar production capacity.

## Return on Capital (ROC)

Total Cost, or Investment, is compounded by a number of cost components. In the most basic case, only one division is made –that between capital and labor. Using Capital Cost as Investment gives

**Return on Capital (ROC)** is calculated as:

$$\frac{\text{Return}}{\text{Capital Investment}}$$

Where *Return* is the actual net return or profit, as above, and the *Capital Investment* is usually the total cost of Capital used in the production

The "Capital" in "Return on Capital" could however, as we have discussed be a great many things.

In table 3 we consider an example where capital is used in the most basic sense; non-labor. Labor cost, possibly the opportunity cost, is also valued in $-terms, to make the calculations relevant.

**Table 3**

| | | PRODUCTION | | | |
|---|---|---|---|---|---|
| | Per hectare | A | B | C | D |
| C | Capital Investment ($) | 100 | 500 | 800 | 600 |
| L | Labor Investment ($) | 600 | 200 | 500 | 100 |
| TC=(C+L) | Total Production Cost (Investment) | 700 | 700 | 1300 | 700 |
| I | Gross Income | 1250 | 3000 | 5000 | 3000 |
| R=(I-TC) | Return | 550 | 2300 | 3700 | 2300 |
| ROC=(R/C) | **Return on Capital** | **550%** | **460%** | **463%** | **383%** |
| ROL=(R/L) | Return on Labor | 92% | 1150% | 740% | 2300% |
| ROI=(R/TC) | Return on Investment | 79% | 329% | 285% | 329% |

Looking at ROC in table 3 tells us that the most efficient use of capital you find in the production of A! Now recall that that GMA suggested that we should produce C, whereas ROI suggested that we should produce B or D. Now we learn that if we really have a shortage of capital, it would pay best to produce A. Furthermore, ROC also shows that with respect to capital, it is more efficient to produce C than either B or D. This highlights the phenomenon discussed in chapter 3:

**-the most limiting factor determines which profitability measure is most relevant!**

**Example:**
Consider a crop that needs a lot of input in the form of fertilizers and chemicals, but that does not need very much labor. This crop will, in comparison to the investment, have a relatively low Return on Capital, but a high Return on Labor. As has been discussed, when it comes to small scale farmers it is likely that it is safe to assume that money (or capital) is by far the most common, and most severe, limitation to production, which makes the "appropriate information" task a lot easier. As long as this does not change, due to better banking systems or the like, it should be fairly safe to assume that Return on Capital is the most important measure for commercially oriented small scale farmers.

However, also the increased usefulness offered by the ordinary Return on Capital measurement does not present

an ultimate solution to the specific problem small scale farmers in southern Africa are facing.

*The problems with ROC*

1. The Return in ROC is calculated using total costs, including fixed costs and opportunity costs.

2. Even Capital Costs are not entirely straightforward to calculate, as they include all costs attributed to the use of capital, including the difficult ones discussed under ROI (opportunity costs and share of fixed costs corresponding to the project)

3. ROC in its standard form does not take differences in project duration into account.

# Profitability Analysis for Small Scale Farmers in Southern Africa;

## Return On Cash Cost (ROCC), Time and the Cost Return Budget.

We have so far dealt with three profitability analysis measurements; GMA, ROI and ROC. These measurements all have their own strengths and weaknesses. Let's recapture.

| Measurement | Advantages | Disadvantages |
|---|---|---|
| GMA | • Extremely simple to calculate<br>• Well known and commonly used | • Does not deal with use of assets<br>• Of very little value for making comparisons between ventures |
| ROI | • Relevant for comparisons between ventures<br>• Relevant for comparisons between ventures | • Difficult to calculate<br>• Ignores duration |
| ROC | • Differentiates between labor and capital, focusing on the"most limiting factor" | • Difficult to calculate<br>• Ignores duration |

Although it may seem silly to invent even more Profitability Measures in this paper, this is exactly what we will do.

Commendable efforts to supply small scale farmers with useful market information have been made by field workers, extension services, NGOs and aid organizations, though the actual end results have been meager. It seems that agricultural economists believe that as long as people are provided with data, all is fine. This is not the case. On the contrary, data is very difficult to interpret, and it becomes more difficult the less education the user has. However, this must not serve as an excuse to settle for information that is so simplified that it is useless.

