A Nuffield Farming Scholarships Trust Report

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Does the family dairy farm have a future?

Trevor Alcorn

August 2016

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A Nuffield (UK) Farming Scholarships Trust Report

Date of report: August 2016

"Leading positive change in agriculture. Inspiring passion and potential in people."

Title	**Does the family dairy farm have a future?**
Scholar	Trevor Alcorn
Sponsor	The Thomas Henry Foundation
Objectives of Study Tour	• What lessons can be learnt from large dairy farms, that may help ensure the future viability of the family dairy farm? • What options are available to help family dairy farms survive? • What is the most appropriate production system within the constraints of Northern Ireland?
Countries Visited	Germany, Denmark, Ireland, UK, USA, China and France
Messages	There is a future for many, but not all family dairy farms: to survive however – • They must improve all aspects of farm efficiency • Be prepared to adapt and innovate – grasp opportunities when they arise • Further develop both technical and management skills • Access outside support and advice to aid management decisions • It is a business – cost of production, margins/profit are important • Growth is good but at a manageable/ sustainable level that you are comfortable with • Consider collaboration with other farmers to improve efficiencies

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DISCLAIMER

The opinions expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, or of my sponsor, or of any other sponsoring body.

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Chapter 1: Introduction

I live on the outskirts Omagh, Co Tyrone, with my wife Barbara. Our family has farmed in this area for generations and whilst it is an attractive green and undulating countryside, it does have its challenges – heavy clay soil with almost 1500mm of rainfall annually.

Having grown up on the family dairy farm, I completed an HND in Agriculture at Greenmount College before going on to Queens University where I obtained a degree in Agriculture. During this time, I had work experience placements in Holland and British Columbia, Canada, which gave me a taste of travel and agriculture on a world wide scale. The Young Farmers Clubs of Ulster also gave me an opportunity to develop new skills at this time, as well as take part in the exchange programme to Sweden, European rally to Poland, and various other destinations.

My parents moved to the current farm when it was purchased in 1974 and began milking cows on it in 1980, gradually building it up to the current 200 cows, plus followers, on 110 hectares of grassland. It is fairly typical of many Northern Ireland dairy farms with Holstein cows being grazed from mid April until late October and then housed during the winter months, being fed a diet of grass silage and concentrates.

I work full time off farm as a dairying advisor for the College of Agriculture Food and Rural Enterprise. My work is varied and includes giving technical advice on cost of production, building design, farm walks and, more recently, facilitating discussion groups. It is both challenging and rewarding and I enjoy the interaction with farmers on a regular basis.

Most of my spare time is spent on the farm; however I am actively involved in the local community and farmers' groups, various committees, steward at our local agricultural show and act as president of Clanabogan Young Farmers Club.

Figure 1: That's me, Trevor Alcorn, the author

Chapter 2: Background to my study topic

The Northern Ireland (N.I.) dairy industry, like that in many other countries around the world, is still very much family farm based. Some 2742 dairy farms in N.I., with an average of 88 cows producing almost 7500l/cow, are key to this.

This equated to 2.262 billion litres produced in 2015, of which only 12% went into liquid milk. Approximately 85% of this production will be exported in the form of cheese, whole milk powder, skim milk powder and various other products. This dependence on exporting means a very volatile milk price, something which the industry as a whole has difficulty managing.

During the last decade there has been a 17% decrease in the number of dairy farms, while 40% more milk has been produced. An increase of almost 2000l milk/cow over the same period can account for some of this, but the reality is that farms are getting bigger and herd size is increasing. How does this compare to other countries in the world?

With the abolition of milk quotas in the EU in 2015, Common Agricultural Policy reform ongoing and now Brexit, are we in a period of even greater market instability? This is on the back of an already prolonged period of poor milk prices. Just how much longer can some dairy farms keep going on and, if they can, how long will it take them to bring their business back to profit?

As I come from a family dairy farm and my job is based around working with dairy farmers on a daily basis, their future survival is a subject which concerns me deeply. Whilst I have said that herds are getting bigger in N.I. and milk output is increasing, is it increasing at a fast enough rate or is this even the right direction to be going in?

We only have to look at how all the high streets in the UK have changed over the years: from numerous family run independent stores, to the now bland and faceless chain stores. Are dairy farms going to go the same direction with an increasing number of large scale dairies under corporate ownership?

How can the family dairy farm in Northern Ireland compete with the large scale dairy farms in the U.S.A or China? Are they efficient enough to survive? How does their cost of production compare? Are there any ways of reducing market volatility to help stabilise milk price?

These are all the questions - and more - that I hope to find answers to during my study.

Chapter 3: My study tour

Where I went and why I chose those countries

Germany – June 2015/ September 2016

Based in eastern Germany (June 2015) to attend the European Dairy Farmers Congress "25 years of entrepreneurship – always looking to the future". How farms have developed since the reunification of Germany, to visit large scale, family and cooperative businesses.

Bavaria, Southern Germany (September 2016) to visit small scale farms determined to stay in business by diversifying and innovating.

Denmark – June 2015

Family dairy farms that have gradually developed into larger scale, labour-efficient and diverse businesses, with the ambition to succeed.

County Cork, Ireland – July 2015

Family farms, expanding their low cost, grass-based, spring block calving dairy herds and their plans for the post quota era.

USA – September & October 2015

I took part in the "Zinpro three trucks trip" and the "International dairy short course" while also attending The World Dairy Expo in Madison.

Dairying at its best, combined with family farms of all sizes and various diversification businesses. I visited farms in the states of Minnesota, Wisconsin, South Dakota, Iowa, Illinois, Missouri and Pennsylvania.

United Kingdom - throughout 2015 & 2016

To look at the various intensive and extensive dairying systems, family-managed, which are upscaling or diversifying.

China - April/May 2016

Largest importer in the world of dairy products and currently undergoing a massive transition in milk production, from a diminishing number of small family farms to the creation of large scale corporate dairy farms.

France - June 2016

Another European Dairy Farmers Congress, based in North West France on the theme of “Think differently, think diversity”. Family farms with a collaborative approach, diversification and a very healthy outlook on lifestyle.

Figure 2: Locations of my visits.

Chapter 4: What is a family dairy farm?

Before starting into the main part of the report I feel that there needs to be a bit of a debate around what is meant by a family farm. I don't think that there will be a definitive answer. I could quote various definitions and I did ask a lot of farmers on my travels what their view point was on this question. I came across this interesting quote below which set the scene for my study.

> ***" …. there would be less confusion if politicians and policy makers would specify 'the small farm' or the 'family worked farm' if this is what they mean, rather than introduce references to 'family farming' which, while having a certain emotional appeal, may not even mean very much. It is after all, a great mistake to be influenced by an over-romantic view of the family farm". (Gasson et al, 1988)***

Small farms are generally family farms, however not all family farms are small – here are a few examples I came across while on my travels:-

- **When visiting Co Cork** I was asked to a dinner party one evening, which was being hosted by a fellow Nuffield Farming Scholar. During the dinner I was in deep discussion with one of his dairy farmer neighbours who had 800 cows. I said to him, "Surely you don't consider your farm to be a family farm?" He took great objection to my statement and told me quite the contrary, that he employed eight people on his farm, who all had families and that he was the equivalent of eight family farms.

- **Crave Brothers, Wisconsin.** On another occasion when in Wisconsin, I visited the Crave Brothers' farm and cheese business. This consisted of 1500 cows with a herd average of 15,000 kg per cow, farming 1700 acres. They then processed their own milk into various types of cheese at a processing plant close by.

  This business was started with the purchase of the farm in 1982 by the four brothers. They gradually built it up to what it is today with 27 employed on the farm and the same again employed in the cheese business. The next generation is now also involved in the business and succession plans are in place for a smooth transition.

  Each family member plays a key role in the business and is responsible for a different aspect of it. This is a family business, but very different to what we are used to in Northern Ireland.

Figure 3: The Crave Brothers

From my point of view during this study, I took a family farm to mean a typical farm in Northern Ireland, where the family are all involved either on a part or full time basis and do the majority of the work, but may still have one or more employees. Herd size can range from 40 cows to 400 cows in the extreme, but typically is from 70 – 250 cows. N.I. is unique in that the vast majority of these farms are still family owned and operated.

4.1. Dairy farm structures on a worldwide basis

based on an estimation from IFCN (International Farm Comparison Network)

- **Households –** 78% of all farms worldwide – 33% of the world's production.
  Based on very small farms with 1-3 cows, milk is produced as a source of income, 50% is consumed directly, with the remainder being sold for cash for living expenses.

- **Family Farms** – 22% of all farms worldwide – 33% of the world's production.
  Farm work is mainly done by family members. Farms generally have 10 -100 cows (300 in a developed country). Milk is produced and sold for income.

- **Business Farms** – 0.3% of all farms worldwide – 33% of the world's production
  Farm work is mainly undertaken by hired labour. Farms generally have >300 cows (developed countries). Return on investment (or other indicators of profitability) is expected and must be generated.

Chapter 5: Can dairy farmers be classified into different groups?

Just a short time into my USA travels I had the pleasure of meeting Dr Gordie Jones, a veterinarian and partner at Central Sands Dairy in central Wisconsin. Again discussing the definition and future of family dairy farms, Gordie outlined to me what he believed were the four broad categories that dairy farmers could be broken into. I found this a very relevant and useful template which I have subconsciously used on many farms throughout my travels.

Figure 4: Dr Gordie Jones, partner of the 4200 Jersey Herd at Central Sands Dairy, Wisconsin

These four broad categories were:

Sunset farmer

- No successor
- No significant debt
- Generally, a moderate level of overall farm performance
- Happy to coast along until he/she decides it's time to stop

Lifestyle farmer

- Has chosen that way of life
- Partner works off farm
- May work part time off the farm
- Likes the countryside environment, good place to raise a family
- Use of labour saving devices, robot milker/scraper/ feeder

Niche farmer

- Adopted some type of diversification/added value to supplement farm income
- Pedigree genetics/stock sales
- Ice cream, yoghurt or cheese production
- Organic or specific quality of milk to meet market requirement
- Open farm/shop or adventure type park

Commodity farmer

- Managed like a corporate business – profit driven
- Large scale
- Focus solely on milk production
- High degree of technical competence and efficiency
- Significant debt burden
- Progressive go-ahead business with ambition

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I will now detail my findings from the various countries I visited.

Chapter 6: Germany

Germany is Europe's largest milk producer and is ranked 15th largest milk producer in the world. It is a country with a wide and varied history, not only in politics, but in agriculture as well.

Table 1. Snapshot of Germany

Human population	80.62 million (2013)
Number of dairy farms	76,893
Number of dairy cows	4.26 million
Average herd size	55.5 (2014)
Average milk yield	7,352kg
Annual milk production	31 billion litres

I visited Germany for several reasons:-

- To shadow a former small dairy farmer from Northern Germany who is now managing four large cooperative farms in Eastern Germany.
- To attend the European Dairy Farmers (EDF) Congress – "25 years of entrepreneurship – always looking to the future".
- To see first hand how the small family dairy farms in Southern Germany have adapted and innovated to ensure their future.

The EDF Congress was based in Rostock, which is situated in the state of Mecklenburg Vorpommern, North East Germany.

Table 2. A breakdown of farm ownership in Mecklenburg Vorpommern state

Type of farm	Number of farms	% of the land	Average size(ha)
Farm companies	700	41	714
Family farms	3,850	30	129
Farm partnership	840	29	465

Table 3. A breakdown in the range in size of dairy farms in Mecklenburg Vorpommern state

Dairy Farms	Number of Cows	Total Cows
318	1 – 50	3,131
138	50 – 100	10,326
184	100 – 200	26,235
121	200 – 300	30,014
191	> 300	102,624

6.1 Farm structure

While many countries have a colourful history in terms of various land reforms over the years, Eastern Germany in particular has a story worth telling from the end of the Second World War.

