

## Risk in tropical dairy farming

This chapter introduces the concept of risk and how smallholder farmers have to live with it.

### The main points in this chapter

- Risk is basically uncertainty about the future, hence the difficulties farmers have to live with when trying to predict their farm performance and profitability in years to come.
- There is business risk and there is financial risk. Business risk is the cost of inputs, returns from outputs and the level of farm production, while financial risk is concerned with the uncertainty about using other people's money.
- Sources of risk can be external and internal. External sources arise from natural, economic, social and political environments, while internal sources are those to do with the farm manager, such as his health, attitudes and aspirations.
- There is short-term and long-term risk. Variations in milk prices are a good example of long-term risk currently influencing the smallholder dairy farmer.
- Farmers can develop risk management strategies, such as planting more drought-tolerant forage legumes as well as higher yielding forage grasses.
- Farm budgets and sensitivity analyses are useful tools for managing risk.
- Biosecurity against introducing cattle diseases and other animal health problems is a good example of risk management.

The concept of risk can be summarised by the following statements made by Malcolm (pers. comm.):

- If the future was known with certainty, it would have happened.
- Life is risky as we cannot remember the future.
- The future is going to happen anyway, so prepare for it.
- If you know what is going to happen, it's easy; it's preparing for what you don't know that is hard.
- Last year doesn't happen; it's been.

As we cannot remember the future, we have to imagine it instead. Things might happen, but they might not. The good thing about this is that risk and uncertainty make it possible to earn good profits. If there was not much risk, there would not be much profit either.

A dairy business is made up of a mix of people, livestock, natural resources, technology, economics and finance. Farmers buy their inputs to production and sell their milk in the markets. What they do is subject to laws and affected by things governments do. Running a farm business means dealing with lots of risks. There is risk about how much grass they can grow, how much milk their cows will produce and of what quality, hence unit price. There is risk about what their farm production will cost and how much it is worth. There is risk affecting how much spare cash they will have to pay interest to the people who have loaned funds to their farm business. There is risk about what governments all over the world might do that will affect how the farmer's business is able to operate. The 2008/09 global financial crisis is a direct result of unpredicted risk!

In other words, farming is a risky business. Most farm decisions involve risk or uncertainty. Risk and uncertainty challenge the technical and managerial abilities of all farmers. They impact on every part of farming: its productivity, stability, resilience and equity. Uncertainty is defined as imperfect knowledge, or not knowing what is going to happen in the future. Decisions that do not have a single outcome are then uncertain decisions. Risk is only present when the uncertain outcomes of a decision are regarded as significant or worth worrying about. Rather than the risk, it is the consequences of the risk that matter because they have to be managed to achieve resilience in the farm business.

Resilience is the ability of the system to withstand severe, usually unpredictable, disturbing factors and includes consideration of the rate and degree of recovery from that disturbance. Resilience then depends on how well the risks are understood and incorporated into farm decisions, the ability of the farm business to respond to unforeseen events and the capacity of the farmer to cope in the face of adverse outcomes.

Uncertainty means that the financial performance of the farm business cannot be controlled and accepting this makes a good manager. The key objective of farming is long-term survival, and farmers should focus on defining and working towards the farm's productive potential. This will position the farm to more fully exploit business opportunities as they arise.

## 16.1 Types of risk

### 16.1.1 Business v financial risk

There are two main types of risk in farming, business risk and financial risk (Chapman *et al.* 2007):

**Business risk** stems from variable yields of crops, reproduction rates, disease outbreak, climatic variability, unexpected changes in markets and prices, changes in government policies and laws, fluctuations in inflation and interest rates and personal mishaps. Sources of business risk can be condensed to price and production. These exist regardless of financial matters, such as how much money is borrowed. Price risk refers to

change in prices of inputs and outputs, whereas production risk results from factors such as weather and pests that affect output yields. These risks affect the ability of the business to pay for the inputs used, to service any debt and to appropriately reward labour and management.

**Financial risk** derives from other people's money that is used in the business relative to the proportion of the owner-operator's capital. The higher the ratio of debt to equity, the higher the financial risk. Any new farm practice must be assessed both as a business and financial risk. It could look good from a technical viewpoint or after considering the market forces beyond the farm, but it must be financially feasible before it should be adopted. If it requires borrowing large amounts of capital and reducing equity to dangerously low levels, this could make it vulnerable in adverse circumstances. Therefore, it becomes too high a financial risk and should be rejected at this particular time.

### 16.1.2 External v internal sources of risk

Another way of looking at risk is whether it originates from sources external to the farm or the internal ones affecting the farm's operating efficiency (McConnell and Dillon 1997).

