17

Case studies of profitable tropical dairy farming systems

This chapter presents a series of case studies to quantify the profitability of different dairy production systems varying in herd size and location (both between and within countries).

The main points in this chapter

- The possibility of differences in assumptions and terminology between report authors makes it difficult to confidently compare, or bulk, results from different studies.
- From a study of four herd sizes in Thailand (from 5–117 milking cows), the net profit, or difference between farm return and farm costs, did not greatly differ (1.6–3.7 Thai baht/kg milk).
- From a comparison of smallholder farms in Vietnam and Thailand, the authors concluded that the optimal herd size increased from five cows in Vietnam to 20 cows in Thailand.
- Comparing rural and peri-urban farms in India and Pakistan, the authors concluded that milk can be produced 40–50% cheaper on rural farms, but that investment in a peri-urban farm was more profitable.

Assessing the skills of smallholder dairy farmers to integrate the principles of good farm business management, as discussed in this book, is best undertaken by closely examining the end results of any improvements in their management practices, in terms of their annual profit margins. Such detailed case studies can also highlight some of the limitations of existing systems. For example, a 12-month whole-farm economic analysis of cost of production (COP) on 10 smallholder dairy farms in Thailand by Chantalakhana and Skunmun (2002) found that only 54% of the total farm costs were directed towards the milking cows, with 34% used to grow out replacement heifers and 12% used to maintain the adult cows when dry. To improve their profit margins, they concluded that the farmers needed to:

- Reduce feed costs by sourcing cheaper non-conventional roughages during the dry season.

Figure 17.1 Well-managed calf rearing is an integral part of profitable dairy farming (Sri Lanka)

- Reduce the number of replacements kept on-farm to 20–25% of the milking herd.
- Keep daily cow performance records and cull low yielding cows.

This chapter presents more recent case studies to provide further insight into the practical application of FBM. Such detailed case studies help farmers and advisers to more fully understand how the 'bottom line' was reached. However, these studies can be fraught with danger because of the different assumptions and methodologies used by different report authors. As we say in Australia, you must compare apples with apples and not with oranges. This means that any economic measure, such as COP or profit margin, must be clearly defined so as to allow only truly comparative data to be compared.

17.1 Cost of production of dairy farming in Thailand

A comprehensive financial analysis of smallholder dairying in Thailand was undertaken as part of the worldwide International Farm Comparison Network (IFCN) for four case study farms in Chiang Mai province of Thailand (Garcia *et al*. 2005) with differing herd sizes. The information was derived from farm records in 2003.

Details of the four farms were as follows:

1. Five crossbred cows plus heifer replacements, 0.8 ha land, family labour with some off-farm income, hand milking, 1200 hr labour/milking cow/yr, 0.3 kg concentrate/kg milk.

Figure 17.2 A grass auction in East Java, Indonesia, where smallholder farmers can purchase forages

2. 14 cows plus replacements, 2.1 ha land, family labour, machine milking, 480 hr labour/milking cow/yr, 0.5 kg concentrate/kg milk.
3. 21 cows plus replacements, 0.6 ha land, family labour with some off-farm income, machine milking, 320 hr labour/milking cow/yr, 0.6 kg concentrate/kg milk.
4. 117 cows plus replacements, 3.0 ha land, hired labour (6 units) plus some off-farm income for family, machine milking, 284 hr labour/milking cow/yr, 0.6 kg concentrate/kg milk.

All farms fed crop by-products (rice straw, sweet corn stover) and freshly harvested tropical grasses, together with high protein concentrates (including minerals). Cows produced 3150–3350 kg milk over their 280–300-day lactations, averaging 11–12 kg/day, with milk containing 3.8% fat and 3.1% protein. Virtually all the milk was sold through the local dairy cooperative. Calf mortality was 10–20% and all calves were fed milk for 12 weeks.