After World War 2, Eastern Germany was under Soviet control; there was lack of any real infrastructure, poverty and hunger were rife. To resolve these issues agricultural reform was needed, followed by various government policy changes:

Agrarian Reform 1945 – 1949
Existing properties of over 100hectares (3.3 million ha/ 35% of farmland) were split up to create:

- 200,000 new farms averaging 8.1ha – selling or renting of this land was forbidden.
- 1100 state farms – 700 arable and 400 livestock
- Local facility to rent out machinery to farm the land

Collectivisation 1952 – 1960
SED (Socialist Unity Party) decided on Collectivisation to :

- Improve productivity and structure
- Socialist means of production
- Many of the small farms recently established joined first (8ha)
- larger private family farms (>20 - <100ha) had to supply their produce to the state
- pressure mounted on these farms by propaganda and criminalisation to become collectivised

By 1960 the process was complete with some 19,000 collectivised farms farming 84% of the farmland, with an average size of 600ha. During this time some 15,500 farmers left for the west, with virtually no private family farms remaining.

Industrialisation 1968 – 1975
By 1968 the decision was made to enlarge the collective farms to areas over 4000ha and specialise either in arable or livestock production.

These were either run as a cooperative, where the workers had a say, or as a state farm where they were just employees.

By 1985 in Eastern Germany there were –

- 465 state farms
- 3,855 cooperative farms

Reunification of Germany 1989 – 1991
After the fall of the Berlin Wall on 9th November 1989 and the reunification of Germany, reorganisation of the entire economy and a special agricultural adaption law.

- Land reform was not attached
- Collective/State farms had to liquidate or form a new legal setup
- At this stage, members could decide to stay or leave
- Land ownership and shareholding for members had to be agreed

This resulted in 3000 reformed collective farms averaging 1100ha and the formation of many more private family farms.

Figure 5: A recently installed automated feeding system on a 50 cow Fleckvieh farm in southern Germany

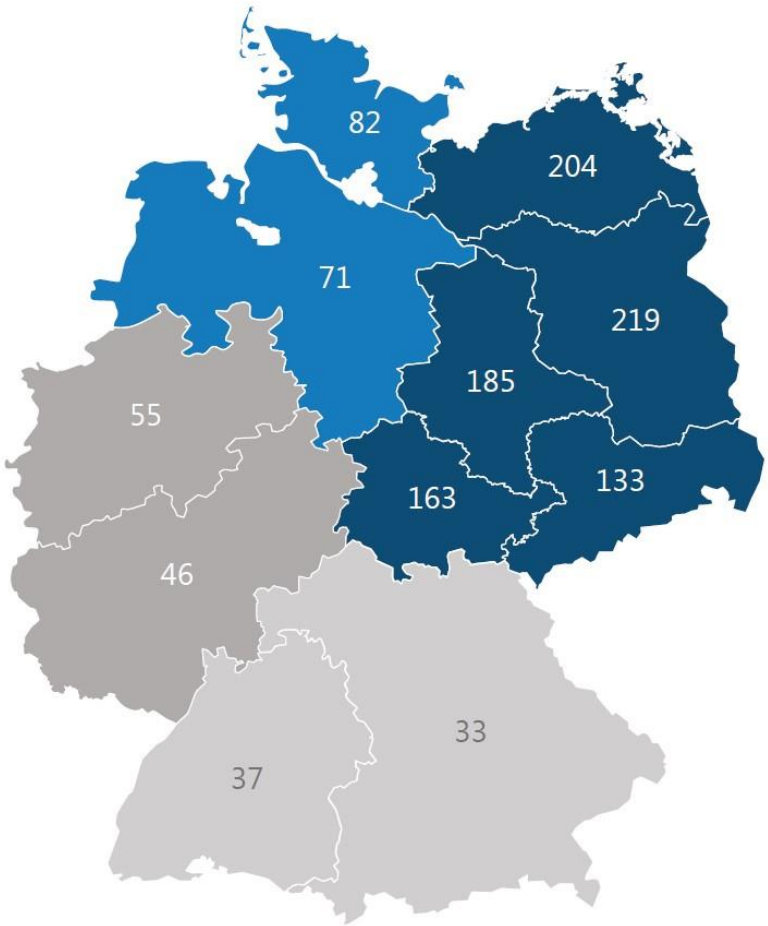

Figure 7. Average dairy herd size in the different regions of Germany today

6.2 Grasping opportunities

From small family farm in Lower Saxony to a large scale family dairy farm in eastern Germany

Figure 6: European Dairy Farmers in front of the maize clamp on Ecki's farm

Ecki Meiners saw his opportunity after the fall of the Berlin wall. Coming from a small family farm in Lower Saxony, Northern Germany, he bought a former agricultural cooperative in 1991, near the village of Butzow, Eastern Germany.

Starting off with 170 cows and 900,000 litres of milk quota, tie stall barns and an old milking parlour situated out in the fields, he started to develop the farm.

Initially buildings were restructured to incorporate cubicles and a milking parlour. Expansion got under way and today the herd stands at 630 cows plus followers, a 650kw biogas plant, on-farm veterinary practice and 696 hectares of farmland.

Cows are housed full time yielding 11,305 litres/cow/year at 3.87% butterfat and 3.29% protein. Over 20 staff are employed and this, along with the continuous expansion, proved to be very challenging.

Plans are in place to expand the herd to 1400 cows after a new barn is completed, and the possibility of another future diversification project.

The challenges that Ecki had to overcome during the development of the family farm:

- managing employees – delegating rather than doing
- getting the business established – new farm, new challenges and lots of work
- managing high levels of debt – finance the farm, buildings and expansion
- integration in the local area both at a business and social level
- rising land prices – to buy and rent, largely due to the popularity of biogas
- government regulations

6.3 The people

Figure 7: Ekkehard, farm director, on the right, along with his dairy consultant, centre, and one of the dairy herd managers

It would be very remiss of me not to mention people in this report. They are key! Regardless of the type or size of business we cannot underestimate their importance.

6.3.1 A real people person

During my travels I met many fantastic people, but one who stood out to me was a farm director whom I had the pleasure of shadowing for a few days while in Eastern Germany.

Originally from a small family dairy farm in Northern Germany, where opportunities were limited, the farm soon became no longer viable. Ekkehard also worked off farm as a farm business consultant. As this business grew he saw the opportunities in the east of the country and took over the management of one former cooperative farm.

This proved to be a great success and gradually other cooperative farms asked if he could help manage them as well. Today 4 separate cooperative farms are managed by Ekkehard amounting to 6500 hectares of land and some 15 million litres of milk produced.

Whilst they are 4 separate cooperatives and they are in relatively close proximity, Ekkehard has pooled and refined many of the resources to cut costs. Inputs are bulk purchased and many of the outputs are marketed together.

The business is very diverse. Apart from the main dairy, beef, pig and arable enterprises, there are also:

- butchery business/farm shop

- sales vans visiting country markets
- grass seed production
- cafe/restaurant
- horse livery
- quarantine facilities for exporting cattle
- office space/meeting rooms

While each area of the business has a manager and there are in the region of 100 staff, Ekkehard knows them all on a personal basis. After visiting many of the different sites with him, I found he knew each and every staff member, would ask how their family was keeping, and was quite happy to have a detailed discussion about the current job in hand.

However, when discussing his fantastic people skills, he told me that they were still his greatest challenge. Due to the nature of the cooperative farm structure, many of the staff can either be shareholders or own the land that is farmed. These all have to be kept on board by:

- regular meetings
- informal conversations
- praise/motivation
- getting to know them on an individual basis

As farm director he is paid by the shareholders to run an efficient and profitable business. There is a fine line between pushing too hard and rocking the boat, especially when many of the shareholders are also employees or land owners, so compromises have to be made.

Good communication is key!

> What relevance has this in relation to the future of family dairy farms? I have touched on various topics so far, many of them in relation to larger farm businesses. But for a family farm they are just as important, even if someone is employed for the occasional relief milking. If there are any thoughts or plans of expansion or diversification, people will be key. Farmers who have gone through this process found managing people the most challenging aspect.

6.4 Take home messages from Germany

- Opportunities do exist, some are not for the faint hearted!
- Positive mindset is required for success
- Farmers are prepared to adapt, innovate and expand to survive
- Government policy had and still has a major influence on German agriculture
- Large farms, managed with a high degree of technical efficiency (eastern Germany)
- Diverse businesses – eggs aren't all in one basket – biogas, photovoltaics, wind energy and arable
- Diverse range of farm and herd size, many family farms throughout Germany
- People are your biggest asset – keep them on board
- Communication is key – with family and employees

Chapter 7: Denmark

The Danish dairy farmers are often regarded as being the world leaders when it comes to dairy farming. This has been achieved by their progressive nature, combined with top class technical knowledge, labour efficiency and the rapid rate of genetic improvement in their dairy cattle.

Table 4. Snapshot of Denmark

Human population	5.68 million
Number of dairy farms	3,428
Number of dairy cows	570,000
Average herd size	166 cows
Average milk yield	9,961kg
Annual milk production	5.3 billion litres

7.1 Farm structure

Regardless of their progressive nature, the number of dairy farms in Denmark are in decline. The table below illustrates the following points over the years of 2005, 2011 and 2015:

- The number of dairy farms decreased from 6,253 in 2005 to 3,428 in 2015
- The number of farms producing under 250,000 litres dropped the most
- There was a reduction in the number of farms producing under 1,250,000 litres
- There was a large increase in farms producing over 1,500,000 litres right up to over 5,000,000 litres

Table 5. A breakdown in the number of dairy farms and the amount of milk produced

	Number of farms		
000 litres produced	**2005**	**2011**	**2015**
<250	1,220	455	244
250-500	1,335	541	384
500-750	1,054	477	321
750-1000	949	471	326
1000-1250	945	594	380
1250-1500	394	460	413
1500-1750	153	306	296
1750-2000	83	213	234
2000-2250	42	146	173
2250-2500	27	93	111
2500-3000	27	145	194
3000-3500	11	68	125
3500-4000	5	41	65
4000-5000	6	44	82
>5000	2	21	80
Total no of dairy farms	**6,253**	**4,075**	**3,428**

Source – Danish Dairy Board, Danish Agriculture & Food Council

The reduction in the numbers of dairy farmers has not had any adverse effect on overall milk production, as this has been met by an increasing herd size and a significant improvement in milk yield (1985: 6000 litres, 2015: 10,000 litres).

Family farms still dominate in the country, with a lot of the labour employed being from eastern Europe and further afield.

7.2 High output, total confinement

Figure 8: Cows at pasture, now a rarity in Denmark

Traditionally cows in Denmark were always grazed. However as herd size has increased, farms gradually moved to fully housed systems. This housed system now dominates, particularly with larger herds, although the occasional herd, with access to enough land around the yard still grazes by day.

Housing cows full time has also allowed them to express their full genetic potential with many of them yielding 11-12,000 litres per year. This comes from a diet of high quality maize and grass silage.

7.3 Managing debt

Danish farmers are also well known for their high levels of debt, which currently stands in the region of 20,000 euro per cow. This accumulated over the years for a number of reasons:

- **Succession** – the successor to the farm has to buy the assets from their parents at 85% of the market value. It is normal for the debt to be passed on from one generation to the next.
- **Land price** - between 2003 and 2008, land price rose in the region of 80%, encouraging farmers to borrow more against their land value.

