

## **Strategies to Increase the Domestic Production of Raw Milk in Indonesia and other South East Asian Countries**

**John Moran<sup>1</sup> and Phillip Morey<sup>2</sup>**

<sup>1</sup>Profitable Dairy Systems, Kyabram, Victoria, Australia, <sup>2</sup>Morelink Asia Pacific, Jakarta, Indonesia. Corresponding email: [jbm95@hotmail.com](mailto:jbm95@hotmail.com)

**ABSTRACT :** The increases in domestic milk production throughout Asia have failed to keep up with the increasing demand for liquid milk and processed dairy foods. Consequently self-sufficiencies have and are still falling to such an extent that Asia now accounts for over 40% of the world's total dairy imports. Taking Indonesia as a case study, poor on-farm management, selling off dairy cows for beef and high animal feed prices are major contributors to their 30% self-sufficiency in raw milk. Small herd sizes (from one to five milking cows) are also a major constraint to increasing per cow performance. Increases in national milk production can result from more dairy farms, more cows per farm and/or higher milk yields per cow. Because of very high herd wastage rates, importation of dairy heifers from overseas is the main way to increase the national herd size. Such animals require high quality feeding and herd management, particularly during their early post-arrival phase and this is rare to find with most of the unskilled small holder farmers. There is increasing interest in "mega dairy farms" holding 500 to 1,000 or more milking cows in virtually all of the South East Asian countries. This review concludes with listing 14 pros and 19 cons, as well as other considerations, when assessing the potential viability of large scale intensive dairy farms in the humid tropics.

**Keywords:** Milk production, dairy demand, feeding and herd management, large scale, intensive dairy farms.

### **AN OVERVIEW OF THE DAIRY INDUSTRIES OF SOUTH EAST ASIA**

Globally, agriculture provides a livelihood for more people than any other industry (primary or secondary) while dairy farming is one of the major agricultural activities. Hemme and Otto (2010) estimated that 12 to 14% of the world's population (in fact 750 to 900 million people) live on dairy farms or are within dairy farming households. Milk is nature's most complete food and dairy farming represents one of the fastest returns for livestock keepers in the developing world. Furthermore, the majority of these farmers are small holders, with average herd sizes often as small as one to five milking cows. In fact, small holder dairy (SHD) farmers produce over 80% of the world's annual 240 billion litres of milk.

The Asia-Pacific region has seen the world's highest growth in demand for milk and dairy products over the last 30 years. Even though Asia has increased its milk outputs (as a percentage of global production) from 15% in 1981 to 37% in 2011, it still accounts for over 40% of the world's total dairy imports. The consumption of milk and dairy products in Asia has doubled over the last 30 years, now contributing to more than 60% of the total increases in global consumption. In the future, per capita milk consumption in SE Asia is expected to nearly double from the current 10 to 12 kg/hd/yr to 19 to 20 kg/hd/yr by the year 2020 (Delgado *et al.*, 2003). This 3% per annum growth will lead to a total milk consumption of 12 million tonnes/yr by 2020, which Delgado *et*

al (2003) predict will require 9 million tonnes of milk/yr net imports just to satisfy this demand.

This is up from the 4.7 million tonnes of milk/yr imported in 2000. In summary by 2020, SE Asia will then only be producing 25% of its total milk requirements.

Such growing demands have arisen by a combination of:

- increasing per capita incomes
- the emergence of affluent middle class people in many low to middle income countries
- westernisation trends which increase the demand for protein foods and value added dairy products
- increasing urbanization
- expansion of modern retail outlets (with refrigeration cabinets) throughout Asia

In other words, higher incomes and increasing urbanisation have combined with economic reforms and market liberalisation policies to heighten the import dependency of many countries in this region. Asia has then become increasingly dependent on the highly competitive, but ever increasingly volatile, global dairy commodity markets.

Table 1 presents FAOSTAT (2010) data from 19 countries in South and East Asia on the numbers of dairy cows and milking buffalo and their total annual milk production, together with their changes in self-sufficiency over the last 10 years or so. To give an idea of the role of dairy products in their diet, the per capita consumption of all dairy products is also included in this table. These range from extremes of Pakistan (over 170 kg/capita/yr) to Laos (with only 2 kg/capita/yr).

With regards to changes in self-sufficiency of milk and dairy products, several countries have maintained close to 100% self-sufficiency, while others have been unable to maintain previous levels of self-sufficiency because demand has greatly exceeded supply. Others have minimum levels that have hardly changed over the last 10 years.

