

# Milk prices and production costs world wide

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## Introduction

In 2014, milk production of 778 million ton ECM (energy corrected milk with 4% fat and 3.3% proteins) was produced by around 121.5 million dairy farms (IFCN estimate) keeping 363 million milking cows and buffaloes. This means that the world's average farmer keeps 2.9 milk animals with an average annual milk yield of approximately 2.145 ton ECM/animal/year. Of course, building averages is an oversimplification. There is a wide range of dairy farms in the world keeping mostly less than 3 cows per farm on the one hand and on the other hand in some countries, dairy farms are much bigger and keep over 1000 cows per farm. The simple example shows that milk production is performed distinctively in different countries and their dairy regions. The dairy farming systems differ significantly in terms of farm size, housing, milking and feeding systems.

This article follows the approach of the IFCN Dairy Research Network (IFCN). It is a global network of dairy researchers from 100 countries. The network focuses on dairy economic analysis to create a better understanding of the dairy world. The main focus is in analysing global milk production trends, milk prices and production costs. The IFCN work is coordinated by the IFCN Dairy Research Centre located in Kiel, Germany ([www.ifcndairy.org](http://www.ifcndairy.org)).

## Milk and feed prices development 1996 – 2015

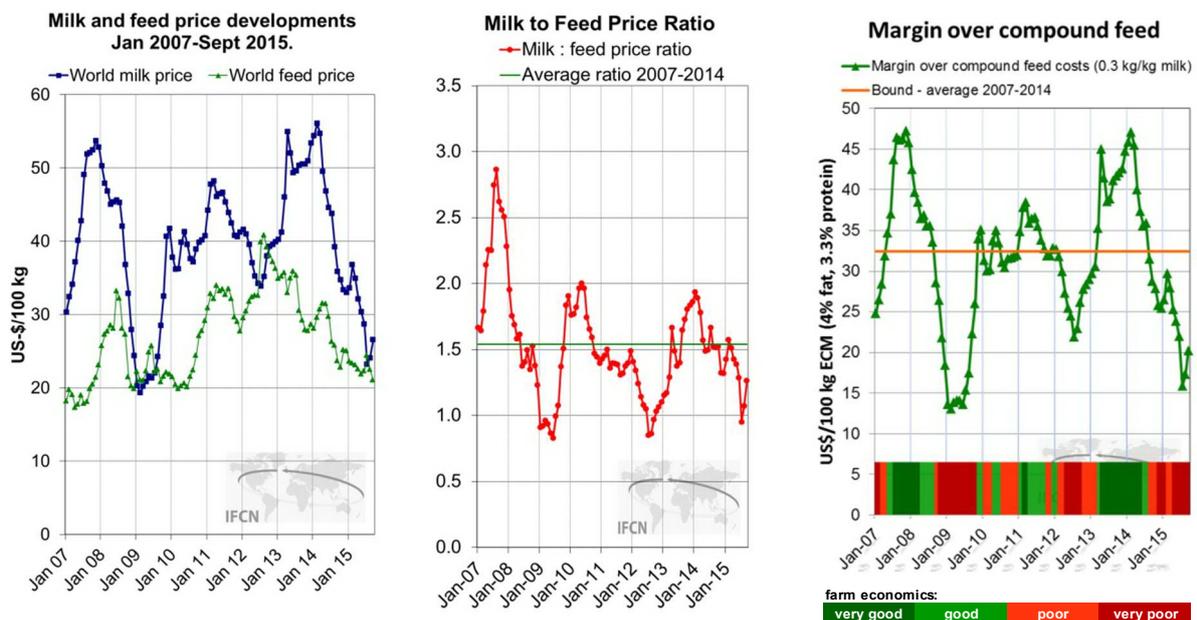
The graphs in chart 1 below describe the development of the world market prices for milk and feed. The world milk prices are based on the weighted average of three IFCN world price indicators: skim milk powder & butter (35%); cheese & whey (45%) and whole milk powder (20%). The IFCN world feed price indicator represents the world market price level for feed. The calculated feed price indicator is based on the price for a diet comprising 70% corn (energy feed) and 30% soybean meal (protein feed). The milk: feed price ratio indicates how much feed a dairy farmer receiving global milk prices and paying global feed prices can buy, after selling one kg of milk. The ratio is defined as favourable, when it is  $\geq 1.5$  and in general one can conclude that the higher the ratio, the more favourable intensive feeding is considered.