- **Expansion** – instead of paying down debt in times of good returns, many farms chose to continue expanding their businesses.
- **Investment** – due to the strive for efficiency, a lot of investment was made on improving/ replacing buildings, to improve both labour efficiency and cow comfort.

Land prices have halved from their peak in 2008, which has left 30% of full time farmers in negative equity. Combined with a poor milk price, this resulted in 100 dairy farmers going bankrupt in 2015, and the number increasing for 2016.

The Danish dairy farmers are accustomed to debt; it just depends what level that they are comfortable with. As one quoted to me "*debt drives performance*" so they have to be efficient operators and do their best.

7.4 Labour efficiency

While in Denmark I saw many examples of excellent labour efficiency, including the following examples -

- On one dairy farm a number of fields were combined to create one which was 1.5km in length and another 1km long, allowing a total of 120 hectares to be mowed without having to fold up the mower.
- A large beef unit which bought 2-week-old Holstein bull calves and finished them at 10 months old. They finished approximately 2000 cattle per year using only 1.5 labour units in total. Calves were fed by automatic calf feeders in groups of 33. After weaning they were moved into a 40-bay (192 metres/ 630 feet) shed. They were automatically bedded with straw twice a day and fed concentrates by an automatic feeder running on a mono rail.

Figure 9: Automatic straw dispenser for bedding cattle, working in a 192-metre long cattle house

7.5 The ambition to succeed

I visited five Danish farmers who came from Holland during the 1990s. This was at a time when land prices were high and it was hard to get a sizeable area in Holland. They saw Denmark as the land of opportunity, with sizeable blocks of good quality, affordable land.

Each started off with what would be viewed as a good sized family farm - averaging 80 hectares and 120 cows. Their ambition was to gradually expand, and each now farms around 500-600 hectares, producing in the region of 6 – 7 million litres of milk per year.

These farmers all had a positive outlook, drive and ambition: all necessary requirements to develop the family farm business to the extent that they did.

Figure 10: Still progressing – large, modern and well-designed buildings are commonplace on the Danish farms owned by Dutchmen

7.6 Central cattle database

Denmark is one of the leading countries for food quality and safety. It has one of the most comprehensive central databases in the world to collect the following animal data:

- Milk recordings
- Animal movements, births and deaths
- Breeding records
- Slaughter data
- Veterinary treatments

The detail from this database is used very effectively for farm and industry development including:

- Breeding plans/evaluation

- Feeding plans
- Herd health plans
- Research and development
- Medicine usage

7.7 Take home messages from Denmark

- Small scale family dairy farms are rapidly going out of business
- Family dairy farms producing above 1.5 million litres per year are now becoming the 'norm'
- High level of on farm technical and labour efficiency
- The Danish farmers take everything in their stride – debt, regulations etc
- Strict protocols/ standard operating procedures for all jobs on the farm
- Good genetic improvement has played a large role in the increasing yields of the dairy herds
- Optimists with ambition
- Major effort being made to reduce antibiotic usage

8.0: Ireland - County Cork

Cork is the largest county in Ireland and regarded as the heartland of Irish dairying. It produces just over 25% of the milk in Ireland and has a similar number of cows to Northern Ireland.

Ireland has a rich history in butter making with international trading taking place in Cork butter market for centuries. Today it is still viewed as an international dairy hub, with dairy companies like Dairygold, Carbery and Kerry all having a strong presence in Cork. It is also home to many small scale farmhouse makers of cheese and other dairy products.

Table 6. Snapshot of County Cork, Ireland

Human population	542,196
Number of dairy farms	4277
Number of dairy cows	292,044
Average herd size	70
Average milk yield	4800 kg
Annual milk production	1.41 billion litres

8.1 Grass based production

Figure 11: Grass based systems are common in Cork, with an increasing number of farmers using crossbreeding to improve milk quality and achieve a more 'robust' cow.

Having travelled widely and seen dairying in predominantly housed systems, I thought it was important to look closer to home to see what grass based systems had to offer. Where better than

Cork, with a range in size of family dairy farms, some with diversification projects, but all producing milk from grass?

Cork has good free draining soils, temperate climate and moderate rainfall, meaning that it is ideal for both grass growth and utilisation. Depending on the year, some farms I visited had the potential to turn cows out from late January and not house again until early/mid December.

The result is one of the lowest costs of production in not only Europe, but the world, due to a lot of milk being produced from grass with little dependence on concentrates and a low demand for silage due to the comparatively short length of the winter.

8.2 Government influence

Milk production in Ireland increased fairly rapidly after it joined the EU in 1973, as it did in other member countries as well. This led to the introduction of milk quotas across Europe in 1984. This stagnated the dairy industry in Ireland for 30 years as quota was not freely traded like it was in other countries. Farmers could not really expand, unless they received more quota from their co-op, so they had to focus on producing milk as cheaply as possible from forage.

Food Harvest 2020 was launched in 2010 and devised by the Irish Government and industry leaders in agriculture as the best strategy to take the whole agricultural industry forward. Achievable targets were set for 2020. For dairying these included -

- To increase milk production by 50% (from 2008/2009 level) – majority of this extra production will come from the southern half of the country.

To achieve this Teagasc (Irish Farm Advisory) devised the 'Road Map for Dairying' which predicted the dairy sector will:

- Have 16,500 dairy farms
- 1,500 new entrants
- Increase cow numbers by 330,000 to 1.395 million
- 15% increase in yield to 5400 litres/cow
- Herd size will increase to 85 cows or 450,000 litres produced per farm

Part of the plan to help achieve these targets were the following actions:

- Increased focus on strategic and financial planning, especially for expanding farmers.
- Identification of appropriate risk management strategies to help farmers cope with risks like milk price volatility and extremes in weather.
- Promotion of collaborative farming arrangements to take advantage of any growth opportunities.

Worth a mention as other assets in Ireland are:

- **Teagasc Moorepark** – A world class facility for Animal & Grassland Research and Innovation with a particular focus on grass based dairying.
- **Grant Schemes** – with a particular focus on farmyard development/ labour efficiency and health and safety, with extra incentives for younger farmers.

8.3 Glenilen Farm

Figure 12: Mr Alan Kingston of Glenilen Farm

Glenilen Farm, owned by the Kingston family, is situated near the town of Drimoleague in rural County Cork. In 1997 Valerie Kingston started using the milk from the small dairy herd to make cheesecakes in the farmhouse kitchen to sell at the local market. These proved to be very popular, along with a variety of other dairy products, and led to the first purpose-built dairy in 2002, quickly followed by a second larger one in 2008.

What started as a bit of a hobby in the kitchen, has now developed into a business supplying supermarkets and smaller shops right across the UK and Ireland. Thirty five staff are employed to process 1.3 million litres of milk per year and the farm itself is now contract-managed by a local dairy farm.

Learning to delegate and trusting staff to get on with the job were some of the many hurdles that had to be crossed as the business grew 5-10% each year. This eventually led to managers being appointed to run each part of the business on a daily basis and let the Kingston family look at the bigger picture.

An excellent example of innovation and progression on a small family dairy farm.

8.4 Take home messages from Ireland

- Family farm orientated, currently with relatively small herds, but increasing gradually
- Cork has the benefit of a mild year-round climate associated with the Gulf Stream, fertile and free draining soil and moderate rainfall, ideal grass growing conditions.
- Low cost of production, grass based dairying systems.
- Excellent research and training resources.
- Real potential to increase milk output at all levels without the restraints of milk quota.

Chapter 9: The United States of America

The USA is the world's largest milk producer, producing some 95 million tonnes (208.6 billion pounds) of milk in 2015, almost 15% of the world's production. It is a large and diverse country and as somebody said to me "*each state is like a different country in Europe*."

Table 7. Snapshot of the USA

Human population	318.9 million
Number of dairy farms	43,584
Number of dairy cows	9,317,000
Average herd size	214
Average milk yield	10,178kg
Annual milk production	95 billion litres
Milk market	80% liquid, 10% cheese

9.1 Family farm structure

Dairy farms in the USA have undergone a major transformation with an almost 60% reduction in numbers over the past 20 years. In 1992 there were almost 135,000 dairy farms compared with just under 44,000 in 2016.

Table 8. There are still many small dairy farms, but their numbers are shrinking

	Farms with < 100 cows		Farms with > 100 cows	
Year	**Farms (number)**	**Share of cows (percent)**	**Farms (number)**	**Share of cows (percent)**
1992	134,931	49	564	10
1997	97,134	39	878	18
2002	73,725	29	1,256	29
2007	53,324	21	1,582	40
2012	49,683	17	1,807	49

Source: USDA Census of Agriculture

Ninety seven percent of dairy farms are still family owned and operated, but on a different scale in comparison to Northern Ireland

In 1992 there were just 554 herds with over 1000 cows. By 2012, there were 1807 herds with over 1000 cows, which managed 49% of the cows in the USA.

The growth in the number of herds with over 2999 cows is also visible, with only 31 in 2002 compared to 440 herds of over 2999 cows in 2012.

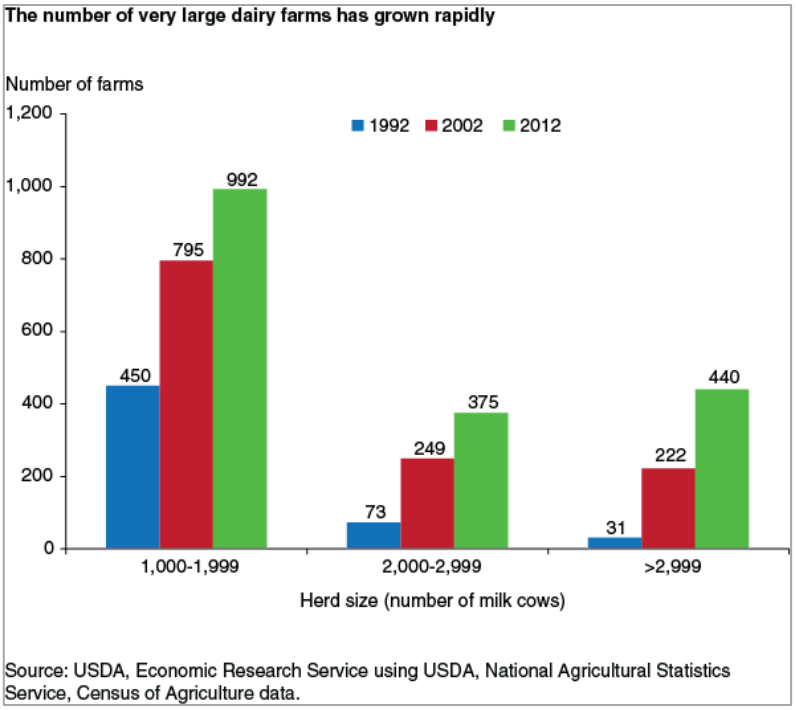

Figure 13: Graph highlighting the increasing herd size in the USA

The shift to larger farms has been driven largely by economics, with production costs being much lower than those of small farms. Smaller farms can generally survive for periods of time with reduced profitability, but this is not sustainable in the long term.

They have several options: go out of business, expand or innovate to survive.