The lack of relevant market information for commercially oriented small scale farmers in southern Africa is striking, and basic profitability information is the most important market information of all. We have seen that the commonly used Gross Margin Analysis does not provide any such profitability information, but that GMA nevertheless holds a prominent position in the environment we are working within. As it is imperative that a relevant profitability measurement is successfully introduced, the factors making GMA so popular as well as the demands on a possible replacement in the minds of people must be selling.

The main success factor for the GMA is its simplicity. Adding value to a measurement invariably increases the complexity of the measurement itself as well as to the calculations. We must therefore construct a measurement that is as intuitive as possible at the same time as we simplify the calculations as far

as possible. The measurement must furthermore be easy to use, preferably reducing the user's own input to a minimum. Finally, it must be seen as productive, directly helping the user to increase income.

**We need profitability analysis that is:**

- Intuitive
  - Transparent, including only familiar factors
  - Corresponding with common knowledge and understanding
- Easily calculated
- Productive
  - Appropriate and sufficient to compare business ventures in terms of profitability
  - Appropriate and sufficient to compare business ventures with different duration
- Easy to use

If the profitability analysis fills these criteria, it is *selling.*

*Creating a new concept*

We have shown that to calculate a measurement that is sufficient to compare relative profitability between possible production lines, only the most limiting factor is pivotal. Hence, using only the most limiting factor in the profitability

calculations should not change the applicability of the generated measurement, given the basic assumptions.

Calculating Return as Gross Income less Cash Cost (CC), and then dividing the Return by the Cash Cost will give us a new measurement: Return on Cash Cost (ROCC).

ROCC should satisfy the demands that the measurement be "Intuitive", "Easily calculated" and "Appropriate and sufficient to compare business ventures in terms of profitability".

**Gross Income**
**- Cash Cost**
**= Return**

**Return**
**Cash Cost = Return on Cash Cost (ROCC)**

Where Cash Costs are all costs that emanate from direct Cash expenses, and Input Loans are treated as Cash expenses.

*Caution!*
*If one assumes that production is limited only and always by Capital, it is possible to come to very strange, and totally incorrect, conclusions. The reason is that this cannot be true. There are always limitations attached to access to any production factor. Assuming that land and labor are free and abundant, irrespective of the amount of capital we have, is clearly incorrect.*

**Example**
Consider four crops, A, B, C and D, with the following characteristics:

**Table A**

| | | PRODUCTION | | | |
|---|---|---|---|---|---|
| | Per hectare | A | B | C | D |
| CC | Cash Cost ($) | 100 | 500 | 800 | 600 |
| LU | Labor use (man hours) | 600 | 200 | 500 | 100 |
| G | Gross Income | 1250 | 3000 | 5000 | 3000 |
| R=(G-CC) | Return | 1150 | 2500 | 4200 | 2400 |
| ROCC=(R/CC) | **Return on Cash Cost** | **1150%** | **500%** | **525%** | **400%** |

Production of A is clearly the most lucrative, given that cash is the limiting factor. However, the return is produced using other factors of production as well. The return, labor use and land use for an investment of 100 $ is displayed in table@@@

**Table B**

| | | PRODUCT | | | |
|---|---|---|---|---|---|
| I | Investment 100$ | A | B | C | D |
| R=IxROCC | Return ($) | 1,150 | 500 | 525 | 400 |
| H=I/CC | Area cultivated (hectare) | 1 | 0.2 | 0.13 | 1.17 |
| L=I/CCxLU | Labor (man hours) | 600 | 40 | 63 | 17 |

We now see that the return of 1150$ resulting from production of A uses 600 man hours (equaling two people working 5 hours per day for two months) and one hectare of land, whereas the other products use considerably less of

these assets. This is very well as long as we have 600 man hours and one hectare of land, which should not be a big problem, but not much more than 100$. However, employing more money will sooner or later result in the situation getting out of hand. Consider the effects of employing 5000$ in the same ventures:

**Table C**

| | | PRODUCT | | | |
|---|---|---|---|---|---|
| I | Investment 100$ | A | B | C | D |
| R=IxROCC | Return ($) | 57,500 | 25,000 | 26,250 | 20,000 |
| H=I/CC | Area cultivated (hectare) | 50 | 10 | 6.25 | 8.33 |
| L=I/CCxLU | Labor (man hours) | 30,000 | 2,000 | 3125 | 833 |

Now, finding the thirty thousand man hours to produce A (equaling 100 persons working 5 hours a day for two months) would probably be a considerable problem, and that kind of labor input would definitely have to be employed, incurring cash costs, and hence lowering the ROCC. In this case, it is likely that another use of the money would actually produce a higher net return. The reason why the original ROCC can nevertheless be useful is that most small scale farmers will not have access to 5000$.

