

ANNEX B – DAIRY INDUSTRY BACKGROUND REPORT

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1 Description of the Industry/Sector

There is a particular sensitivity associated with dairy farming which largely arises from its disproportional (potential) impact on lower-income groups. Firstly, comparatively low entry costs mean that dairy farming is relatively accessible (in its simplest guise). Secondly, dairy farming has both a direct and indirect socio-economic impact on smallholders (direct nutrition vs commercial sales). Thirdly, by necessity, dairy farming is often localized in rural areas where there are fewer employment opportunities. Finally, a significant proportion of families in rural societies already rear cows for personal consumption (leading to the common notion that commercializing existing activities would be a lesser leap than alternative industrial undertakings).

The International Livestock Research Institute highlights the fact that dairy farmers are highly dependent on the global milk price and yet they occupy a weak and vulnerable position on the global market. This is due to the inherent perishability of milk; farmers are unable to defer selling their product in hope/expectation of a more favorable price on the international exchange (as grain farmers are able to do)¹. Although herd sizes for commercial farming are steadily growing, the IFCN estimates that the average global herd size is still 2 to 3 cows and that most dairy farms in Africa, Asia, Eastern Europe and parts of Latin America comprise less than 10 cows.

Typically the 'Dairy Industry' includes milk production, processing, sale and consumption of animal milk. Globally, cow milk represents 80% of total production in all regions apart from South Asia where buffaloes are an important source of milk accounting for 51% of production. At a global level, buffalo-milk is less significant (11% of global production and 23 percent of developing country production). Goat milk, sheep milk and camel milk is also popular but has a much smaller contribution (less than 5% combined)². The "dairy" designation has expanded over recent years to include plant-based milk substitutes typically produced from almonds, soya beans, coconuts and rice. Although the strength of these substitutes are relevant to our investigation and are discussed in more detail later in this report, this analysis will largely focus on cow milk.

At a product-level, the dairy industry includes retail "end products" such as raw milk, fermented milks, pasteurised milk, (whole, semi-skimmed, skimmed etc), long life milk (whole, semi-skimmed, skimmed etc), cheese (hard, soft cheese), cream, yogurt, ice-cream cottage cheese, condensed milk, powdered milk and butter as well as lesser known 'ingredients' and traded milk products such as milk powder, anhydrous milk fat (concentrated butter), milk protein concentrate, rennet casein, whey products and lactose (See

¹ Schelhaas, H. *The dairy industry in a changing world* The International Livestock Research Institute Available from: <<https://www.ilri.org/InfoServ/Webpub/fulldocs/SmHDairy/chap1.html>> [Nov 2015]

² Food and Agriculture Organization 2012, *Milk availability: Trends in production and demand and medium-term outlook* Available from: <<http://www.fao.org/docrep/015/an450e/an450e00.pdf>> [Nov 2015]

Table 1). However the analysis notionally excludes final products that include dairy but have undergone significant secondary processing before sale. This would include chocolates, biscuits, cakes and pastries.

From an 'activities' perspective, "The Dairy Industry" as it is referred to in this document and ensuing analysis refers to all activities that may be undertaken from dairy breeding to consumption of milk products. This includes breeding, farming activities (such as animal-handling, milking, storage), milk processing activities (such as homogenization, pasteurization, inoculation, flavouring, recombination), cold chain logistics and research and development.

Table 1 - FAO Dairy Products and Characteristics³

Type of Product	Description
Liquid Milk	The most consumed, processed and marketed dairy product. Liquid milk includes products such as pasteurized milk, skimmed milk, standardized milk, reconstituted milk, ultra-high-temperature (UHT) milk and fortified milk. Worldwide, less and less liquid milk is consumed in its raw form.
Fermented Milks	Commonly used to make other milk products. They are obtained from the fermentation of milk using suitable microorganisms to reach a desired level of acidity. Fermented products include yoghurt, koumiss, dahi, labneh, ergo, tarag, kurut and kefir
Cheeses	Produced through the coagulation of milk protein (casein), which is separated from the milk's whey. Hundreds of varieties of cheese are produced, many of them being characteristic to a particular region of the globe. However, most cheese is produced in developed countries. Cheese can be soft, hard, semi-hard, hard ripened or unripened. Cheese's diverse characteristics derive from differences in the compositions and types of milk, processes applied and microorganisms used.
Butter And Ghee	Fatty milk products. Butter is produced by churning milk or cream; in many developing countries, traditional butter is obtained by churning sour whole milk. Ghee is obtained by removing the water from butter and is especially popular in South Asia. Ghee has a very long shelf-life of up to two years.
Condensed Milk	Obtained from the partial removal of water from whole or skimmed milk. Processing includes heat-treating and concentration. Condensed milk can be sweetened or unsweetened, but most is sweetened. In Latin America, for example, condensed milk is often used in cooking and baking instead of jam.
Evaporated Milks	Result from the partial removal of water from whole or skimmed milk. Processing includes heat-treating to make the milk bacteriologically safe and stable. Evaporated milks are generally mixed with other foods, such as in milky tea.
Dry Milk Or Milk Powder	Obtained from the dehydration of milk and is usually in the form of powder or granules.
Cream	The part of milk that is comparatively rich in milk fat; it is extracted by skimming or centrifuging the milk. Cream products include recombined cream, reconstituted cream, prepared creams, pre-packaged liquid cream, whipping

³ Dairy Production and Products Food and Agriculture Organization of the United Nations, 2015 Available From <<http://www.fao.org/agriculture/dairy-gateway/milk-and-milk-products/types-and-characteristics/en/#.VkELHtJViko>> [Nov 2015]

Type of Product	Description
	cream, cream packed under pressure, whipped cream, fermented cream and acidified cream.
Whey Products	According to FAOSTAT, whey is “the liquid part of the milk that remains after the separation of curd in cheese making. Its main food use is in the preparation of whey cheese, whey drinks and fermented whey drinks. The main industrial uses are in the manufacture of lactose, whey paste and dried whey.” Whey can be sweet (from the production of rennet-coagulated cheeses) or acid (from the production of acid-coagulated cheeses).
Casein	Casein is the principal protein in milk and is used as an ingredient in several products, including cheese, bakery products, paints and glues. It is extracted from skimmed milk by precipitation with rennet or by harmless lactic acid-producing bacteria.

2 The Global Supply

2.1 Fresh Cow Milk

2.1.1 Gross Production

In the third quarter of 2015, more milk was produced than the market demanded, according to Rabobank⁴. Continued expansion of production - including a surge in EU supplies, as timed investments came online following the removal of the quota system-- has sent global milk prices plunging to their lowest levels since 2009. Region wise, the Americas, North America and Western Europe are the biggest producers. Production in these regions has been stable and growing slowly. Eastern Europe is an interesting case in that production was declining till around the year 2000 - a negative 2.7% average annual growth rate between 1990 and 2000. The decline in the early 1990s in Eastern Europe is most likely explained by possible shocks in transitioning from collective farming to privatization. East Asia is where production has been growing the fastest but from a very low base.⁵

USA, India, China, Germany and Brazil were the top five producers of fresh cow milk between 2010 and 2012. Over that period, the USA contributed about 15% to global production, followed by India (9%), China (6%), Brazil (5%) and Germany (5%).⁶ The contribution of these countries to global production was stable. Farming systems vary greatly across major dairy producers ranging from India’s conventional (average herd size of less than two), EU’s high producing system (where cows spend time outside and in barns

⁴ Rabobank, 2015. “Rabobank Dairy Quarterly Q3: Scaling the Milk Mountain,” Rabobank. 8 October 2015. Press Release

⁵ Food and Agriculture Organization of the United Nation. *FAOSTAT*. Web. 13 November, 2015. *Figures calculated using milk production data*.

⁶ Ibid

with a moderate to high use of supplementary feeds) and New Zealand's low cost, largely outdoor pasture only system.⁷

Figure 1 - World Production of Fresh Whole Cow Milk

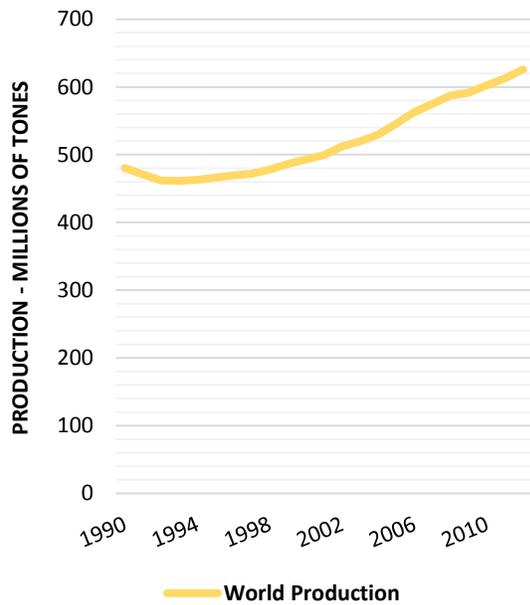
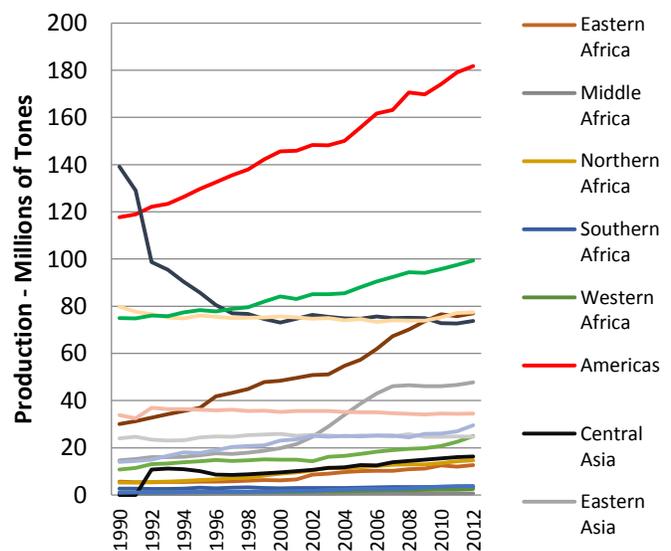
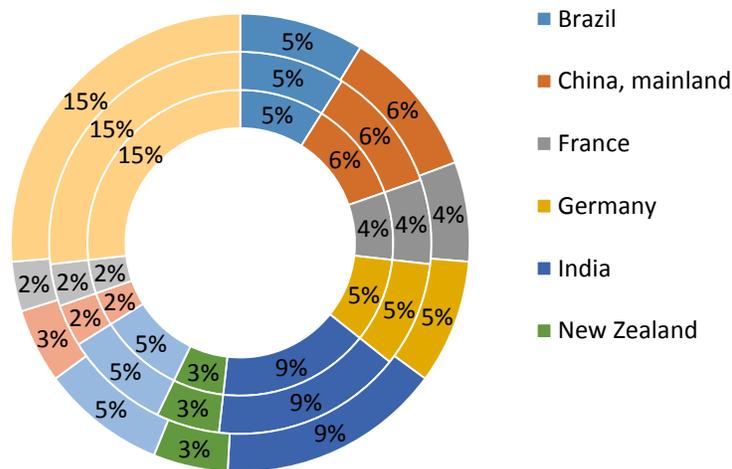


Figure 2 - World Production of Fresh Whole Cow Milk by Region



Source: FAOSTAT

Figure 3 - Top 10 Producers of Fresh Cow Milk - Based on Percentage Share in Global Production (2010 - 2012)



Source: FAOSTAT

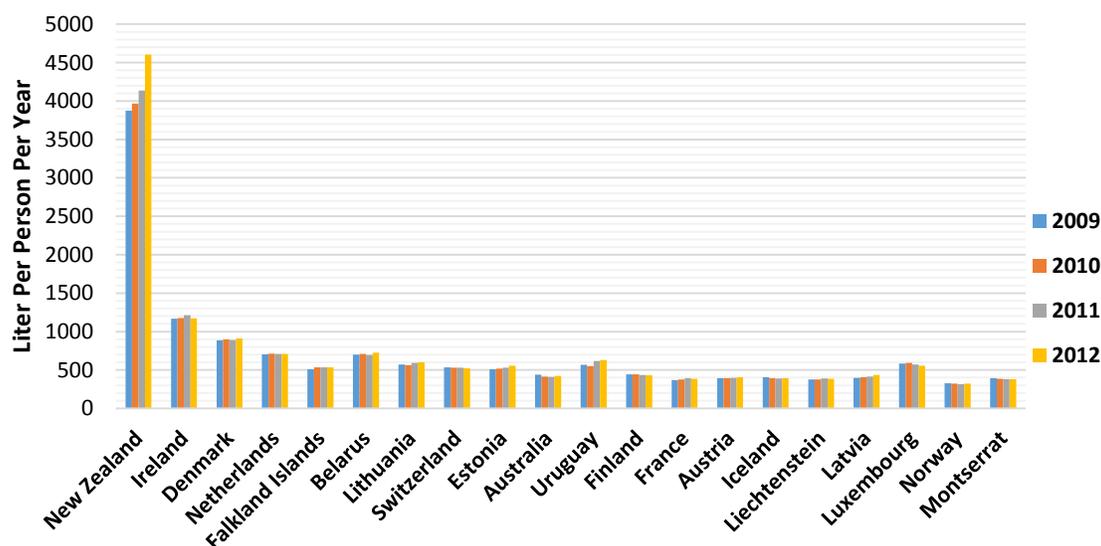
⁷ Fonterra. *Global Dairy Update*. 2015. Print.