Besides, this commonly used milk: feed price ratio, IFCN has developed a new farm economic indicator. This is the margin over compound feed costs. This indicator assumes an average feed intensity of 300 g compound feed per 1 kg milk. This feed intensity could represent a farm with a milk yield of 8000 kg milk / cow / year using 2.4 ton of compound feed per year. The key improvement is that the milk : feed price ratio weighs milk and feed price changes one to one, whereas the margin indicator weighs the feed price based on the amount of compound feed fed per kg milk and weather related uncertainties. This enables us to give a better assessment of existing farm economics situation in real time.

Since 2007, the milk price indicator showed a rollercoaster behaviour, swinging between less than 20 US-\$ per 100 kg ECM (energy corrected milk with 4% fat, 3.3% protein) to peaks of 56 US-\$. Low milk prices of less than 25 US-\$/100 kg ECM throughout 2006 were followed by a steep increase to more than 50 US-\$ at the end of 2007, just to be followed by a sharp decrease to 20 US-\$ in early 2009. Between January 2010 and January 2013, fluctuations were less extreme. During this period, the milk price varied around 40 US-\$, with a range between 48 US-\$ in March 2011 and 34 US-\$ in July 2012. This low point was followed by a strong increase to a level above 50 US-\$ for nearly a year, peaking at 56 US-\$ in February 2014. The ensuing decline was not finished in August 2015. By that time, the milk price had dropped by approximately 35 US-\$ to 21.4 US-\$ within 18 months.

The feed price indicator also showed fluctuations, though to a lesser extent than the milk price indicator. Besides, their behaviour was not synchronised, i.e. peaks in the milk price did not necessarily mean peaks in the feed price. Until 2010, the feed price hovered around 20 US-\$ with the exemption of June 2008, where it reached 32.2 US-\$. Between January 2011 and June 2014, the feed price was generally higher than 20 US-\$. In August 2011, the threshold of 40 US-\$ was surpassed for one month. Since June 2014, the feed price has declined by more than 10 US-\$ to 22 US-\$. The highest difference between milk and feed price was noticed in August 2007 at 33.8 US-\$. This led to a milk : feed price ratio of 2.9 The very low milk prices in the first half of 2009, summer 2012 and summer 2015 were accompanied by feed prices that were actually higher per 100 kg, causing a milk : feed price ratio below one during these three time periods.

**Chart 1. World milk prices for milk and feed 2006 – September 2015**



The very high milk : feed price ratio in August 2007 followed by low milk and high feed prices quickly led from a very profitable situation in the end of 2007 to a negative margin over compound feed cost by the end of 2008. It was the beginning of the first global dairy crisis which lasted until early 2010 with the lowest milk prices on the level of 20 US\$/100kg ECM. The next phase was a period of relative stability of the milk price on average of 40 US\$/100kg ECM. Later in 2011 milk price began to decrease while feed price continued to rise pushing dairy farmers to produce milk with a milk : feed ratio below the long-term average. In this period margin over compound feed cost was lowering since March 2011, dipping below the long term average of 32.4 US\$/100kg at the end of the year. That was the beginning of the second global dairy crisis which has its epicentre in middle 2012 when milk prices dropped and feed prices rose towards new highs until the middle of the year.

From the IFCN perspective, the margin over compound feed indicator better describes dairy farm economics, since it considers the feed intensity and weather condition anomalies. It also enables us to assess the intensity and depth of farm economics situations. The margin over compound feed cost demonstrates farm economics after having taken into account the milk and compound feed prices given. For farming systems which operate at a lower milk yield and lower use of compound feed per kg milk, the fluctuation of the margin over compound feed is generally only influenced by milk price developments. On the other hand, dairy farming systems with much higher milk yields and higher compound feed use are strongly driven by a combination of milk and compound feed price, especially when exposed to world market prices.

The year 2015 shows the milk prices dipping to the lowest levels since 2009 in July touching the 23.2 US-\$ mark – the climax point of third global dairy crisis. Observing the world milk price development and the drop of 59% vs February 2014, IFCN assumes that the world milk price is currently in the middle phase of the roller-coaster price scenario – similar to the one from the first world crises in 2009. August world milk price shows an increase of 4%. Despite the world milk price increase of 10% and the world feed price decrease of 6% in September vs August, the farm economics didn't improve significantly. September margin over compound feed cost is at the level of 20 US-\$/100kg. This is the 6th month in a row of very poor farm economics. Country-wise the farm economics situation is deteriorating. From 60 countries analysed 46 are in the group of poor and very poor farm economics.