Most Asian countries still and will rely heavily on imported dairy products even though many have active government policies to increase domestic milk production. There are a group of Asian countries with low per capita milk consumption and low self-sufficiencies and these are likely to be the ones with most pro-active dairy development programs. These include Philippines, Indonesia, Thailand, Malaysia, Vietnam, Cambodia and Laos.

**Table 1.** The size and self- sufficiency of selected Asian dairy industries in 2010

	Total dairy consumption (kg/capita/yr) [2009 data]	Dairy cow population (000 head)	Buffalo population (000 head)	Total milk production (Kt or million kg)	Self-sufficiency in milk (%)		
					2000	2005	2009
<b>South Asia</b>							
Afghanistan	-	3,500	-	1,401	100	100	100
Bangladesh	20.2	4,059	90	866	74.7	66.7	70.5
India	72.2	44,900	37,131	117,253	100	100	100
Nepal	43.0	974	1,291	1,495	99.1	98.6	98.0
Pakistan	171.9	10,493	11,864	34,716	99.5	99.8	99.8
Sri Lanka	35.9	251	90	209	32.9	24.7	33.8
<b>East Asia</b>							
China	30.0	12,298	5,706	39,136	87.0	91.8	95.1
N Korea	4.5	36	-	95	100	91.2	84.4

Japan	76.5	1,000	-	7,720	79.8	80.4	81.2
Mongolia	150.5	623	-	243	99.2	96.4	96.7
S Korea	22.9	186	-	2,073	90.7	86.1	82.2
<b>SE Asia</b>							
Cambodia	4.3	137	-	27	48.5	52.1	33.4
Indonesia	11.5	597	-	840	37.6	31.9	30.0
Laos	2.2	35	-	7	26.5	22.5	35.2
Malaysia	36.7	147	10	74	3.3	3.5	6.1
Myanmar	29.0	2,600	540	1,387	83.0	85.6	92.2
Philippines	13.3	6	-	10	0.7	0.8	1.1
Thailand	21.9	285	-	851	28.8	45.5	50.3
Vietnam	11.5	133	32	341	19.5	19.6	30.6

### **INDONESIA: AN EXAMPLE OF A DEVELOPING DAIRY INDUSTRY**

Indonesia's dairy industry and dairy products industry is undergoing a boom with market demand rising by over 10% on an annual basis for the past ten years due to changing consumer habits and population growth. While not a traditional part of the Asian diet, dairy products such as milk in fresh and powdered form as well as cheese and yoghurt are gaining popularity to become a regular feature on the shopping list for middle income families. Indonesia has the highest rate of growth in milk consumption in the ASEAN at 4.8% per year over the period 2006-2010 (Morey 2011). This is presenting exciting opportunities for the private sector in both the upstream and downstream segments to make up the shortfall in milk supply as well to introduce new products that appeal to the growing health consciousness of the market.

One of the key challenges currently facing the industry is the lack of supply from local dairy producers and the quality of the milk being produced (GBG 2013). Indonesia has approximately 500,000 dairy cattle which are mainly found in small numbers and tended to by individual farmers who are members of their local dairy cooperative. The country's demand for milk in 2011 stood at 3.5 million tonne/year with local producers supplying approximately 950,000 tonne. This figure is set to increase to 6 million tonne by 2020 in line with the current growth in demand.

Reliance on imports, mainly from EU, New Zealand and USA, are a concern given the country's vast availability of land and labour for cattle farming. Only 30% of the raw materials for milk supply are produced locally with 70% coming from foreign imports to a total value of US\$1.3 billion in 2011, up from US\$750 million in 2010. The pricing and quality of the milk being produced by dairy farmers is holding back the further development of the domestic upstream dairy industry. Government subsidies for staple agricultural goods including milk in various OECD countries makes such products cheaper to import compared to locally produced fresh milk in Indonesia. Local, small scale producers implement suboptimal production methods such as for the feeding and nutrition of the cows as well as using domestic cattle breeds which produce inferior yields. Such producers are also failing to meet international industry standards in hygiene as they lack their own processing facilities and coordinated supply chain therefore only 12% of locally produced milk meets minimum industry standards and holds a significantly lower market value. Milk produced in Indonesia is therefore being used as a supplementary supply source in the production process as opposed to the main component of the supply chain. However, the last five to ten years has also seen local and international dairy producers make significant investments in their livestock capacity and production facilities in preparation for the sector's further expansion.

