



**A Nuffield Farming Scholarships Trust
Report**

Award sponsored by

Alan and Anne Beckett



**Profitable Dairy Farming
in Scotland**

Robert Gray

March 2019

NUFFIELD UK

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A Nuffield (UK) Farming Scholarships Trust Report



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

Date of report: March 2019

Title Profitable dairy farming in Scotland

Scholar Robert Gray

Sponsor Alan and Anne Beckett

Objectives of Study Tour

- To discover best current practice to enable dairy farming in Scotland to be as profitable as possible
- To assess what needs doing to ensure a profitable dairy farming industry in Scotland in future

Countries Visited Chile, Uruguay, Ireland, UK and Qatar

Messages

- The UK has the 2nd largest net dairy deficit in the world. So the market is there
- But milk as a commodity must be produced at world prices, which means producing off grass
- Scotland has huge natural advantages for growing grass: high rainfall, temperate climate, the right pH levels
- It also has access to finance plus a comparatively reasonable land price. Touch wood, it is so far TB-free.
- The major problems are:
 - shortage of processing companies and plant
 - a negative mindset amongst farmers, bred by the agricultural subsidy system
 - lack of opportunities for young people to build equity through share farming contracts
 - tax system discourages handover of land to a younger generation

EXECUTIVE SUMMARY

As a young farmer who had recently bought a greenfield site in the middle of Scotland and was developing it into a New Zealand-style dairy farm, I was frustrated in particular by the shortage of dairy processors in Scotland. This meant there was little competition to buy the milk I was producing, and lack of alternatives is never healthy for any industry.

The market for product was clearly there: the UK has the second largest dairy deficit in the world. But there was apathy among farmers which I attributed to the government's subsidy system and taxation policy. The labour situation was difficult as young people did not consider that dairying offered them an attractive career option.

On the other hand Scotland offers perhaps surprisingly many natural advantages for dairy farming. The temperatures are such that the growing season for grass is in excess of 200 days a year for most of the country. Soil pH levels are in the 6 range, ideal for grass growing. Crucially rainfall averages 1,000+ mm a year. Scotland enjoys one great advantage over England and Wales in that so far it is clear of bovine TB. Land prices are comparatively low against many other countries in the world which can grow similar tons of dry matter per hectare.

To study "Profitable dairy farming in Scotland" I took advantage of my Nuffield Farming Scholarship to visit Ireland, Chile, Uruguay and – to see a completely contrasting system of dairying – Qatar. At an earlier stage in my life I had spent 7 years living and working in New Zealand so I was already very familiar with, and impressed by, the dairy farming in that country.

Today all milk, in almost any country, destined for anything other than supermarket direct supply contracts has to be produced at world price. The world price setter is New Zealand, which has developed a simple but highly efficient no-frills system based on spring block calving, maximum production off grass, low labour requirement and minimal capital expenditure. This system has since been copied successfully in many other countries which have expanded rapidly into the world milk market. Labour issues have largely been solved by developing a sophisticated sharemilker contract scheme with many variations that the junior partner can offer in exchange for an agreed share of the total milk cheque. It all helps to create a motivated workforce and shared values.

I have returned from my study tour convinced that a viable dairy industry, based on the NZ system, is both entirely possible and highly desirable for Scotland. But there are two issues which must be put right by those who steer our industry: more processing facility must be constructed to enable us to sell, promote and potentially export Scottish branded produce; and labour issues must be addressed by the introduction of a sharemilker contract scheme.

In addition, Government should (and almost certainly will) overhaul both the subsidy and inheritance tax systems.

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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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1. Personal Introduction



Figure 1: The author, Robert Gray, standing in a field of triticale wile in Chile on his travels

On leaving school at 16 years old I left family, home and Scotland, and travelled to New Zealand where I started my career in the dairy industry.

My first experience of milking cows was in Twizel, NZ on a large cow unit: this was baptism by fire! I spent 6 months here before heading over to Australia for a look around. I worked for John and Jo Knight out in the bush on their cotton and beef farm and then returned home to help my parents with the lambing season.

But it was only 6 months before I got itchy feet to return to NZ. This time I went to Timaru where I spent 3 years. A job as a farm manger with Blue River Dairies was next, and it took me to Invercargill, milking sheep. Then I saw an opportunity as a sharemilker in the North Island which, along with savings made over the years, allowed me to purchase my own block of land - 178 hectares in Pahiatua.



In 2011, seven years after originally leaving Scotland, I sold up in New Zealand and returned home where I joined my parents in their beef and sheep farming business. In 2014 we converted to dairy farming, with a spring calving Jersey herd.

In autumn 2016 my wife Rhona and I took on a greenfield site land block just outside Dunblane, with no power, no running water or any other infrastructure, and found ourselves in an access dispute with Transport Scotland while at the same time converting this block into a dairy farm and undertaking my Nuffield Farming Scholarship. We ploughed and reseeded our bare land, found a caravan to live in and set about creating a set of farm buildings in the centre of the block.

It has been another baptism by fire and we have encountered just about every sort of problem and setback; but hopefully the worst of the initial teething troubles are now behind us and the way ahead is set fair.

Today, I place more emphasis on capital appreciation than the number of cows I am milking. I have also come to accept that I am not basically a cow man. Instead I prefer and enjoy the challenge of business and thinking up and developing new creative ideas for making this pay. I guess this has always been in me – even from school age when I chose to visit the Glasgow stock exchange as my work experience project, rather than looking at other farming businesses. But that in turn made me realise that wearing a suit every day was not for me either.

My real vocation, I believe, is building farm businesses and, ultimately, giving a helping hand to other aspiring, would-be farmers.

A UK Nuffield Farming Scholarship consists of:

- (1) A briefing in London.
- (2) Joining the week-long Contemporary Scholars' Conference attended by all new Nuffield Farming Scholars worldwide.
- (3) A personal study tour of approximately 8 weeks looking in detail at the Scholar's chosen topic.
- (4) A Global Focus Tour (optional) where a group of 10 Scholars from a mix of the countries where the scheme operates travel together for 7 weeks acquiring a global perspective of agriculture.

The Nuffield Farming Scholarships scheme originated in the UK in 1947 but has since expanded to operate in Australia, New Zealand, Canada, Zimbabwe, France, Ireland, and The Netherlands. Brazil, Chile, South Africa and the USA are in the initial stages of joining the organisation.



2. Background to my study tour

In 2015 when I applied for a Nuffield Farming Scholarship my proposed topic was: “Adding value to and marketing the dairy farm’s product”. At the time I was working on our family dairy farm near Callander where I was in partnership with my parents: the cost of production was very low.

Cost of production is something that I am still very focussed on because there is little room in the milk price to the farmer to increase the profit margin. But one can only do so much. I am frustrated to be at the mercy of a milk processor who could change the price we receive for our product with little to no warning. There is no alternative supplier who would be willing to take our milk and I fear this lack of competition, along with the power of the supermarket giants squeezing the value out of our product, is a serious threat to my business and the wider agricultural industry. Initially I wanted to look at selling our own produce ourselves, learning to market our products successfully, as the marketing aspect is equally, if not more important than, product quality and cost of production.

But the range of products into which milk can be processed, over and beyond the basic product itself, is pretty long: cheese, butter, butteroil, whey, buttermilk and fermented products, yoghurt, concentrated milk, powders, milk and cream, infant formula, ice cream, vending drinks ... all would require the installation of expensive plant, all would be at the mercy of a fickle public demand, all would need sophisticated marketing input. The market for no one sector of these products would clearly be anywhere as large as that for the basic product itself. And Scotland’s population is not huge.

On the other hand, the UK has the second largest net dairy product deficit in the world. (*See chapter 3a for further details*). The scope for milk to be consumed within Scotland itself was pretty huge. There was no need to try to compete in export markets.

Scotland is not generally viewed as a leading milk production nation. But in fact she enjoys considerable natural advantages: a high rainfall, a temperate climate, the right pH levels for optimum grass growing, no bovine TB problem, access to finance plus a comparatively reasonable land price.

With those advantages offered right here, in Scotland, it seemed to me the right topic was to study exactly how basic milk production could most profitably be achieved within my own country and nail the recipe for doing so. I would hope this way to encourage both more entrants into dairy farming, and more processors to set up in business to buy and process the basic product.