2.1.2 Per Capita Production and Milk Surplus

Global per capita milk production has gone through a period of decline followed by a slow recovery. Between 1993 -1998, per capita production grew by -0.6 % on average followed by a 0.7% average growth rate from 1999-2012.⁸ Over all per capita production of fresh cow milk over 1993 to 2012 has been much slower than growth in total production reflecting comparatively faster growth in global population.

New Zealand had the highest production of milk per person between 2009 and 2012 followed by Ireland, Denmark and the Netherlands. During that period New Zealand produced an average of 4,146 liters of milk per person per year. The corresponding figure for Ireland, Denmark and the Netherlands is 1182, 897 and 709 respectively.⁹ High per capita fresh milk production in these countries has translated into exports (see Figure 4). More generally, most countries with milk surplus are located in the EU, Eastern Europe, North and South America, New Zealand and Australia.

Figure 4 - Top 20 Countries in Per Capita Production of Fresh Cow Milk



Source: Calculated using production data from FAOSTAT and population size data from the UN Population Division

A number of the dairy surplus countries are active in the export market. New Zealand, Europe, United States, Belarus, Argentina, Australia and Uruguay alone export about 55 million tons of dairy products annually which is equivalent to about 84% per cent of global dairy exports. Table 2 shows their principal exports.¹⁰

⁸ Food and Agriculture Organization of the United Nation. *FAOSTAT*. Web. 13 November, 2015. *Figures calculated using milk production data.*

⁹ Food and Agriculture Organization of the United Nation. United Nations Population Division. *FAOSTAT*. UN Population Division. Web. 13 November, 2015. *Figures calculated using milk production data from FAOSTAT and Population head count estimates from UN Population Division.*

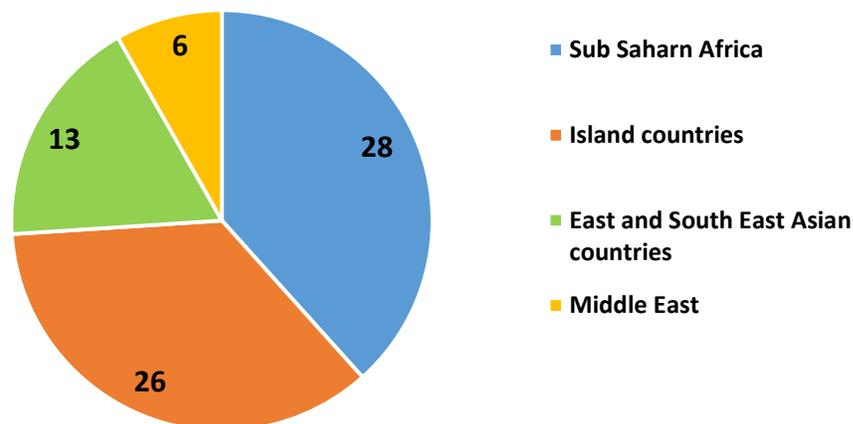
¹⁰ Fonterra. *Global Dairy Update*. 2015. Print.

Table 2 - Principal Exports by Country/Region

Country / Region	Principal Exports
New Zealand	Milk Powder (skimmed milk powder and whole milk powder - SMP and WMP) and milk fat (Butter/AMF)
Europe	Milk Powder (SMP and WMP) and cheese
United States	SMP, cheese and whey powder
Belarus	SMP, cheese and fluid and fresh dairy
Argentina	WMP and cheese
Australia	Powder (SMP and WMP) and cheese
Uruguay	WMP and cheese

Source: Fonterra

Figure 5 - Number of Countries producing less than 20 liters of cow milk per person



Source: Calculated using production data from FAO and population size data from the UN

Few countries are self-sufficient in milk production, which means they import more dairy products than they export. Very low self-sufficiency rates in milk (less than 25 percent) were observed in Bahrain, Democratic Republic of the Congo, Côte d'Ivoire, Gabon, Gambia, Ghana, Jamaica, Kuwait, Liberia, Malaysia, Papua New Guinea, Philippines, United Arab Emirates and Viet Nam.¹¹

2.2 Processed dairy products

Processed dairy products include condensed milk, cheese, dry milk products and butter/ghee. Compared to liquid milk which is 90% water, processed dairy products are less perishable and bulky which in turn makes them more suitable for trade. Globally, countries can be divided into three groups with respect to the share of milk processed into tradable products:

¹¹ Chapter 2 World Dairy Sector: Status and Trends. Print

High (more than 50 percent): Australia, Belgium, Czech Republic, Denmark, France, Germany, Ireland, Netherlands and New Zealand convert more than 50 percent of their milk production into tradable dairy products.

Moderate (30-50 percent): Results of around 30 to 50 percent were observed for Argentina, Chile, Estonia, Italy, Finland, Hungary, Iceland, Japan, Republic of Korea, Lithuania, North America, Peru, Poland, Sweden, Switzerland and Venezuela.

Low (less than 30 percent): In developing countries the share of milk processed into tradable dairy products is rather low (0 to 20 percent), as seen for instance in Africa, Asia and countries of Latin America. However Spain, Ukraine and Russia also transform relatively low percentages of milk produced in-country.¹²

Table 3 - Top 10 Dairy Exporters and Importers

Exporters	Total Net Value of Dairy Trade	Importers	Total Net Value of Dairy Trade
New Zealand	49	China	-17
Netherlands	25	Russian Federation	-14
France	20	United Kingdom	-11
USA	13	Italy	-10
Germany	12	Japan	-8
Denmark	10	Hong Kong, China	-8
Belarus	10	Mexico	-7
Australia	8	Algeria	-7
Ireland	8	Spain	-5
Argentina	7	Indonesia	-5

Source: Calculated using data from the International Trade Center (2010-2014, in Billions of USD)

China is one example where per capita consumption of milk is rising but is still extremely low compared with the rest of the world. In China, milk production has risen but not at a rate sufficient to meet demand. The lack of coordination between milk producers and dairy processors in China remains a problem. As in other dairy-resource-scarce countries, the mismatch between domestic supplies and demand fuels increases in imports.¹³

¹² Chapter 2 World Dairy Sector: Status and Trends. Print

¹³ Ibid

2.3 Whole Cheese

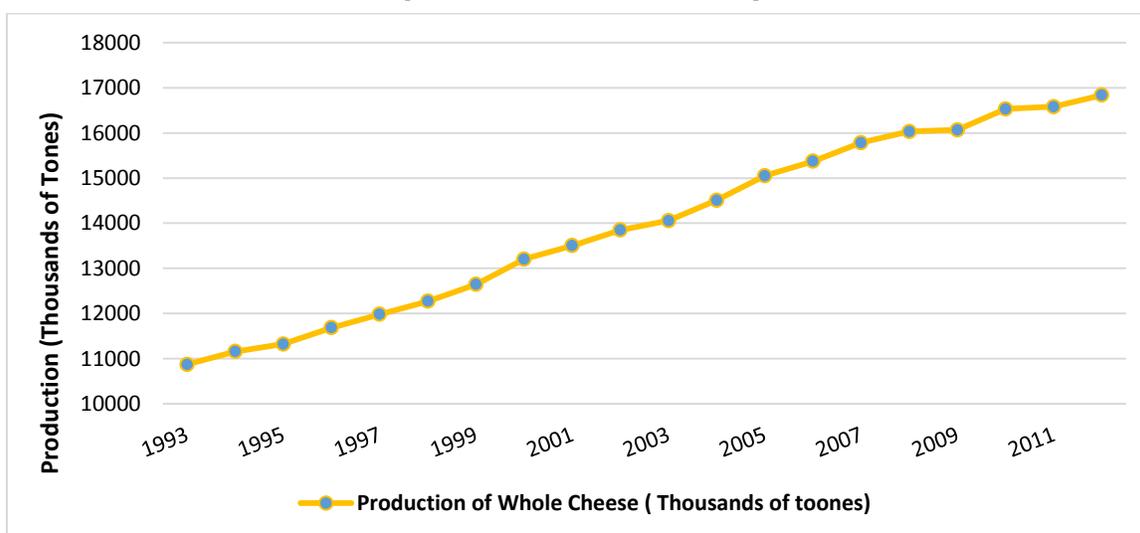
2.3.1 Gross Production

The global cheese market expanded significantly in the 1990s and the beginning of the 2000s but since 2005 the growth rates have not been at the same level as for fresh dairy products and milk powder although the world cheese market has continued to expand¹⁴. From 1993 to 2004 global production of cheese grew at 2.4% per year compared to just 1.4% during 2004-2012¹⁵.

Global cheese production is expected to show dynamic growth till 2020. However this will depend on the cheese market's capacity to adapt to saturated markets in OECD countries and little or no tradition of consuming cheese in many of the emerging dairy markets.¹⁶

Cheese from cows' milk represents more than 80% of the global natural cheese production.

**Figure 6- Global Production of Whole Cheese
(In Thousands of Tones)**



Source: FAOSTAT

2.3.2 Major producers of cheese

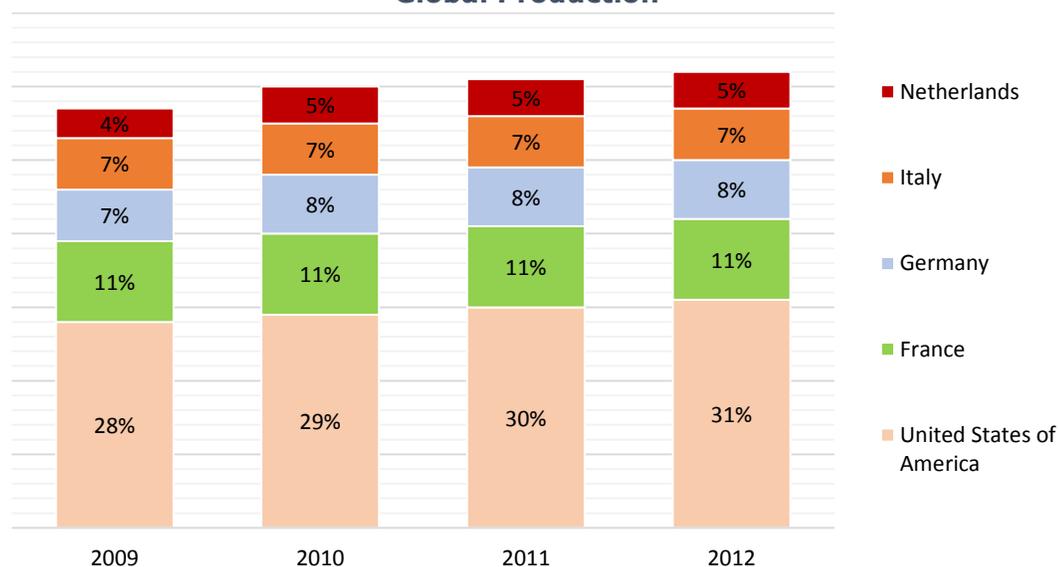
EU and USA account for 70% of the world cheese production in 2012. In terms of individual countries USA is the major producer of whole cheese followed by France, Germany, Italy and the Netherlands.