The Indonesian dairy industry tends to go against the consumer trends of other markets both in the region and globally. For example, over 90% of the dairy market is dominated by processed milk as opposed to fresh (pasteurised or ultra high temperature or UHT) milk and that in powdered or sterilised form. Consumption in liquid milk is forecasted to increase by 16% per annum, while sweet condensed milk is another highly popular dairy product with annual growth of 4.8%. Changes in retail habits and the shift towards modern retail such as grocery stores and supermarkets is opening up further opportunities for liquid milk and other fresh dairy products as previously such goods could not be stored correctly in traditional retail facilities. Improvements in transport infrastructure and the establishment of cold chain supply management are enabling dairy producers to reach beyond the traditional economic centres of Java to the country's main and outer lying islands. Fresh cheese, yoghurt and pro biotic yoghurt drinks are the key product segments that can benefit from this trend as they gain popularity among Indonesian consumers. However, both local and multinational downstream producers face the challenge of adjusting such dairy products to the local consumer tastes. For example, the preference for sweet tasting dairy beverages and the addition of more traditional ingredients to cream or cheese based products such as chili is seeing the production of dairy products which are particular to the Indonesian market. This presents the opportunity for local dairy players to gain an inside track in crafting innovative products and brands, yet the technology, knowhow and downstream production facilities remain a hurdle to realising such potential.

### **Planning for the future**

For the medium term, the Indonesian dairy industry must concentrate on building its capacity to ensure that the local upstream and downstream players are able to take advantage of the boom in dairy consumption. Large scale investment is required to import cattle from Australia and New Zealand in order to double the current number to reach over 1 million cows. Improved coordination among Indonesia's 220 dairy cooperatives and 100,000 independent farmers to introduce modern production methods are also crucial to Indonesia's dairy capacity. The successful implementation of such measures coupled with Indonesia's wide availability of suitable land and labour for cattle farming could well see the country return to being a dairy exporter for both fresh milk and value added processed goods.

Dairy industry players are rightly focusing their investment and marketing efforts on the domestic consumer market given the scope for growth at over 4.8% annually to 2014 (Morey 2011). Local farmers and dairy producers must play a larger role in this trend given Indonesia's potential in this area to limit its reliance on imports and thus insulate the industry against currency fluctuations and supply side shocks.

Indonesia therefore needs to increase the number of dairy cattle, introduce more productive cattle breeds and ensure that the cooperatives play a role in the socialisation of new methods of production to local farmers. Such areas are key opportunities for international dairy players and investors who are prepared to work with cooperatives for supply chain management and invest in processing facilities to elevate the standards of locally produced milk. Such investment is also required in the downstream industry to develop the capacity of local producers in creating unique products and successful brands that effectively combine quality with local tastes that in turn could appeal to export markets with similar diets beyond Indonesia's borders.

The consumption of milk and dairy products continues to increase rapidly in Indonesia, creating an attractive market for local producers and foreign exporters (GBG, 2015). While inadequate road and rail links and a lack of cold storage facilities still pose logistical challenges

for overland transportation of perishable goods, the expansion of modern retail across the island nation is giving ever more consumers access to fresh dairy products. Indonesians' growing appetite for milk and its derivatives bodes well for dairy consumption going forward. The country's large market potential and westernising diets in the fast-growing Southeast Asian region could make Indonesia an attractive hub for dairy manufacturing, provided that sufficient raw materials can be sourced from local dairy farms. The widening gap between national farm output and dairy consumption reflects poor agricultural productivity, but also points to upstream business prospects.

The small scale and often poor equipment of local dairy farms are partly to blame for a low degree of efficiency and inferior milk quality by international comparison. Also, farmers tend to apply suboptimal production methods for the feeding and nutrition of the cows and use domestic cattle breeds that produce inferior yields. Upgrading farm equipment and importing high-yielding dairy cows are ways to address the situation, and the government supports such measures through tax and import policies aimed at boosting domestic production in the name of food security.

Farmers have become the weak link in the domestic dairy production chain. Indonesia's dairy farmers deliver around 1,800 tonnes of milk a day, which satisfies only about one third of national demand. The number of dairy cows (including calves) fell from around 420,000 in 2011 to 350,000 in 2013, and has fallen further since. Seeking to take advantage of high beef prices, many farmers sold off dairy cows to slaughterhouses in between 2011 and 2013, thereby exacerbating the shortfall in milk production. Rising animal feed prices have not helped either, and farmers often complain that the price they receive for milk barely – if at all – covers the costs of production.