My study topic was therefore changed to:

Profitable dairy farming in Scotland

Scottish dairy farming is in decline. Why?

- We seem to have a very mature farm owner age. This could be in part because of a lack of opportunities for young farmers to develop. Furthermore, the tax system in the UK encourages farmers to avoid inheritance tax and hold on to land to pass to future generations. Farmers would be taxed more on cash in the bank if they retire and move on –



this locks up land that could otherwise be released onto the market much sooner if the system did not penalise this. The current subsidy system does not inspire entrepreneurship and innovative farming for the next generation, further slowing down land mobility.

- Much of Scotland has a temperate climate with mostly productive soils which grow grass well; we have access to finance, are TB free, and the majority of Scotland can grow grass for over two hundred days per year. We have predictable rainfall, and a low land price per hectare compared to other countries in the world which can grow similar tons of DM (Dry Matter) per hectare.
- A major challenge for the Scottish dairy farming industry is that it can be very difficult to get milk contracts outwith the south west of Scotland, and no investment at all has been made into milk plant infrastructure north of Central Scotland.
- In this respect Scotland is poor compared to Chile and New Zealand where there are clear opportunities to be able to make a start and get into dairy farming and dairy farm ownership without needing access to family money.

I will examine some of these issues in more detail in the next chapter.



3. Current status of Scottish/UK dairy farming

3a. UK dairy import statistics

The statistics below are quite staggering in the opportunity they demonstrate for UK dairy farmers:

- 90% of UK dairy products are imported
- UK is world's largest importer of EU-produced dairy products
- After Brexit the UK would be the EU's largest customer for dairy products.
- 20% of the EU-27 dairy exports will go to UK.

(Source: *Agricultural and Horticultural Development Board*' website, Accessed October 2018.

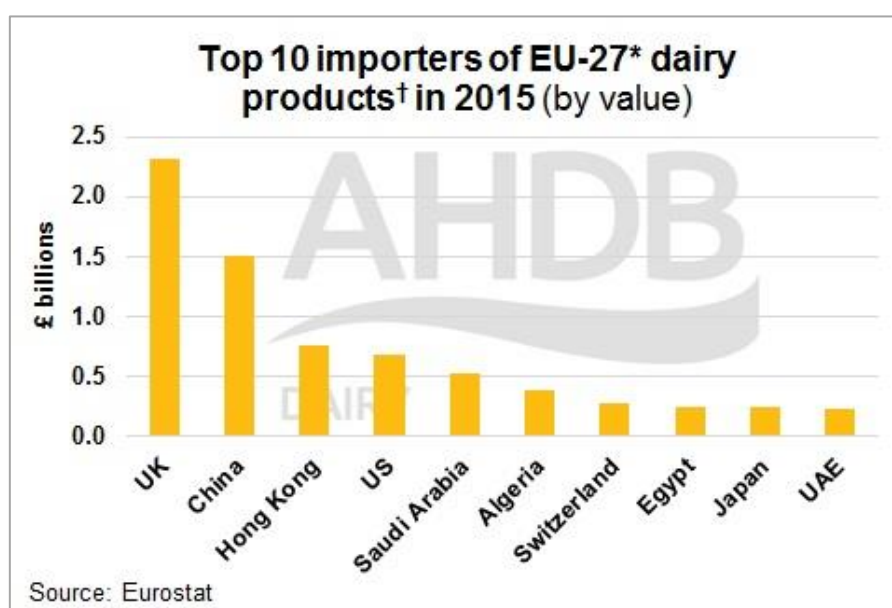


Figure 2: Chart to show top 10 importers of eu-27 products in 2015. Source: AHDB

Total dairy exports (intra and extra EU) in 2015 for selected Member States (MS)*			
	Value of MS's total exports (£m)	Value of exports going to UK (£m)	% of MS's total exports going to UK
Ireland	2,131	672	32%
France	5,005	468	9%
Germany	5,928	290	5%
Belgium	2,057	157	8%
Italy	1,885	155	8%
Denmark	1,559	155	10%
Netherlands	5,673	154	3%
Greece	403	70	17%
Poland	1,287	64	5%
Spain	867	40	5%
Cyprus	80	33	41%

Source: Eurostat

Figure 3: Map to show total dairy exports in 2015 for selected EU Member states. Source: AHDB

*For key to colour coding please over the page:



- Red: member States where exports to the UK exceed 10% of their total dairy exports
- Amber: member States where exports to the UK equate to 5-10% of their total dairy exports
- Green: member States where exports to the UK are 5% or less of their total dairy exports

Note:

- UK has 2nd largest net dairy product deficit in the world. (See chart below: source UN Comtrade)
- Dairy products included are cheese, butter, butteroil, whey, buttermilk and fermented products, yoghurt, concentrated milk, powders, milk and cream, infant formula (includes some starch-based infant products due to commodity code overlap) and ice cream.

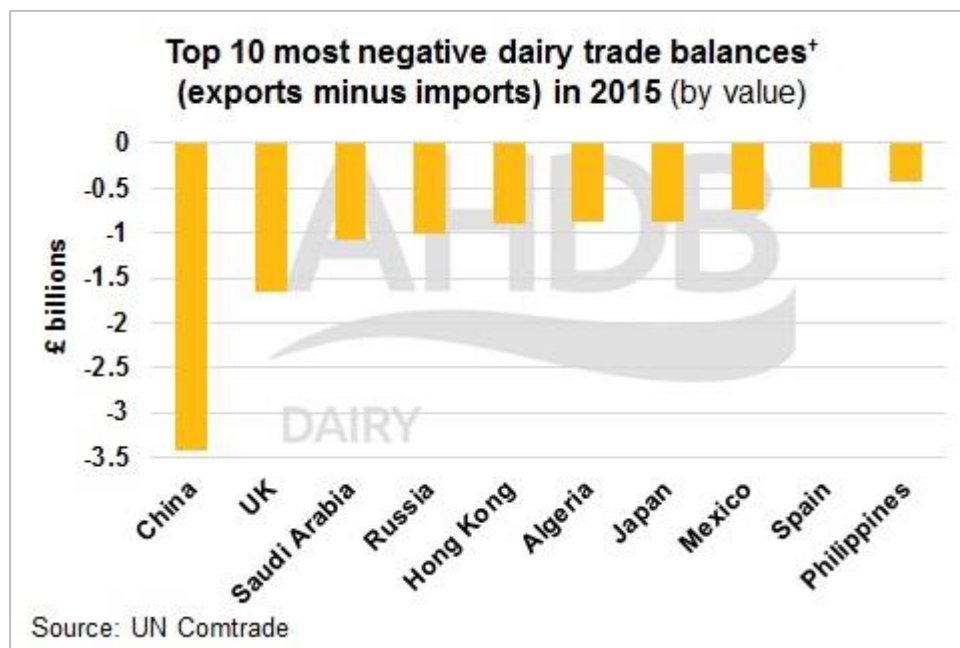


Figure 4: Chart to show 10 most negative dairy trade balances in world in 2015. Source: UN Comtrade

Yet, despite a huge market opportunity clearly being available in the UK in general and Scotland in particular, the number of Scottish dairy farms has reduced by 43.5% between 2004 and 2014 and there has been a 12% reduction in number of dairy cows in Scotland between 2004 and 2014.

A comparatively massive improvement in the production statistics being obtained by those dairy farmers who remain in the country has been achieved:

- Scottish average herd size increased from 124 to 192 cows between 2004 and 2014.
- Scotland has the largest average herd size within the UK.
- UK average milk yield per cow has increased by 17.1% between 2004 and 2014.
- In 2013, UK was 10th largest milk producer in the world.

See chart on next page showing the progressive reduction in dairy farm numbers in the UK in general, and also broken down between England/Wales, Scotland and Northern Ireland.