*Omitting all costs except cash costs is possible only as long as cash is the most limiting factor, which, if business goes well, should not be very long!*

We can deal with this potentially dangerous limitation in a

way that is similar to the sensitivity analysis approach discussed earlier, i.e. by providing the user with information that makes it possible to assess the validity of information given! Displaying the effects of investing an appropriately chosen "normal" sum in the venture analyzed will give the user an idea of whether the resulting need for land and labor is manageable.

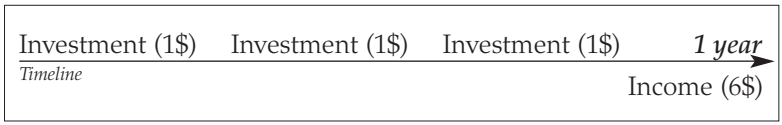
*Ventures with different duration*

The need for a measurement that makes it possible to compare investments with differing durations is one of the more difficult to deal with. By now, it should become clear that there is no perfect solution to this problem. Sometimes, the actual time value of capital can in many cases be neglected. Nevertheless, it is crucial that the actual amount of money that has to be available at any specific time is considered!

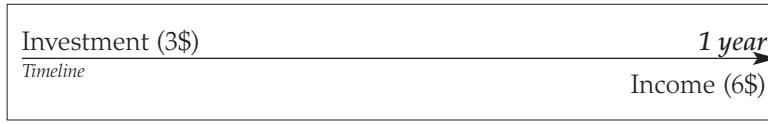
A series of small investments over time add up to a big investment, when it comes to total cost. We can use this fact to come to one important conclusion.

In the example below, it is clear that it is the amount of cash that a farmer must raise at any moment in time that is the real problem, but the "moment" is not always easy to define!

*Timeline T1: three investments of 1$ during period, payoff 6$ at end of period, return 3$, ROCC 100%*

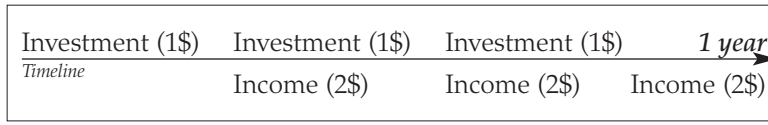


*Timeline T2: one investment of 3$ at beginning of period, payoff 6$ at end of period, return 3$, ROCC 100%*




A comparison of timelines T1 and T2 illustrates the fact that there is no real difference between one big investment and a number of small investments (summing up to the same amount as the big investment), for someone with only one possible source of income. It is the total amount that has to be raised that really matters, not when it has to be raised.

*Timeline T3: three investments of 1$ during period, three payoffs of 2$ during period, return 3$, ROCC 100%*




If we look at the same time period but a project covering three investments (T3), we realize that it is the duration between investment and payoff that is really important.

Clearly, it is better for someone with a restriction in access to Cash to invest 1$ than to invest 3$. Yet ROCC the way we have defined it does not reflect this discrepancy, as we have not determined the timeframe.

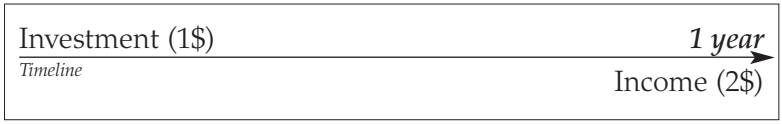
Very often the standard timeframe is one year. Selecting a timeframe equal to one "project period" will in many cases not change the ROCC, but may very well change the

implications for the user significantly. The project depicted in timeline T4 has the same ROCC (100%) as the project depicted in T3, but the timeframe is shorter and the return lower. Should T4 be replicable, it would, over time, be identical to T3.