As domestic output fails to meet the needs of the processing industry in terms of both quantity and quality, the bulk of milk used by local industries is shipped in from abroad. Imports are generally in the form of powder and mostly sourced from EU, New Zealand and the USA. Imports of milk amounted to a value of US\$1.318 billion in 2013. The devaluation of the Indonesian rupiah in recent years makes it expensive for local industries to purchase milk from other countries. In addition, there is the bureaucratic burden of exporting food products to Indonesia, which includes sanitary and health certificates as well as tests from various government agencies and a halal certificate.

Not only are Indonesians increasingly turning to milk as a beverage, but also all of its downstream products. Cheese is becoming more popular, especially among middle and higher-income consumers in urban areas, who are more receptive to western food, such as bread and pizza. Yoghurt and sour milk drinks are likewise gaining in popularity, particularly for their propensity to aid digestion and weight loss. Demand for coffee whitener or creamer is increasing along with rising consumption of instant coffee (as opposed to the traditional Indonesian way of drinking black coffee) and cream is benefiting from the growing popularity of cakes and puddings.

### **Investment opportunities**

Upstream investment is urgently needed to fill the milk supply gap and thereby support Indonesia's dairy industries. Most livestock investment over the past years has gone towards meat production while milk production has made no headway despite rising consumption. Indonesia's total dairy cow herd is far too small and productivity per animal averages at a relatively low 10-12 litres. The government is targeting to meet at least 50% of national milk demand domestically by 2020. This is a tall order given that per capita consumption is estimated to rise to 20 litres by then and to 30 litres by 2025.

Investment opportunities lie in scaling up production, introducing modern technology and improving farming methods. Greater capacity in cold storage and transportation is also needed to

transport dairy products across the archipelago. Teaming up with local dairy cooperatives, which have established sourcing and distribution networks, will generally be the easiest way for foreign companies to enter the market and get access to farmers. As they need to boost their efficiency to compete with imported milk, local farmers should be interested in cooperation that can help them become more competitive.

Meanwhile, the rapid increase in demand means Indonesia will remain heavily dependent on milk imports in the foreseeable future, which creates an attractive market for foreign-based companies.

### **STRATEGIES TO INCREASE DOMESTIC MILK PRODUCTION**

National levels of raw milk production can be increased in various ways. These include:

1. Placing the highest priority on increasing the number of dairy farmers in the country, without greatly changing their average milk outputs per cow or per farm.
2. Placing more emphasis on increasing per cow milk yields in association with increasing the population of dairy farmers
3. Increasing the number of cows (that is the average size of each milking herd) on any one farm, without greatly changing the number of dairy farms or yields of their milking cows
4. Combinations of increasing the number of farms, the size of the milking herds and per cow production
5. Changing the type of dairy farm, from the small holder, but maybe part time, dairy farm (say with one to five cows) to a larger farm which is still privately owned (say with 20 to 100 cows) to a “mega farm” that is owned by investors or other well-resourced individuals or commercial enterprises (say with 500 to 1,000 cows).

The first option requires sourcing new areas for dairy farm development, a task which is often difficult because of competition for existing land use and the current high density of dairy farms in dairying regions. One such example would be sourcing new land for dairy farming on the island of Java in Indonesia, where 97% of the dairy industry is already based. Developing new regions for dairy farming, for example outside Java, is a slow process as it requires;

- finding suitable highland areas and providing alternative locations for current land holders
- building milk processing facilities near these new dairying regions
- sourcing adequate farm services such as water, electricity or gas
- sourcing suitable dairy animals to populate these new farms
- sourcing areas of fertile land to grow the required forages
- sourcing ample supplies of suitable by-products to provide the ingredients of concentrates for the dairy herd
- establishing a population of skilled workers who understand and can carry out the relatively sophisticated farm practices of successful small holder dairy farming

This last point is very important because increasing per cow daily milk yields from the current levels of say 8 to 10 kg/cow/day, to a potential 14 to 16 kg/cow/day (with existing genetic quality of most SHD milking herds) requires a set of skills rarely found in most small holder dairy farming populations.