¹⁴ PM Food and Dairy Consulting. *World Cheese Market 2000- 2020*, 2014. Print

¹⁵ Food and Agriculture Organization of the United Nation. FAOSTAT. Web. 13 November, 2015. *Figures calculated using Cheese production data.*

¹⁶ PM Food and Dairy Consulting. *World Cheese Market 2000- 2020*, 2014. Print

Figure 7 - Major Producers of Whole Cheese - Based on Percentage Contribution to Global Production



Source: FAOSTAT

From 2000 to 2012, cheese production in France, Italy and Netherlands has expanded moderately but steady. The Irish dairy industry has changed strategy away from butter and skimmed milk powder (SMP) and this is illustrated by 86% growth in the cheese production. Major Eastern European countries have also experienced significant growth in the cheese production stimulated by the EU membership in 2004, Poland is the most notable such case.¹⁷

On the other hand Denmark and Sweden has experienced decline in cheese. This decline has been significant in Sweden at 22% compared to 2% in Denmark. In Sweden the decline may be explained by the fast decline in milk production while in Denmark it may be due to shift toward powdered milk production.¹⁸

2.3.3 Emerging Producers of Cheese

Cheese production has been growing fast in countries outside the EU and the US as well. In the CIS countries growth has been led by Ukraine followed by Russia and Belarus. The growth in cheese production in these countries was coupled with significant economic growth which may have stimulated domestic consumption of cheese in addition to demand from the export market.

Cheese production has also expanded in Latin America. Brazil, Argentina, Chile and Uruguay are countries where production has expanded the most. In Asia, Iran and Turkey are the major cheese producing countries and they have experienced expansion in production

¹⁷ PM Food and Dairy Consulting. *World Cheese Market 2000- 2020*, 2014.Print

¹⁸ Ibid

followed by Japan. Africa and Middle East has also experienced increasing cheese production with Egypt and South Africa being at the fore front.

In Australia, cheese production declined by 8% due to severe climate problems including draught and flooding that impacted the total supply of milk to the dairies. In New Zealand, the emphasis until recently had been on milk powder however cheese production recently regained strength and increased by 22% between 2000 and 2012.

Through 2020 the majority of high income dairy producer countries are expected to experience fast growth in cheese production, particularly USA, Canada, New Zealand and Australia. Emerging cheese producing countries will also experience fast growth in production although from a significantly lower starting point. Cheese production is expected to expand in Brazil, Argentina, Turkey, Egypt, and Iran. A substantial part of the expansion will be carried out by multinational dairy companies from the developed world.¹⁹

2.4 Powdered milk

The increased shelf life of milk powder with easier storage conditions and its usage as an alternative to fresh milk has sustained the growth of the global milk powder market. Whole milk powder has all the nutrients of whole milk in its concentrated form.²⁰ Dry milk powders are high in demand, particularly in tropical countries, for both commercial purposes and for at-home reconstitution into beverage milks—important products for feeding children. At one time, large centralized plants undertook commercial reconstitution using skim milk powder alone, recombined with anhydrous milkfat, or combined with vegetable oil. Increasingly, commercial reconstitution has been decentralized and adapted to use whole milk powder. This shift was facilitated by whole milk powder's greater flexibility for reconstitution, less costly packaging that maintains acceptable flavor, and the lack of any price premium between nonfat and whole milk powders.²¹

The U.S., France, and China are the largest markets for powdered milk while New Zealand is the leading exporter of milk powder across the globe.

2.5 Butter

Currently the world is producing about 5.20million tons of butter. During the 1990s production declined significantly and it picked up again in early 2000. Major producers of butter are the USA, followed by New Zealand, Germany, France and Russia.²²

¹⁹ PM Food and Dairy Consulting. *World Cheese Market 2000- 2020*, 2014.Print

²⁰ Transparency Market Research. *Milk Powder Market - Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2012 – 2018*. Transparency Market Research. Web. 13 Nov. 2015

²¹ USDA. *World Dairy Production and Trade Trends*. Print

²² Food and Agriculture Organization of the United Nation. *FAOSTAT*. Web. 13 November, 2015.
Figures calculated using butter production data.

New Zealand, Belarus, the EU, USA and Australia are major exporters of butter; all of these countries are expected to gain moderate increase in sales/production except the USA. On the other hand the principal markets for butter are Russia, China, Saudi Arabia, the EU and Iran. As with other dairy products China is a major buyer of butter²³.

2.6 Yogurt

The Yogurt market has expanded greatly over the last few years and continues to do so. This rapid growth is primarily attributed to the advent of functional products, with characteristics such as low sugar, low fat and favorable impact on digestive health. Among all functional foods, yogurt is considered an ideal medium for delivery of beneficial functional ingredients. Consumer focus on healthy lifestyle is a major driving force for the global yogurt and yogurt drinks market.²⁴ Germany, France, Belgium, Australia and New Zealand are the major exporters of Yogurt²⁵.

2.7 Whey and Milk protein Concentrates

Whey and milk protein concentrates are widely traded, but because they are relatively newer markets, the quantities traded are not as large as those of other dairy products.

2.7.1 Whey Protein Concentrates

Global fluid whey production can be inferred from cheese or casein production data. Only a select number of countries including the USA publish dry whey production data; therefore, global production can only be estimated. Global trade in whey ingredients has increased significantly over the last 10 years. The growth of the infant formula market, notably in China and other East Asian economies, and the development of the “performance nutrition” market has led to significant export growth, particularly in higher protein concentrates and isolates. In 2013, global exports of whey ingredients (all types combined) were estimated at 1.5 million metric tons. Leading exporters were the EU, the United States, and Belarus, with 530,772 metric tons, 494,157 metric tons, and 115,451 metric tons, respectively. Major importing countries were China, Indonesia, and Malaysia. The ongoing emergence of improved, more cost-efficient technologies to separate and purify whey proteins and development of new sources will continue to drive the sector.²⁶

²³ Guillaume, Ragonnaud. Trends in EU-Third Countries' Trade of Milk and Dairy Products. EU Parliament, 2015. Print

²⁴ Yogurt, a Global Strategic Business Report. Companies and Markets.com. Web, 13, Nov., 2015

²⁵ International Trade Center. Trade Statistics 2001-2014. Web. 13 November 13, 2015. Ranked According to volume of exports of yogurt.

²⁶ Veronique, Lagrange., Dacia Whitsett., Cameron Burris. “Global Market for Dairy Proteins”, *Journal of Food Sciences*, 80.S1 (2015). Print

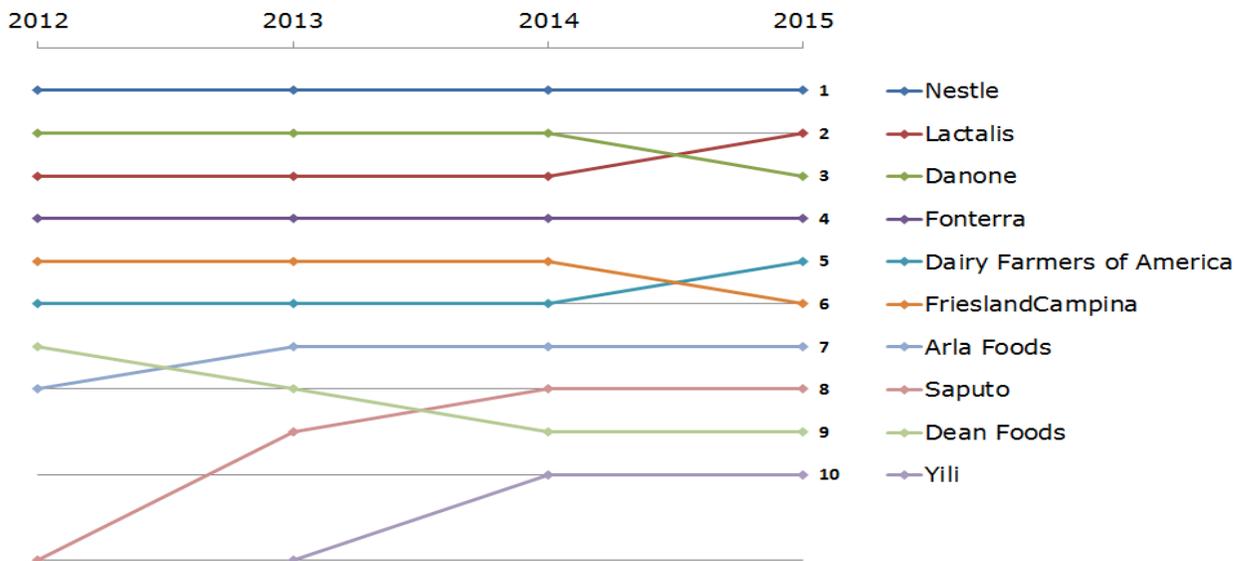
2.7.2 Milk Protein Concentrates

MPC is not defined by the Codex or the U.S. CFR. In the past, blends of whey and casein were traded as MPC. Today, the term largely refers to products obtained by ultrafiltration of milk. The United States is the only producing country with official production data and U.S. production has developed rapidly since 2003. The U.S. market size is estimated at 50000 to 55000 metric ton for MPC42 and MPC56, and 17000 to 18000 metric ton for MPC70, MPC85, and MPI.²⁷

Before 10 years ago, the MPC industry was largely driven by the availability of a tariff allowing imports of milk solids into the United States at a preferential rate. Today, production is driven by both intrinsic demand for milk proteins and derived demand for milk protein permeate, an ingredient used for milk powder protein standardization. Over the past decade, there has been a substantial increase in the use of milk permeate by the dairy industry for such standardization. Expert forecasters have predicted that as the production of milk powders continues to grow in the key producing regions of the world, demand for milk permeate will continue to grow, generating further volumes of MPC.²⁸

2.8 Dominant Firms

Figure 8 - Top 10 Global Dairy Companies 2012 – 2015



Source: Rabobank

Whilst consolidation and concentration continues to be attractive in the global dairy industry (particularly with respect to farming), the list of the top 20 global dairy processors has

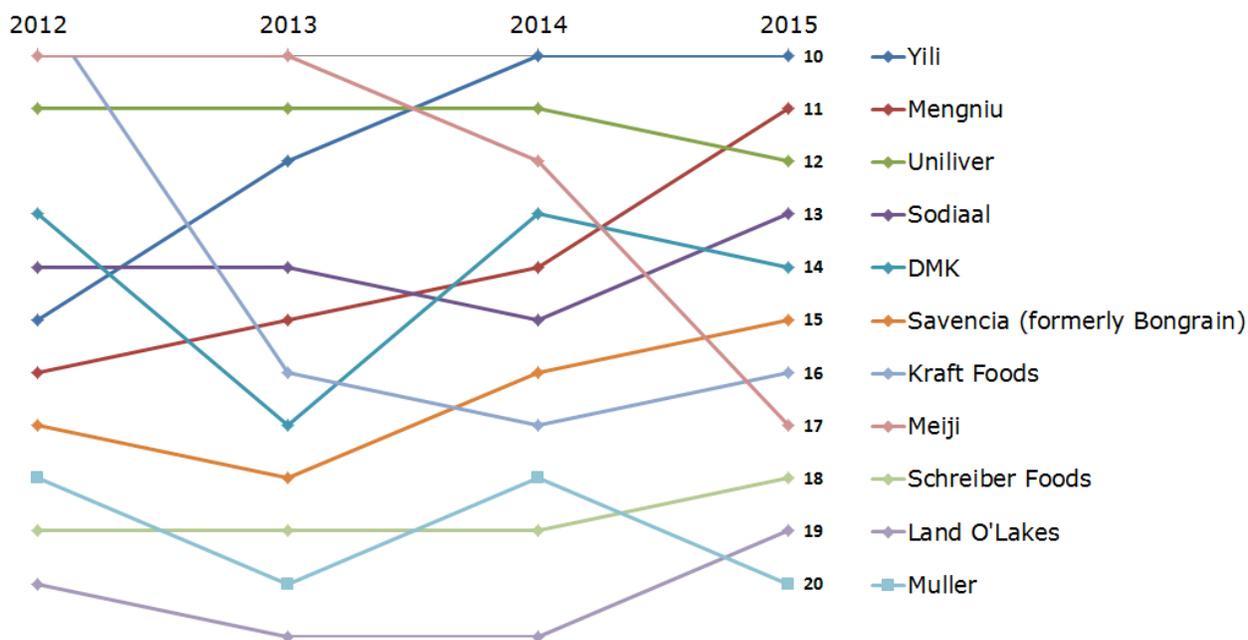
²⁷ Ibid

²⁸ Ibid

remained relatively consistent. Indeed, as can be seen from Figure 8 there has been virtually no change in at the top of the list. Nestle of Switzerland, Danone and Lactalis of France, New Zealand’s Fonterra, Dairy Farmers of America and Dutch multinational FrieslandCampina continue to dominate, with turnovers of \$27.8Bn, \$19.5Bn, \$19.5Bn, \$18.5Bn, \$17.9Bn and \$14.8Bn respectively.