*Timeline T4: one investment of 1$ during period, one payoff of 2$ during period, return 1$, ROCC 100%*


In essence, we need a measurement that reflects that there is a difference between timelines T4 and T5

*Timeline T5: one investment of 1$ during period, one payoff of 2$ during period, return 1$, ROCC 100%*




One simple way of doing this is to attach a higher value to a shorter investment, using some relevant formula. Which formula is relevant is again not simple. An investment with duration two months is not with certainty much better than one with duration three months, all other things equal.

***Time value of capital***

The example above also points to another factor that can be important: the time value of capital. In essence, this means that there may very well be opportunity costs connected to

the use of capital, e.g. foregone opportunities to make money or extra costs incurred because of lack of cash. Consider the following:

**Example:**
Imagine two crops that can only be grown during the rainy season, X and Y.

- X takes two months to produce, Y needs three.
- The margin is 5 for X and 10 for Y, but the necessary capital investment is also 5 for X and 10 for Y, so that the ROC is 100% for both crops
- The rainy season is usually four months

Calculating the profitability for one crop of X and Y respectively will result in profitability measures that are the same. The problem is that choosing to produce Y will make only one harvest possible, whereas choosing X will probably make two harvests possible.

However, one must acknowledge that different durations are not always very important. Many small scale farmers primarily stand to choose between rainfed crops that can be grown and harvested only once a year, making it less relevant whether the actual project period varies by a month.

**Explanation:**
Consider three crops; L, M and N.

- L and M take two months to produce, N needs three.
- L for some reason can be grown all year
- M and N are both rainfed and can be grown only during the rainy season
- The Gross Income is 9 for L and M and 20 for N
- The necessary Cash investment is 5 for L and M but 10 for N
- The margin is 4 for L and M and 10 for N
- The rainy season is usually four months long (i.e. choosing to produce N will make only one harvest possible, whereas choosing M will probably make two harvests possible)

Calculating ROCC for one crop of M and N respectively will result in numbers that signal that it is better to produce N.

**ROCC (L,M)=(9-4)/4=80%**
**ROCC (N)=(20-10)/10=100%**

The problem is that the different durations of the three investments implies that the actual return realized over a

year may differ very much! We can try to capture this by adding some time value to the Profitability Measurement.

The easiest way to do this is by simply adjusting the ROCC. It can be done by giving a higher value to a shorter investment, as this allows for using the money for something else:

| | |
|---|---|
| ROCC(X) | **ROCC** / **(duration of enterprise [as part of year])** |

The formula ROCC(X) measures what the total profitability would be over a year if the initial investment is reinvested in identical projects over a year, irrespective of whether this is actually possible.

A time value could also be related to how many times (per year) the investment can be made:

| | |
|---|---|
| ROCC(Y) | **ROCC x (times per year it is possible to get "the" return)** |

ROCC(Y) in this case measures what the total profitability on an initial investment would be if the initial investment is reinvested in identical projects the number of times it is actually possible.

Adding Time Value will change the results drastically:

| | PROFITABILITY | | |
|---|---|---|---|
| | L | M | N |
| ROCC | (4/5)=80% | (4/5)=80% | **(10/10)=100%** |
| ROCC(X) | **(4/5)/(2/12)=480%** | **(4/5)/(2/12)=480%** | (10/10)/(3/12)=400% |
| ROCC(Y) | **(4/5)*(12/2)=480%** | (4/5)*2=160% | (10/10)*1=100% |

If any adjustment of the measurement shall be made it must be selected carefully, keeping in mind what the measurement is going to be used for. In the example above, both the adjustments (X) and (Y) capture the fact that N in reality is not a very profitable product, even though ROCC suggests that it is. Also, we see that the adjustment (X) does not distinguish between L, which can be grown all year round, and M, which can be grown only twice a year. Seen from this perspective, it would make sense to choose time adjustment (Y), as it captures the actual higher income that is possible from L, over a year.

However, claiming that a product is better only because it can be grown and harvested more times per year, is clearly wrong. It is often necessary to change products over time, in order to avoid pests or depletion of soils. In such cases, it is totally irrelevant that a crop can be grown all year. In other cases, one product may be very lucrative to grow one time of year, and another crop equally lucrative another time of year. A combination of two products may then be very lucrative, although each of them only can be produced once a year.

The fact that some products, such as cassava, can be grown all year is very difficult to value correctly. The same goes for the value of having some kind of irrigation system, making continuous production possible.