## Cost of milk production 2014 by world region

The annual IFCN work of comparing typical farms around the world has been an on-going process since the year 2000. Since then, the number of countries participating has increased from 8 to 55. Moreover, the number of dairy farm types analysed has increased from 21 to around 170.

The IFCN methodology applied for data collection, economic analysis and results validation uses the three elements:

- a network approach of research continuously co-operating,
- the concept of typical farms described below and
- a standard model TIPI-CAL (Technology Impact Policy Impact Calculation model) to ensure technical comparability of indicators.

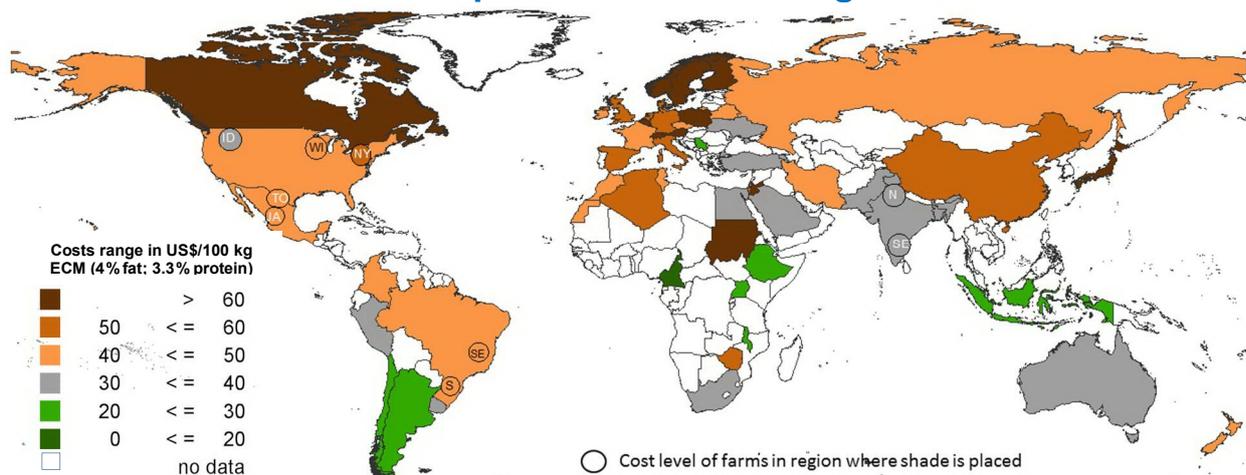
**A typical farm** represents the most common production system which produces a significant proportion of milk in a country or a region. Usually, two farm types are used per dairy region – the first represents an average farm and the second a larger farm type. The typical farms were built and validated by a combination of accounting statistics and a panel of dairy experts. The data collection and validation were done by researchers in the represented countries, researchers in the IFCN Dairy Research Network and also during the IFCN Dairy Conference held in Germany in June 2015.

**ECM correction:** As the dairy farms operate with milk of very different fat/protein content, the IFCN uses the energy correct milk (ECM) approach to standardise milk volumes to 4% fat and 3.3% protein. The following formula was used:  $ECM\ milk = (milk\ production * (0.383 * \% fat + 0.242 * \% protein + 0.7832)) / 3.1138$ .

**Cost indicator:** The IFCN uses the indicator cost of milk production only which can be directly related to a milk price. This cost includes all costs from the profit & loss account of the farm. From this cost level, the non-milk returns from sales of cull cows, heifers, calves, manure, etc. and also returns from coupled direct payments have been deducted. Furthermore, the opportunity costs for own labour, land and capital are also included. For creation of the world map, the average size farm from each country was used.

In chart 2 below, a simplified global overview on costs of milk production is shown. The illustration is based on the results of the typical average sized farm analysed per country in 2014. The results can be summarised as follows:

**Chart 2: 2014 Cost of milk production on average sized farms**



**Cost range:** Cost of milk production ranges from 4.5 US-\$ per 100 kg milk in extensive farming systems in Cameroon (where beef is the major output and milk is a side product) to 118 US-\$ for an average sized farm in Switzerland. The average cost over all countries analysed was 46 US-\$/100 kg milk.

**Low cost regions:** Based on the average sized farms, three low cost regions have been identified: a) Argentina, Peru, Chile and Uruguay b) Central and Eastern Africa c) Some farms in the CEEC. Some selected countries in Asia (except Japan and large farms from China) also have low costs.