There is much more observable movement in the second half of the list. Particularly notable is the steady rise of Chinese firms Mengniu’s and Yili. It is especially significant when one considers that there were no Chinese firms in the Top 15 firms before 2008²⁹. However - largely in response to the Melamine crisis of 2008 - the government of China pushed for greater consolidation and large-scale, vertically-integrated production. The result was that by 2014, three companies - Yili, Mengniu and Bright - accounted for 60% of sales of liquid milk in China (Sharma, 2014³⁰). It remains to be seen whether these firms will be able to hold their position as China’s slowing economy affects household spending.

Figure 9 - Global Dairy Companies Ranked 11-20, 2012 – 2015



Source: Rabobank

²⁹ Dairy Foods, 2015 Chinese dairies crack the ranks of the world's 15 largest firms Available From: <<http://www.dairyfoods.com/articles/89842-chinese-dairies-crack-the-ranks-of-the-worlds-15-largest-firms?v=preview>> [Sept 2015]

³⁰ Sharma S.,Rou Z., 2014 China’s Dairy Dilemma: The Evolution and Future Trends of China’s Dairy Industry Available at: <<http://www.iatp.org/documents/china%E2%80%99s-dairy-dilemma-the-evolution-and-future-trends-of-china%E2%80%99s-dairy-industry>> [Sept 2015]

3 The Global Demand

3.1 Global markets

In terms of total consumption of dairy products, statistics can be difficult to disaggregate by product. For instance, the “fluid and fresh dairy” category often encompasses skim milk, whole milk, cream, pasteurized milk, UHT milk, concentrated milk products (evaporated milk and sweetened condensed milk), and yogurt. Actual consumption of each of these products varies widely between and within countries. However, Table 4 shows the top five countries in domestic consumption of dairy products in five basic categories: Fluid milk, non-fat dry milk, dry whole milk powder, butter, and cheese.

Table 4 - Domestic Consumption (1000 metric tonnes) - 2015 estimated

Country	Fluid Milk	Non-fat Dry Milk	Dry WMP	Butter	Cheese
EU-27	151,300	951	352	2,170	8,936
India	146,500	470	--	5,025	--
United States	96,252	496	--	854	4,925
China	39,359	360	2,009	--	--
Brazil	34,506	--	613	--	770
Mexico	--	265	153	227	--
Algeria	--	--	160	--	--
Russian Federation	--	--	--	368	695
Argentina	--	--	--	--	511

Source: *Index Mundi*, United States Department of Agriculture

According to market analysis by Fonterra, the top five dairy importing countries are China, Russia, Mexico, Japan, and the United States.³¹ China is by far the largest market, importing roughly 2 million tonnes of dairy products annually. Russia imports about three-quarters of China’s total, around 1.4 million tonnes/year. However, volatile demand in China in recent years and a Russian-imposed import ban in 2013 have had wide-ranging repercussions on exporters.³² Together, the sudden halt in demand has caused global milk prices to plunge to

³¹ Fonterra, 2015. “The Global Dairy Industry.” Retrieved from: <http://www2.fonterra.com/our-financials/the-global-dairy-industry>

³² Gale, J., 2015. “New Zealand Farmers See Red with China Buying Less Imported Milk,” *Bloomberg*. 30 July 2015. Retrieved from: <http://www.bloomberg.com/news/articles/2015-07-29/china-spurns-new-zealand-milk-and-12-000-farmers-see-red>

their lowest levels since 2009.³³ Russia is likely to remain out of the market, with Chinese imports only expected to stabilize heading into 2016, according to Rabobank's latest dairy forecast.³⁴

The next tier of markets is led by Mexico and Japan, each importing roughly 500 thousand tonnes per annum. They are followed by the United States, Indonesia, Philippines, Saudi Arabia, and Algeria, which each import over 400 thousand tonnes/year. Singapore, Iraq, Malaysia, Venezuela, and the United Arab Emirates follow at roughly 300 thousand tonnes annually. These 14 countries account for over 8 million tonnes, or around 55% of global dairy imports, according to Fonterra. Of these, only the United States is also a major net exporter.³⁵

More broadly, demand continues to grow in the emerging markets of the Africa, Asia (excluding China), and the Middle East. Imports in Asia rose across all major categories throughout early 2015, up a total of 13% through June. In particular, SMP imports were up 25%, WMP up 19%, cheese up 16%, and fluid and fresh dairy up 10%. Imports into the Middle East and North Africa are also up, although not to such an extent-- rising 2% overall from January through June. Imports in the MENA region are being driven by WMP (up 18%) and fluid and fresh milk (up 8%).³⁶

Looking forward, Asia is expected to remain the main driver of rising international demand. Despite recent volatility and slowing economic growth, China is expected to increase purchases in the long-term-- especially after the government announced in October that it was ending its one-child policy. Each family will now be allowed to have two children, and with China being the world's largest consumer of dried milk powders used in infant formula, this has led to some optimistic estimates of demand surging as much as 20% over the next few years.³⁷ Other countries forecast to increase purchases include Malaysia, the Philippines, Thailand, and Vietnam. Japan, the Republic of Korea, and Singapore will remain important markets, but their level of imports is expected to remain stable, if not actually decrease in some instances. In the Middle East region, Saudi Arabia, the United Arab Emirates, and Oman are expected to see growth, and in Africa, lower international prices should help stimulate imports in the near term, particularly in Algeria, Egypt and Nigeria.³⁸

³³ United States Department of Agriculture (USDA) - Foreign Agriculture Service, 2015. *Dairy: World markets and Trade - July 2015*. Available: <https://apps.fas.usda.gov/psdonline/circulars/dairy.pdf>

³⁴ Rabobank, 2015. "Rabobank Dairy Quarterly Q3: Scaling the Milk Mountain." *Rabobank*. 8 October 2015. Press Release.

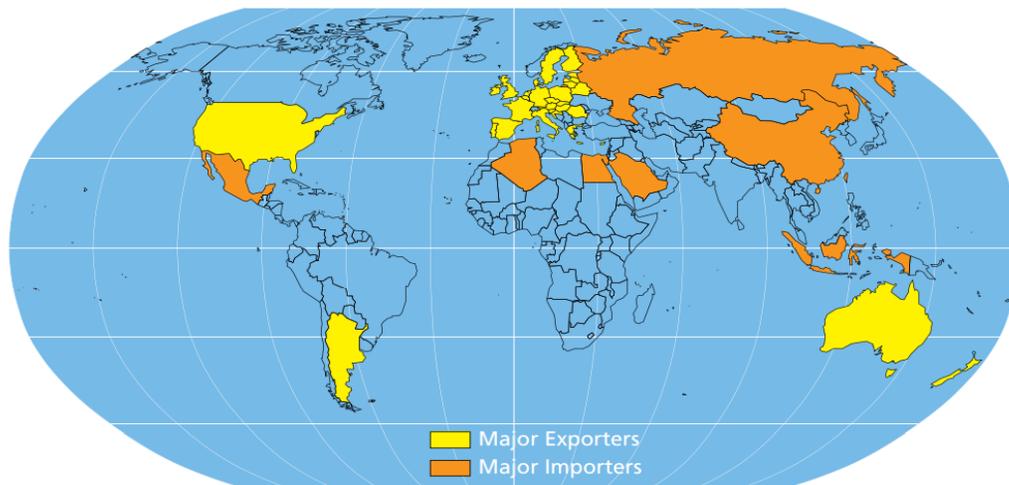
³⁵ Fonterra, 2015. "The Global Dairy Industry." Retrieved from: <http://www2.fonterra.com/our-financials/the-global-dairy-industry>

³⁶ Fonterra, 2015. *Global Dairy Update*. October 2015. Available: <http://www2.fonterra.com/files/2015-08/global-dairy-update-october-2015-reworked.pdf>

³⁷ O'Keefe, M., 2015. "More Babies in China, More Customers for US Dairy?" *U.S. Dairy Exporter Blog*. 4 November 2015. Retrieved from: <http://blog.usdec.org/usdairyexporter/more-babies-in-china-more-customers-for-u.s.-dairy-products>

³⁸ Food and Agriculture Organization of the United Nations (FAO). *Food Outlook: Biannual report on global food markets*. May 2015. Available: <http://www.fao.org/3/a-i4581e.pdf>

Figure 10 - Major Dairy Exporters and Importers



Source: FAO

Overall, dairy demand is expected to grow by between 2-2.4% through 2016.³⁹ Trade in dairy products is also forecast to grow, increasing 2.7%, to 74 million tonnes of milk equivalent.⁴⁰ Consumption of dairy products is expected to rise by 36% over the next decade to in excess of 710 million tonnes on a liquid milk equivalent basis (3% CAGR).

3.2 Evolution of demand in China

The volatility of global milk prices can, in part, be traced back to a series of events in China in early 2013 that dramatically drove up global demand before it quickly plummeted back down. China's role on the global market is most pronounced as an importer of WMP. Due to certain cultural traditions related to child rearing and breast feeding,⁴¹ and the country's population, China is a very large market for infant formula-- which relies on WMP as a primary ingredient. In 2008, the industry was rocked by a scandal when melamine was added to milk and ended up in infant formula. The adulterated milk products caused kidney stones in children, killing at least six and leaving hundreds of thousands affected.⁴² Today, milk powder remains a sensitive topic, and citizens generally distrust the domestic dairy industry, as well as domestic producers of infant formula.

39 Wyrzykowski, L. "IFCN Outlook 2015/2016: How will the dairy industry look in the next 15 months?" 13th International Farm Comparison Network (IFCN) Supporter Conference 2015.

Minneapolis, Minnesota, USA. 9-11 September 2015. Conference presentation.

40 Food and Agriculture Organization of the United Nations (FAO). Food Outlook: Biannual report on global food markets. May 2015. Available: <http://www.fao.org/3/a-i4581e.pdf>

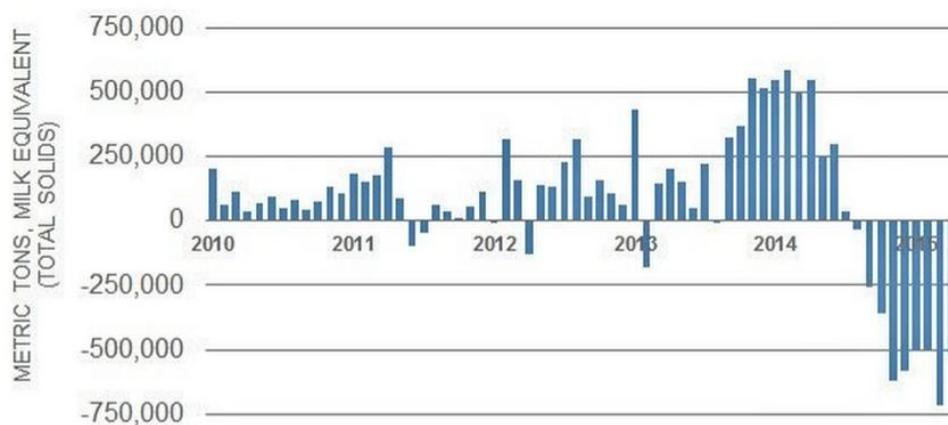
41 Chinese tend to end exclusive breastfeeding very early in comparison to practices in other countries, and sooner than the recommended timeframe of the World Health Organization. In 2014, fewer than 16 percent of urban Chinese women exclusively breastfed their babies through the WHO's recommended period of six months.

42 Branigan, T., 2008. "Chinese figures show fivefold rise in babies sick from contaminated milk." The Guardian. 2 December 2008. Retrieved from: <http://www.theguardian.com/world/2008/dec/02/china>

In 2013, a series of events further eroded market confidence. Botulism was reportedly found in Fonterra dairy products, followed by allegations of bribery from France's Danone, and record fines for price fixing by milk powder firms.⁴³ As a result, the country suddenly experienced a brief shortage of milk powder by mid-year, causing prices to spike. In response, the Chinese government encouraged the country's two largest producers to stock up on milk powder-- recognizing both the food security and the business implications.

Chinese imports of WMP soared in 2013 and 2014 (Figure 11).⁴⁴ Global exporters saw this as an opportunity to invest in increased production to supply growing demand.⁴⁵ However, China's imports of WMP have since flattened, and prices have fallen drastically. The total inventory stockpiled in this time is contested, but is likely to shrink as 2015 imports have fallen sharply. From January to June 2015, imports fell 24%, although there are signs of this decrease tapering.