The conclusion must be that it is not possible to come up with a measurement that correctly captures the time value of money, and one that does not introduce new problems, such as potentially detrimental interpretations. Measurements collecting very much information become excessively difficult to use, and one of the most important qualities of the profitability analysis we construct must be simplicity.

*The solution must again be to present the user with the information to make the appropriate choice herself, and to present that information in a way that makes the choice as simple as possible. The ROCC measurement should always be presented together with a sensitivity analysis and information on the duration and the timing of the analyzed investment.*

## The Presentation

The importance of presenting more information than a simple measurement has been highlighted several times in this Guide. It is now time to conclude what the presentation should contain, and how it should be presented.

The Profitability Analysis Presentation should include information on

- When the analysis was made

- Where it is applicable
- What the duration of the analyzed investment is
- What time of year the investment can be made, or, alternatively, that it is season independent
- The costs that have been included
- The incomes that have been included
- ROCC given different circumstances (i.e. drought, normal, perfect)

The Kansas State University (KSU) supplies farmers in Kansas, USA, with market and production information. They have come up with a format for presenting the needed information that is beautifully clear, delivers all the crucial information in a compact format, and makes comparisons very straightforward. They call these presentations, of which they produce impressive numbers covering very many products, Cost-Return Budgets.

The Cost-Return Budget format is commendably clear and straightforward, explaining the costs incurred as well as whatever simplifications or assumptions that have been made. Although the content has to be adapted to the special circumstances that we are facing here, the overall structure is perfect, and we give the creators full credit for that. Appended you will find an example of a Cost-Return Budget from KSU. It can of course be used as a blueprint for

calculations and so forth. However, we have not included a paper template for the calculations, as such a template must be rather complex if it shall cover all important sectors and products.

One of the biggest problems facing providers of market information is that no matter how beautiful a presentation format we come up with, most of us are not in a position to actually manage to produce such presentations, especially not when a number of different people should stick to one format, and visual as well as content consistency is essential. To solve this, we have come up with the

## SCC ROSA Profitability Presentation Generator: PPG

The PPG is a software tool that simplifies all the steps necessary in creating a presentation that fulfills the demands made above. It takes the user through a number of simple steps, asking for the information needed to calculate ROCC. It then makes the calculations and generates the final presentation, which can be printed, sent digitally or published on the web. All of these steps are fully automated to ensure that the user will end up with a perfect product in a minimum of time.

The PPG generates a two page presentation for any given product. The presentation contains

- Time, place, product, production technology, duration of project and other important basic information

- Two tables explaining the costs included in the calculation

- Text explaining all assumptions and simplifications made, as well as any other details giving reason for caution

- One table with the whole ROCC calculation, resulting in easily comparable percentage figures

- A sensitivity analysis with three scenarios; a "drought" scenario; a "normal" scenario; and a "perfect" scenario, for each factor in the calculations.
- An estimate of how much of other assets will be required for a "standard" amount of money (a precaution to prevent misinterpretation)

The PPG, finally, is an application that will run in any web browser, on- or offline, which means that you can use it on your own computer without any internet connection, or you can use it online, without having it on your own computer! All the data entered into the PPG is collected in a database, the contents of which can be shared with other users or submitted to a central database, should this be of interest. The generated presentation can be exported digitally in a variety of formats, published on a web server or printed.

More information on the PPG is available on www.sccrosa.org

# Appendix 1

## What numbers to use

Though calculating profitability can be made to seem incredibly simple, as the Profitability Presentation Generator (PPG) certainly illustrates, this simplicity is deceptive. The calculations are uncomplicated, but the numbers that go into the equation are not.

Consider the following terms:

- Expected
- Average
- Mean
- Extremes
- Extrapolation
- Inflation
- Deflation

These are all terms that are frequently used when discussing time series and prices, but their usefulness is

hampered by the difficulty to understand what they really mean.

What is, for example, the "expected yield"?

Well, we could assume that the "expected yield" is the "average" yield over a number of years in a particular place. This may be what we can expect to get any specific year. In that case we also have to decide whether "average" depicts "mean" or "median" values. The difference between the two can be rather substantial, as high yield volatility (for example as a result of high rainfall sensitivity) may reduce the mean yield very much while not affecting median at all.