The farms had three to four family members of which off-farm work comprised 25% of the family utilisation on the 5-cow farm, and 35% on both the 21- and 117-cow farms. In addition to milk, the 14-cow farm produced poultry and mangos while the 21-and 117-cow farms sold cow manure. Local wages were valued at 10–15 Bt/hr.

The varying size of the farms and differing stocking rates influenced the value of their land and stock as proportions of total farm assets. For example, the 14-cow farm had 60% of its assets as land and 28% as stock in contrast to the 21-cow farm, which had 22% as land and 49% as stock.

Table 17.1 Breakdown of farm costs and income for four farms in Chiang Mai in 2003 (Bt/kg milk produced)

Herd size (cows)	**5**	**14**	**21**	**117**
Herd milk yield (t/yr)	15.8	46.8	67.8	396.0
Farm returns (Bt/kg)				
Milk sales	11.7	11.3	11.3	11.6
Stock sales	4.6	3.9	3.3	3.7
Manure sales	0	0	1.7	0.1
Total	**16.3**	**15.2**	**16.3**	**15.4**
Milk prod costs (Bt/kg)				
Purchased feed	7.5	9.2	9.6	10.8
Other cash costs	1.2	1.6	1.7	2.5
Labour	3.1	1.3	0.8	1.2
Capital	0.7	0.4	0.5	0.6
Land	0.1	0.2	0.0	0.0
Total	**12.9**	**12.7**	**12.6**	**13.8**
Dairy enterprise profit	**3.4**	**2.5**	**3.7**	**1.6**
Profit margin	**44%**	**33%**	**32%**	**17%**

The breakdown of farm costs and income are presented in Table 17.1. Dairy enterprise profit is the difference between farm return and farm costs (in Bt/kg milk). Profit margin is the net cash farm income as a per cent of total farm returns, in other words, the proportion of total revenue generated that remains as income.

In their analyses, Garcia *et al.* (2005) do not include a specific cost component for home-grown feed, only including purchased feed. The contribution of home-grown feed would vary considerably between farms, considering the very high stocking rates on the 21- (35 cows /ha) and 117-cow farms (39 cows /ha) compared to the 5- and 14-cow farms (7 cows/ha) and the fact that the 5-cow farm was only feeding concentrates at half the rate as the 21- and 117-cow farms.

For such a diversity of farming systems, it is surprising that total farm costs and returns (in Bt/kg milk produced) were so similar. Purchased feed comprised 58–78% of the total milk production costs. Labour costs varied because of inefficiencies on the 5-cow farm. The 117-cow farm had the lowest profit (Bt/kg milk and percentage) because of the high amount of purchased feed and other herd cash costs. The 21-cow farm did not hire labour and had lower land costs. Compared to the 14-cow farm, its higher profit margin highlights the benefits of intensification, with smaller farm size and higher purchased feed inputs. The manure sales from the 21-cow farm, 1.7 Bt/kg milk, was greater than the difference in profit between the 21- and 14-cow farms (1.2 Bt/kg milk).

Most of the milk produced in the Chiang Mai area is destined for UHT and pasteurised milk either for local consumption or the School Milk Program. In 2003, the farmers received on average 11.0 Bt/kg, the co-op sold it for 12.5 Bt/kg with formal markets receiving 28.9 Bt/kg for UHT and 23.4 Bt/kg for pasteurised milk. The farmers then received only 38–47% respectively of the returns, which for UHT milk is low compared to smallholder dairy industries in other countries, such as Bangladesh (52%) and India (45%) (Garcia *et al*. 2005).

The 14-cow farm of this study was also used as a case study farm in one of the FBM workshops conducted in Thailand. This analysis, presented in Table 18.8 (Chapter 18), compared the financial responses to three different milk production scenarios, with varying herd average peak milk yields and yield persistencies.