Table 1: Table to show dairy farm numbers in UK 2004-2014: Source: AHDB website

	Dairy Farm numbers as at June		
	2004	2013	2014
England & Wales	15,846	10,581	10,274
Scotland*	1,569	894	886
GB	17,415	11,475	11,160
Northern Ireland**	4,201	2,684	2,655
UK	21,616	14,159	13,815

3b. Suitability of Scotland for milk production

The charts on this and the following pages are sourced from 'UK Meteorological Office', *Climate Averages*. Website accessed October 2018. They demonstrate clearly that:

- Growing season length is greater than 200 days for much of Scotland
- Rainfall is high for Europe

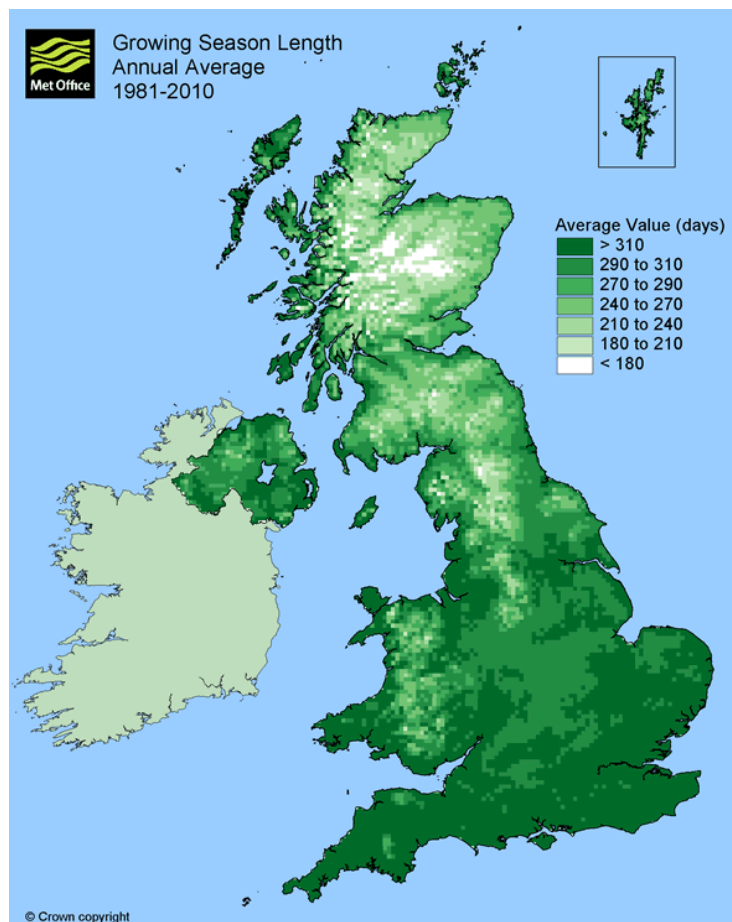


Figure 5: Map to show Growing Season annual average in UK 1981-2010. Source UK Met Office, climate averages



A minimum of 200 grass-growing days is considered optimum for profitable production of milk from grass.

The chart below illustrates that average rainfall in Scotland is round about the 1240 mm per annum level (50" per year), ideal for dairy farming. (*UK Meteorological Office', Climate Averages.*) Website accessed October 2018.

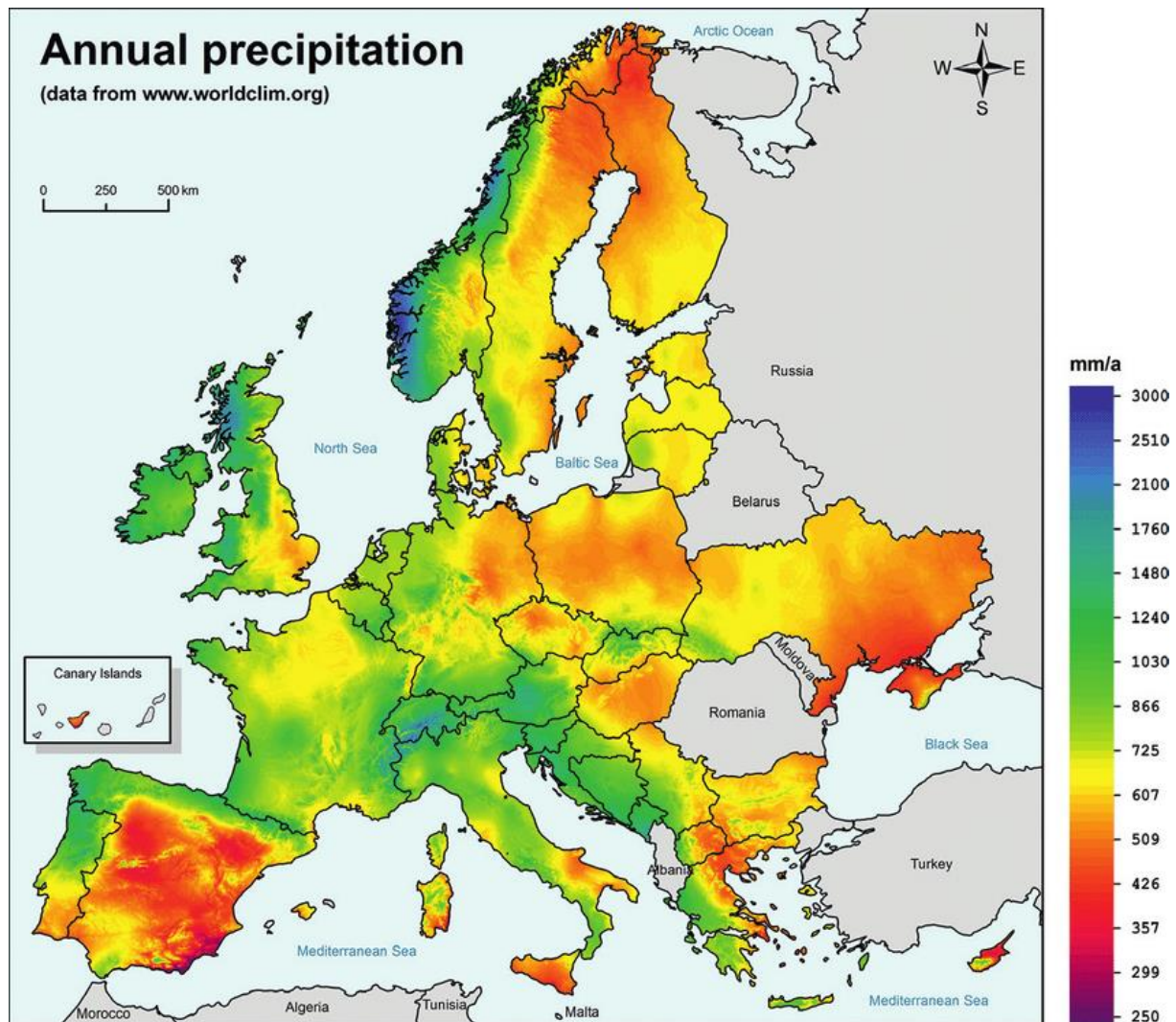


Figure 6: Chart to show average rainfall in EU countries.
Source: UK Meteorological office, Climate Averages

The chart on the next page shows that average pH levels in Scotland are around 6.14, again ideal for grassland production. (www.teagasc.ie/media/publications/2015/grow-more-grass-by-applying-lime.pdf)