**Western Europe:** The leading farms in Western Europe had costs ranging from 45 – 55 US-\$.

**The US:** The smaller farm types in the Eastern Region of USA i.e. Wisconsin and New York had a cost of 46 and 59 US-\$, respectively. In the western region, the large farm in Idaho had the lowest cost of about 35 US-\$.

**Oceania:** The cost level in Oceania was about 36.6 US-\$. Cost of milk production in Australia is in the range of 30-35 US-\$ while in New Zealand it is about 41-42 US-\$ per 100 kg ECM. The difference is mainly on account of higher feed prices, land costs and exchange rates to US-\$. It is important to note that New Zealand cost estimates refer to the seasonal year i.e. July 2013- June 2014.

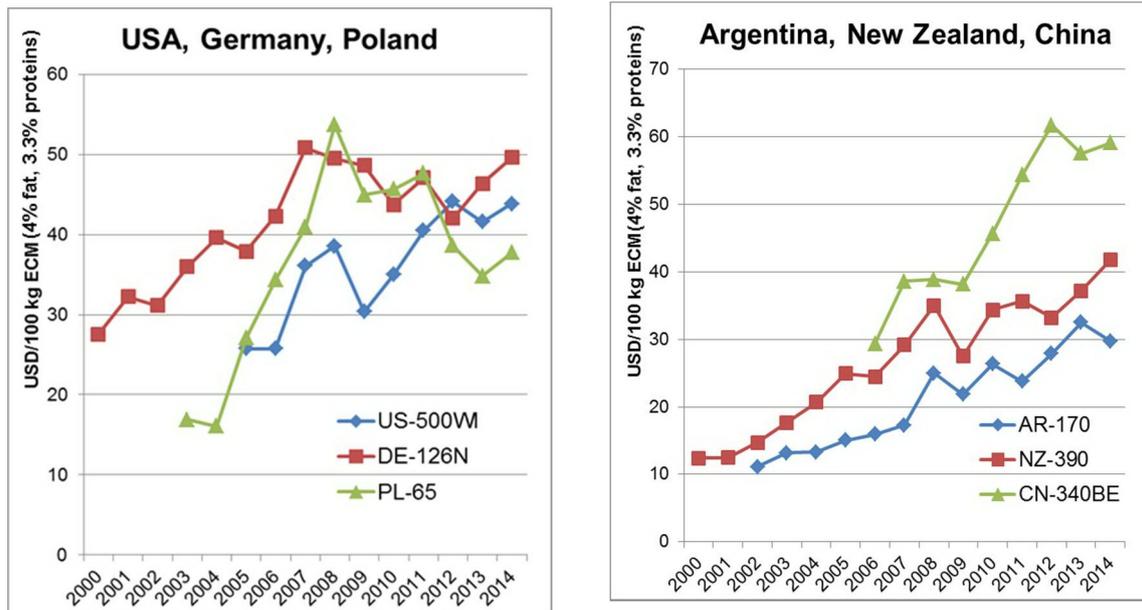
In the year 2014, the cost of milk production (in national currency terms) stayed constant in most dairy farms in the world compared to 2013. Major changes in feed costs could not be seen in most countries. The milk price experienced a rollercoaster ride in 2014, from reaching the highest level ever in February 2014 to a steep decrease in December 2014 which continued in 2015. On average for the whole year 2014 though, the farm gate milk price reached the same level as in the year before or even experienced an increase, e.g. in the USA. Therefore, farm profitability proved to be better in 2014 than in 2013, but the downwards trend at the end of 2014 gave already an indication that a difficult situation might follow in 2015.

**Hence, on an average, the milk prices for the year 2014 were at similar levels as in 2013. This along with good feed prices made farm economics a very profitable year for many dairy farmers in the world.**

## Cost of milk production developments 2000 – 2014

It is very important to understand the average cost trends of typical farms over a period of time to understand the factors behind the competitiveness of milk production. It also enables us to take a view on the levels of milk production costs to sustain milk supply levels or the milk prices level in the short and medium term. Hence, in this part of the analysis, we tend to compare the cost trends of average typical farm types from the six major milk producing nations representing the major regions of the world.

**Chart 3: Cost of milk production 2000 – 2014 of typical dairy farm types in 6 countries**



**Legend on farm types:** US-500WI: 500 Cow family farm in Wisconsin; DE-126N: 126 cow family farm in Germany-North; PL-65: 65 cow family farm in Poland; AR-170: 170 cow family farm in Argentina; NZ-390: 390 family farm in New Zealand; CN-340BE: 340 corporate farm I North China, Beijing.