17.1.1 Competitiveness analyses

When assessing the competitiveness of these case study farms, the authors differentiate between 'private' and 'social' price scenarios. They conclude that all four farms are profitable under a private price scenario (returning 3.4, 2.5, 3.8 and 1.7 Bt/kg respectively for the four farms). However, the 21-cow farm was the only one profitable after applying social prices (returning –2.5, –0.4, +1.3 and –0.4 Bt/kg respectively for the four farms).

The differences between the two scenarios represent the so-called 'net transfer' and give an indication of the money transfers Thai society incurs to permit these dairy farms to operate and make current levels of private profit. Hence the five-cow farm requires external support of 5.9 Bt/kg and the 117-cow farm requires 2.1 Bt/kg. Such external support arises from two sources. Firstly, farmers receive higher private prices for their outputs than those prevailing on the world market (in 2003) and secondly, farmers pay lower private prices for domestic factors of production than would be the case without policy intervention (Garcia *et al.* 2005).

The authors then concluded that under the existing system, Thailand has a comparative disadvantage in milk production, which is counterbalanced by national policy measures. Without such support, domestic milk production would be not economically viable and hence would discontinue.

17.1.2 Comments on IFCN methodology

The IFCN analysis was developed to create a standard format to compare production data of major agricultural products. It uses a single and homogeneous method to calculate the costs of production for all participating countries.

It is based on the principle of 'total costs', which include:

- Direct costs and margins
- Indirect (fixed) costs, such as depreciation and interests of the infrastructure used
- Opportunity costs for owned assets and production factors (family labour, land capital).

The first step is to define a typical milk production system of the major dairy regions in any country. The second step is to collect all the required data using a standard input format. IFCN does not aim to collect data from an individual farm nor be an arithmetic mean. It was developed to represent real and common situations of the region and show clearly the predominant technology and infrastructure.

In other words, IFCN was not developed to analyse the business performance of a single dairy enterprise. To obtain a true and meaningful interpretation, the required inputs may be too detailed for any one particular farm. Being a 'one size fits all' approach, various assumptions have to be made, some of which may not be valid for farms in specific areas, such as calculating capital costs below.

ICFN calculates returns from the dairy enterprise as follows:

- Milk price: Average milk price adjusted to 4% milk fat
- Cattle returns; returns from sale of cull cows, male calves, surplus heifers +/– livestock inventory
- Other returns: sale/home use of manure.

Associated costs are calculated as follows:

- Costs for means of production: all cash costs (such as fuel, fertiliser, concentrate, insurance, maintenance) plus non-cash costs (such as depreciation for machinery and buildings)
- Labour costs: costs for hired labour + opportunity cost for family labour
- Land costs: based on land rents paid + calculated land rents for owned land
- Capital costs: non-land assets* interest rates (which are equity *3% or liabilities *6%)
- Opportunity costs: costs for using own production factors (land owned, family labour, equity).

Economic assessments are as follows:

- Profit margin: farm income/total returns
- Entrepreneur's profit: farm income less opportunity cost allocated to dairy enterprise
- Return to labour: (entrepreneur's profit + labour cost)/total labour input.

Clearly IFCN have developed a robust system for calculating COP which could be simplified to make it more 'farmer friendly' for use when collecting FBM data from a number of farms in any one region.

One area that has not been addressed is remuneration for farmer's management skills. For example, the farmer with a 117-cow milking herd (compared to the one with 14 milking cows) should ideally be rewarded more for his skills in feeding, herd, labour and other aspects of farm management.

17.2 Comparing dairy farm production economics in Thailand and Vietnam

This IFCN approach, to standardise COP estimates in different countries, provides opportunities to assess impacts of dairy policies on different farm types. This is important because with the worldwide trend towards trade liberalisation, there are increasing pressures for countries to bring the level of competitiveness of their dairy sectors to international standards. This is easier for countries where farmers receive little or no farm support and are efficient dairy producers. In other words, these farmers are less dependent on public support. Garcia *et al.* (2007) recently compared the farm economics of dairy industries in countries with high support (Germany), intermediate support (Vietnam and Thailand) and zero support (New Zealand) under their current policy frameworks, and also once such policy distortions were eliminated. It is within the interest of readers of this book for some comments to be made on the farms surveyed in Vietnam and Thailand. The

comparative currency is US$, with the milk price being expressed in US$/100 kg energy corrected milk (ECM), to standardise milk to the same fat and protein contents. A milk return of US$20/100 kg ECM is then equivalent to 20 c/kg.