External sources of risk arise from the natural, economic, social and political environments. Of most importance is the natural or climatic environment (that is, nature). Farming is profoundly affected by nature, which provides all the basic elements for biological growth and production, such as short-term and long-term weather, as well as the many natural hazards such as the recent earthquakes, tsunamis, volcanic eruptions and landslides seen in Indonesia over the last few years. All these affect yields and market supply, hence global and local prices.

Risks of the economic environment relate to the market (demand and supply), hence prices of farm inputs and outputs, inflation and interest rates and productivity through the availability and merit of new technology.

The social environment is not a major source of risk, although over time, it can influence education and lifestyle, hence impacts on farm labour supply. Social upheavals such as civil conflicts are certainly becoming more important in developing countries.

Political factors influencing risk include change in government policies which can influence commodity prices and marketing, availability and cost of credit, public infrastructure, environmental standards, labour and import laws, exchange rates and many other government reactions to the globalisation of our food production. Other more typical political influences are changes in political ideology, such as moving from a socialistic centrally planned, to a capitalistic free market economy, as occurred in Sri Lanka during the 1970s. This had a great influence on agricultural policy, including the supply of local milk, compared to imported milk.

Sources of internal risk affect the operation of each individual farm and include the health of the farm household, their interpersonal relations as influenced by personality, changing values, attitudes and aspirations. They also include the farmer's approach to conservation of farm resources, use of credit to finance farm development and inter-generational transfer of farm ownership. There is an additional one involving any external farm advice, namely its relevance to, and its likely impact on, that particular

farm. Such a change in farm practice could impose additional pressures on the social, biological or economic aspects of the current farming system.

This can be particularly important for near subsistence dairy farmers with little contact with their potential markets. Milk can be sold through formal or informal markets, while in more subsistence operations, the milk may be consumed on-farm or bartered for other goods. Increasing the farm's output of raw milk may lead to a change in market outlets, and a new set of risks for the farmer.

### **16.1.3 Risk in short-term and long-term decisions**

Changes in product prices and yields are the most important short-term risks, because the cost of the key variable inputs (such as purchased concentrates and fertilisers) are either known and/or determined by the farmer at the time of the decision. In the long term, all yield price and cost variables are uncertain, even those under government 'control'. Yields can be predicted with some degree of confidence without the occurrence of unpredictable climatic events. The increasing costs of importing cereal grains is one classic uncertainty adversely affecting Asian smallholder dairy farmers in recent years. The extreme volatility of cost of imported dairy products is another long-term uncertainty, as this affects farm gate milk prices.

All these uncertainties make farmers very cautious with their decision making because their survival depends more on surviving adverse outcomes than benefiting from good outcomes. On the whole, farmers, particularly resource-poor smallholders, exhibit risk aversion rather than risk neutrality or risk preference. Small farmers are more susceptible to downside risk than are other sectors of society. They are more exposed to the vagaries of nature and don't have easy access to insurance or futures markets because of their small-scale structure. Unlike larger operations, they don't normally use the more formal market based institutional approaches to risk management such as bank lines of credit or overdrafts, crop and livestock insurance, forward pricing through price, futures or options contracts or market guarantees through vertical integration.

### **16.1.4 Good and bad risks**

People outside farming generally view risk as something to be minimised. Farmers clearly know that minimising risk can minimise farm returns as well. Risk is then the source of above average profits and losses. Risk and uncertainties create opportunities and rewards that people are in business to capture. If the future was known with certainty, the profits would have already been made.

Fundamental to understanding risk in farming is to distinguish between good and bad risks, and right and wrong decisions. A good decision is based on the best information and judgement available at the time. Whether it turns out to be right or wrong depends on the outcome of subsequent events. For example, the decision to increase herd size should be based on an expected increase in demand for feed nutrients and their supply from home-grown forage supplemented with purchased feeds (additional forage and concentrates) when required. Such a decision can be classified as a good one if it is made using sound information on historically typical forage growth

rates and purchased feed costs. However, increasing herd size could turn out to be the wrong decision if seasons and costs vary substantially from the expected. Bad decisions are those made without considering the best information available and these often have little prospect of success if the expected conditions prevail. Only good luck can make a bad decision the right decision.