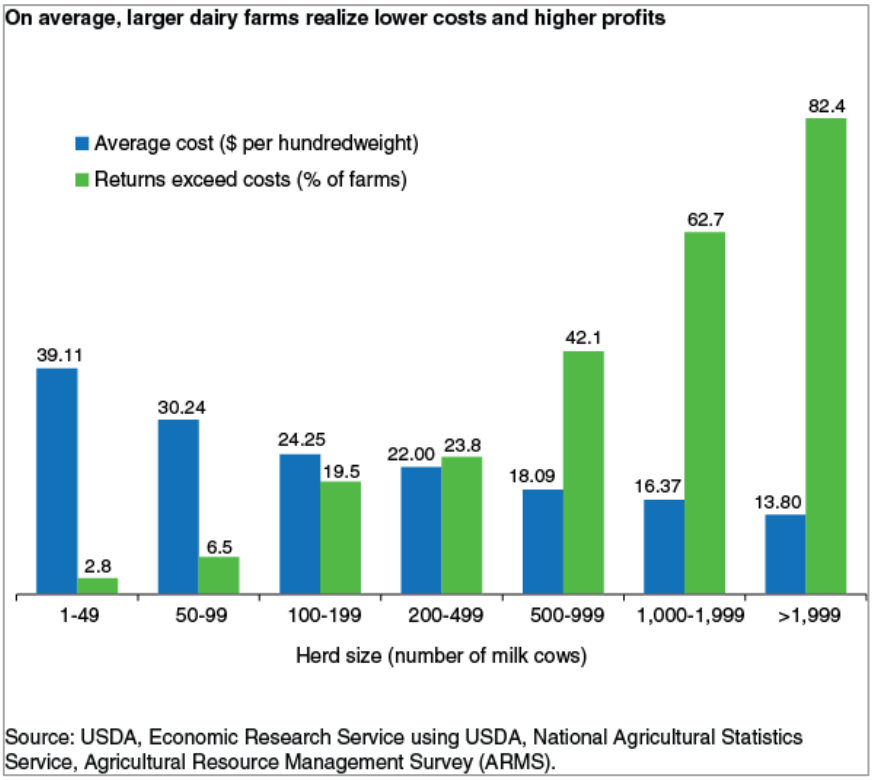

Figure 14: Graph illustrating the reduction in production costs as herd size increases

9.1.1 The Amish family farms

Figure 15: Contrasting sides of dairying in the USA – an Amish farmer with 15 cows visits his neighbour with 1200 cows

The Amish are a group of traditionalist Christian church fellowships who originate from Switzerland. They began to migrate to Pennsylvania in the early 18th Century and still today hold to their principles of a simple life without technology, primarily based on farming. These farms are very much family based and tend to be very labour intensive due to the lack of technology and equipment – for example the use of electricity is not allowed.

Figure 16: A newly constructed Amish tie stall barn for 50 cows – note the gas lamps in the centre

Alvin Lapp, an Amish farmer who lived near Lancaster in the state of Pennsylvania was in the process of building a new greenfield dairy unit on the family farm when I visited. The farm currently had 36 cows which Alvin had now taken over from his father. The new buildings were going to house 64 cows in a tie stall barn with young stock accommodation, slurry storage and tower silos. The estimated cost of this new set up was in the region of $8000 /cow (£5160/ cow @ 1.55 exchange rate).

Alvin's view point on this expansion was that if his father was able to rear a family on his 36 cows, hopefully he will be able to rear his family with 64 cows.

9.2 Production system

9.2.1 Housing

The vast majority of herds are housed full time, especially the larger herds. Approximately 20% of herds in Wisconsin were pasture based, mainly the smaller herds (< 100 cows). As herd size grew this tended to lead to total confinement in some sort of forced ventilation (cross or tunnel) barn. This was largely due to the lack of grazing area and the housing helped manage the extremes in temperature during the summer and winter periods.

Figure 17: A recently constructed cross ventilated barn with sand bedded cubicles in South Dakota

Design and layout of these buildings is excellent with the primary aims of -

- Labour efficiency
- Cow comfort
- Ample feed space
- Good cow flow

Sand-bedded cubicles and some form of sand recycling system (in the region of 90% can be recycled) were the preferred option on many of the larger more progressive farms. Evidence shows that cows housed on sand bedded cubicles produce 1000 litres per annum more as opposed to those on mattresses, due to the improved comfort levels and longer lying times.

Many of the smaller farms tended to house cows in the more traditional tie stall barns, which generally tended to be less comfortable for the cow and more labour intensive for the farmer. These cows often have access to an open yard, which tends to get very mucky during wet periods.

9.2.2 Genetics

While there are many Jersey and crossbred herds in the USA the Holstein breed still dominates. Many of the better herds are yielding in and around 100 pounds of milk per cow per day (45 litres), over the whole herd.

The Holstein breed is at home in a fully housed, comfortable and well managed dairy unit, with herd averages up 15,000 litres. Breeding is mainly done by artificial insemination (little or no use of stock bulls) with fertility programmes very popular for getting cows pregnant.

Calving index is not a real KPI (key performance indicator) due to the widespread use of BST to increase yield and extend the lactation length. This is worth an estimated 1000l per cow per lactation and gives a return of 2:1 of its cost, but it tends to be used where milk is going for processing and not for liquid consumption. At the time of my visit some milk processors were trying the stop the use of BST altogether.

9.2.3 Nutrition

Great emphasis is placed on feed space for cows with adequate feed always in front of them. Rations are fed once a day but pushed up every couple of hours. They are over-fed by 5% and any feed left over is “weigh back” and adjusted accordingly for the next day. This is all done remotely as the office computer is linked to the diet feeder, which can provide information on the mix contents, how long it was mixed for, time fed, route taken to name a few.

Maize silage, alfalfa, corn and soya are the main diet ingredients, with storage and mixing facilities on all the larger farms. Forage is sampled on a weekly basis, again equipment to test this is located on farm.

9.2.4 Milking

Pipeline systems are still widely used in tie stall barns and the Amish, due to religious beliefs, still use bucket plants – both of which are time consuming and labour intensive.

The larger scale farms tend to operate 90 degree rapid exit parlours with no in-parlour feeding. Once herds approach 3000 cows, rotary parlours are the norm. Many of the larger scale units will operate a separate ‘hospital’ parlour where any cows treated with antibiotics are milked.

Most of the herds I visited were on 3x milking, with the staff working eight hour shifts. For this reason parlours are generally sized so milking time is around 7 hours, with an hour to wash up and change over shifts. Hispanics comprise approximately 80% of the labour force on US dairy farms.

Staff are given intensive training on a stringent milking routine with strict protocols in place.

9.2.5 Robotics

During 2013 in the region of 5100 robotic milking plants were sold, with similar manufacturers to those available in the UK. These were mostly sold to family farms, ranging in size from 100 – 300 cows, where little or no outside labour was employed.

One such farm I visited was that of JTP Dairy, Dorchester, Wisconsin. Father and son, Tom and Jake Peissig, started milking in their new barn in January 2012. It is a cross ventilated, sand bedded barn with 4 Delaval robots milking 250 cows.

In 2013 cows were averaging 47.5 litres/ milk/ day (104.5 pounds), a record at the time for Delaval robots. Previously cows were milked in a double 4 parlour and the lack of availability and cost of good labour were the main reasons for going down the robotic route.

Figure 18: Father and son, Tom and Jake Peissig, in front of their new 250 cow robotic dairy unit (*source Delaval*)

9.3 Government influence

Sometimes farmers in the EU feel that they are over regulated and don't get the support that is needed during times of low prices, resulting in a volatile market place. I feel it is necessary to touch on several examples of policy which I came across while in the USA which help control and regulate the dairy industry:

- **CAFO –** Concentrated Animal Feeding Operation, implemented by the Environmental Protection Agency. Different bands according to number of stock, but really comes into play for 700 or more mature dairy cows. Farmers will employ consultants to apply for this before they carry out any expansion. Nutrient management planning and closed periods for spreading slurry also apply in some areas.
- **MPP –** Margin Protection Programme – included in the 2014 farm bill to help protect against the losses that dairy farmers experienced in 2009 and 2012. It allows farmers to use an insurance style programme to cover the margin between national average milk prices and feed costs.
- **Crop Insurance –** originally set up by the Risk Management Agency of the USDA, after a number of adverse weather situations, it allows farmers to insure their crops against any future adverse weather and is based on an average of their previous crops' performance.
- **State incentives for new business –** some of the less populated and less industrialised states are keen for new economic development. They will offer various incentives such as interest free loans for new dairy units being established in remote grain growing areas. Part of the contract will be that the farm will have to employ a certain number of people from the local area. This helps to improve the rural economy and keep it alive.

9.4 Training/upskilling

Throughout my time in the USA I had the opportunity to visit various colleges and universities which offered various training opportunities for farmers at all levels. A few are mentioned below:

- **Dairy Grazing Apprenticeship** – covering all of the US to try and promote the grazing of dairy herds through training, farm walks and discussion groups.
- **New Sweden Dairy & Dairy Education Centre** - in conjunction with the Davis Family Dairies and University of Minnesota. A 2700-cow commercially run dairy unit which calves approx. 10,000 cows per year on one site. Training for vets and managers.
- **The Dairyland Initiative** – ran by the University of Wisconsin, Madison to promote welfare-friendly cattle housing, through various workshops.
- **Department of Dairy Science** - University of Wisconsin, Madison – various dairy science courses at different levels.
- **PennState College of Agricultural Sciences** – awarding agricultural qualifications of all sorts from 1861.
- **Value added dairy courses** – for cheese, ice cream and other dairy production - are very common and in demand, especially in Wisconsin.

9.5 Adding value - Wisconsin State

Wisconsin, known as "America's Dairyland", is the second largest state for milk production in the USA after California. It is the state that has shown the largest increase in milk production over the past 10 years.

Whilst 98% of dairy farms are family owned, there has been a reduction from 22,500 dairy farms in 1997 to the current 9,494 (2016) with the average herd size now at 129 cows per farm.

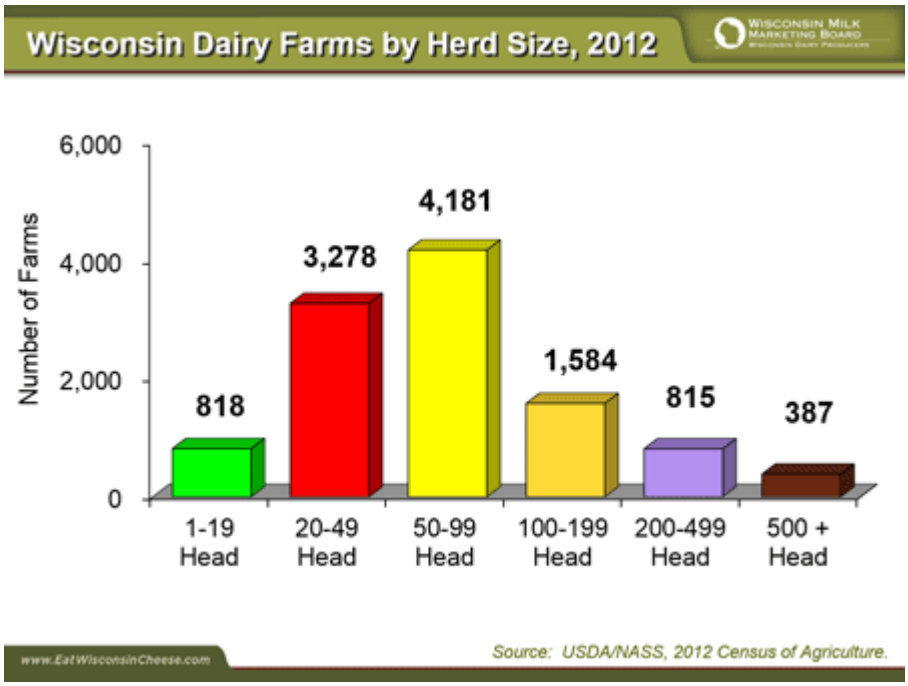

Figure 19: A breakdown of the range of herd sizes in Wisconsin.