**Table x**

| *Year* | *Yield by year* |
|---|---|
| 1 | 0.3 |
| 2 | 1.2 |
| 3 | 1.4 |
| 4 | 1.3 |
| 5 | 1.6 |
| 6 | 1.5 |
| 7 | 0.3 |
| *Mean year 1-6* | *1.0* |

| | *Yield by size* |
|---|---|
| | 0.3 |
| | 0.3 |
| | 1.2 |
| *Median year 1-6* | *1.3* |
| | 1.4 |
| | 1.5 |
| | 1.6 |

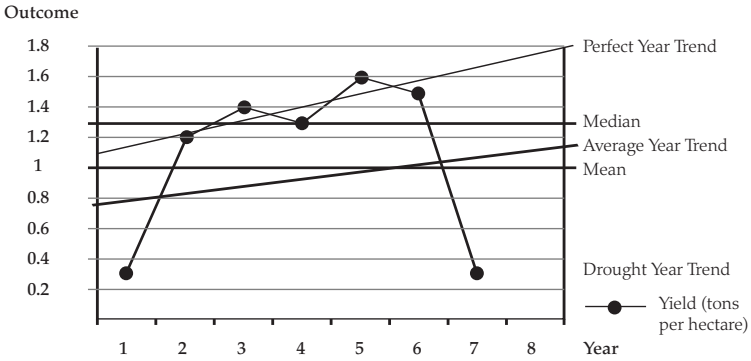
Over a number of years, the mean yield will approximate the expected yield, risk accounted for. This is excellent if we want to come up with a single digit that describes "all" possibilities. Sadly, a single digit like this provides no risk

information in itself, and consequently a seemingly decent mean can "hide" dangerously low outcomes. To include externalities of yield levels, these have to be weighted, which is a not only difficult and highly subjective task, but also one that gives a result that no longer is a mean.

Furthermore, if we use a"sensitivity analysis approach", the mean yield will not allow for separation of "good", "expected" and "worst case" outcomes. This is a major problem, as the whole idea behind the sensitivity analysis exercise is to provide the unique producer to apply her own risk assessment. From this point of view there is a strong argument to use medians rather than means in the profitability calculations. There are more problems though.

If we again take a look at the numbers in *table x*, these can be plotted as below.

**Outcome, Mean, Median and Trends**




Trends have been added in the chart. They illustrate the facts

that average outcome and well as "drought year" and "perfect year" outcomes have increased over the period. This is basically the same as saying that the mean for some "earlier" period is lower than the mean for some "later" period. It is also obvious that the trends will be quite different depending on whether the "extreme values" for years 1 and 7 are included or not.

Assuming that the following year is not going to be a "low extreme", we should, if we look at the tendency, expect to get a higher outcome the following year than the mean or median, depending on what we use. This is, briefly, what is called extrapolation. We might, for example, have reason to believe something like "if there is not a drought next year the outcome will grow a bit compared to some previous average", which would motivate us to estimate an outcome of perhaps 1.4 or even 1.5 for the coming year, compared to the mean 1.0 or the median value 1.3. To correctly construct tendencies is another difficult task, often including advanced statistical instruments. Although it would naturally be possible to include such analysis, it is far beyond the scope of this material. Instead we stress the importance that whoever produces a forecast takes these things into consideration, and that she clearly explains which assumptions that have been made and why.

Explanations are also very important when it comes to estimating price rather than production. First of all, prices are sometimes depending on local production volumes. Secondly, prices also depend on external factors. Plotting not only production but also price in the same chart can visualize this neatly. Should a mere plotting of price/kg of produce over the

years show that price has constantly gone up may mean nothing or a lot, depending on external factors. It should be obvious that unless the increase in price is bigger than is motivated by inflation, no real price change has taken place (which is saying that all other prices have gone up by the same ratio, and hence the total effect is nil). Should it show that price has depended on production, this is usually a result of supply and demand –prices go up when there is only a little for sale. As everybody in agro-economics is aware, it is also common that a "high profit" year for a certain product is followed by a "low profit" year for the same product, as producers shift their production towards what looks as higher income areas. This is another reason why profitability forecasts are important. A forecast that is correctly made will show what profitability is reasonable for any product, therefore potentially reducing the volatility in both production and price. The reason would be that farmers get a chance to see that the plausible increase in profit is not very big. In this case it is important to stay away from the temptation to use historical knowledge of how markets react to shortages or profitability spikes to project drastic reductions in profitability following a high profitability year. The projection should show what is plausible assuming that all producers behave rationally, and hence should be correct if producers use the information in the projection rationally and appropriately.