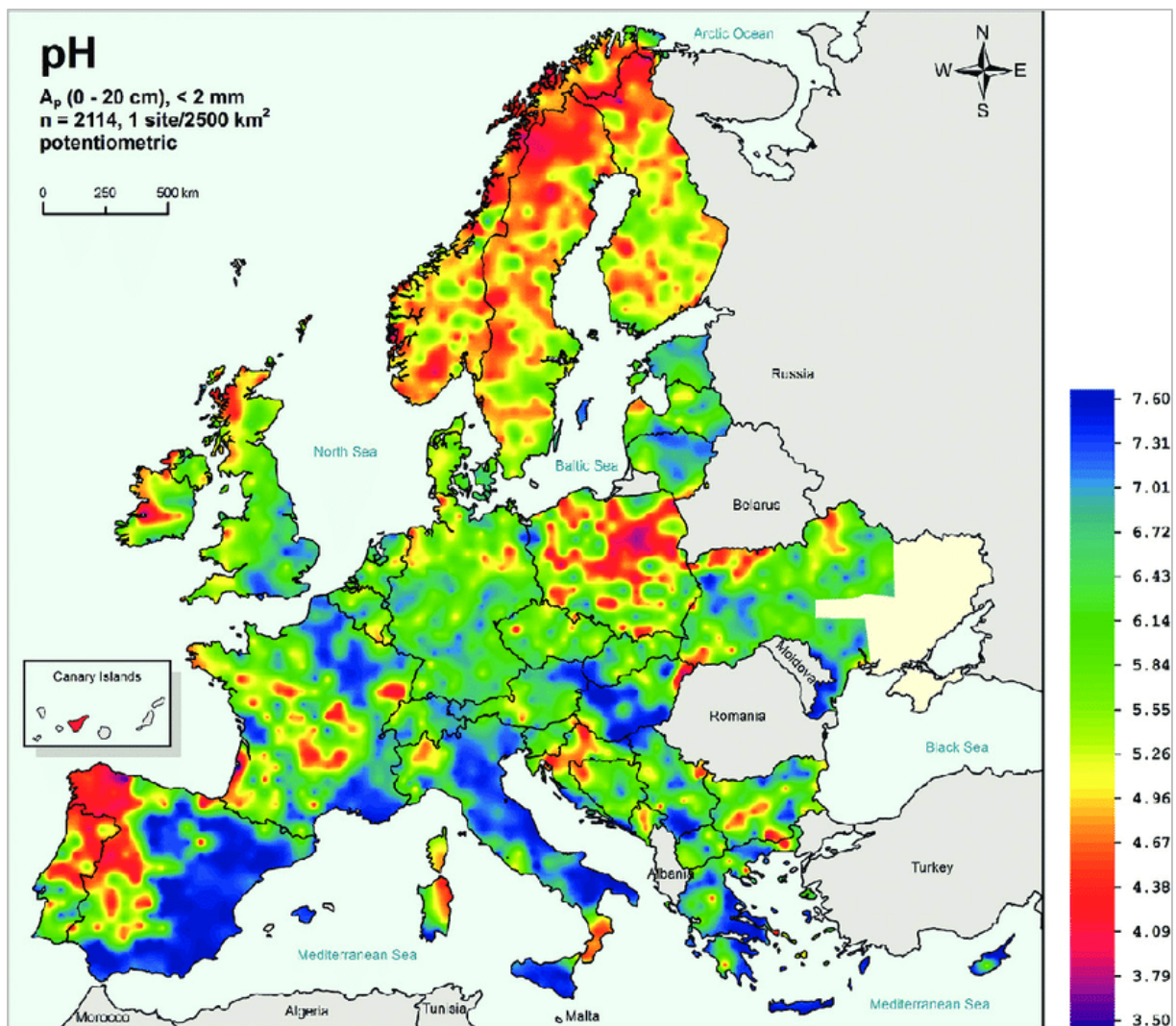


Figure 7: Map to show pH levels in Europe.

Source: <https://www.sciencedirect.com/science/article/pii/S0883292714001802>

3c. Scottish dairying's unique advantage within GB

Scottish dairy farming at the moment enjoys one huge advantage as opposed to the west and south of England and Wales. Scotland is bovine TB-free. It is probably difficult for Scottish dairy farmers to appreciate the financial and emotional impact of TB breakdowns on English dairy farms.

Because of the restrictions imposed following breakdowns on a farm or neighbouring farms, farmers are prohibited from selling even their TB-free stock other than to an abattoir. Farmers are not in control of their businesses. The whole scenario is negative and causing large numbers of English dairy farmers to quit that method of farming whenever government restrictions make it possible for them to do so. This is desperately sad for dairy farmers in England and Wales but does represent an opportunity for their Scottish counterparts.



3d. Barriers to Scottish dairy production

So, what are the threats and barriers to milk production in Scotland?

- Subsidies (current system of paying farmers to keep land out of production reduces motivation to look for higher return opportunities – albeit these require a lot of work and effort)
- Unreliable market (it is difficult to get a milk contract, and contracts impose restrictions on volumes and penalties on seasonal over-production).
- Boom and bust industry – wholesale milk prices fluctuate
- Lack of investment leads to comparatively small herd sizes and poor structure and therefore a higher overhead load.
- Profitability is not standard and largely depends on individual business and management methods. There are large variations in the costs of milk production on individual farms
- It is difficult to negotiate new milk contracts. Most large milk processors are EU companies and Brexit might well affect their attitudes and policies considerably.

The chart below shows average farmgate milk prices in GB 2012-2018:

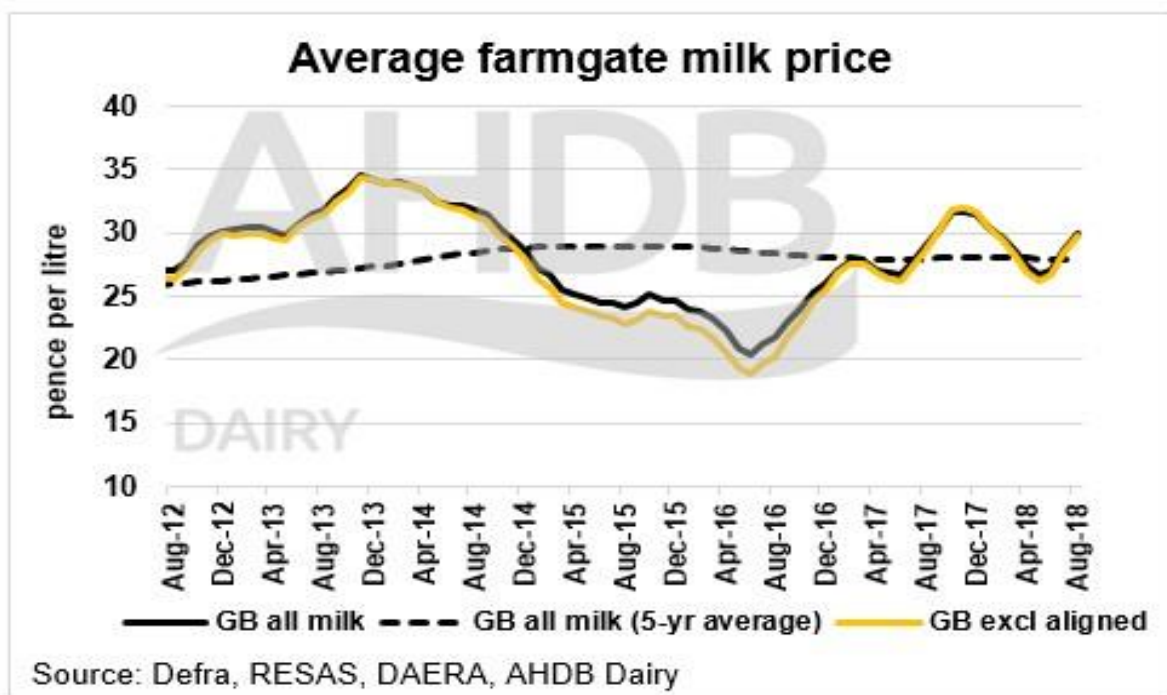


Figure 8: Chart to show average farmgate milk prices 2012-18 in UK. Source shown on chart itself.

The barriers to Scottish dairy production already mentioned in this chapter are now examined in more detail in Chapter 4, overleaf.



4. Why are the majority of dairy products imported?

Look at supermarket shelves and you will see that the majority of processed dairy products originate in Europe.

The UK simply doesn't have the processing capacity or drive; we are suited to handling volumes of liquid milk but are not specialised enough in processing this into other products.

Added value products (milk by-products) are not manufactured in the UK in the same volume as they are in Europe.

- Butter: in Scottish supermarkets the brand leader by far is Lurpak, which is Danish.
- Cheddar cheese in the main comes from Ireland and many other cheeses are imported: a lot from France and mozzarella from Italy
- Infant formula is imported from around the world
- Chocolate: we have the home-produced Cadburys, but Swiss and Belgian chocolates are seen as the premium lines.
- Confectionery in general: Scottish confectionery companies use Irish butter in their products.
- Yoghurts: the top brands are Muller, Activia, Muller Crunch Corner, Actimel, Yeo Valley, Onken, Weight Watchers and Cadbury (Muller). (<https://www.dairyreporter.com/.../Top-10-UK-Yogurt-Brands-Mueller-dominates-Danon..>)

4a. Barriers to milk production and milk product processing in Scotland

The main reasons why Scotland is not producing enough basic milk, let alone dairy products, are as follows:

- Shortage of processing companies and plant
- Negative mindset amongst farmers, bred by the agricultural subsidy system
- Tax system discourages handover of land to a younger generation
- Lack of opportunities for young people to build equity through share farming contracts

Each of these points is discussed in following sub chapters.