Driving around in the state it was evident that there was a large number of redundant small dairy farms, many of which went out of production during the dairy crisis of the 1990s when as many as 300 per month were going out of business.

Figure 20: A familiar sight in Wisconsin state - a former family dairy farm, with the dairy, tie stall barn and tower silos in the background.

However, more milk is being produced than ever before but more and more of it is being produced by the large scale dairies, many of which are corporate owned, with investment coming from outside the state.

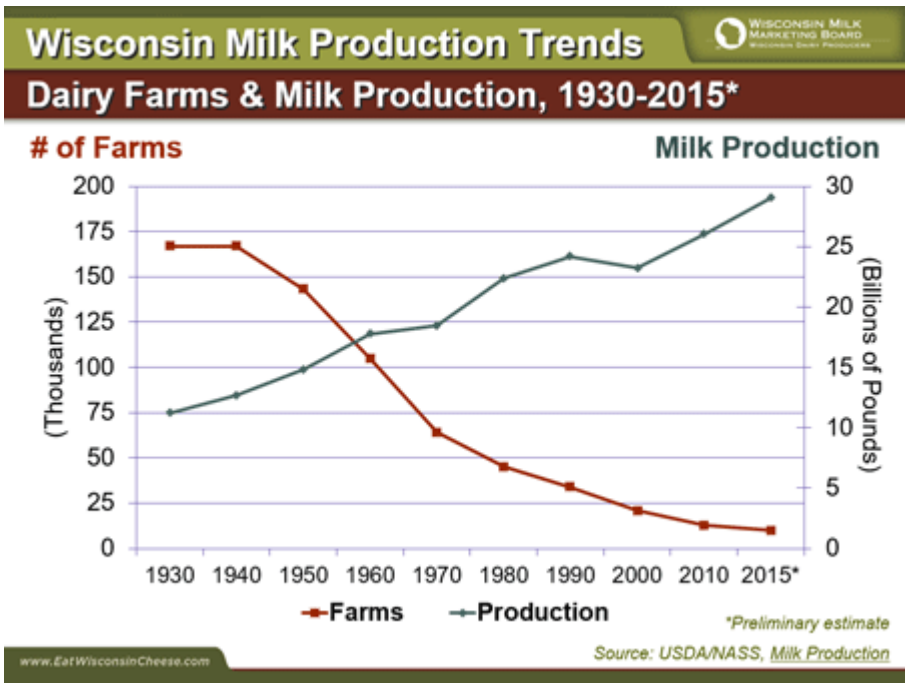

Figure 21: Wisconsin Milk Production Trends

Cheese is big business in Wisconsin with 129 cheese processing plants making in the region of 600 different cheeses. About 90% of the milk produced goes into cheese production, which has seen a massive growth in the last 8 years. This growth has helped many dairy farmers maintain their viability.

Figure 22: Saturday morning farmers' market in Madison, with Wisconsin State Capitol in the background.

Figure 23: Dairy Statistics for Wisconsin state (*source Wisconsin Cheese*)

Figure 24: Sassy Cow Creamery and Store

Of those farms that are still in business, some have increased in size, while others have diversified or found their niche in some shape or form. One such example is the Baerwolf family in Columbus, WI, which I visited.

Two brothers, James and Robert, are the third generation to farm on land that was purchased by their grandfather in 1946. Today their wives and children are very much involved in the family business. This farm has gradually grown from a 50 cow herd in the 1990s to the current herd of 450 cows farmed conventionally, as well as another 250 cow organic herd.

In 2008 a new creamery was opened on a green field site to process the milk from both their farms. Today 15 people are employed in the creamery alone, bottling milk from both farms, producing over 50 flavours of ice cream, making cheese in conjunction with an artisan cheese maker, and a farm shop that sells a wide range of locally made produce.

This was a fantastic example of how a family farm can adapt and innovate to ensure their future viability.

9.6 Take home messages from USA

- Family dairy farms still dominate milk production in the USA, but many on a much larger scale in comparison to Northern Ireland

- Smaller (<100 cows) family dairy farms are declining rapidly, especially in times of a poor milk price
- Many smaller dairy farms have had to adapt and innovate to survive
- Others have expanded or found their 'niche'
- Larger farms are managed with a high degree of technical efficiency
- Extremely labour efficient
- Very specialised and focused, with clear targets
- Make good use of outside advice, vets, nutritionists and consultants
- Dairy herd expansion in the U.S. is based on buildings and cows, not land. Most of the feed is contracted in.
- Very dependent on foreign labour.
- Good dairy herd management is as easy as A B C -

    A – air quality & ventilation

    B - bunk ration quality

    C - cow comfort

Chapter 10: China

China is the most populous country in the world, with almost one fifth of the world's population. It is the largest producer of pork, second largest producer of poultry, the fourth largest dairy producer and the largest feed importer in the world.

In the past three decades both dairy production and consumption have soared; however the last decade has seen the largest transition in the increasing scale of milk production at farm level.

Table 9. Snapshot of China

Human population	1.393 billion (July 2014) 19.24% of world population
Number of dairy farms	1.71 million (2014)
Number of dairy cows	14.85 million (2015)
Average herd size	10 cows
Average milk yield	6000kg
Annual milk production	38 billion litres
Farms > 1000 dairy animals	1426 (20.2% of dairy population)

Figure 25: A map of China with the main milk producing provinces highlighted (*source agweb.com*)

10.1 Setting the scene - 2008 melamine scandal

During the 2000s there was a rapid increase in dairy production and competition between the dairy companies. With new products and increased demand, milk was sourced from outside the traditional dairy areas. This led to milk being supplied from millions of small farmers, which had received support at both local and national government levels. In fact, in 2006 approximately 81% of China's dairy farms had under 5 cows.

Cows were milked in village milk centres (VMC), where each farmer would bring his cows to be milked twice a day. These were owned by local government or milk companies, which employed somebody to manage them. However, disease (including mastitis) was rife and milk yield/quality were poor. With

stiff competition and low margins, the managers of the VMC were under pressure to improve both quality and quantity. Initially water was added, but this led to other additives including melamine.

This came to a head in 2008 when the melamine scandal broke out. Tens of thousands of infants fed baby milk formula fell ill, resulting in six deaths. After this, consumer confidence slumped in the dairy industry resulting in a reduced consumption of dairy products. Attitudes changed towards the small, fragmented farms and the focus was turned to the creation of large corporate type dairy farms. Both milk companies and government now favour these large units, with many of the small farmers exiting the industry (as many as 100,000 per year after the scandal broke out).

10.2 Production system

"The dairy industry is trying to advance 50–100 years in a short space of 10–15 years."
Dr Frank Delfino.

Aside from the traditional backyard farming, all the dairy units that I visited were very much based on total confinement, high input/high output dairying. Large herds of cows were fully housed, being fed a diet of maize silage, alfalfa (1 million tonnes imported annually, much of it from California and South America) and hay (a lot imported from Australia).

Stock were all fed TMR diets which are mixed in a stationary mixer and then fed out by another wagon. Most concentrates came in 50kg bags which were fed manually on to an elevator before going into the stationary mixer.

**Figure 26: As far as the eye can see!
A modern 3500 cow cross ventilated barn,
on the outskirts of Beijing**

**Figure 27. A newly constructed naturally
ventilated barn on a new 10,000 head dairy unit
500km south west of Beijing.**

continued on next page

10.3 Farm structure

Figure 27: A traditional family dairy farm with 80 milking cows

Figure 28: That's me in the middle, with the farmer to my left and milking parlour supplier to my right.

Table 10. Highlights the transition from small farms to an increasing number of larger ones

	2,007	2,008	2,009	2,010	% Change 2010/09
Annual inventory (Head)	Farms	Farms	Farms	Farms	Farms
1-4	2,159,701	1,970,755	1,816,359	1,750,895	-3.6
5-9	295,789	398,744	374,541	345,667	-7.7
10-19	149,106	143,358	138,265	138,246	0.0
20-49	42,079	51,804	49,490	49,450	-0.1
50-99	14,175	13,842	13,685	14,758	7.8
100-199	4,421	4,425	4,324	4,640	7.3
200-499	2,336	2,679	3,341	3,579	7.1
500-999	768	1,026	1,773	2,061	16.2
1,000 and above	339	454	706	898	27.2
Source: The Ministry of Agriculture					

The dairy farm structure can be broken down into three broad groups –

1. **Backyard farm** – up to 20 cows, milked at a local village milking centre.
   Yield 10-15litres/cow/day due to lack of technical knowledge and feeding. Paid the lowest milk price due to quality and quantity. *See photo on next page.*
2. **Cooperative farm** – size can vary greatly from several hundred to one thousand cows
   A number of farmers have joined together (influenced by government and milk companies) to make a larger more viable dairy unit that will have better overall efficiency, better quality milk and achieve a better milk price. Yields will also be higher (15- 20 litres) due to higher level of management
3. **Commercial/corporate farms –** these can be classified as small (< 500 cows), medium (500 – 1000 cows) and large (> 1000 cows). These farms are generally TMR fed, with higher yields and better genetics. They will also receive a premium milk price due to their scale and better milk quality. Most of these are either owned by milk companies or investors.
   Many of these farms are vertically integrated, in that the corporate may process the feed for the cows and the milk that they produce. This is increasingly becoming the trend.

Figure 29: Traditional backyard farm in Northern China

Rabobank have estimated cooperative, commercial and corporate farms will supply in the region of one third of China's milk production by 2016, whereas previously they accounted for one fifth.

In 2013 farms and cooperatives with over 100 cows accounted for 37% of the total cow population. This compares to 19.54% in 2008 and it was estimated that it would be 40% by the end of 2014.

The table below illustrates that in 2013, 15% of dairy farms had over 1000 head of dairy cattle.

Table 11. Dairy farm size and percentage in 2013 (*source Orient Dairy Consultants, 2013*)

Number of dairy cattle	Percentage of Farms
1-4 head	23
5-19	22
20-99	18
100-199	5
200-499	7
500-999	10
Over 1000	15

10.4 New Hope Dairies

An example of a large scale dairy operation owned by a feed and milk processing company

New Hope Dairies are situated near Chengdu the capital city of Sichuan province. This temperate area is much less suited to dairying due to being a more mountainous region with a patchwork of small irregular fields. None the less it is where the New Hope Group, the largest producer of animal feed in China, has sited one of its New Hope Dairy farms.

Figure 30: Dr Haopeng Jiao, general manager of New Hope Dairy Farms, assessing the quality of imported alfalfa, along with the farm manager. (note small bags of feed in the background – even for this size of farm)

I met Dr Haopeng Jiao, who completed his PhD at AFBI Hillsborough, Northern Ireland, several years ago. He is general manager for the 16 dairy farms (20,000 dairy cows) that New Hope Dairies currently have spread throughout China, with the aim of providing high quality fresh milk for the dairy processing arm of the business. Fifty percent of this is now pasteurised and goes to the expanding fresh liquid milk market (traditionally UHT milk is the most popular).

New Hope has recently increased the number of dairy farms it owns - as many of the dairy companies that they acquired had their own dairy farm. It has also started a joint venture with Moxey Farms in New South Wales, Australia, which is already the country's largest milk producer at 50 million litres per year produced.

10.4.1 Labour

Whilst people are plentiful in China, finding good, skilled labour to work on dairy farms is not easy. Government policy has been to basically move people from the country to the city where work and money are more plentiful. But this has left a severe shortage of skilled labour in the countryside, to do what is already seen as a peasant's job.