Figure 11 - China Dairy Imports, change vs. prior year (2000 - 2015)⁴⁶



Source: US Dairy Export Council, GTIS, includes SMP, WMP, cheese, butterfat, whey, lactose, fluid milk, infant formula

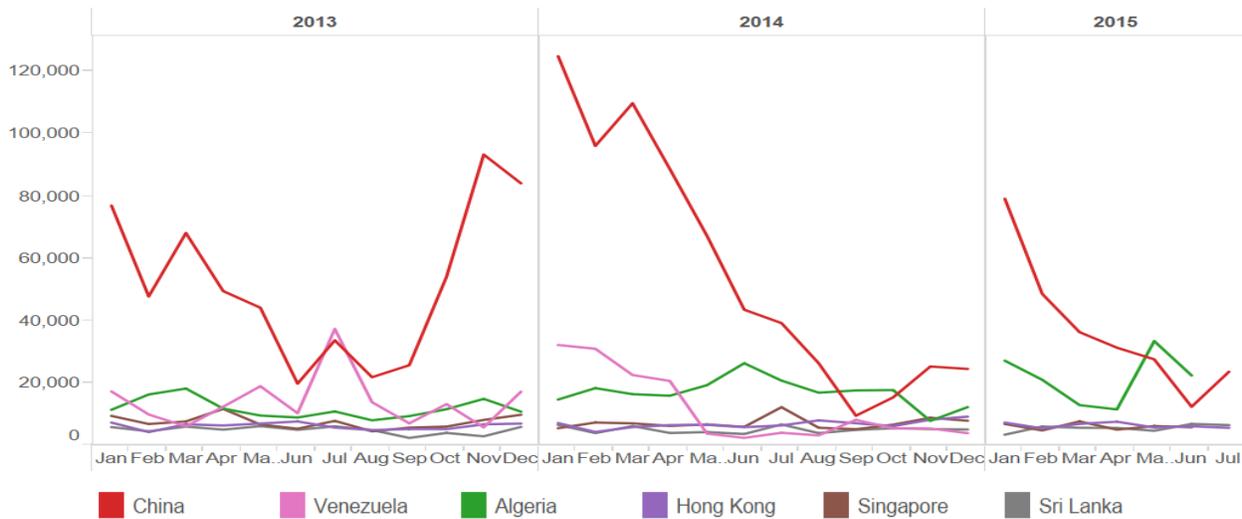
⁴³ Blanchard, B. and Rose, A., 2013. "China tightens rules again to promote breast feeding." Reuters. 29 October 2013. Retrieved from: <http://www.reuters.com/article/2013/10/29/us-china-milk-idUSBRE99S0LD20131029>

⁴⁴ Levitt, A., 2015. "Trade Flows: China, Russia slowdowns redirect trade flows." U.S. Dairy Export Council. 16 March 2015. Retrieved from: <http://www.usdec.org/research-and-data/market-data/trade-flows>

⁴⁵ USDA. See also: Hilsenrath, J. and Howard, R., 2015. "How China's Thirst for Milk Actually Hurt the Value of New Zealand's Cows." *The Wall Street Journal*. 2 June 2015. Retrieved from: <http://blogs.wsj.com/economics/2015/06/02/how-chinas-taste-for-milk-actually-hurt-the-value-of-new-zealands-cows/>

⁴⁶ Levitt, A., 2015. "China Imports of Whole Milk Powder Lowest Since 2012" U.S. Dairy Export Council. 2 June 2015. Retrieved from: <http://blog.usdec.org/usdairyexporter/china-imports-of-u.s.-whole-milk-powder-lowest-since-2012>

Figure 12 - Long-term Trend for Major WMP Importers⁴⁷



Source: US Dairy Export Council, GTIS, USDEC (Russia imports exclude Belarus)

3.3 Evolution of the demand in smaller markets

Based on initial interviews and desk research, demand trends are different based on income and country (overall level of development). In countries with excellent logistics and historical access to fresh dairy products-- Australia, Canada, New Zealand, the United Kingdom, and the United States-- consumption of HTST milk is declining, though it is still the preferred type of liquid milk product. While demand for fluid milk is falling, demand for other milk-derived products has kept production rising. There are 42 basic products derived from milk, and milk is a minor component in a broader list of 142 products. Of these, the most explosive growth has been in yogurt products.

In middle- and lower-income countries, demand for dairy is rising steadily. Research has shown empirical linkages to growth in income, as well as rising urbanization, and an increase in consumption of higher protein sources of food, as well as previously unattainable "luxury" products.⁴⁸ In Bangladesh, for instance, demand is growing roughly 4% y-o-y, while production is only increasing at just over 3%.⁴⁹ This creates an ever-growing gap in supply and demand. However, it should be kept in mind that any type of processed and packaged milk product is almost certainly unattainable for low-income segments in these countries. For these often poor and rural households, raw milk is the only option, if available.

⁴⁷ US Dairy Export Council. Retrieved from: <http://www.usdec.org/research-and-data/market-data/trade-flows>

⁴⁸ See Popkin, 1993; Delgado, 2003; Pingali, 2007.

⁴⁹ Uddin et al., 2011. "Milk production trends and dairy development in Bangladesh." *Outlook on AGRICULTURE*, Vol 40, No 3, pp 263-271.

3.4 Tradable Products

On the export market, you will find primarily milk powder and dry proteins. However, a smaller set of other products are traded regionally and even globally. It is important to note that the WTO's Agreement on Agriculture's tariff rate quotas (TRQs), as well as national and regional standards can act as significant barriers to trade. For example, to import into the EU, a trader may need to have veterinary and/or public health certificates, come from an EU approved premise, enter the EU through a Border Inspection Post where veterinary checks are carried out, and/or come from a country authorised by the European Commission (EC) to export this type of product to the EU. Primary products traded across borders include:

- WMP
- SMP
- butter (and other fats and oils)
- cheese (specialty/processed/fresh)
- whey products
- casein and casein products
- products consisting of natural milk constituents
- other milk protein substances
- (depending on regional proximity to production) milk, cream, ice cream, and yogurt.

3.4.1 Private Sector Response to Changing Demand

Due to the fact that the US home market is relatively large, US-based companies tend to be comparatively inward-facing.

As a result they are less likely to make foreign investments and are less export driven (although that is changing a little) as global economic shocks have started to push them beyond US borders and start to do a bit more internationally. The US' large production base is also a significant contributor to this trend. US companies are starting to see that they can be competitive when it comes to export and are increasingly interested in exploiting this fact.

European companies tend to be more focused on the EU however milk consumption patterns are stagnant and even declining in some cases across high income countries and so they are much more inclined to make investments overseas. As an example, companies like FrieslandCampina invest in the Philippines and have shown some interest in Africa.

Similarly, Danone and Lactalis have interests all over the world with operations in Brazil, in the US, in Northern Iraq, Colombia and Zambia. In doing so they are looking for two things; a market that has a competitive production base of raw milk (i.e. below the average global price), and a strong potential consumer base. An example of a country that combines these two requisites well is Kenya; Kenyans traditionally drink a lot of milk and have an emerging significant middle class, but their production cost is still relatively low. West Africa and particularly Northern Nigeria (in highland areas) would have good production opportunities as well as a large market.

The competitiveness of firms in China is questionable. This is mainly because the feed costs are high, and there has been a state-sponsored shift away from small farms to big farms. These big farms are more feed-lot based, and that requires feed-grain and feed-grain all has to be imported. The Chinese government has several “non-tariff” barriers on dairy imports (particularly powder and UHT) which keep the price of milk high artificially. These might include mandated plant inspections by Chinese government officials or arduous accreditation requirements that aggregate into a long extended process that dissuades investment from foreign (US and EU) companies. Consensus suggests that large processors are still producing a lot of milk and at higher cost than ‘peasant farmers’ because they are using a lot more high-cost imported feed grains. (Whereas small farms with only 1 or 2 cows are feeding their cows with grass and straw that they collect themselves as virtually zero cost).

4 Industry Structure

4.1 Dairy farming

4.1.1 Farm types and their evolution

Different types of farm systems are used to produce milk; farms may be small scale, extensive farms where animals are exclusively grazed or more intensive farms where cows can be housed for all or part of their lactation. The choice of farm system model largely depends on the resources and space available, on the buyers’ specifications for the milk they wish to acquire and on access to capital.⁵⁰

According to the IFCN Country Profile collection of over 100 countries, milk supply increase has been driven over recent decades by increases in the number of farms and herd sizes. The number of dairy farms has increased constantly from 1996 to 2013; there are now about 118 million dairy farms across the world each with an average of 2.9 cows and an average yield of 2.2 tons of milk per cow per year.⁵¹ However, trends are now tending towards larger herd sizes and higher yields. As the dairy industry becomes more global, it is expected that the structure in different countries will become more similar.

4.1.2 Farm types, cost structure and profit

According to an analysis of the structure of dairy farming industry in Great Britain by The Andersons Centre, there is no evidence that larger units are forcing smaller ones out. In

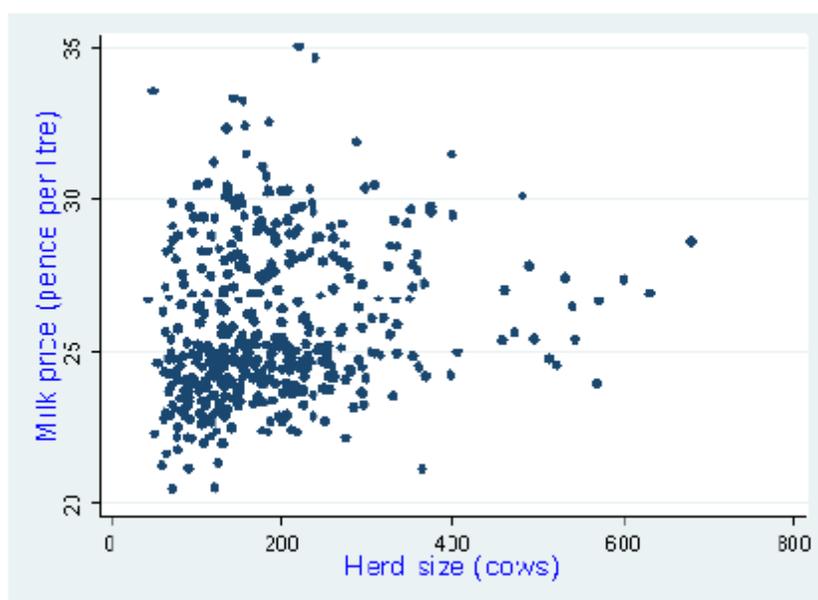
⁵⁰ Dairy UK, 2013 *The White Paper 2013, A guide to the UK Dairy Industry* Available From: <<http://www.dairyuk.org>> [Sept 2015]

⁵¹ IFCN, 2015 *Press Information, IFCN Dairy Conference 2015* Available From: <http://www.ifcndairy.org/media/downloads/Press_Information_EN_IFCNDairy_Conference_2015_dairy.pdf> [Oct 2015]

that market, assessments of farms' profit levels show that they vary among farms of all herd sizes, and that they are more a function of management than of size.

As seen in Figure 13, larger units do not receive a particularly higher milk price. Supply and demand trends at a national, EU and global level appear to have a much greater impact on milk prices than the relative bargaining powers of individual large dairy farms. However, even if average milk prices do not seem to depend on farms' sizes, high volume contracts seem to offer a premium - rewarding the logistical convenience of more milk per collection and lower transport costs, thereby allowing larger farms in certain geographical areas to receive higher prices and to make larger profits as a result.