4a.i. Shortage of processing companies and plant

Dairies to buy a farmer's milk are in decidedly short supply. In central Scotland one dairy has a monopoly, giving huge leverage when negotiating the contract price. No dairy will buy milk (with the exception of organic milk) from a farm in the northern half of Scotland without imposing a penalty for collection costs, which causes the farmer's margin to be further suppressed.

It is appreciated that the costs of building and initiating a milk processing plant are huge for the dairy concerned. It would take years from inception to being fully operational, while the business



concerned navigated the hurdles of market research, capital acquisition, planning permission, regulations, actual building and hiring suitable staff. Initial approach would have to come from a representative group of farmers (Scottish Dairy Growth Board has already taken steps) and possibly the Scottish government could get involved. **It must be recognised that an increase in processing capability In Scotland is vitally needed.**

4a.ii. The agricultural subsidy system

Regardless of what type of Brexit we have, or even whether we have a Brexit at all, the government's agricultural subsidy policy is going to change and the total amount of payment available will reduce. The emphasis will be on helping environmental projects and will move away from financing production agricultural issues.

The current system of farming subsidies acts as a safety net to many large scale land-owners (who can indulge in 'passive farming': i.e. non-productive land use). The net result is that some farms feel it is easier not to look for opportunities for more profitable agriculture. They can just collect a low-level income from the subsidy system.

I give details of the current Scottish agricultural subsidy system below:

4a.ii.1. Current subsidy picture for Scottish Agriculture

Under the former **Single Payment Scheme**, "eligible land" included any arable land or permanent pasture. This allowed claimants to receive income support even if they were not undertaking an agricultural activity such as growing crops or keeping livestock.

(<https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/basic-payment-scheme/basic-payment-scheme-full-guidance/eligible-hectares-and-minimum-activity---bps/>)

This changed as from May 2015 when the Single Payment Scheme was replaced by the **Basic Payment Scheme**. Farmers needed to have an eligible business and eligible land in order to claim the money and needed to prove they were actively farming every year.

To be eligible for payments farmers now need to fall into one or more of the following categories (and I am quoting from the Rural Payments website):

- *"automatic right of allocation – for businesses that were active in 2013 and also declared land in 2015. This will include businesses as buyer or lessee who can take over the original business's qualification for subsidy (either in whole (all land) or in part (particular fields))*
- *active farmers in 2013 – you must be able to supply evidence if you did not apply for Single Farm Payment Scheme. This will include businesses in previously excluded sectors, such as fruit and vegetable producers or deer farms*

If none of the above apply to you, you may be eligible to apply to the National Reserve.

It's important to remember that entitlements do not give an automatic right to a payment. You must activate your payment entitlements each year by declaring at least the eligible land your entitlements equate to in your Single Application Form. Source: www.ruralpayments.org.



Although the above Rural Payments website states that land must be '*actively farmed*' there are no actual definitions for this term, which in turn means there are huge areas of Scotland where livestock are incredibly sparsely stocked to meet the subsidy criteria albeit with minimal effort; or where contract farming agreements allow land owners to use contractors to do all the work and sell the produce without themselves actually doing anything.

4a.ii.2. Land in Scotland which is defined by government as 'Severely Disadvantaged'

The map on this link (<https://www2.gov.scot/Resource/0052/00521299.pdf>) which unfortunately I cannot get to print out in this document (the reader will have to paste the link for themselves into their browser) shows all the land which the government defines as 'Severely Disadvantaged'. It covers the whole of Scotland except for the quality arable land in the eastern Borders, the estuaries of the Forth and Tay, a strip along the coast east of Inverness and a small area in Dumfries.

Through personal knowledge of Scotland I would suggest that up to 50% of the area (defined by the government as 'Severely Disadvantaged') could in fact be productive in dairying or other relatively intensive farming systems.

However, even if land is defined as LFA on the above map, such land is not eligible as LFA (our own personal circumstances) if actively dairy-farmed: because this is considered officially as being profitable and therefore not requiring subsidy.

(<https://www2.gov.scot/Resource/0052/00521299.pdf>)

Land values for dairy land tend to be higher than those for sheep/beef even for the same soil types. Arable and vegetable ground command higher prices again.

Page 3, in particular, of the website quoted below, shows favourable statistics of the income value of dairy as opposed to other sectors of agriculture:

<https://www.gov.scot/binaries/content/documents/govscot/publications/statistics-publication/2017/06/agriculture-facts-figures-2017/documents/00518694-pdf/00518694-pdf/govscot%3Adocument>

Regrettably it is again not possible to copy the information shown in the above website. I have reproduced it myself by copy-typing, and page 3 of the document on the webpage can be seen on the next page:



Table 2: Farm business income and direct subsidies per farm by type of farming, 2014-15 and 2015-16.
Source quoted on previous page.

Farm business income and direct subsidies per farm by type of farming, 2014-15 and 2015-16								
Farm Type	2014-15				2015-16			
	Farm Business Income	Subsidy & Payments	Subsidy & Payments as a ratio of Output	Subsidy & Payments as a ratio of FBI	Farm Business Income	Subsidy & Payments	Subsidy & Payments as a ratio of Output	Subsidy Payments as a ratio of FBI
	£/farm	£/farm			£/farm	£/farm		
Cereals	18,508	33,691	0.17	1.82	7,444	29,132	0.15	3.91
General cropping	26,987	32,290	0.14	1.20	24,086	30,496	0.13	1.27
Dairy	68,932	36,373	0.07	0.53	1,884	30,854	0.08	16.38
LFA sheep	14,827	34,040	0.38	2.30	7,362	36,001	0.44	4.89
LFA beef	25,013	47,109	0.27	1.88	22,482	45,636	0.27	2.03
LFA mixed cattle & sheep	27,547	53,256	0.32	1.93	20,893	49,949	0.32	2.39
Lowland cattle & sheep	26,740	36,864	0.22	1.38	12,302	32,392	0.20	2.63
Mixed	11,918	39,365	0.19	3.30	2,264	35,351	0.18	15.61
ALL	23,944	40,172	0.21	1.68	12,615	38,092	0.22	3.02

The net effect of this subsidy system is to have created a negative and non-entrepreneurial mindset among Scottish farmers and landowners.

It is an horrific but accurate fact that subsidies accounted for 82% of the profit for Scottish farmers in the most recent year for which figures are available. (<https://www.gov.scot/publications/total-income-farming-estimates-scotland-2016-18/pages/1/>) . It is not a figure to take pride in, and it clearly leaves Scottish agriculture in a highly vulnerable position.

4a.iii. Tax system currently applying to agricultural assets in Scotland

The current tax system for agricultural assets encourages farmers to avoid inheritance tax by holding on to land instead of selling it and/or passing it on to a younger generation.

Readers would of course need to discuss their own personal situations with a qualified accountant. But, put very simply, an existing farming business incurs less in the way of inheritance tax on the death of the owner than if the latter had sold it before death and banked the money or invested it into a non-agricultural asset. Like the subsidy system, this has the net effect of promoting negativity in the agricultural industry, increasing the average age of farmers, inhibiting entrepreneurship and ensuring there is less opportunity for a younger, more dynamic would-be farmer to get a business going.

Action on tax systems is of course entirely the prerogative of government: but farmers and their leaders could lobby MPs on the subject.



4a.iv. Lack of a “farming ladder” to enable a young farmer to create his own business

One of the many problems existing dairy farmers in Scotland complain of is the difficulty of finding committed and enthusiastic labour.

Equally, ambitious youngsters who dream of owning their own farm one day, have little or no chance of fulfilling this wish unless they have access to family capital.

The New Zealand sharemilking contract system for workers in the dairy farming industry is very successful in addressing these issues. It is well known about in principle by farmers in the UK. For example, in return for an agreed share of the milk cheque an employee can give his/her labour for free; or offer their labour plus undertake to buy the inputs for a dairy herd; or, in addition, provide the dairy herd itself, which would leave the senior partner in the business to provide solely the land and infrastructure.