The mention of cow milk yields in Asia of 30 or more kg/cow/day in high genetic merit herds is simply unrealistic because of the many production constraints in the humid tropical climate (Moran 2013), even in the highland areas. Dairy cows only produce milk to their genetic potential when these constraints are essentially overcome. In Asia we have taken a temperate species of

animal, the dairy cow, and expected it to be easily translocated to the foreign environments of high temperature and humidity, often infertile leached soils and relatively constant day lengths.

Furthermore, low per cow milk yields are energetically highly inefficient because of low nutrient outputs produced each day in raw milk relative to the high nutrient requirements for maintenance in milking cows hence the inability to dilute these high maintenance energy requirements with copious yields of high energy raw milk. Therefore mainly depending on increasing per cow milk yields to satisfy the high national demands for raw milk is a very slow and unreliable process.

The most obvious way to more rapidly increasing domestic milk supplies is through sourcing more dairy stock, assuming the land, feed supplies and skilled labour force are also available or can be developed. Natural increases of dairy cow populations cannot be relied upon to increase national cow numbers because of the high mortality rates of young stock and the poor reproductive performance of mature cows on most SHD farms in the tropics (Moran 2005). Granted some countries may develop national breeding centres to address these issues, such as at Baturadden in Central Java in Indonesia. However the only reliable way to increase dairy cow populations in Asian countries is through importation of breeding heifers, either unjoined or in early pregnancy. This is certainly occurring in many Asian countries. These stock are available from developed dairy industries such as those in Australia and New Zealand. Some Asian countries, for example Thailand, also have stock available to import into other Asian countries.

These animals are usually exotic heifers, either unbred or up to 5 months pregnant, in that they originate from temperate dairy industries where they have been reared on pasture in a largely climatically comfortable environment. Upon arrival, they then have to adapt to all the constraints of tropical SHD farming, such as high temperatures and humidities, limited quantities of poor to moderate quality feed and the vastly different rearing environment of a low investment system with limited to no grazing and a small cow shed. Changes in animal behaviour clearly indicate that this adaptation period can be quite traumatic and lengthy, up to six months according to experienced small holder farmers. This is exacerbated by the often different standards of acceptable practices of stock welfare on their new home farm.

To find the most suitable stock, tropically adapted stock or at least stock with some degree of *Bos indicus* (Zebu) breeding are required or the temperate adapted heifers must be destined for highland regions with fewer constraints to profitable milk production. Even when imported into tropical highlands, they will be more susceptible to environmental and farm management constraints than the indigenous dairy stock. In addition, because the imported heifers will be invariably be of higher genetic merit than the local dairy stock, they require a higher quality of post-arrival feeding and herd management than would the local dairy heifers. Therefore the higher level of skills necessary for satisfactorily managing these imported heifers, means that the farmers to which these animals are destined, need to be selected and/or trained in such herd management skills.

### **The range in size of the milking herd on dairy farms**

As already mentioned, most dairy farms in Asian countries only have relatively few milking cows. In addition to actual milking cows, the farms would also contain a few replacement dairy stock such as milk-fed calves or weaned heifers. Such farms often have other farming pursuits hence dairy farming would not be a full time activity for these farmers. The definition of a small holder dairy farmer may include farms with milking herd sizes up to ten or even twenty cows. In countries such as Indonesia, these farms may not have additional land on which to grow forages so

the farmers would need to source the herd's forage requirements from grasses and other herbage from the roadsides, rice paddies or other areas (such as state forests or under cultivated cash crops) which is generally freely available during the rainy season. Another source of forage for the "landless" farmers would be from forage crops grown under the supervision of dairy cooperatives: in these cases they would not be free.

National governments, international aid agencies or benevolent governments or agencies from developed countries have and are still devoting a lot of resources to improving the productivity, profitability hence sustainability of the SHD industries throughout Asia. The success rate of such programs is very variable when assessing the achievements of their long term objectives.

Other dairy farms range in herd size from 20 to 50 to 100 milking cows, which can still be privately owned. However, there is increasing interest in developing much larger dairy farms, containing 200 to 500 to over 1000 milking cows. Such farms could be considered as corporate farms, with ownership of land, facilities and stock by investors or other well-resourced individuals or commercial enterprises. Such "mega dairies" are constructed for, and generally achieve, increased production of high quality milk. However they are often criticized because their emphasis is more on the yields and economics of domestic milk supplies rather than the social and economic development of the country or region in which they are based. However, employing many of farm workers on large farms will be of direct benefit to the local economy. In the long run, it is up to the particular Asian country to decide which is the higher priority, producing more, cheaper quality milk or facilitating the social development of the region.