Generally, a lot of the labour is not from farms at all, so a significant level of training is required, particularly from parlour manufacturers, as all the farms tend to have a high degree of automation.

Labour is cheap, costing in the region of £300 per month, with the employer providing accommodation and 3 meals per day. In most of the dairy units, staff are housed on site within the compound.

But the expectation is that labour costs are going to rise.

10.4.2 Biosecurity

The farm buildings and often staff accommodation are all situated within a secure compound, with a check point and security staff. Due to widespread foot and mouth disease, brucellosis and TB, staff and visitors have to go through a disinfection procedure.

With larger farms having in excess of 10,000 head of stock on one site, entry and disinfection is even more stringent. A vehicle wheel dip is standard on all sites. Some will have an all-over vehicle spray which is a requirement for all vehicles entering.

One large farm I visited even had an eye recognition key pad for staff to enter, along with changing and wash rooms, before putting on farm wellies and white coat.

Figure 31: A typical entrance to a large scale Chinese dairy farm.

10.5 Training/upskilling

Nestle DFI (Dairy Farming Institute) – located in the north east of China, it is a new training facility that Nestle have developed with various universities including University of Wisconsin, Madison and commercial industry partners (GEA & Kuhn plus a few others).

It is a fantastic teaching facility based around 2 dairy units:

- One for 200 400 milking cows to help develop the future of the professional family farm
- Another for 600–1200 milking cows targeting labour-efficient, smaller scale corporate farms
- Plans are also in place for a 3600 milking cow unit for the large scale farming companies

The purpose of this is to provide hands on training at different levels for:

- Farm workers/ technicians
- Farm specialists
- Farm managers
- Graduate trainees

This recently completed facility which I had a tour around offers excellent opportunities for much needed training, from industry experts from around the world.

Figure 32: Nestle Dairy Farming Institute, Heilongjiang Province, Northern China

10.6 Government influence/support

Works at two levels – central government for the whole country and at local level, for each province.

As a whole, government policy favours the large scale dairy producer (see 2008 melamine section).

Government support is available in various formats (very hard to get the exact detail) for the setup of new dairy units:

- Interest free or reduced rate loans (interest rates currently 10%)
- Little or no tax payable on profits from dairy farming
- Grant aid of up to 50% to purchase modern efficient machinery e.g. self propelled forage harvester
- Incentives to build new dairies in areas of rural decline (one farm I visited had received approx. £500,000 towards building it in that location)
- Due to land being publicly owned, government may give favourable terms/lease agreement of land to the large scale farm to the disadvantage of the small farm

- No tax payable on imported dairy stock

Will some type of land reform/privatisation be necessary for further development of the dairy industry in China?

10.7 Genetics

College of Animal Science & Technology, China Agriculture University, Beijing

I met with Dr Yachun Wang who specialises in animal science and technology. She is currently working on key projects for dairy genetic improvement. These include developing a breeding system for 2 native dual purpose breeds, Sanche and Xinjiang brown cattle, as well as the effects of crossbreeding the Holstein with Montbeliarde and Fleckvieh.

Since a national genetic improvement plan was implemented in 2003-4 much progress has been made in dairy cattle breeding and increasing production. In 2013 there were approximately 14.4 million dairy cattle in China, with cows producing an average of approximately 5500 litres (this was around 2000 litres in the mid nineties).

- 44 bull stations in China – 1800 Holstein bulls including 600 young ones
- DHI (Dairy Herd Improvement) scheme started in 2006 – to test and improve performance of dairy cows
- CPI (China Performance Index) used for sire selection (similar to PLI in UK) now incorporates genomic testing as well
- Focus on breeding lower SCC (somatic cell count) cows
- Chinese bull semen supplied free to farmers, but many still prefer to source it from north America
- Holstein has dominated the dairy sector from the mid 1990s
- Large number of stock imported to help expansion drive, can only be imported from: N.Z, Australia, Chile, Brazil and Uruguay due to BSE restrictions (215,405 imported in 2014)

10.8 International Dairy Expo, Harbin

The Expo is held in Harbin, the capital of Heilongjiang province, the most northerly province in China, which borders Russia. It is also the 3rd largest milk producing province in China, after Inner Mongolia and Hebei. It is known for its flat plains of dark fertile soil.

I attended the annual International Dairy Expo which provided a wide range of trade stands all associated with the dairy industry. Western suppliers of both milking equipment and farm machinery were well represented, with fewer, less developed and refined Chinese agricultural equipment suppliers being in attendance. A number of companies offered a ‘one stop shop’ for the design, supply and build of new, large greenfield site dairy units.

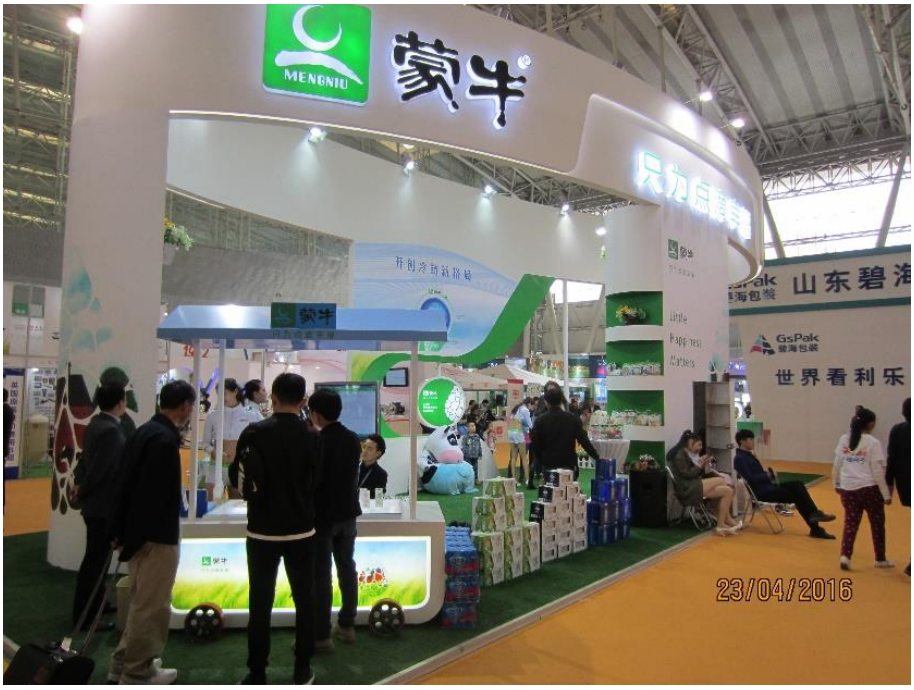

Figure 33: Dairy companies had a major presence at the Dairy Expo with a range of their products on display

Observations from the Dairy Expo

- Yili, Mengniu and Bright – 3 of the largest dairy companies with 60% of liquid milk market in 2012 - were all in attendance
- Milk companies well represented, very glitzy trade stands, with good product promotion.
- Baby milk powder, UHT milk in 200ml drinking cartons, and drinking yoghurt were the most popular products on promotion.
- Development taking place of energy/protein milk drinks and a low lactose milk drink.
- Ice cream increasing in popularity, with Yili selling 100,000 per hour throughout China.

10.9 Take home messages from China

- Family dairy farms rapidly disappearing in favour of large corporate farms influenced by government and dairy companies.
- High dependence on imported feed.
- Major issues with feed quality.
- Increasing environmental regulations and constraints.
- Lack of land ownership/availability, a major constraint which needs reform.
- Chinese consumers still have a major mistrust of Chinese dairy products.
- While there are many new large scale dairy units being built, these still cannot match the rate that the small farms are going out of business – self sufficiency is still a long way off.
- Lack of skilled labour, especially at farm management level.
- Cost of production very high, cannot compete with cheaper imports.

Chapter 11: France

France, the largest and one of the least densely populated countries in Europe, produces 16% of the EU milk supply. It is a large and diverse country with many agricultural specialities, especially cheese, but still very supportive of and dependent on the family farm.

Table 12. Snapshot of France

Human population	66.03 million (2013)
Number of dairy farms	64,000
Number of dairy cows	3.695 million
Average herd size	58
Average milk yield	8,309kg
Annual milk production	24.6 billion litres

11.1 Farm structure

Milk comes from about 64,000 dairy farms and a total of almost 3.7 million dairy cows. Average herd size has increased in the last ten years from 40 cows, to the current 58, while the number of dairy farms has decreased at a rate of 3.5% per annum.

While many farms are pasture based, it is more set-stocking than paddock-grazing and cows still have access to maize silage. Depending on the region, pasture is inclined to burn up during the summer months.

There are not many large herds in France (herds of 200 cows or more need government permission to expand), but there is a tendency, like many other parts of Europe, to house them full time, with zero grazing being a popular option.

The type of milk produced in France can be broken down into the following categories :

- PDO (Protected Designation of Origin) 9.6% of deliveries – this milk is produced for certain products in specific regions. This includes 45 cheese varieties, 3 butter varieties and 2 cream varieties.
- Organic milk – 2.3% of deliveries
- Certified milk from mountainous regions – 0.6% of deliveries
- Conventional – 87.5% of deliveries

11.2 Regulating milk production

French farms like others in the EU had been limited in their milk production by quota. However, unlike other countries, there were strict rules which meant no free market for quota: i.e. no quota transfer between regions. The result is that dairy production is still widespread throughout France, with two key areas in the north west and the south east.

Now that the EU quota system is gone, many of the milk processors are still regulating supply. Sodiaal and Danone are two examples that operate an A-B price system, under which the A price is based on dairy product returns in the French market and the B price bases on prices for butter and milk powder.

The farm's share of A milk is based on historic production. Expanding dairy farms will have a lower average milk price because more of it may fall into the B price.

Growth by increasing milk production in France is not necessarily the best option to improve income and profitability.

Figure 34: A pasture based 70 cow organic herd

11.3 Reducing volatility

Sodiaal, one of the larger dairy cooperatives, collects about 5 billion litres of milk from 13,200 farmers right across the country. It has a wide and diverse range of products including cheese, liquid milk, powder, ingredients, yoghurts and frozen items. It main current challenge is volatility. It has devised a plan to help manage milk prices:

- **Just completed** – double volume/double price system
- **Short term** – fixed price contracts with futures market
- **Medium term** – derivatives contracts (fixed price and guaranteed margin) connected with long term contracts with clients
- **Long term** – margin insurance

Traditionally French farmers have not been exposed to the same extremes of milk prices that many other countries have.

11.4 Self sufficiency

Whilst herd size is relatively small, the area of land farmed tends to be much larger in comparison. Most dairy farmers tend to grow a sizeable area of crops which they will either feed to their own cattle or use as a cash crop. As a whole, 83% of the total feed consumed by the national dairy herd is produced on farm.

11.5 Collaboration

A common theme on many European farms, is that a number of farmers join their businesses together to form a larger unit, with better economies of scale. Because of the various milk quota regulations and difficulty accessing extra land, it has not been that easy for French farmers to expand.

I had joined a tour organised by EDF (European Dairy Farmers) and many of the farmers who hosted the visits had collaborated either with family members, neighbours or other business partners. This had allowed them not only expand their business, but in many cases diversify it as well. Each partner can look after a different aspect of the business, share responsibilities and enjoy more free time. But for this to work there has to be a clear vision of where the business is going with good communication and trust.

Figure 35: A 210 hectare, 160 cow farm in France owned and managed by 3 business partners. They have also diversified into a 350kw biogas plant, drying wood chip and photovoltaic panels.

11.6 Work/life balance

Despite the comparatively small herd size, French dairy farms are characterised by the high input of family labour, while also employing external labour as well. On the average French EDF (European Dairy Farmers) farm, 2.5 family labour units and 0.8 employed labour units, manage 116 cows and 200 hectares of land.