There are many variations of the NZ sharemilking contract scheme and each is subject to an individual arrangement and contract. I myself when I was in New Zealand in my late teens/early twenties took part in such schemes. They enable an ambitious young person whose skill level and work ethic are high to increase their income over and above what would be enjoyed by simply being an employee, and thus climb the farming ladder to the point where ultimately they own an entire business. They enable the senior partner and land owner to retain his business but relinquish much of the daily grind and responsibility.

Details of sharemilking schemes can be found on the net via a Google search, and it was not the purpose of my Nuffield Farming Scholarship to look into them in detail. But there are few if any equivalent schemes operative in Scotland today. This is a great pity because they would ensure a pool of ambitious, highly motivated young people entered the dairy farming industry. (For example see: [https://www.dairynz.co.nz/news/latest-news/sharemilking-remains-a-viable-career-path-new-report/.](https://www.dairynz.co.nz/news/latest-news/sharemilking-remains-a-viable-career-path-new-report/))

It is appreciated that the NFUS and SAYFC launched an initiative last year aiming to connect farmers with no succession to young people who want to get a step on the ladder. One can only wish them more power to their elbow, and that they keep up the good work.

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It was with all these background issues in mind that, in 2015 while on my honeymoon, I applied for a Nuffield Farming Scholarship. My application was typed by my incredibly supportive new wife who shares my ambitions and dreams – and to our great joy I was successful in gaining an award.



5. My study tour: where I chose to go and why

Details of my Nuffield Farming Scholarship study tour are given below. The chart summarises the countries I visited, when I went, and the primary reason I chose to visit them:

Country	Month/year of visit	Reason for visiting
Ireland	September 2017	The leading northern hemisphere country for the production of milk from grass
Chile	November 2017	To see a southern hemisphere country, remote from the market, which has comparatively recently set up to enter milk production for the world market
Uruguay	December 2017	New Zealand nationals have invested heavily in Uruguay over the past few years, but equally I had heard that the farming model there was not working and I wanted to see what had gone wrong and why it was not successful.
Qatar	January 2018	Looking at food security – what can be achieved in a short timeline when profit is not the focus.

Figure 9: Chart to show locations/dates visited on the author's Nuffield Farming study tour

5a. Ireland

Ireland produces 54% of the UK dairy products. They have a joined up milk marketing body (ORNUA), a dairy co-operative which markets and sells dairy products on behalf of its members: Ireland's dairy processors and, in turn, the Irish dairy farmer.

I visited Moorepark Research Institute, internationally famed for research into grass varieties that would also grow well in the Scottish climate and suit grass-based dairy farming. The visit was very informative and reassuring: they are confident grass-based dairy farming is the most profitable way to produce milk.

I attended the EU Milk Marketing conference in Dublin where I was the only British dairy farmer present among an audience of primarily milk processors.

5b. Chile

In November 2017 I flew with Alexander Brewster, a fellow Nuffield Farming Scholar, into Santiago Airport en route to Osorno. We had scheduled several farm visits through a contact who had been involved with the purchases of several farms in southern Chile. David van der Jagt, the general manager on Lacteos Tamesis Farm, picked us up at Osorno Airport and took us straight from the airport to an agricultural show. It was interesting to see a majority of Irish machinery on show as well as some products from New Zealand being advertised. This indicated that companies from established dairy nations are recognising the potential of an emerging dairy industry in Chile. I was very interested to see how Chilean farms had adopted the systems of other nations.



After the show, David took us to his farm, a 2000 cow, 1000-hectare grass-fed operation milking in 3 herringbone sheds. This farm was a prime example of how correct assembly of an archetypal New Zealand grass-fed system, with substantial investment and experienced management, can quickly result in a profitable dairy farm. This confirmed yet again the efficacy of a system that was invented in the early 20th century by Arthur Hosier with portable bails in Wiltshire, UK, and has since spread to dominate the dairy operations in countries as far flung as Ireland, New Zealand, and now Chile.

5c. Uruguay

Their beef industry sector was very good – traditional style Angus cattle extensively grazed and slow maturing. There were good links to market for the sale of products. Crucially, and unlike most South American countries, it was free from foot and mouth disease. Their strong focus on traceability, with all cattle having EID tags which can be traced through to end products sold in supermarkets, was impressive. But most importantly it taught me it was vital to grow at least 11 tonne/hectare of dry matter to support dairy cows.

5d. Qatar

Visited Baladna Farms in the desert of Qatar. It was a huge corporate farm which is funded by oil money and backed by the State. Baladna dived into dairy after the blockades imposed by neighbouring states significantly restricted supply of produce to them. There was a sudden need for locally produced milk to fulfil the deficit and provide food security.

Baladna was an example of what can be achieved when money is no object. Thousands of cows and a milking parlour were flown in on jumbo jets to start production within weeks of the above-mentioned blockade being imposed. This was farming on a phenomenal scale. It was not financially producing a return on capital investment and is unlikely to do so even in the distant future. But it has solved Qatar's supply issue and provided food security. See <https://baladna.co/>

Everything I saw on my Nuffield Farming Scholarship study tour confirmed to me that there was only one recipe for producing milk profitably for the dairy processing industry in Scotland: what is called the New Zealand system.

The basics of this relate to:

- Land requirements and issues
- Buildings/infrastructure
- Machinery and equipment
- Livestock and Feed
- Grassland optimisation and management
- Labour
- Finance and regulations

These issues are all explored in the following chapter, Chapter 6.



6. The basics of a simple and profitable dairy farming system

I have looked at new dairy setups in Ireland, Chile, Uruguay and Qatar, as well as being able to draw on my experience several years ago in New Zealand and, more recently, setting up my own new farm on a greenfield site. Everything I have seen has led me to believe that, for any other market than year-round domestic liquid milk supply, one needs to base one's farm model on the basic New Zealand system.

This is a low-cost, no frills, spring block calving, maximum-production-off-grass, concept, albeit being constantly updated in the light of farmers' experience and knowledge. It is also based on the principle of scale, and I had always believed that to be essential until, in Ireland, I saw some 100-cow operations that were certainly profitable. I believe that the difference here was that such operations were owner-operated and motivation very high and regular days off were probably not taken. So doing the job right was in those circumstances a given.

The New Zealand system is described below under various headings and I have incorporated the latest tweaks:

6a. Land requirements and issues

- In order for a grass-based dairy system to work you need free draining soil so it does not become water-logged. In Chile they had fantastic free draining soils so cows could be grazed for extended seasons as fields did not poach up and grass did not become sour from lying in water. This is also vital for cow feet health as they were not standing in soggy paddocks. It made it feasible for winter forage crops to be grown and grazed to reduce need to keep all animals inside during winter months.
- Need land that has the ability to grow 11 tonnes/hectare dry matter in order to sustainably feed cows. As I learned in Uruguay this can go horribly wrong if cows cannot get enough pasture intake.
- Need 200+ days of grass growing season.
- Logistical shape of land block should preferably not be too long and narrow. In Ireland I saw some awkward shaped farms that were fragmented by roads which required to be crossed. This created additional needs for time and labour to manage traffic while cows crossed a road.
- Need a relatively large single block with low number of transections (e.g. rivers, roads, train tracks going through land)
- Must have good access to water in some shape or form: mains water, borehole water or spring water - as we have personally learned. Water is needed for cows to drink (an average dairy cow requires 30 – 50 gallons of water each day, and during periods of heat stress this intake will double); to clean equipment and wash down yards. (Qatar, with its extremely hot temperatures, was particularly disadvantaged by water availability and costs. Water had to be desalinated before it could be used. Cows required climate control in sheds and water misting in areas between sheds. The Irish farm manager at Baladna farms, John Dore, told me a staggering number of litres of water was needed to produce 1L of milk on farm)