The specific Thai farms selected for the analyses were the two larger farms, with either 14 and 117 cows, as presented in Table 17.1. Details of the two Vietnamese farms (located near Hanoi) selected were as follows:

1. Two crossbred cows plus replacement heifers, renting 0.5 ha government land. The stock are fed crop residues and high protein concentrates, plus a mineral premix for milking cows. Only 93% of the milk is sold to the local Milk Collection Centre. The main income source is cash crops.
2. Four crossbred cows plus replacement heifers, renting 0.47 ha government land. The feed base is the same for Farm 1. The only difference is that income sources are either from dairy farming or off-farm employment.

Details of the four farms are presented in Table 17.2. The economic terminology is the same as used in Section 17.1.

High beef and heifer prices play a key role in determining the profits of dairying in both Vietnam and Thailand. The positive entrepreneurial profit on all farms suggests they are sustainable in an economic sense at the ongoing farm costs and returns.

The authors then reported a favourable situation for dairy farming throughout South-East Asia, due mainly to the governments' focus on promoting milk production through setting high farm output prices and encouraging the use of local resources for food production. Despite their high profitabilities, the productivity levels of two Thai and Vietnamese farms were low. However, raising productivity would be discouraged, firstly by the high profits these farmers are already making and secondly, the countries' taxes on tradable inputs required to raise farm performance, such as concentrates, machinery and other farm equipment.

The authors conclude that the optimal herd size in Thailand was 20 milking cows while in Vietnam, it was only five cows. They believe that there are considerable opportunities to improve competitiveness through cost reduction. This can be achieved through increases in productivity or farm size. However, throughout Asia, smallholder farmers are often unable to improve efficiency without government support. They continue to run less productive local breeds using labour intensive technology.

17.2.1 General comments on Asian dairy industries

IFCN (2005) extended their surveys to 22 farms in six Asian dairy industries, namely India, Pakistan, Bangladesh, China, Vietnam and Thailand and have made several relevant observations:

- The lowest milk price was in Pakistan (14–18 US c/kg), followed by India (19–24), Vietnam (22), China (25), Bangladesh and Thailand (28 c/kg).
- The cost of milk production could be classified into two categories, namely <20 c/kg (Pakistan, large farms in India, north China) and >20 c/kg (small farms in India, Bangladesh, Thailand and Vietnam).

Table 17.2 Farm details and breakdown of farm costs and income for two case study farms in Vietnam and two in Thailand

Country	Vietnam		Thailand	
Farm	**A**	**B**	**A**	**B**
Farm descriptors				
Milking cows	2	4	14	117
Stocking rate (cows/ha)	4.0	9.3	6.7	39.0
Land productivity (kg ECM/ha/yr)	18	35	22	123
Labour units (% family)	1.9 (100%)	1.5 (100%)	2.3 (100%)	12.7 (18%)
Labour productivity (kg ECM/hr)	3	5	10	14
Milk yield (kg ECM/cow)	4083	3928	3342	3155
Farm milk production (t/yr)	8	16	47	369
Replacement rate (%)	25	22	21	20
Age at first calving (mo)	30	29	26	27
Farm equity (%)	91	81	100	100
Farm returns and costs (US cents/kg milk)				
Milk sales	19	19	28	28
Total farm return	26	29	37	38
Cost (means of production)	12	14	27	28
Labour	5	3	2	2
Capital	3	3	1	1
Land	4	2	1	0
Total costs	24	22	31	31
Entrepreneur's profit	**2**	**8**	**6**	**4**
Profit margin (%)	**41**	**37**	**32**	**17**