### **THE PROS AND CONS OF LARGE SCALE DAIRY FARMS**

Large scale corporate type dairy farming is not new in the developed world and is becoming more refined with increasing technical and commercial knowledge and experiences. Many of these current management practices can easily be transferred to the tropical, developing dairy industries, provided the management is made more fully aware of the constraints to high levels of per cow milk production and fertility in such hot, humid environments. They are certainly harder to manage in the tropics than in the temperate, developed dairying countries. Nevertheless, there is growing interest in establishing such "mega dairy" farms in virtually every SE Asian country. Therefore the design, construction and day to day management of such ventures justify closer investigation.

There are many "pros and cons" associated with increasing milking herd sizes from 20 to 500 to 1000+ cows. A total of 14 pros and 19 cons have been listed below:

#### **Pros**

- Allows for mechanisation hence reduced human error in everything from growing and sourcing forages to feeding and herd management to milk harvesting
- Provides enough cash flow for appointment of experienced farm manager and other professional onsite staff
- Provides enough cash flow to justify routinely testing all feeds for their nutritive values
- Provides large volumes of shed effluent that can either be sold as fertiliser or used to supply many of the essential nutrients for soils to grow quality forages on farm
- Potentially provides large numbers of bulls or steers for local dairy beef farming either by the dairy farm or by small holder beef farmers
- Supplies large volumes of high quality milk (or processed dairy product) which provide better bargaining and/or marketing opportunities



- Allows for more consistency with forage crop agronomy hence more consistent forage quality
- Allows for bulk purchasing (hence cheaper) suitable by-products to provide the ingredients of concentrates for the dairy herd
- Requires investment in large numbers of livestock, which would have higher genetic merit and be more consistent than when sourcing local stock
- Mechanisation of milk harvesting reduces variation in milk quality
- Provides for opportunity for on-site milk processing to value add the raw milk
- Provides raw products of better consistent quality more suitable for milk processing
- Provides employment opportunities for locals as farm workers
- Provides opportunity to outsource some activities (such as contract growing of forages) and developing closer commercial and social relationships with the local population

#### **Cons**

- Requires access to large cash reserves to construct facilities and purchase farm equipment (such as for milk harvesting and preparing Total Mixed Rations or TMR)
- Requires access to large cash reserves to purchase livestock, generally in large numbers
- Requires specialist skills in land preparation, planting, maybe irrigating, harvesting and processing large quantities of forages
- Requires skills in design and construction of large sheds and other farm facilities
- Requires skills in ration formulation and other aspects of feeding management
- Requires skills in reproduction and other aspects of herd management
- Requires skills in addressing mastitis and lameness and other specific animal health issues
- Requires skills in animal health issues arising from heavy concentration of stock in one place
- Must improve local infrastructures (roads) to handle extra heavy traffic
- With poor effluent management, it could increase local pollution loads
- Need access to large quantities of suitable by-products to provide the ingredients of concentrates for the dairy herd
- Ideally requires access to year-round supplies of quality forages
- May require additional skills and infrastructure for forage conservation, specifically silage making
- Requires skills in information and communications technology (ICT) for capturing data from many sources (stock, feed reserves, HR management) on the farm
- Requires ensuring all staff develop animal welfare friendly herd management practices
- With such large numbers of stock, any small mistake in farm management can have large scale and expensive ramifications
- Bio security is of high priority for all equipment, livestock and staff
- Personality interactions between management, farm and administrative staff require close monitoring and if required, early intervention
- Integrity of management staff is paramount to set as best examples to farm and administrative staff

#### **Other aspects of large farm management**

It is more desirable to gradually increase herd (hence farm) size over a period of years to allow for the staff to become more familiar with the principles and practices of large herd management. This will also provide better opportunities to observe and address any unforeseen key issues in such a large scale intensive dairy enterprise.

Achieving the Key Performance Indicators (KPI) for cow performance (such as age at first calving, milk yields at different stages of lactation, herd fertility, mastitis & lameness problems) and others listed by Moran (2009) are essential to ensure the KPIs for farm and business performance (such as cost of production, gross profit, return on assets) can be achieved within predetermined time frames.