6b. Buildings/infrastructure

- Ideally buildings should be located in the centre of the land block so walking distances for cows to outlying paddocks are roughly equal at each extremity of the land border.
- Effluent pond should be lower than parlour/collecting yard to take advantage of gravity for dirty water collection. I have seen some farms on my travels where slurry ponds are on higher ground which required slurry/dirty water to be pumped up – this creates a lot more potential for things to go wrong and additional time to oversee this happening, plus the cost for pumps to be operated.
- Fencing should be carried out properly using large posts and either single or twin wire electrics. Gateways should be large and numerous – at least 2 per paddock so cows can enter at the furthest away gate and leave from the nearest access.
- Fence unit sited near parlour
- Water troughs should be in the centre of paddocks so cows can easily access and fields can be subdivided and the cows still have access to water.
- Large water pipes (32mm and upward) should be used to maintain fast flowing water to troughs so cows are not waiting for troughs to fill.
- Tracks should be cambered to allow rain water to run off and minimise occurrence of potholing.
- Concrete should be level (no lip joins if possible). Methodology should be carefully thought through prior to construction or analysed as to how it can be improved.
- Dirty and clean waste water should be thought about. Dirty water must be collected and area/volume of storage of this be calculated to ensure at least 6 months storage so this can be used as a nutrient fertiliser when you wish to put it on the land; as opposed to needing to be spread because storage is limited.
- Water, whatever the source, is an expense. Clean water (e.g. roof runoff) etc should be diverted to field drains (not into a dirty water area) or collected and recycled on farm for wash down etc.
- Cluster calculator - the total number of milking units required on a farm - can be calculated simply as 10% of maximum stocking rate. E.g. 100 hectares unit with a stocking rate of 3 cows to the hectare = capacity for 300 cows. This unit should in turn have 30 clusters in the parlour to facilitate efficient milking. When in Ireland there was a lot of focus on milking times and ensuring the total operation does not take so long that the cows are waiting excessive amounts of time to be milked. Similarly, the farm's labour should not suffer burn out because the total milking operation is taking too long.
- Cow housing of some type will almost always be required in Scotland to cover the worst weather spells. I am open minded in regard to indoor or outdoor cubicle units or a straw shed, as long as sheds have adequate ventilation/air flow to minimise disease risk, but can also be closed in if required (for example during 'The Beast from The East' storm of 2018). In Ireland I saw that outside cubicles can work. To me personally they appeared to be clean and did not require sawdusting, so saved on infrastructure and running costs.

Readers are strongly recommended to download and read AHDB's booklet "Dairy Housing – a Best Practice Guide".

https://dairy.ahdb.org.uk/non_umbraco/download.aspx?media=15672 and also to study **Dairy NZ's pdf: <https://www.dairynz.co.nz/media/215384/Tracks-and-Raceways.pdf>**



6c. Machinery and equipment

- Aim for the minimal amount of equipment you can manage on. All machinery depreciates in value and costs money to maintain and repair. This is pure cost to the business.
- Contract out as many jobs as possible, e.g. silage making, to allow you to focus on the cows and not be distracted by arable work.
- A quad bike is essential.
- A telehandler of some form will probably be required for winter months to feed animals/put straw bales into pens: although for some this need may be catered for by the use of a bobcat type machine or a loader on a tractor.
- Electric fence reels should be invested in as these can be used to break paddocks up if required to manage grazing versus grass growth.
- The milking parlour itself can be kept relatively simple and does not need to be new as long as it is installed properly. Fall of concrete must be carefully planned and drainage channels are essential.
- Cow-flow through sheds/parlour should be thought about to move cows easily.
- Good water pressure is essential for refilling of troughs and ability to wash down parlour. (See AHDB leaflet <https://dairy.ahdb.org.uk/technical-information/buildings/housing/water-provision/#.XJzipVX7SUK>)

6d. Livestock

In my experience and from travels abroad I believe the best cow breed for grass-based dairy farming is the Friesian X Jersey. Black cows with black feet (for natural resistance to feet issues) around 500kg are idea for grass-based systems. They should produce a high quality milk with high constituent value and hopefully a yield of approximately 5000L/cow/year. These are efficient milk producing animals that have a level of cross bred vigour.

As a general observation I believe the more you cross the breeds the more the hybrid vigour is increased. Select the following breeds to improve particular traits:

Jersey	To increase butterfat and reduce cow size to inhibit poaching of land
Friesian	To improve yield
Fleckvieh	Has good beef characteristics – therefore both calf and ultimate cast cow prices are higher
Montbeliarde	As per Fleckvieh has good beef characteristics plus milk yield is good
Swedish Red	Improves both constituents and volume of milk

6e. Grassland

- It is an essential pillar of the NZ system that the maximum amount of milk should be produced off grass. Optimum grass production requires a rainfall in excess of 1000 mm, and pH levels in the 6 range.
- Select high sugar grass varieties which are matched to the soil type. Tetraploid and Diploid grasses are preferred. Mix 2 varieties of grass seed both with similar heading date: one with



spring vigour and one with autumn vigour. Sowing rate should be 14kg of grass seed/acre + 1kg small leaf white clover/acre.

- I noticed that in Chile there was a large variety of natural herbs which supplemented the grasses. I believe this made the grass more palatable for cows and probably increased intakes as a result. Further research/experimentation with herbs in sward mixtures here in the UK with herbs, e.g. chicory, plantain, is called for.

6f. Feed through the year

- You require 6 tonnes dry matter per cow per annum for a 500kg cross bred cow producing 5000L/year.
- Concentrate can be used to supplement a grass-based diet but this must be carefully managed in terms of quantity/cow.
- It has been shown in studies that increasing the amount of concentrate fed will increase milk yields but beyond the optimum amount there is direct correlation with reduced farm profits. For further information I would recommend the report of my fellow Nuffield Farming Scholar, Iwan Vaughan, "Sustainable protein feeding for the UK dairy industry", located on the Nuffield International website (www.nuffieldinternational.org/reports)
- Feed should be sourced with the support of a good nutritionist, and based on market prices at the time as well as dietary requirements. If one foodstuff is at a premium rate then one must look for an alternative: e.g. potatoes, "draff" (whisky by-product), maize, turnips.
- Grass and silage must be analysed to determine its nutritional value: metabolic energy (ME), protein content, dry matter, are key although some analyses can give a fuller breakdown. Buffer feed should then be selected to complement the grass in the diet to ensure cows are receiving all necessary nutrients
- Mineral supplements are also required to ensure cows are receiving full requirements so that they transition well through the phases from dry cow to freshly calved; and then for fertility to maximise health and therefore the ultimate returns from these animals.
- Feed budgets are very important in order to know how much you *have* versus how much you *need*. Again, there is a lot of information elsewhere on this subject, and it would certainly be available from a good nutritionist.

6g. Labour

- Statistics from leading dairy farms have shown that you require 20 man hours per cow per year. This equates to approximately one person per 100 cows.
- As an industry we are poor at motivating people to progress themselves. Here in Scotland we are desperately short of labour in the dairy sector and it does not appear to rank as an attractive career pathway for young people to enter. This should be a major area of focus for dairy farmers.
- When I was in New Zealand there were defined roles: e.g. milker, general farm worker, tractor man, second in charge (2iC), farm manager, farm owner, operations manager. In



Scotland there are not so many identified roles in the dairy sector mainly because these are family-run units

- Career pathway - to encourage new entrants to work in the dairy and farming sector, clear progression pathways should be introduced industry-wide.
- Induction and training. When new employees come to a farm unit they should be given information on what roles they are expected to complete plus given an opportunity to shadow more experienced staff/managers until competent carrying out such duties on their own.
- Health and safety. As the industry with the worst Health and Safety statistics in the UK we must all strive to improve this and have processes in place to minimise risks.
- Protective clothing. Wet weather gear and suitable footwear should be provided to staff on dairy farms, plus latex gloves for milking, to help protect hands and minimise the smell that can linger on them.
- Wages and incentives – staff must be paid in line with government regulation and if possible incentives offered over and above this. E.g. bonuses for achieving KPI indicators such as improving milk volume, reducing mastitis incidence, reducing bactoscan and somatic cell count. There are also small things that can be done to create a positive working environment, e.g. having a couple of beers together at the end of a shift, the odd meal out or extra day off. These small gestures can go a long way in improving morale and building a reputation as a positive employer
- Mental health Issues - being able to talk about them
- Discussion groups – allowing and encouraging staff to attend these where they can learn from one another and build knowledge for future development roles. The time invested in staff this way will be repaid as staff put into practice what they have learned.
- Placements from colleges. I believe that work placements and time spent on hands-on practice should be a compulsory element in agricultural degrees
- The hardest part about managing labour is getting it recruited in the first place! Farmers should consider attending career events and getting into schools to raise the profile of farming with a younger generation who would not necessarily be suited to an academic future.
- Feeling of belonging. There is a need to change the image of farming as being purely a family business in order to encourage those from outside the industry to enter it.