## Cost developments for the typical farms 2000 – 2014

**Germany (DE-126N):** This farm type stands for an average farm in Northern Germany representing an estimated 13% of the farms and 46% of cows in the country. The farm has grown from 68 cows in 2000 to 126 cows in 2014 at an average annual growth rate of 4.5%. In the year 2000, the costs were 28 US-\$/100 kg milk and increased towards 42 US\$ per 100 kg milk in 2006. The key driver was the appreciation of the Euro (+36%) and moderate increase of costs in Euro terms. From 2008 – 2012, the costs showed a declining trend towards 42 US-\$ per 100 kg milk. The key drivers were a devaluation of the Euro by 14%. Costs have increased again to 50 US-\$ since then. This is mainly due to higher feed and energy prices and labour costs in Euro terms.

**Poland (PL-65):** This farm type represents a larger family farm type in Poland in the range of 20-100 cows. It represents about 10% of the farms and 41% of the cows in the country. This farm has been monitored since 2003 when it had 60 cows. This Polish farm had very low costs in 2003 and 2004 and was almost as cost competitive as dairy farms in New Zealand. After joining the EU, costs increased from 17 US-\$ to 53 US-\$ per 100 kg milk in 2008. This was driven by an increase of wages, land prices and an appreciated currency against the Euro. This increase could not be compensated by an increasing farm productivity. After 2008, the farm type followed a similar cost trend as the German dairy farm. The 20%

reduction in costs in 2012 was a result of the devaluation of the Zloty (-7%) and improvements in farm efficiency. Costs stayed under the 40 US-\$ mark for the last three years.

**USA (US-500WI):** This farm type is a larger family farm in the range of 200-1000 cows and represents 10% of the farms and about 18% of the cows in the USA. This farm has been in our data base since 2000. In the US, costs were relatively stable from 2000 to 2006 as inflation driven change of input prices could be compensated by increasing milk yields. Once feed prices started rising, this had a direct impact on these farms and costs, which increased by 50% to a level of 38.5 US-\$ per 100 kg milk. The sharp drop in costs in 2009 can be interpreted as a result of very bad milk prices, when farmers tried to cut costs wherever possible. Until the year 2012, cost had increased – mainly driven by feed prices - towards 44 US-\$ per 100 kg milk. US dairy farms had a significant cost advantage over larger family farms in Germany for over 10 years. In the year 2012, the costs were on a similar level. They have stayed between 40 and 45 US-\$ per 100 kg milk for the last four years.

**China (CN 340BE):** This typical farm represents 30 to 405 of the farms and is a larger farm type in China in the range of 200-500 cows. It has been monitored since 2006 with 300 cows. It enables us to understand the dynamics of cost trends in China. Since 2006, a strong increase in cost due to the appreciation of the Yuan could be seen. In 2012, the Yuan had gained value by + 25% to the US-\$ compared to 2000. The costs on Chinese farms did not drop sharply in 2009 as was observed in most other countries, because the drop in prices in national currency was almost fully compensated by the appreciation of the Yuan. From 2010 until 2014, the rising feed prices were a strong driver for increasing cost of production.

**Argentina (AR-170):** This farm represents an average sized farm in Argentina in the range of 100-500 cows which represents about 65% of the farms and 68% of the cows in the country. The costs of a 170-cow farm in Argentina have nearly tripled since 2002. Nevertheless, the positive trend has slowed in the last 7 years and costs have become more volatile. This farm is a grazing farm and economics are highly dependent on weather conditions and fodder availability. Parts of the costs decreases and increases in the recent years can be attributed to favourable and unfavourable weather conditions.

**New Zealand (NZ-390):** The typical farm representing an average sized farm covers about 60% of the farms and milk production in New Zealand. This dairy farming system was a world leader in cost competitive milk production in the year 2000. IFCN identified costs of 12 US-\$ per 100 kg milk, which was the lowest cost level in those days. Driven by an increase in input prices and an appreciating currency, costs increased to a level of 40 US-\$ per 100 kg milk in 2014. Like in Argentina, weather conditions and pasture growth had an impact on milk yield and thus production costs per 100 kg ECM. Based on the typical farms chosen for this analysis, the costs in New Zealand were approximately 25% higher than in Argentina and ca. 25% below the costs level in Germany in 2014.