In far too many situations, smallholder dairy farmers may decide to increase herd size or purchase high genetic stock without taking into account their increased feed requirements. They invariably find that although the farm may produce more milk, the per cow milk production actually decreases and with it, the efficiency of converting home-grown and purchased feed into milk. Granted, the farm has more stock, hence more assets, although the equity may not change if money had to be borrowed to purchase them. However, if each cow produces less milk because of less feed being available, the decision to increase herd size or purchase superior stock, will adversely affect the overall business performance of the farm. Not only was it a bad decision, but the farm now has an increased risk to higher unit price changes for feed supplies (both on-farm and purchased).

One major problem to decision making in tropical dairy farming is the lack of objective data available with which to make such major farm decisions. Without a good knowledge of yields and quality of home-grown forages, it is difficult to make good decisions on optimum stocking capacities on smallholder farms. Table 13.2 (page 154) presents theoretical estimates of the forage produced under various levels of forage management and the forage requirements of the entire dairy herd. The bottom line is that to provide sufficient quality home-grown forage for a well balanced diet to all stock, the typical 0.5 hectare smallholder farm should have no more than two to five milking cow units, that is two to five adult cows plus one replacement heifer, depending on management of the forage production area. Therefore a good ‘rule of thumb’ is – for a farm depending entirely on home-grown forage and with a typical level of forage agronomy – no more than eight cows (together with their replacements) should be kept per ha of forage production area.

## 16.2 Strategies for managing risk

There are a variety of risk management strategies that smallholder dairy farmers can use and these are summarised in Table 16.1.

In drought-prone areas, diversification of cropping systems is a risk management tool. Use of different varieties and sowing them in different sequences (rotations and location within the farm) can improve yield and income stability because crop mixtures generally yield better than monocultures under stress conditions. In addition, they can reduce the incidence and build-up of pests and diseases and even exhibit compensatory yields. Differences in terms of days to maturity and variability in resistance or tolerance to stress also reduce the chance of total crop failure. This applies to both cash crops, which often supply by-products for livestock enterprises, as well as forage crops grown specifically as livestock fodder. Planting more drought-tolerant forage legumes as well as higher yielding forage grasses is a good example of risk management. A recently released CD presents a process for selecting forages for smallholder dairy farmers throughout the

**Table 16.1** Risk management strategies available to smallholder dairy farmers (McConnell and Dillon 1997)

Management activity	Strategy	Type of risk reduced
Production	Use of stable enterprise – dairy genotypes	Yield, technology, policy
	Use of proven forages – e.g. Napier grass	
	Diversifying enterprises – in livestock – in cash crops – within seasons – across farm area	
	Maintain flexibility – over time – in durable assets	
	Keep reserves – seed – fodder – concentrate ingredients	
	Use risk reducing inputs	
	Share-leasing	
	Assess new technology	
	Seek information	
Marketing	Spread sales over time	Price
	Arrange alternative outlet	
	Seek barter opportunities	
Financial	Maintain high equity ratio	Financial, yield, price
	Maintain creditworthiness	
	Maintain a cash reserve	
	Develop relationship with cooperatives	
	Maintain farm assets	
	Maintain social network	
	Off-farm employment	

tropics based on their optimum climate, soils, production system and management (Cook *et al.* 2005).

### 16.2.1 Analysing risk in farm management

Farm management can be defined as a process by which resources and situations are manipulated by the farm manager in trying, with less than full information, to achieve his goals. When a change is made on a farm, the final outcome will not be precisely that which is thought most likely to happen at the time the change was made. Many different



**Figure 16.1** Quality silage is a valuable risk management strategy (North Vietnam)

outcomes are possible. Farmers make decisions based on their best guesses about the responses of outputs to inputs and the variability of these responses.

The resilience of farm systems is most severely tested by the relatively rare but most severe circumstances that may occur when drought (hence low yield), for example, coincides with high feed costs, low milk prices and high interest rates. Or, in an extended run of dry conditions, poor prices and high interest rates. Conversely, the risk of encountering a combination of favourable events with resulting high incomes, needs to be prepared for. Weather and economic conditions may be more stable in the humid tropics than elsewhere, such as in Australia. In any one decade, Australian farmers can experience two or three poor years, a run of ordinary years then three to four good years. A similar scenario can be developed for any Asian country.

Suppose the question is whether in a particular situation, one system of dairying has more potential for profit than a feasible alternative. For example, the decision comes down either to maintaining a farm stocking capacity of eight milking cows per ha forage production or increasing it to 12 cows per hectare and relying more on purchased forages. One approach would be to undertake a risk analysis to:

- Test the effects on milk production of different levels of stocking capacities either singly or in combination, say 8 versus 10 versus 12 cows per hectare.



- Test the performance of the various systems under the full range of possibilities for feed costs (home-grown and purchased), herd costs, farm milk yields and reproductive performance and for various milk prices.