Figure 13 - Herd Size and Milk Price



Source: *The Andersons Centre, DairyCo Milkbench+.*

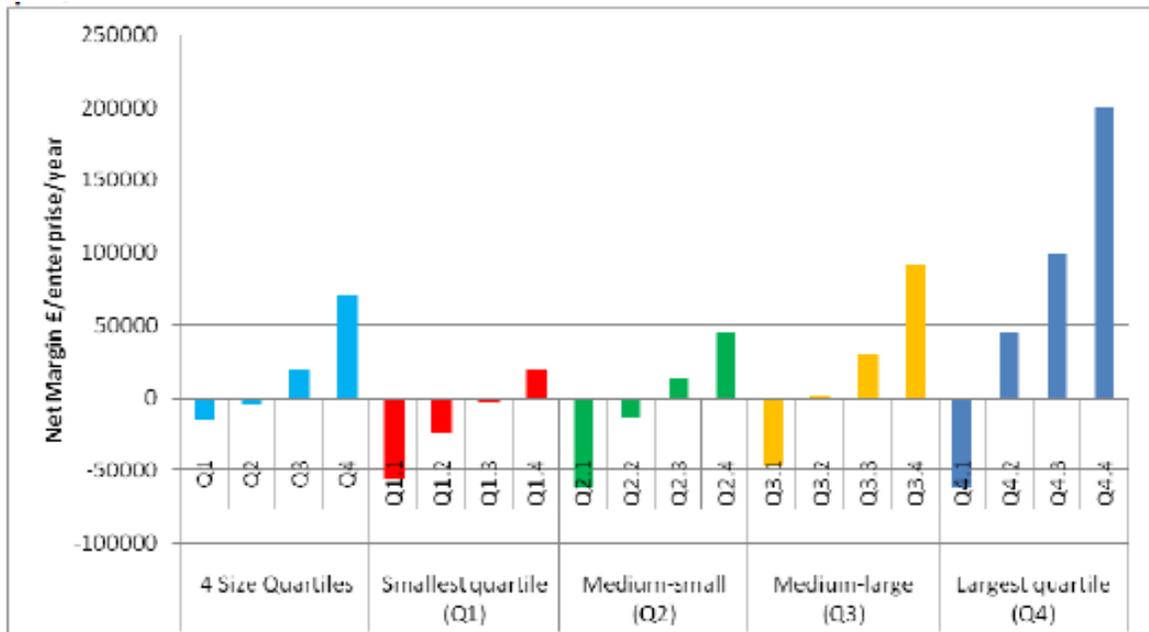
Larger farms are also not consistently capable of realizing the potential for economies of scale that one could assume would derive from efficiently managing a larger herd size.

An analysis performed by The Andersons Centre using data from Milkbench+ sought to highlight the relationship between dairy farms' size and profitability in the UK market. Farms are first broken down into quartiles based on volume of annual milk production (average size of 600,000 liters for Q1, 1.05 million liters for Q2, 1.53 million liters for Q3 and 2.65 million liters for Q4). Each quartile is then split into performance quartiles based on net margin. In the analysis, net margins take into account full economic costs including unpaid labor, full land rental value and opportunity cost of capital.

The results shown in the figure below indicate that producing larger volumes can be associated with increased net margins. The contrast is particularly apparent between Q3 and Q4. It seems however that profit can be achieved for each size quartile and that the lowest performing quartiles for each size quartile are performing equally poorly. This

suggests that being able to generate higher profit through a larger herd size is not automatic and will be dependent on the farm's management's performance.⁵²

Figure 14 - Relationship between Farm Size and Total Dairy Net Margin Ranked by Performance Quartile



Source: The Andersons Centre, DairyCo Milkbench+.

The same analysis by Milkbench+ of 315 farms in the UK also broke down data based on the farm's type:

- **Cows at grass:** predominantly grass-based and operating at lower yields
- **Composite:** maximum use of family labor and mixed approach for feeding and housing.
- **High-output cows:** generally housed for more of the year with more intensive use of major inputs.

Once again, the conclusions point towards the importance of the efficiency and quality of management to maximize the farm's profitability when compared to its peers. The average yield per cow was not the main driver for profit, which relied more on striking the right balance between feed use and milk yield.

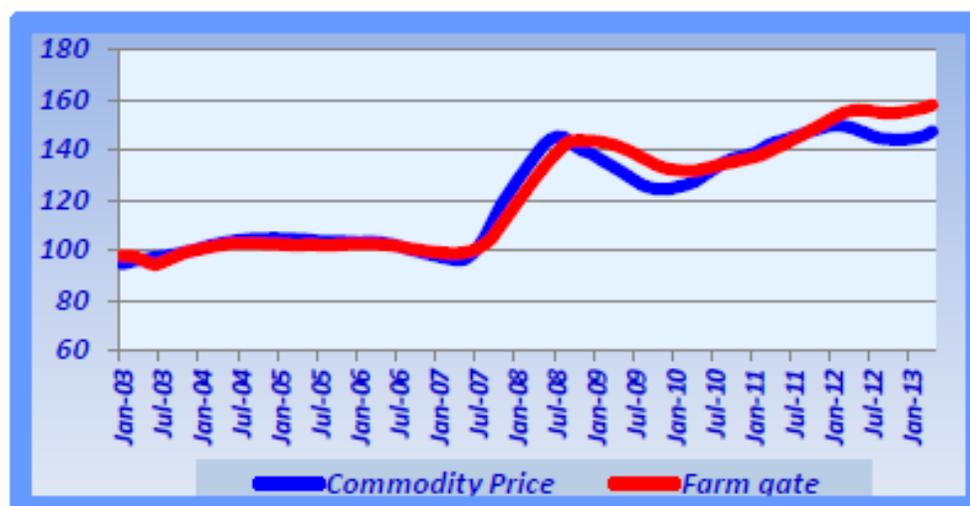
4.1.3 Profitability of the dairy farming industry

When considering the dairy industry as a whole, profitability is mainly driven by the cost of inputs (i.e. notably the cost of feed) and the price of milk (i.e. the main driver impacting revenue).

⁵² The Andersons Centre on behalf of DairyCo, 2013 *The structure of the GB dairy farming industry – what drives change?* Available From: < <http://dairy.ahdb.org.uk/resources-library/market-information/industry-structure/the-structure-of-the-gb-dairy-farming-industry-what-drives-change/>> [Sept 2015]

In deregulated markets like the UK, the prices of commodity products such as powder, butter and cheddar set the trend for farm gate price of raw milk, as most raw milk can be employed for different end uses. Also, the inherent volatility of milk supply affects commodity prices that tend to be cyclical.⁵³

Figure 15 -Farm Gate Price versus Commodity Price (Butter / SMP / Mild Cheddar) Moving Annual Mean



Source: Dairy UK.

When milk prices are high and costs of feed low (as was the case throughout 2014) dairy farming can generate significant returns. However, the complexity and cost levels of dairy farming systems vary widely within a region and from one region to the next, as evidenced by Table 5.

Table 5 - Ranges of Herd Sizes, Milk Yields, Costs of Milk Production and Milk Prices

Parameter	Unit	Minimum	Maximum
Herd size	Nos.	1	5000
Milk yield	Ton ECM/cow	0.55	12.38
Cost of milk production	US\$/100kg ECM	4.4	118.3
Milk price	US\$/100kg ECM	24.9	115.2

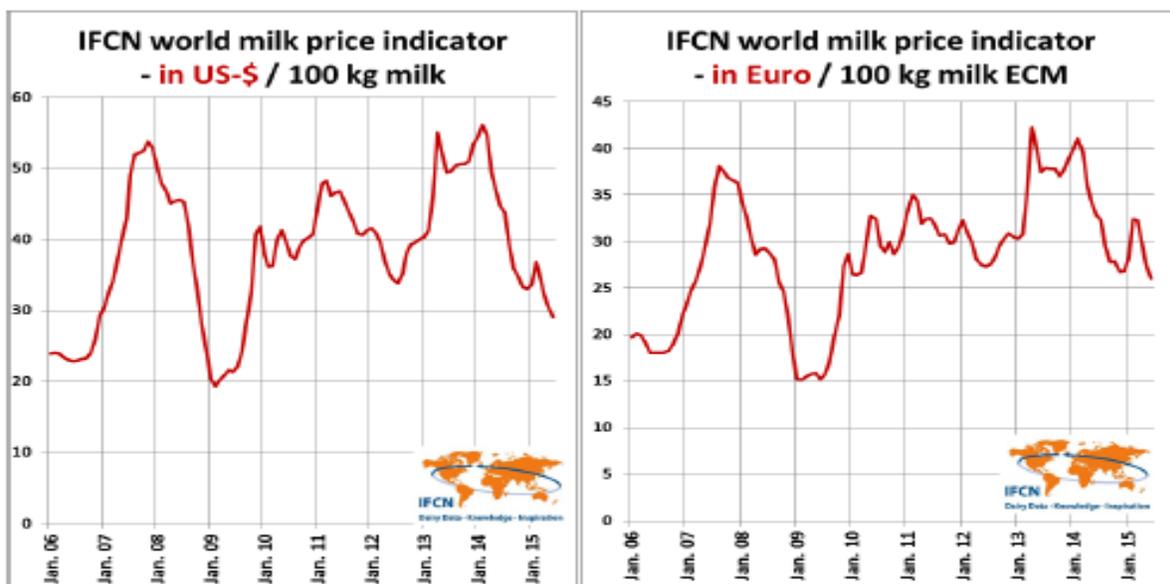
Cost levels for larger farms in key regions (US\$/100kg ECM)			
Western Europe	45-55	New Zealand	41
Poland	38	Brazil	39
Western part of USA	35	India	32
Eastern part of USA	44	China	55

⁵³ Dairy UK, 2013 *The White Paper 2013, A guide to the UK Dairy Industry* Available From: <<http://www.dairyuk.org>> [Sept 2015]

Source: IFCN.

As a result, any shock affecting milk prices or the cost of feed can jeopardize a dairy farm's profitability. For instance, world milk prices collapsed toward the end of 2014 arising in serious consequences for the global dairy industry. The sharp decline in prices resulted from an imbalance between world milk supply and demand. Favorable climatic conditions combined with the removal of EU quota encouraged an increase in milk supply despite low prices, while markets like Russia and China imposed import bans that depressed demand.

Figure 16 - World Market Price of Milk 2006-2015 in US\$ and Euro



Source: IFCN.

In countries where national milk prices are tightly correlated with world prices, farm profitability appears to have become problematic. In 2014 milk prices fell below production costs. As a result, and if milk prices do not appreciate, world milk production is expected to drop significantly, which would ultimately prevent milk supply from covering milk demand and thereby would put pressure on prices to go up.

It should be noted that the 2015 crisis is the third one faced by the dairy industry in eight years.⁵⁴ In 2012, the crisis was driven by feed price increases, whereas the 2009 and 2015 crises derived from a fall in milk prices.

4.2 Dairy processing

⁵⁴ IFCN, 2015 *Press Information, IFCN Dairy Conference 2015* Available From: <http://www.ifcndairy.org/media/downloads/Press_Information_EN_IFCNDairy_Conference_2015_dairy.pdf> [Oct 2015]

4.2.1 Types of Processing⁵⁵

Raw milk produced by dairy farmers can be turned into a variety of dairy products ranging from fresh pasteurized milk, to cream, butter, yoghurt or ice cream among others. For food safety and shelf stability purposes, one of the first steps in processing milk is usually pasteurization or Ultra High Temperature (UHT) treatment. In the pasteurization process, raw milk is brought to 72 to 75 degrees Celsius for 15 to 20 seconds, while UHT processing will heat milk to 135 to 137 degrees Celsius for three seconds. The shelf life of pasteurized milk will be about 5 to 15 days, provided appropriate cold chain infrastructure and services are used from processing to consumption, while UHT milk in a Tetra Pak will have a shelf life of up to six months without requiring refrigeration or preservatives.

4.2.2 Perishable Dairy Processing

Liquid milk tends to be consumed fresh, whether raw or pasteurized, by end consumers across the globe. When they are given the choice, consumers often prefer the taste of fresh milk over the one of UHT.⁵⁶ Margins on milk tend to be low and liquid milk is too bulky to travel long distances while remaining cost competitive. This is especially true for fresh pasteurized milk that is also perishable and requires additional costs for refrigeration during transportation. Therefore, almost all liquid milk is consumed or processed in the country of production, with only a little over 1% of the total volume crossing borders in liquid form⁵⁷ and as a result, the market for fresh pasteurized milk is essentially local⁵⁸ from milk production, to processing, to distribution.

Overall, the perishable dairy market is the main market in most developed countries where it has become a mature, low growth industry. It is enjoying much more robust growth in developing countries starting off a low base.

Pasteurization technology is relatively affordable, which, given the local nature of fresh pasteurized milk markets mentioned above, should intuitively lead to a multiplication of local market players in each geography. It appears however that substantial capital investments are needed to compete and that concentration is hard to avoid.

In the UK, where the market is principally focused on perishable dairy products, notably fresh pasteurized milk, concentration among processors is considered to be a little lower than in the rest of the EU. Yet, the figures below show that about 94% of liquid milk output is produced by only six firms with individual annual outputs exceeding 100,000 tons per

⁵⁵ Annex 1 details the processes that need to be followed to produce pasteurized or UHT milk, milk powder, butter and cheese.

⁵⁶ CORIOLIS on behalf of the New Zealand Pacific Economic Cooperation Council (NZPECC), 2014 *UHT Milk Value Chain* Available From: <<http://www.pecc.org/pecc/208-publications/540-nzpecc-global-value-chains-report>> [Oct 2015]

⁵⁷ CORIOLIS on behalf of the New Zealand Pacific Economic Cooperation Council (NZPECC), 2014 *UHT Milk Value Chain* Available From: <<http://www.pecc.org/pecc/208-publications/540-nzpecc-global-value-chains-report>> [Oct 2015]

⁵⁸ At the country or sub-national level depending on the country's size.

year. Likewise, a little less than 90% of cheese output stems from twelve companies producing each over 4,000 tons a year.