### **Outlook milk production costs in 2015**

The devaluation of the Euro against the US-\$ has been about 20% in 2015. In Oceania the New Zealand dollar has also depreciated by about 11%. In Brazil, the currency devaluated by 28% while in Poland by 17%. This will probably make the costs competitive in this part of the world.

Milk prices began to decline from the all-time peaks in February 2014 to its lowest levels since 2008 in July 2015 at 23.2 US-\$. By July 2015, milk prices had dropped by 30-40 %. The ensuing crisis has led farmers to respond in a way to reduce their intensity of dairy farm operations in many countries in EU and Oceania. Though costs in USA have remained more or less stable, costs in EU are expected to decline by currency devaluation and farmers reactions. It is expected that the average costs of milk production will reduce in EU by a range of 8-9 US-\$ per 100 kg ECM primarily driven by euro devaluation against US-\$ while in Oceania by 5-6 US-\$ due to farmers response and NZ-\$ devaluation.

Details to be delivered during IFCN analysis and dairy conference in 2016 .

## Summary

This article summarises the research work of the IFCN – which has been analysing dairy farm economics since the year 2000. In the year 2015, 55 countries participated in the annual comparison of costs of production and 100 countries participated in the country profile analysis. The results of this article are summarised as follows:

### **121.5 million dairy farms on this planet keeping on average 2.9 cows per farm**

Based on IFCN data collection and estimations, in 2014 there were 121.5 million dairy farms and farming households on this planet producing 778 million ton of ECM milk (cows and buffaloes with 4% fat and 3.3% proteins). The average dairy farm size has 2.9 milk animals with an average milk yield of 2145 kg milk ECM / milk / animal.

### **2014 Costs to produce milk ranges from 4 to 128 US-\$ per 100 kg milk**

Based on the IFCN cost comparison, 170 typical farms in 55 countries were analysed. Cost of milk production ranged from 4.5 US-\$ per 100 kg milk in extensive farming systems in Cameroon to 118 US-\$ for an average sized farm type in Switzerland. The simple average cost over all countries analysed was 46 US-\$/100 kg milk.

### **From 2000 – 2014, cost of milk production increased in all countries analysed**

As the IFCN has analysed typical dairy farms since the year 2000, a time series analysis was possible. The results show that costs in a specific country can increase significantly within 3-6 years. This is especially the case for countries like Poland, China, and New Zealand where the value of the currency has significantly strengthened against the US-\$ and farm input price like land, feed, and labour costs have increased significantly.

Costs in EU and US reach a level of 40 – 50 \$

### **Cost of milk production in China still significantly higher than EU and Germany**

An extreme case was observed in China where dairy farming highly depends on purchased feed. In addition, China had the strongest increase in salaries and an appreciation of the currency of 24%. The combined effect of these factors drove the costs in China from a level of 40 US-\$ / 100 kg milk in 2008 to a level of 60 US-\$/100 kg in 2014.

### **Very volatile milk and feed prices – we are now in the 3<sup>rd</sup> dairy crisis since 2008**

Via standardised world milk and feed prices, IFCN tracks the overall farm economic situation for dairy farming. The IFCN developed an indicator “margin over compound feed costs” which is a significant improvement compared to the often used milk:feed price ratio. By using this margin, it becomes visible how much of a threat dairy farmers face in a situation when milk prices fall and feed prices increase to such an extent that 100 kg feed are more expensive than 100 kg ECM. This situation occurred three times within the last eight years, in 2009, in 2012 and most recently in the beginning of 2015.

### **2015 perspectives of production costs to decrease in US-\$ terms**

1. The cost analysis results shown are based on 2014 data– but changes to be expected for 2015 will be mainly driven by 2 factors: a) changes in exchange rate and b) lower milk price which drives changes in dairy farming systems.
2. First estimation by IFCN for costs in 2015 show stable costs for USA and significant costs reduction of 5-9 US- \$ in the EU, NZ, BR, PL.

### **Annual benchmarking a part of strategic dairy development and milk sourcing**

In times of significant change in dairy related output prices, farm input prices, and exchange rates, it is extremely important to benchmark the competitiveness of the current dairy farming system annually. Competitiveness means in this sense costs competitive on the market for dairy products and also competitive on the local market for production factors especially land and labour. Such benchmarking exercises enable all dairy stakeholders to see and react faster to threats, but even more to anticipate opportunities which will arise.