Consistency is essential:

- Once a certain methodology has been selected and established, any changes must be highlighted and explained.

- If, for example, inflation is used to estimate future prices, it must either be done across the board for all prices in all budgets, or there must be an explanation of why it is done in some cases and not in others.

Below you will find typical examples of the most important information to enter into a profitability analysis equation. Observe that it is necessary to find information for at least two, but preferably three, scenarios, in order to provide the user with a sensitivity analysis. In practice, this implies income and cost data for Drought years, Normal years, and Exceptionally Good years.

| *Basic Information* |
|---|
| Date |
| Your Name |
| Your organization |
| Place where the analysis is valid |
| Currency |
| Base unit for calculation (e.g. "hectare" or "head") |
| Approximate total labor input (man hours per base unit) |
| Project duration (days) |
| Project Period (from date to date) |
| Irrigation or not |
| Production Method (technology) |
| Typical cash investment<br>(typical amount of money that could be invested) |

| *Important Crop information* |
| --- |
| Crop |
| Variety |
| Primary Product: |
| Primary Product unit |
| Secondary product |
| Secondary Product unit |
| and so forth… |

| *Important Livestock information* |
| --- |
| Livestock |
| Start input (e.g. "calves") |
| Primary Product (e.g. milk) |
| Primary Product unit |
| Secondary product |
| Secondary Product unit |
| and so forth… |

| *Income* |
| --- |
| Amount: primary product |
| Selling price: primary product, per production unit |
| Amount: secondary product |
| Selling price: secondary product, per production unit |
| and so forth… |

| *Costs: Crop* |
| --- |
| **Seed** |
| **Fertilizer** |
| Basal: |

| |
|---|
| Topdressing: |
| Lime: |
| **Herbicide** |
| **Insecticide/Fungicide** |
| **Cultivation** |
| Hired Labor: |
| Tractor hire: |
| Plow hire: |
| Draught Animal hire: |
| **Crop insurance** |
| **Harvest** |
| hired labor |
| **Irrigation** |
| Hired Labor: |
| Fuel and Oil: |
| Repairs and Maintenance: |
| Interest on Equipment: |
| **Other labor** |
| **Crop consulting** |
| **Drying** |
| **Packaging** |

| |
|---|
| *Costs: Livestock* |
| **Starter** |
| **Concentrate feeds** |
| Creep feed |
| Starter feed |
| Grower feed |

| |
|---|
| Finisher feed |
| Developer feed |
| Layer I feed |
| Layer II feed |
| Lactation feed |
| Gestation feed |
| Dry feed |
| **Other feeds** |
| Feed additives |
| Feed ingredients (add more) |
| **Veterinary services** |
| **Other labor** |
| **Animal consulting** |
| **Roughage and Fodder** |
| **Veterinary drugs and chemicals** |
| Penicillin |
| Oxytetracycline |
| Tylosin |
| Sulfaxacyline |
| Doxycyline |
| Diminutive acetorates |
| Imizol |
| Ivernectin |
| Beremil |
| Vitamin ABE |
| Vitamin B-Complex |
| Furataltone |
| Euroflaxacine |

| |
|---|
| Levamizole |
| Albertazole |
| Oxyphenbendazole |
| Amitrazine |
| Selenium |
| Other Antibiotics |
| Other Dewormers |
| Other Dipping or spraying chemicals |
| Other Vitamins |
| Disinfectants |
| Other Veterinary supplies |
| **Animal insurance** |

The Swedish Cooperative Centre (SCC) has a long history of supporting farmers' organizations around the world. We take pride in partnering with organizations representative of the farming societies, providing important services to what is often a majority of the population.

This material is one in a series of SCC publications aiming at contributing to enabling farmers and their organizations to engage more effectively in marketing activities. It focuses on explaining what profitability really means and how it can be used, and, perhaps most importantly, it explains how a simple profitability measurement suitable for a small scale farmer in southern Africa can be calculated and presented. It is furthermore an important complement to the Profitability Presentation Generator software, PPG.

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