As in all countries, there are likely to be government (national, provincial or local) regulations and incentives related to developing a large scale dairy enterprise. It is essential to seek such information at an early stage of farm development.

It must be emphasized that large scale dairy farming requires large amounts of readily available liquidity (or cash). Cash flows are likely to remain negative for several years. If sourcing dairy heifers to populate the farm, they will also take several years to reach maturity hence attain adult levels of cow performance. For example, when developing a budget and projected cash flow on a farm with optimum feeding and herd management, it is best to gradually increase the predicted milk yields, even of high grade Friesians, over the first few years of farm operation from say 4000 to 5000 to 6000 to 7000 kg/cow/year consecutively for their first four lactations. Furthermore, it is always better to err on the pessimistic side of projected cash flows until you are certain that all the anticipated (including some of the unforeseen) constraints to cow and farm performance have been identified and addressed. Intensive large scale dairy farming is a long term program so profits will arise in the near not the immediate future.

## CONCLUSIONS

Dairy farming in the humid tropics is fraught with problems. However once they are addressed, good profits can be made. For example in 2014, Seruni *et al* (2015) compared the financial performance of a large scale (with 1467 head) and a small, well managed farm (with 52 head) in the Chiang Mai highland region of northern Thailand, finding on both farms, positive profit levels. Although the capital costs were 65% higher per cow on the large farm, profits expressed as the income less costs as a percentage of costs, was 63% on the large farm versus 55% on the small farm. On the large scale farm, daily income was US\$7.49/cow, daily costs (both variable and fixed) were US\$4.59/cow thus providing a daily profit of US\$2.70/cow.

## REFERENCES

- Delgado, C., Rosegrant M. and Wada, N. (2003). Meating and milking global demand: Stakes for small-scale farmers in developing countries. p. 13-23. The livestock revolution. A pathway to poverty? ATSE Crawford Fund conference, Canberra, Australia.
- FAOSTATS (2010). FAO statistics on line. <http://faostat3.fao.org/home/index.html#DOWNLOAD>
- Global Business Guide. Indonesia (2013). Overview of Indonesia's dairy industry. [http://www.gbgingonesia.com/en/agriculture/article/2012/overview\\_of\\_indonesia\\_s\\_dairy\\_industry.php](http://www.gbgingonesia.com/en/agriculture/article/2012/overview_of_indonesia_s_dairy_industry.php)
- Global Business Guide. Indonesia (2015). Indonesia's dairy industry needs to scale up to meet local demand. [http://www.gbgingonesia.com/en/agriculture/article/2015/indonesia\\_s\\_dairy\\_industry\\_needs\\_to\\_scale\\_up\\_to\\_meet\\_local\\_demand\\_11207.php](http://www.gbgingonesia.com/en/agriculture/article/2015/indonesia_s_dairy_industry_needs_to_scale_up_to_meet_local_demand_11207.php)
- Hemme, T. and Otto, J. (2010). Status and prospects for smallholder milk production: A global perspective. FAO, Rome.

- Moran, J. (2005). Tropical dairy farming. Feeding management for small holder dairy farmers in the humid tropics. CSIRO Publications, Melbourne.
- Moran, J. (2009). Key performance indicator's to diagnose poor farm performance and profitability of smallholder dairy farmers in Asia. *Asian-Aust. J. Anim. Sci.* **22**, 1709-1717.
- Moran, J. (2013). Addressing the key constraints to increasing milk production from small holder dairy farms in tropical Asia. *Int. J. Agric. Biosci.* 2 (3):90-98.
- Morey, P. (2011). Dairy industry development in Indonesia. Market report for International Finance Corporation.
- Seruni, A.P, Utami, H.D. and Nugroho, B.A. (2015). The insight into financial performance of commercial and small scale dairy farming at Thailand. [http://fapet.ub.ac.id/wp-content/uploads/2015/01/THE-INSIGHT-INTO-FINANCIAL-PERFORMANCE-OF-COMMERCIAL-AND-SMALL-SCALE-DAIRY-FARMING-AT-THAILAND\\_Ainun-Pizar-Seruni-115050107111024.pdf](http://fapet.ub.ac.id/wp-content/uploads/2015/01/THE-INSIGHT-INTO-FINANCIAL-PERFORMANCE-OF-COMMERCIAL-AND-SMALL-SCALE-DAIRY-FARMING-AT-THAILAND_Ainun-Pizar-Seruni-115050107111024.pdf)