Table 6- Size Distribution of Dairy Companies by Annual Output of Liquid Milk and Cheese in England and Wales (2012)

Size Band (tonnes per year)	Companies Producing Liquid Milk		Volume of annual output	
	Number	% of Total	Thousand Tonnes	% of Total
Under 10,000	8	38.1	19.3	0.3
10,001 – 100,000	7	33.3	301.8	5.2
Over 100,000	6	28.6	5,428.2	94.4
Total	21	100.0	5,749.3	100.0

Size Band (tonnes per year)	Companies Producing Cheese		Volume of annual output	
	Number	% of Total	Thousand Tonnes	% of Total
100 and under	8	19.0	0.3	0.1
101 – 1,000	10	23.8	3.6	1.4
1,001 – 4,000	12	28.6	23.1	8.9
Over 4,000	12	28.6	233.5	89.6
Total	42	100.0	260.5	100.0

Source: Dairy UK, Defra.

Dairy processors in the UK, whether private or owned by cooperatives, are also investing in their processing facilities. The figure below shows high levels of capital investments by the top five dairy firms in the UK over the past few years, with sharp increases in 2012 and 2013. A striking example of this trend is the recent £150 million (about USD230 million) investment by Arla Foods to create a one billion liter liquid milk processing plant near London.⁵⁹

Table 7 - Capital Investment by the Top Five UK Dairy Businesses

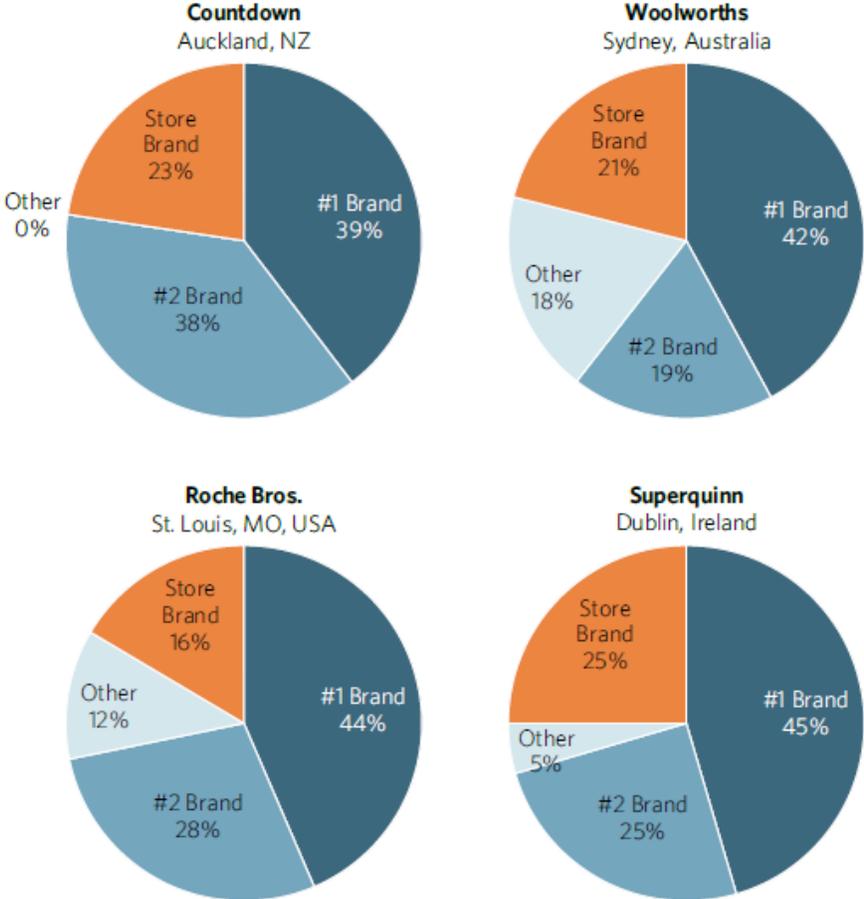
Year to March	Capital Investment (£m)
2006	104.5
2007	119.1
2008	139.2
2009	131.2
2010	126.9
2011	133.6
2012	209.9
2013	265.9

Source: Dairy UK.

⁵⁹ Dairy UK, 2013 *The White Paper 2013, A guide to the UK Dairy Industry* Available From: <<http://www.dairyuk.org>> [Sept 2015]

In fact, it is observed that, in most regions, fluid milk tends to be a regional duopoly complemented by a retailer store brand (see figure below).

Figure 17 - Share of Fluid Milk Items on Shelf by Firm Across Four Countries (% of SKU, August 2013)



Source: CORIOLIS.

One of the main drivers explaining this concentration of the supply of perishable dairy products within a given region could be the high logistical requirements imposed on the processor, such as the need to deliver perishable products several times a week, ideally to all the myriad of clients in its catchment area (from supermarkets, to convenience stores, restaurants or institutional clients like schools), which makes distribution a relatively expensive and capital intensive activity for processors.

Another aspect to consider is the need to offer a full range of dairy products (from whole, low-fat and flavored milk to cream or butter), particularly in order to service supermarket chains. In developed markets, supermarkets are the main market outlet for perishable dairy products. They belong themselves to a consolidated industry with high bargaining power toward suppliers and they capture a high and growing share of the perishable dairy market through their own store brand (see figure above).

The local nature of the perishable dairy market, with the need to source raw milk and sell processed perishable dairy products in a relatively defined geography, combined with the high concentration of processors, put the processor in a state of monopsony vis-à-vis dairy producers, in the sense that producers have limited alternative outlets for their milk apart from their local processor. This is one of the factors that have prompted the vertical integration of large cooperatives into processing (some of the largest dairy processors are cooperatives, like Fonterra).

This trend is currently intensifying. The low growth of the sector and the pressure on margins (notably from increased internal rivalry and increased bargaining power of retailers) in developed countries are making dairy processing less attractive for diversified large corporations, which are progressively being replaced by farmer owned cooperatives.

4.2.3 Non-perishable dairy market and UHT milk processing

As mentioned in the section above, the shelf-stable dairy market enjoys higher market shares in developing countries, especially dry and tropical countries near the equator, where consumers are more inclined to find and buy powdered milk or UHT milk due, notably, to limited access to fresh milk.

Milk powder is relatively inexpensive to transport. It is usually imported from milk surplus regions in New Zealand, Australia and the EU producing milk powder from excess seasonal milk. New Zealand is by far the largest market player globally with over 50% of cross-border export volumes.⁶⁰ As a result non-perishable products face significant global price pressures, as products can be more readily manufactured either from fresh milk in a dairy producing region or from reconstituted milk powder from anywhere around the globe.⁶¹

Milk powder can either be sold as powdered milk or used to produce consumable products like UHT milk. When producing UHT milk, the manufacturer has the choice between sourcing raw milk locally and using reconstituted milk powder. As a result, the availability of an aseptic packing line is extremely important.

The ease of procuring milk powder combined with the wide availability of Tetra-Pak machines for aseptic packaging makes production of UHT milk within reach in almost all geographies. Because of these low barriers to entry, UHT milk has also become a low-margin commodity sold mostly on price in a lot of markets. Prevalent consumer preference for the taste of fresh pasteurized milk further constrains the price of UHT milk that has to be sold at a discount to the one of fresh milk.

⁶⁰ CORIOLIS on behalf of the New Zealand Pacific Economic Cooperation Council (NZPECC), 2014 *UHT Milk Value Chain* Available From: <<http://www.pecc.org/pecc/208-publications/540-nzpecc-global-value-chains-report>> [Oct 2015]

⁶¹ Pasteurized perishable liquid milk can also be produced from reconstituted from milk powder. It is however most often processed from locally produced raw milk.

The production of UHT milk from raw milk remains however a capital intensive business. In a lot of developed markets, companies are able to produce at a low cost thanks to large-scale facilities that are mostly depreciated.

4.3 Cost structure

Because it is possible to produce UHT milk from either raw milk or powder milk, several approaches are available for a dairy company to insert itself into the value chain for UHT production.

Considering a dairy firm implanted in a country with access to low cost raw milk and considering targeting export markets, the company could:

- Process raw milk into retail UHT and either i) sell the UHT FOB to a distributor, or ii) establish its own sales and marketing team in the export market;
- Process raw milk into whole milk powder and either i) sell the powder FOB to another processor/distributor in export market, or ii) set up a processing plant to turn the whole milk powder into retail UHT.

The breakdown of the value captured by the different market players along the value chain in the scenario where whole milk powder is exported from New Zealand and then used to produce and then sell retail UHT in a market like the Philippines is shown in

Table 8.

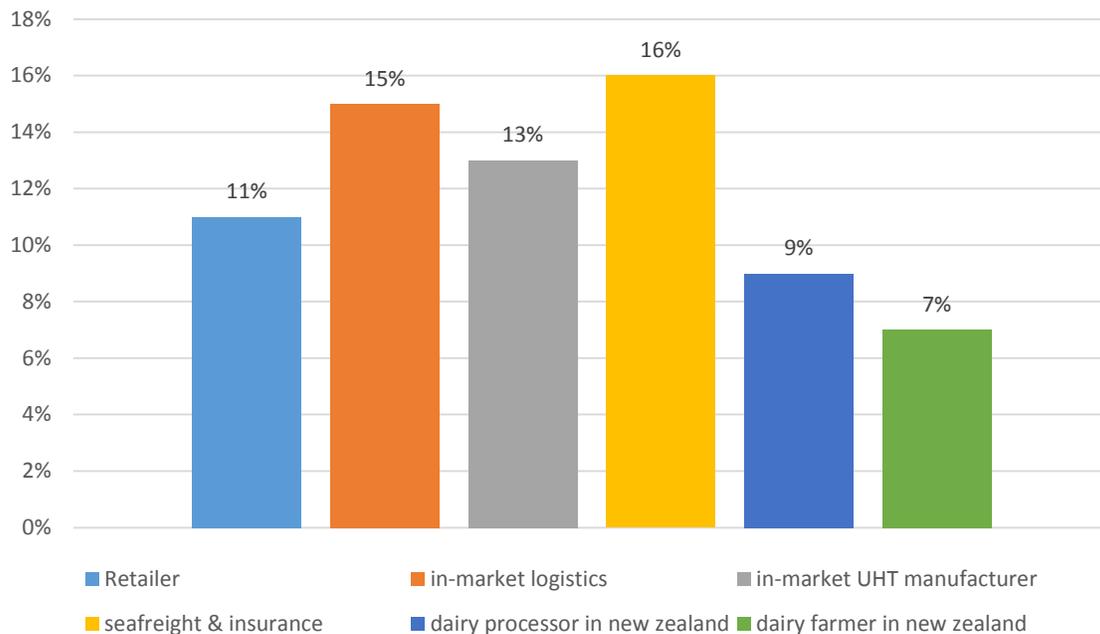
Table 8 - Breakdown of value capture from Retail Shelf Price of a Carton of UHT Milk through to Farm Gate Value to Dairy Farmer in New Zealand (NZ\$, 2012)

	Value Capture
Dairy Processor	0.13
Freight and Insurance	0.02
Manufacturer	0.92
Retailer	0.28
GST	0.21
Total (retail price)	1.73

Source: CORIOLIS.

By capturing their respective slices of the value along the chain, each market player will be able to achieve positive returns on assets, as described in Figure 1Figure 18.

Figure 18 - Return on Assets by Stage of the Given UHT Milk Value Chain (% EBITDA to Total Assets, Model)



Source: CORIOLIS.