They value their free time and take the view point that there is much more to life than farming. A large focus is placed on people and their wellbeing. A 35-hour week was introduced in 2000 and this, combined with taxation and social contributions, leaves employing labour a fairly expensive exercise.

11.7 Take home messages from France

- The small family farm structure still plays a major role in French dairying
- Farmers and neighbours collaborate to develop larger, more efficient and diverse farms
- Large government influence to keep the rural areas alive, in favour of the smaller farms
- Work/life balance, very important, even for dairy farmers
- Milk production still largely regulated by the milk processors, with A-B pricing system
- Steps being taken by milk processors to help reduce milk price volatility
- Land is cheap, but not easily available
- France has the potential to produce much more milk – will they exploit it!

Chapter 12: United Kingdom

The UK is the tenth largest milk producer in the world and third in the EU after Germany and France. Most of the 14 billion-odd litres of milk produced each year is consumed within the UK, around 50% as liquid milk and the remainder as various dairy products.

N.I. on the other hand produces in the region of 2.3 billion litres of milk per year, but only 12% of this is consumed as liquid milk. There is a high dependence on exporting the remainder as various dairy products, many of which will end up on the UK mainland.

Table 13. Snapshot of the UK

	United Kingdom	Northern Ireland (N.I.)
Human population	64.1 million	1.81 million
Number of dairy farms	13,815 (2014)	2,742 (2015)
Number of dairy cows	1.84 million	311,500
Average herd size (cows)	133	88
Average yield	7,916kg	7,470kg
Annual production (billion litres)	14.4	2.3
Milk market	Approx. 50% liquid & 50% manufacture	Approx. 12% liquid & 88% manufacture

12.1 Overview

I don't plan to dwell on the UK dairy industry but just to say that family dairy farms are in decline like many of the other countries that I visited. In 1998 there were 31,753 dairy producers compared to just over 13,000 producers that are in existence in today. Total milk production declined at the beginning of the century, until it bottomed out during the dairy crisis of 2009. The current production of 14.4 billion litres is just fractionally above that of 1998.

Again, similar to other countries that I visited, herd size has increased from an average of 95 cows in 2003 to the current 133 cows per herd.

Milk yield has also increased from 5,775 litres per cow in 1998 to the current 7,916 litres per cow today. While this is a significant improvement it is not to the same extent as the USA and Denmark.

12.2 Mindset for success

I had the pleasure of visiting many successful family farm businesses in the UK that had gradually developed and evolved through time. This was through expansion, innovation and diversification. But key to this was the person or people who drove the business and made it successful. They and their family members had the ambition and foresight, combined with a positive attitude, to develop the business.

12.3 The Prince's Dairy Initiative

This was launched in the UK during 2012 to help struggling dairy farmers with under 200 cows. The aim was to ensure a diverse, resilient dairy farming sector through a series of workshops, covering topics such as cost of production, financial management and herd health, over a three-year period.

As a result of this initiative, over 200 dairy farmers have participated in the various workshops, which has allowed them to review and improve their business. The success of this programme has led to the development of another initiative to help all types of small farms across the U.K. including Northern Ireland.

Figure 366: Recently established spring calving herd in Shropshire

Chapter 13: Other relevant aspects of my study tour

So far I have highlighted some of the relevant issues for family dairy farms in the various countries that I have visited. At this stage I would like to introduce several more issues and sum up the common themes that I feel are important.

13.1 Protocols

With the amount of technology available today, the old saying "keep it simple stupid" can often be forgotten about. But having protocols and standard operating procedures (SOPs) for the routine jobs on a dairy farm is one of the simplest and most cost effective things that can be done, even on family farms. It leaves no one in doubt about the way a job should be done, especially for family members who are not used doing that job.

I first became aware of SOPs on a large UK farm, but as I travelled around more countries, I appreciated their importance on all sizes of farms. They can be completed in various formats, level of detail and with pictures, depending on what points are being illustrated. They can be used for:

- Milking routine
- Mastitis detection
- Drying cows off
- Feeding a new born calf with colostrum
- Treating a calf for scour
- Herd health planning

I have included a few examples that I came across in the pictures below.

Figure 377: Mastitis detection & treatment on farms in Denmark and USA

Figure 38: Washing and milking routine on a family farm in China

13.2 Organisational charts/notice boards

Again a very simple, but extremely useful item on farms. I saw various formats to do different jobs. It could be as simple as numbering the baby calf pens or a farm plan of paddocks. A few examples are illustrated below.

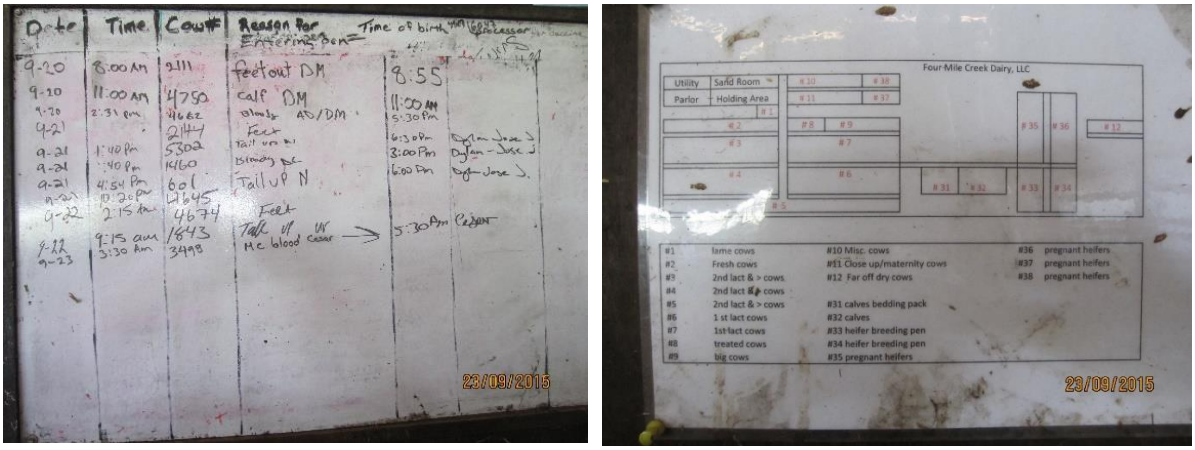

Figure 389: White board used for recording calvings and pen layout on a farm in Wisconsin

another photo of a farm map is shown overleaf

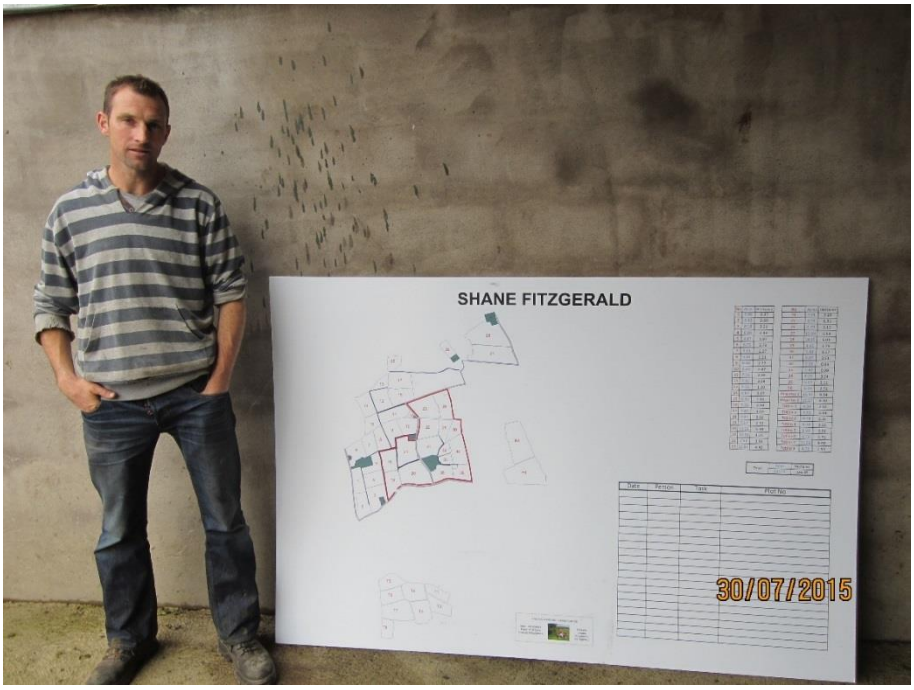

Figure 40: A farm map with field sizes and locations on the farm of Shane Fitzgerald in Co Cork

13.3 Use of technology

I came across many different examples of technology on my travels, some of which I have already touched on earlier. Some examples of technologies that I have seen widely used to great advantage of the farm business include :

- **CCTV** – very simple and widely used across the countries I visited to monitor staff, milking routine, deliveries, security and cows calving/ bulling to mention a few. Relevant to every farm regardless of size.

Figure 391: A purpose built room to house the CCTV and recording system on a large farm in China

- **Facial recognition system** – certainly not commonplace on farms, but on one farm I visited in China, this was routine for the employees clocking in and out.

Figure 402: A facial recognition device on a large farm in China

- **DairyComp 305** – a dairy herd management package, used widely in the USA and further afield. It links in with parlour software to provide a very user friendly package where anything to do with the herd – production, reproduction and health - can be recorded and generate reports. A real time saver on any scale of business.
- **Precision diet feeding** – already in the UK but not yet widely used, it is a live time programme that connects the feeding software in the office to the weigh cell in the diet feeder. The advantage of this is that any changes in the diet via the computer are directly updated to the weigh cell in the diet feeder. It can also monitor mixing time, feed out time and the route taken to optimise labour efficiency. It further allows the 'weigh back' process to be carried out and the amount of feed will be automatically adjusted for the next feeding. This package was used extensively in all the larger dairies that I visited and also the family farms in Denmark and Germany.

13.4 Connecting with consumer

Figure 413: Marshland Acres contract heifer rearing farm in Wisconsin which hosts an annual open day for the general public

Most examples were in the USA, but the principle is catching on in other countries. Many of the farms would host annual open days where the general public would be asked to come and view the farm and its facilities, as well as laying on some locally produced food.

Many of these farms would also regularly host visitors and larger groups to help educate the consumer and promote their produce. Websites and social media are also widely used to give updates on what is happening on the farm.

Chapter 14: Relating my study tour to Northern Ireland's family dairy farms

14.1 Strengths, weaknesses, opportunities and threats for Northern Ireland's family dairy farms

Based on the lessons learnt from extensive travel and observation I feel that it is essential to look at the strengths, weaknesses, opportunities and threats for N.I. family dairy farms.

Strengths

- Hardworking
- Multi skilled
- Good owned land base
- Climate suitable for growing grass
- Favourable cost of production
- Flexible production system
- Excellent quality assurance and traceability
- Good animal health status
- Resilience – will tolerate lack of profitability longer than corporate type farms

Weaknesses

- Independent in nature – won't seek outside advice/lack of collaboration
- Fragmented farm structure/field size
- Land availability – cost /conacre system
- Labour intensive systems
- Not business minded enough
- Capital intensive – housing/land
- Low population density – reduces diversification opportunity
- Climate – difficult to fully utilise grass
- Over regulation

Opportunities

- Brexit – new trade deals
- Improve disease status – eradication
- Exploit green, environmentally friendly image
- Improve technical performance and efficiency
- Standardise the farming system – increase forage utilisation

Threats

- Cheap imported food
- Volatile markets
- Currency fluctuations
- Environmental regulations
- High dependence on bought in feed

14.2 Unique features of farming within Northern Ireland

Northern Ireland is unique in many ways in comparison with the rest of the UK. It has a very small consumer base and consequently is largely dependent on exporting in the region of 85% of its dairy produce. As a result, it must be competitive on a world market basis. I do not want to appear negative, however I have to be realistic and highlight some of the major constraints that N.I. farmers have:

Farm size & fragmentation – farm and field size tend to be small (40ha on average versus the UK average of 77ha), which as farms expand tends to leave them fragmented with considerable distances to travel between relatively small areas of land. Again this is a major constraint when trying to expand and acquire larger pockets of land.