Once the raw data are available for undertaking such a series of analyses, whole-farm budgets could be developed. The result is that instead of a single value of operating profit for different farm stocking capacities, probability distributions of operating profits, net present values, internal rates of return and net cash flows for the various systems can be generated.

Without any raw data, they would have to be generated for these farm stocking capacities from a series of theoretical assumptions, such as those used in Section 13.1. Clearly, these data need to be validated from on-farm trials.

The key to managing risk is then information. This information must be about technical, human, financial, and beyond-farm elements of the system. The resilience (survival) of farm systems is ultimately determined by circumstances experienced. In addition, the quality of such management decisions depends critically on the quality of information available and the quality of processing that information. This involves judgement and intuition, which is knowledge gained from experience and past learning and understanding the whole system. Part of decision analysis and decision making is testing intuition, using analytical tools such as whole-farm budgets and risk analysis (Chapman *et al.* 2007). It is not necessary to know everything about everything to make a decision – just enough about enough. The best approach is to attain maximum information from minimum data.

Being rational, farmers typically make their risky decisions in a reasoned way, on the basis of their experiences, traditional knowledge and whatever other information is available to them. Firstly, they would assess the alternative choices, develop a set of uncertain outcomes associated with each alternative then finally use their personal subjectivity to choose their line of action. For smallholder farmers, such a decision is usually carried out in an informal (implicit) rather than formal (explicit) manner. Larger operations, utilising the services of professional farm advisers, would be more likely to use a more formal approach to major farm decisions. One such approach is the sensitivity analysis, which could be easily applied to any farming situation.

A sensitivity analysis assesses how sensitive a decision's outcome is to changes in the major variables affecting that decision. It is quantified by testing the effects of variations in selected cost and benefit variables on budgeted outcomes of the decision. These variations are calculated for a percentage change above and below the values used in the base budget. Sensitivity analyses and partial budgets are discussed in Chapter 15.

## 16.3 Biosecurity as a risk management strategy

Ideally every dairy farm should be separated from the outside world, but as this is not practical, a risk-based approach should be developed (Jubb, pers. comm.). Such an approach requires the farmer to:



- Identify the pathogens and their potential impact.
- Identify the likelihood of these pathogens establishing on the farm.
- Decide on whether the disease risk is worth controlling or not.

The most significant risks for introducing diseases come from many sources, such as:

- Animals and insects: sick or dead cattle, introduced stock, neighbouring stock, wild birds and animals (including rodents), pets, flies and other insects.
- People: family and friends, visitors, farm staff, livestock agents (including veterinarians), tradesmen.
- Inorganic material: borrowed farm equipment, market equipment (trailers), vehicles (motorbikes, utility trucks, stock transport).
- Organic material: surface water, farm manure, introduced feed, potentially contaminated feed (opened bags of feed).

Animal disease comes in many forms so requires different approaches depending on its type. These are six categories of disease sources:

1. Viruses, such as foot-and-mouth disease, rotavirus, infectious bovine rhinotracheitis, enzootic bovine leucosis, pestivirus, warts
2. Bacteria, such as *E. coli*, clostridia, salmonella, anthrax, leptospirosis, brucellosis, tuberculosis, Johne's disease, pink eye, vibriosis, haemorrhagic septicaemia, mastitis
3. Protozoa, such as cryptosporidea, coccidiosis, neospira
4. Parasites, ticks, lice, internal parasites, tick fever
5. Fungi, such as ringworm
6. Others, such as genetic defects, drug resistance, bovine spongiform encephalopathy (or mad cow disease).

The risk management strategy can vary depending on the potential level of risk:

- Accept the risk if it is too small to worry about or too expensive to control.
- Avoid the risk by removing it altogether, such as not purchasing the item or changing farm suppliers.
- Transfer the risk, such as contracting someone to rear the calves.
- Mitigate the risk by taking actions to lessen the probability of it occurring.

There are various ways to manage the risk such as:

- Building barriers against the pathogen, both physical and procedural.
- Increasing resistance in the dairy herd, through vaccinations and good management.
- Early detection by routine disease monitoring and increased surveillance.

General management practices include:

- Selecting reputable farm suppliers with good hygiene.
- Reducing build-up of pathogens.
- Limiting vehicle and people access to farm.

- Establishing quarantine areas for introduced stock.
- Segregating stock classes.
- Developing standard operation procedures and checklists for routine farm tasks.
- Ensuring good farm hygiene and cleanliness.
- Developing an emergency plan in case of disease outbreak.