Abbreviations: ECM, energy corrected milk

- Full lactation milk yields per cow varied from more than 4000 kg on large farms in Thailand and India, and in Vietnam to less than 220 kg on a small Indian farm. The small Pakistani and Bangladeshi farms had between 500 and 2000 kg while medium Pakistani farms produced above 2000 kg.
- The highest return to labour was on a large farm in India (US$2/hr), followed by China (<US$1/hr), large Pakistani and small Vietnamese (<50 cents/hr), with the remainder having a return to labour of <20 cents/hr.
- Labour productivity varied from highs of 19 kg (Thailand) and 16 kg ECM/hr (large Indian farm) down to lows of 6 kg (Vietnam) and 4 kg (large Pakistani farm) with the majority of farms less than 3 kg milk/hr.
- The highest capital input per cow in Asia was in Vietnam (<US$2000/cow), followed by Thailand, China and India (<$1000/cow) with most small farms having a capital input of >$1000/cow.

- In conclusion, most farms analysed had low costs and low returns to labour. Cost wise they were competitive as they were able to produce milk below 20 c/kg. This shows that Asian farms have the potential to compete internationally if milk quality improves and the dairy chain costs are reduced.

17.3 Comparing rural and peri-urban dairying

Many countries have peri-urban areas where smallholder dairying has flourished on the outskirts of large towns and cities. Such areas can have access to good supplies of feed, including:

- Green fodder: native and cultivated grasses and legume forages
- Crop residues: rice straw and maize stover
- Agro-industrial by-products and non-conventional feeds
- Concentrates.

Asian dairy systems can then be categorised into two types, rural farmers who own (or lease) land and peri-urban farmers who purchase all their feed requirements. In Table 17.3, IFCN (2004) compared the cost structure of the two types of farms in India and Pakistan using the same methodology as in Table 17.2. The 'typical' farms were:

- Peri-urban: located within a 5–10 km radius of city with no land, hence purchased all their green fodder and concentrates and they sell their milk direct to urban consumers.
- Rural: located more than 10 km from urban centres with land to grow fodder and they sell their milk though the informal markets via a milkman.

They concluded that milk can be produced in the rural areas 40–50% cheaper, but the investment in a peri-urban farm was much more profitable. Therefore, under the

Table 17.3 Comparing the cost structure of typical rural and peri-urban farms in India and Pakistan

Country	**India**		**Pakistan**	
Farm	**Rural**	**Peri-urban**	**Rural**	**Peri-urban**
Milking cows	17	11	2	2
Milking buffaloes	5	26	8	8
Total assets (US$/cow)	2800	550	1950	600
Milk price (c/kg)	**19**	**27**	**16**	**26**
Cost of production (c/kg)	11	19	7	21
Opportunity cost (c/kg milk)	2	2	3	1
Total cost (c/kg milk)	**13**	**21**	**10**	**22**
Total profit (c/kg milk)	**6**	**6**	**6**	**4**
Entrepreneur's profit (c/kg milk)	5	6	5	4
Return on investment (%)	11	37	8	19

Abbreviations: COP, cost of production (calculate as [cost from profit and loss account] – non milk returns)

current conditions, peri-urban farms will continue to operate by sourcing their fodder supplies from rural areas. This could change if the competitive dairy chain generates higher farm gate milk prices in rural areas or environmental restrictions increase production costs in peri-urban areas.

These findings confirm an earlier study undertaken in South Vietnam by Cai *et al.* (2000). Detailed financial data from this study were presented in *Tropical dairy farming* (Moran 2005). Using milk income above feed cost (MIFC) as a measure of profits, rural farmers were 46% more profitable than were peri-urban farmers, whereas profit margins (taking into account all farm costs) were 96% higher for the rural farmers.