'Conacre' system – this is a unique feature of renting land in N.I. It is implemented on an annual basis generally from 1st April until 31st October each year. As this is done on a yearly basis, the major disadvantage is of not having any security of the land from one year to the next. Quite often it is auctioned to the person who is prepared to pay the most and this could be a different farmer each year.

The real downside to this system is that it is not a secure way to grow or expand the business and quite often the economics of it don't add up.

Weather – whilst N.I. is a relatively small area, rainfall and land type varies significantly. Thankfully there are rarely any extremes of weather to contend with, like some of the other countries I visited. However in the west of the country where I live, it just rains, nearly all the time. 1500mm of rainfall annually on heavy clay soils is not a good combination and can restrict grazing systems.

14.3 Land mobility scheme

A scheme like this is currently operating in the Republic of Ireland and one is being developed in N.I. The aim of this scheme is to help and assist young farmers who are trying to get started farming or those trying to expand, by linking them with older farmers who have a land base not fully utilised, or are thinking of retiring.

The benefit of this is that it will allow young and enthusiastic farmers to enter the industry and develop their businesses. This also has the potential to overcome the 'conacre' system in that such areas of land may be managed by joint ventures, farm business tenancies or contract farming, resulting in better land security and long term planning.

Chapter 15: What are the key components in a successful family dairy farm?

Throughout my report I have highlighted the main aspects relevant to each overseas country visited. At this stage I would like to outline the key components of successful family dairy farms, that I feel are most applicable to NI family dairy farms:

Attitude – a positive attitude is key to success in all walks of life. Whether it is attitude to risk/ change/ debt/ expansion, the person/ family will be key in the future direction of the business and how successful it is.

Dairying System - From the total confinement, high production herds in the USA where animal welfare was second to none, to the impressive block calving, grass-based herds of Co Cork, I could find no fault with either system.

Is there a 'right' system for N.I? I'm not sure. The best way to describe the typical N.I. system is a 'half way' house of the two mentioned above, which does complicate management and increase workload. But generally as herds expand they are harder to manage at grass, especially in difficult weather, which is why many are now housed and zero grazed.

Type of system will depend on -

- Land area/quality/accessibility
- Technical ability of the farmer
- Milk contract
- Labour availability
- Succession
- Debt?

There is no right or wrong system, it is simply utilising the best of what you have got to make it a profitable, sustainable and viable business. Think about what system is right for you and have a cow to suit the system.

Simplicity – some of the most profitable farms that I saw were some of the simpler ones. These tended to be block calve in either autumn or spring, meaning that there was always a clear direction, with jobs very focused at certain times of the year. Remember KISS – keep it simple stupid!

Expansion – beware. One common theme throughout the different countries that I visited was the difficulty of expansion. Depending on the number and ability of family members involved in the business, expansion up to around 200 cows worked OK. At this point the farmer still had control and could keep an eye on all aspects of the farm.

Difficulties could arise from over 200 cows right through to 600-odd cows, due to staff being employed and the farmer still trying to do everything that he had done when he had a lot less cows. This

transition period is a real danger area for family farms with many of them not being able to cope and going out of business.

It appeared that once you crossed this size and could manage staff and delegate, further expansion was much easier with all the systems in place.

Unfortunately, many of the larger family farms in N.I. are just at this 200 – 300 cow stage and taking the next step is proving very difficult, from a land/ labour perspective as well as cash flow.

Targets/KPIs (key performance indicators) – essential in any business, but not widely enough used in N.I. They will help progress the overall business's performance.

Milk from forage/feed efficiency – as bought-in feed is the single biggest cost on any dairy farm, more focus needs to be placed on improving forage quality, whether it be silage or grazed grass. It is one of the key drivers of farm profitability.

Labour efficiency – many of the farms that I visited used one labour unit per 60–80 cows. However, the yield per cow ranged from 6000 litres to 15,000 litres. Should be targeting in the region of 750,000 litres per labour unit, by making management more straightforward.

Training – there was a real business focus on all the larger farms that I visited. There had to be because of their scale. But that focus also needs to be implemented at family farm level to ensure long term viability.

Collaboration – many of the farms that I visited collaborated in some way, from simply growing a crop on contract, right through to merging dairy herds. This is not a common occurrence in N.I. but serious consideration may have to be given to it in some form to help improve economies of scale. For some family farms it may be the only option for survival.

Advice - again on many of the larger farms regular meetings were held with advisors, nutritionists, vets, business consultants, family and staff so that the business had clear objectives and everybody was clear what direction they were going in. this does not happen often enough or, in many cases, at all on N.I. dairy farms. It will benefit business of all sizes.

Genetics – using good genetics and having a clear breeding objective pays dividends. This was particularly evident in the USA and Denmark where a high rate of genetic progress combined with excellent forage quality had given herd averages well in excess of 10,000 litres. Virtually no stock bulls were used, breeding was all done by artificial insemination.

And finally…….

Diversification – I visited many different diversification businesses in the various countries. Most were successful, but they mainly revolved around having a large population on your doorstep – which we do not have. Whilst it may be an option for some family farms, it does require time and a whole new set of skills which can result in the core business being neglected.

15.1 In Summary - Key points in managing a successful family farm

Invest time in

- Business management
- Monitoring performance
- Budgeting

Communicate with…….

- Bank manager
- Suppliers
- Advisors/accountant
- Staff
- Financial partners
- FAMILY

A positive future exists for efficient family businesses - but

- Be unrelenting in pursuit of cost control
- Ensure good return for every £ invested

Chapter 16: Conclusions

- Smaller family dairy farms are in decline in all the countries that I visited due to various factors - lack of profitability, access to land, government policy, succession and lack of investment.

- While the number of smaller dairy farms is declining, their lost milk production is being compensated by larger dairy farms continuing to expand their milk output. This is increasingly on a corporate type, large scale, basis.

- Those family dairy farms that remain in business have done so by – expansion, improving efficiencies or diversifying.

- Yes, there is a future for family dairy farms, but not for all of them. They must adapt and innovate to survive. The farm must be treated and managed like a business, with a focus on profitability.

- The family farm has the benefit that it can be more resilient and will tolerate lack of profitability compared to corporate type farms in a turbulent market place.

Chapter 17: Recommendations

At farm level

- Improve on farm efficiencies – both from a technical and labour aspect
- Improve forage quality and utilisation
- The farm is a business – good business skills and acumen are essential
- Focus on your strengths – seek outside advice to help with your weaker areas
- Attention to detail is essential, but look at the bigger picture as well
- Growth and development are necessary, but at a level you are comfortable with
- Improve your knowledge – you are never too old to learn
- Invest where you will get a return
- Embrace technology – it is here to stay
- Don't ignore succession planning
- Protocols are useful even on a family farm
- Communicate with family and staff
- Simplicity has its place, especially where there are labour constraints

At industry level

- Manage volatility through the use of futures markets/fixed price contracts
- Know your market place
- Don't penalise the small farms
- Encourage farmers to cooperate together
- Reform of the 'conacre' land rental system
- Better lines of communication with producers to help steer future direction

At government level

- A policy to help to keep rural areas vibrant
- Funding to improve on farm efficiency
- Regulations are necessary, but at a sensible level

Chapter 18: After my study tour

Whilst one chapter of the Nuffield Farming Scholarship is closing, I feel that my Nuffield Farming Journey is really only just beginning. It has given me many fantastic opportunities, combined with memories of a lifetime. The experience has been challenging, but rewarding, and has certainly taken me out of my comfort zone while teaching me to look at things differently.

From the first meeting of the #Nuffield15 at the annual conference in Ashford, Kent, to meeting 70-odd scholars from around the world in Reims, France, it was a truly memorable experience. From all the interesting people who took time to meet and host me in various countries and those that came to stay in our home, there were many interesting debates and stories to tell.

I have learned a lot from my study tour, from small farm workshop innovations to improve labour efficiency, right through to the importance of strategic planning and organisation. Through my role as a CAFRE facilitator to dairy discussion groups, I have and will continue to discuss and share as much of this knowledge to not only the farmers but also my work colleagues.

The family dairy farm has also undergone a restructuring process to help with succession planning and there is a greater focus on improving all aspects of on-farm efficiencies. Although there has never been a problem growing grass on the farm, good utilisation in wet weather can be a problem, so there is a renewed focus on improving milk from forage. Opportunities are being explored on expanding the land base of the farm and also the possibility of a diversification project.

Through my involvement in various community, farmers' and young farmers' groups, I have been asked to present what I have learnt during my study tour. I am looking forward to sharing this information to hopefully give people an insight to world agriculture and how this may affect us at a local level on the family farm.

Trevor Alcorn

Chapter 19: Executive summary

Northern Ireland (N.I.) is part of the United Kingdom, but it is unique in many respects, not least in terms of its small, fragmented family farm structure and the 'conacre' system. Over this last decade there has been a 17% decline in the number of dairy farms while milk output has increased by 40%. While some of this increase is due to improved genetics, it is largely due to an increase in dairy herd size.

In comparison to the UK, N.I. is very dependent on exports with approximately 85% of its dairy production being exported. The result of this is volatile milk prices, which both farmers and the industry find difficult to manage. As a result of lower profitability, the more progressive producers have expanded their businesses to maintain or improve the economies of scale. However, the family dairy farms which have not progressed or expanded the business are gradually ceasing milk production; at one time these would have been viable family farm businesses.

The purpose of my study tour was to identify if family dairy farms were declining in other countries and if so, how they were dealing with this and the transition to the larger scale dairy businesses. I also wanted to investigate different management practices in the various countries, that may potentially improve efficiencies and profitability on N.I. dairy farms, thus helping their future viability. Or are there other diversification opportunities?

As part of my study I visited and met with farmers, industry experts and learning institutions from Germany, Denmark, Co Cork, Ireland, USA, China and France. I selected these countries due to their various expertise within the dairy industry such as: technical and labour efficiency, scale of production, collaboration, forage utilisation - and China because of its developing dairy industry.

The decline in the number of family dairy farms is occurring across the globe, not just in Northern Ireland. These farms are declining due to a number of factors such as: lack of profitability, access to land, government policy, succession and lack of investment. They are being replaced by fewer, larger corporate-type dairy businesses that are managed to a high level of technical efficiency and in many cases are still family owned and managed, but on a much larger scale.

There is a future for many family dairy farms in N.I, but not for all. This cannot be taken as granted.

Family dairy farms must be prepared to: improve efficiencies, expand or diversify - but key to this survival is the farmer and/or family members. They must have the business skills, knowledge and ambition in order to survive and progress the business. Standing still is going backwards.

A family dairy farm managed in an efficient and competitive way, with compassion for its livestock and farm land, has still a lot to offer. While the numbers may be declining, it will still form the backbone of the rural community and in the longer term may prove much more resilient than the large scale, profit driven, corporate type farms.

Chapter 20: Acknowledgements and Thanks

Firstly, I would like to say a very sincere thank you to The Thomas Henry Foundation and The Nuffield Farming Scholarships Trust for their very generous support and truly giving me the opportunity of a lifetime.

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