5 Substitutes

In wealthy developed markets, substitutes for milk as consumed by adults are essentially any beverage. Sweetened beverages have been a primary competitor for many years, growing in market share until only recently when sugary sodas have become less popular (declining year on year for 10 straight years). In the United States, for instance, based on data from the 1994-1996 Continuing Survey of Food Intakes by Individuals “for each 30-mL reduction in milk consumption by children aged 5–18 years, there is an approximately 126-mL increase in sweetened beverage consumption, with a net increase of 31 kcal (130 kJ) and a loss of 34 mg of calcium for each 30 mL of milk displaced.”⁶²

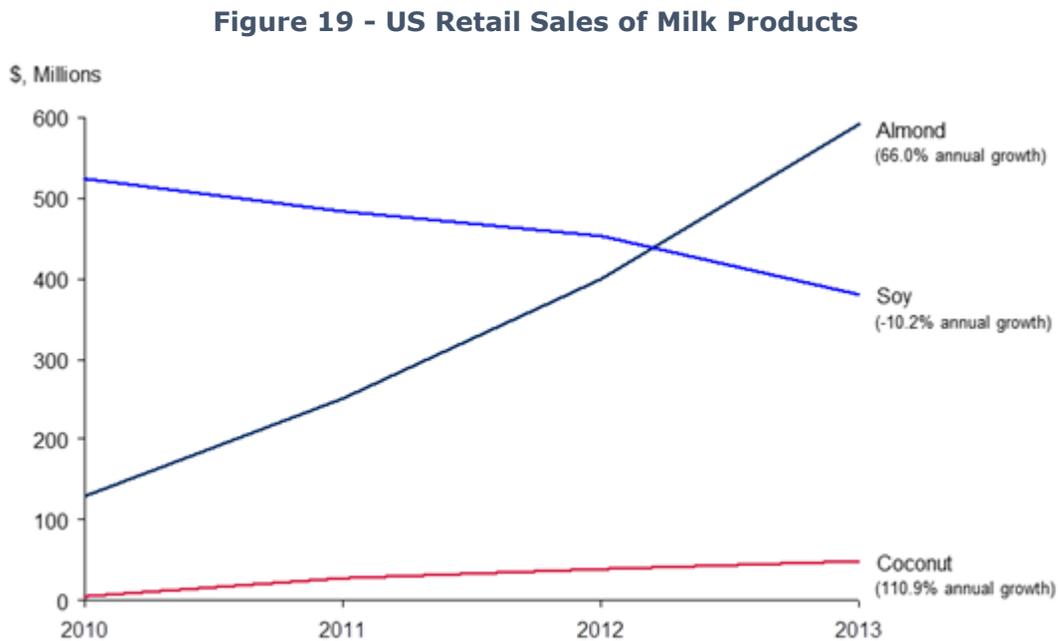
Dairy milk has traditionally been attractive amongst young toddlers as it is an easily-digestible, often-easy-to-access liquid foodstuff that is rich in protein and calcium.

⁶² Dror D., Allen L, 2013 Dairy product intake in children and adolescents in developed countries: trends, nutritional contribution, and a review of association with health outcomes Available From: <<http://kasb-kar.ir/upload1/Pro100.pdf>> [Sept 2015]

5.1 Plant-Based Milk Alternatives

Driven in large part by an increasing awareness of lactose intolerance, there has been a marked increase in the production and consumption of milk alternatives made from rice, almond, soy, coconut, hazelnut and other non-animal products. 2013 saw an increase of 30% in sales of milk alternatives compared with an increase of just 1.8% across entire milk category⁶³ and constituted 20% of the dairy sector in the US in 2014⁶⁴. General health and well-being is also increasingly associated (in western cultures) with reduced dairy intake – considerations which are often synchronous with environmental consciousness. However milk alternatives have come under fire in recent years for their negative affects they pose to the environment.

Figure 19 shows sales trends of leading alternative milk products as compiled by Nielsen between 2010 and 2013. As can be seen Almond milk had been enjoying a steady rise over the experience at the dogged expense of a decline in sales of Soy Milk.



Source: Reproduced from FoodBevBiz. Data from Nielsen Scan Market

Almond Milk has reportedly continued to rise in popularity, having seen a 40% increase in sales from 2013 to 2014, and completely overshadowing Soy Milk whose milk share

⁶³ Allen. J, 2014 *Got milk? From a cow or a plant?* Available From: <https://www.washingtonpost.com/news/to-your-health/wp/2014/06/10/got-milk-from-a-cow-or-a-plant/> [Sept 2015]

⁶⁴ Bizzozero J., 2015 *Dairy Alternative Market Growth Led by Almond Milk* Food Product Design Available From: <<http://www.foodproductdesign.com/blogs/trending-foods/2015/05/dairy-alternative-market-growth-led-by-almond-mil.aspx>> [Sept 2015]

(approximately 30%) is now only half that of Almond Milk (approximately 60%) (Food Navigator, 2014⁶⁵).

This decline in sales of Soy Milk vis-a-vis Almond Milk may be due to their nutritional content. Table 9 compares the nutritional content of a number of milk alternatives based on a sample of 20 readily available milks and milk alternatives⁶⁶. As can be seen, Almond Milk has the lowest calorie-count. However, although it has more calcium on average than Soy, the latter is lower in fat and higher in protein. It is also cholesterol free and low in Sodium.

Table 9 - Milk and Milk Alternatives Comparison Chart

	CALORIES	FAT/SATURATED	PROTEIN	CARBS	FIBER	CALCIUM	VITAMIN D
COW'S	80-150	0.5-8 g fat/ 0-5 g saturated	8-9 g	12-13 g	0 g	30% DV	25% DV
GOAT'S	90-150	2.5-8 g fat/ 1.5-5 g saturated	7-8 g	9-12 g	0 g	30% DV	< 30% DV
SOY	60-130	2-6 g fat/ 0-0.5 g saturated	4-12 g	5-15 g	0-4 g	4-30% DV	< 30% DV
RICE	110-120	2.5 g fat/ 0 g saturated	1 g	20-24 g	0 g	2-25% DV	<25% DV
ALMOND	60-80	2.5-4.5 g fat/ 0-0.5 g saturated	2-9 g	5-11 g	0-4 g	20-30% DV	< 25% DV
HEMP	110-130	3-7 g fat/ 1 g saturated	4-5 g	6-20 g	1 g	2-46% DV	< 25% DV

Source: *Eating Well*, 2015

Perhaps then the decline in Soy milk is more to do with environmental concerns particularly as it relates to deforestation and the associated regulatory tolerance for the toxic herbicide glyphosate (commercially known as Roundup).

Emerging milk alternatives include Hemp milk which as can be seen in Table 9 can be very high in calcium.

5.2 Animal Milk Alternatives

And a significant number of people are opting for lactose reduced or lactose free milk. Goat's milk is a natural alternative to cow milk and can comfortably be consumed by many

⁶⁵ Food Navigator, (2014), "Almond Milk Accounts for Two-Thirds of Sales in Plant-Based Milk Category." Internet access: <http://www.foodnavigator-usa.com/Manufacturers/Almond-milk-accounts-for-two-thirds-of-sales-in-plant-based-milk-category-says-WhiteWave-Foods>

⁶⁶ *Eating Well*, 2015 *A Buyer's Guide to Milk Alternatives* Available from: http://www.eatingwell.com/healthy_cooking/healthy_cooking_101/shopping_cooking_guides/a_buyer_s_guide_to_milk_part_ii [Sept 2015]

patients who suffer from cow milk allergies or sensitivity. Although goat milk, like cow's milk and human milk, contains lactose, many people with lactose intolerance can drink goat milk. It has been hypothesized that the reason lies in goat milk's superior digestibility. Goat milk is more completely and easily absorbed than cow's milk, leaving less undigested residue behind in the colon to quite literally ferment and cause the uncomfortable symptoms of lactose intolerance.

Goat milk is slightly higher than cow's milk in fat content. Higher fat content increases the amount of cheese that can be produced per gallon of milk, this fact contributes to goat milk's popularity in cheese making.⁶⁷

However the supply of goat milk is far shorter compared to cow milk; it accounts only about 2.7% of global milk production compared to 83% for cow milk. Asia is the leading producer of goat milk followed by Africa, Europe and the Americas.⁶⁸

⁶⁷ USDA. The Goat Industry, Structure, Concentration and Growth. Print

⁶⁸ Agatha, Popescu. "Study Regarding The Trends In The World And European Goat Milk Production", Scientific Papers Series Management, Economic and Engineering in Agriculture and Rural Development 15.1(2015). Print

6 Sub-Annex 1: Milk Processing, Step by Step⁶⁹

Figure 20 - Pasteurisation Process

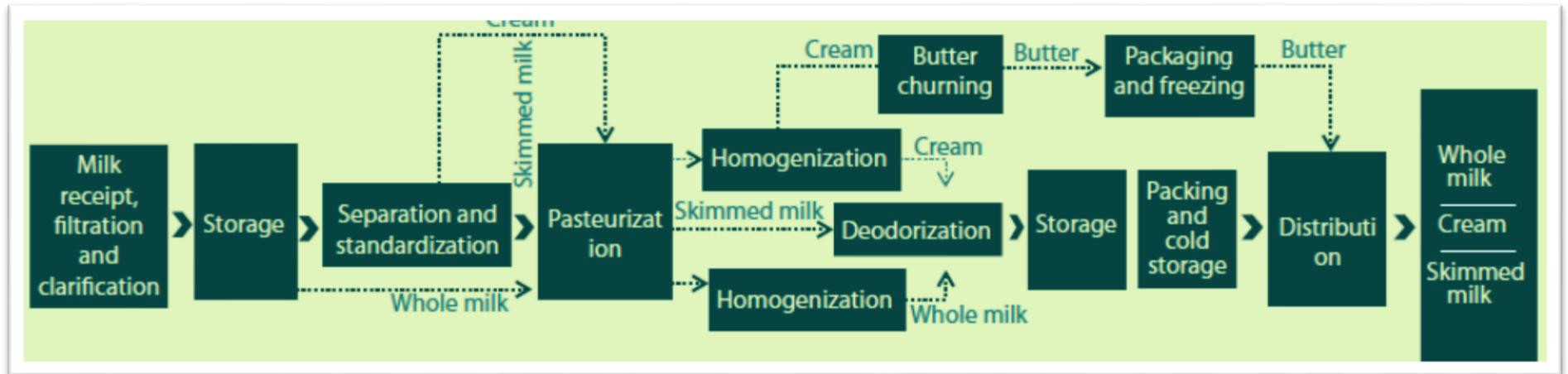
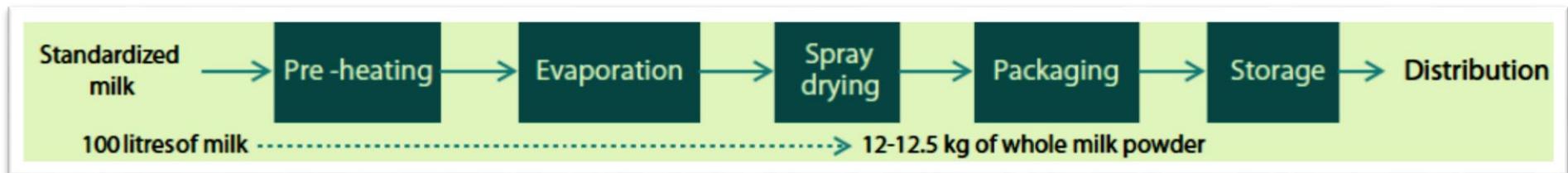


Figure 21- Powder Production Process



⁶⁹ Board of Investment Bangladesh

Figure 22 - Butter Production process

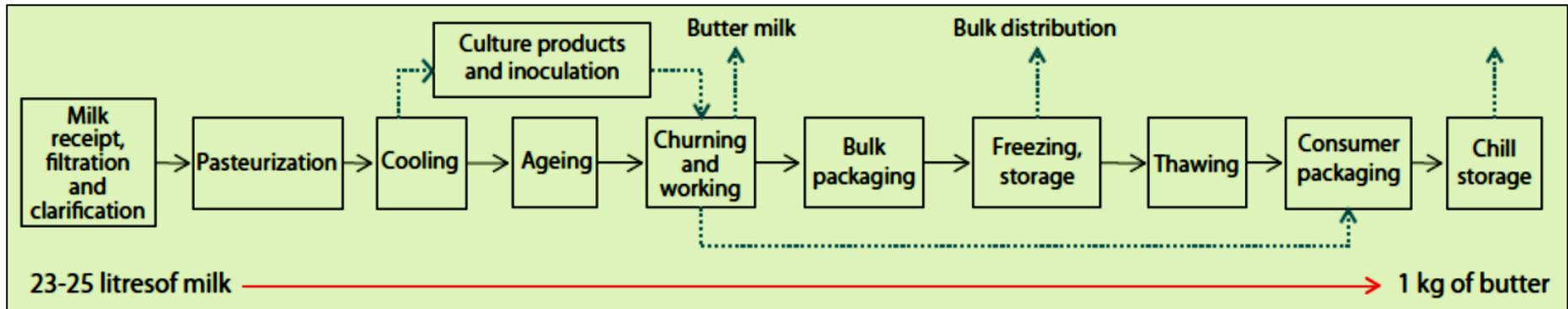


Figure 23 - Cheese Production Process