6h. Finance

- Budgets and spreadsheets are essential with monthly and yearly goals set and reviewed.
- Building relationships and trust with UK banks is essential to finance a project. Starting out can be challenging as generally banks will want to see 3 years of accounts before lending so, for the starting-up farmer, this can take time and be difficult to achieve. If we compare Scotland to New Zealand and Chile, share milking/share farming are much more common practice there, and these systems allow those wishing to start on their own an opportunity to build equity and an accounts record. This would be another benefit of having such schemes in the UK. Borrowing against land generally requires at least 30% equity to achieve a loan/mortgage of 70%.



- Borrowing against cows is rarely available here in the UK, whereas in New Zealand and Chile it is relatively easy to do with 50% to 100% loans on cows available. UK banks seem to view anything with legs as high risk. How could this be changed? Could there be a model, for example, comparable to HP or PCP finance available on a car, where an individual would not have to buy the livestock outright at the start but could pay for them over time? Would this then require a change in the way animals are traded - for example markets would need to check ownership of animals before being sold?

6i. Regulation

If considering converting an existing farm into dairy or establishing a new dairy farm it is vital to consider what regulatory bodies need to be consulted. Involve all bodies as early as possible. Generally these bodies will be much more receptive and willing to assist if you are open and upfront with them. This may highlight factors one would otherwise not have considered which could fundamentally change the course of a project. Some may be afraid of this factor but it is better to know what you are dealing with and address any anomalies before construction starts. Otherwise it may cause much greater issue and put the whole project in jeopardy at a later stage.

Below is a suggested list but this may not be exhaustive:

- **Council Planning Department** – if you are building new sheds on farm to facilitate conversion then these will need planning permission – if under 465 meters Square (120 x 40ft) and more than 400 meters away from independent dwelling houses you can probably get away with Prior Notification Application which is cheaper and faster than a Full Planning Application but it is best to discuss this with your local authority and ask their advice on what is necessary.
- **Transport management** – this will generally be covered by the council planning but if you are significantly changing the use of land – e.g. building where there wasn't any before – you may wish to consider how this affects the access/egress from property and if the current access is suitable for this. If land is directly off a major road this could have significant impact and may require separate consultation with a Transport Management body. For existing farms converting, this should not be so much of a concern.
- **SEPA**. With dairy farms there is a lot of 'dirty' waste water to think about from cow manure (slurry), parlour washings and silage effluent. It is best to discuss plans and ensure all permissions are in place prior to construction of collection facilities, to ensure such facilities are of adequate size and fit for purpose (constructed of appropriate materials etc)
- **Rural Payments Authority** will probably want to know that land is being used for a different purpose as this may affect subsidy claims of an existing farm (LFA is not claimable for Dairy).
- **Red Tractor** – To be able to sell milk in the UK most producers will require accreditation with Red Tractor. It is worth considering these regulations prior to building to ensure you are going to be compliant (e.g. the tank room has to be to food safety standards so no point planning to put your tank in a traditional barn if this will not satisfy requirements).
- **Environmental issues**. These are going to become more important and legislation will constantly be updated.



6j. Greenfield site versus conversion of existing farm

- A greenfield site is the more expensive option as you have to build everything from scratch and have to thoroughly plan all details at the start. Keeping to budget can be challenging with unforeseen changes. However, this does give a blank canvas to hopefully ensure a farm is built to optimise cow flow and meet all regulatory requirements as well as being efficient to operate around.
- Existing farm is probably the preferred option in that it is significantly cheaper and quicker to convert existing facilities to suit. But you do have to work around what is already there and this can prove challenging. Buildings cannot be moved so consider how far cows will need to travel from the shed to grazing – sheds need to be as close to the middle of the farm as possible.
- Remember what you spend at the start has to be paid back - so avoid the cow palaces of Qatar!

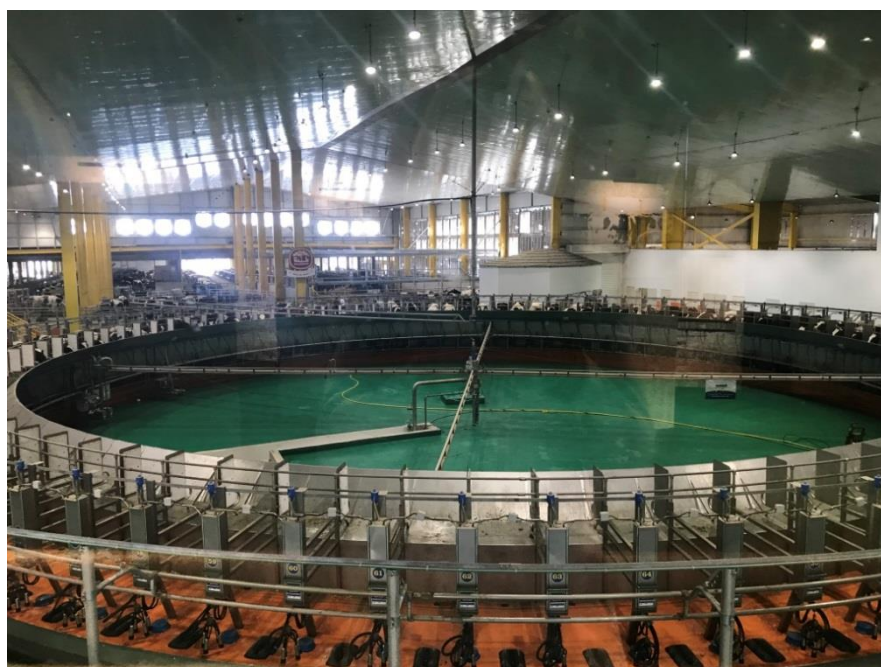


Figure 10: "Cow palace" in Qatar seen from the public viewing gallery, constructed with money no object. Photo: author's own

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The next chapter gives sample budgets to show:

1. The operating costs a NZ-system dairy farm should aim to achieve in order to make a profit.
2. A basic financial model for a farmer contemplating converting from sheep/beef to dairy.
3. The third sample budget is an extrapolation of this conversion from sheep/beef to dairy. It gives comparisons between finance carried solely by the business owner(s) if there was a corporate arrangement, as opposed to when a sharemilker agreement is in place.



7. Hypothetical budgets/costings

7a. Basic financial model for a dairy farm operating costs –

The budget below for an imaginary farm shows the operating costs a NZ-system dairy farm should aim to achieve in order to make a profit. It is assumed this imaginary farm is 250 ha, with 600 cows, average yield 4000 litres. No cost shown for land ownership or rent. *(This example model uses statistics from the AHDB website: milk price is the last 10 year average, labour requirements, power & machinery, depreciation and feed & forage costs are as per AHDB best practice guidance)*

Base Case Model		
Land Requirements	2.4	Cows/Ha
Herd Size	600	
Replacement Rate	20%	
Cow Type, weighing 450 kg per cow	Jersey X Friesian	
Cost per Cow	£800.00	
Yield	4000	litres per cow
Land	250	ha
Total Annual Yield	2,400,000.00	litres
Solids	240,000.00	kg
Milk Price	0.27	per litre
Annual Milk Revenue	£648,000.00	
Cow Fatality Rate	5%	
Cows to cull: 90 cows @ £300	£27,000.00	
Calf fatality rate	5%	
Calves to sell: 450 @ £100 per head	£45,000.00	
Total Revenue	£720,000.00	
Revenue / Hectare	£ 2,880.00	per ha
Labour Requirements	20	hours/ cow
Labour cost	£10.00	per hour
Annual Labour Cost	£120,000.00	
Power and Machinery Costs	£72,000.00	
Depreciation Costs	£24,000.00	
Feed and Forage Costs	£144,000.00	
Herd Replacement Costs	£96,000.00	
Labour Efficiency	£ 0.05	per litre
Power and Machinery Cost Efficiency	£ 0.03	per litre
Depreciation Cost Efficiency	£ 0.01	per litre
Feed and Forage Cost Efficiency	£ 0.06	per litre
Cow replacement Cost Efficiency	£ 0.04	per litre
Total Direct Cost of Milk Production	£456,000.0	
Cost per litre	£ 0.19	per litre
Total Indirect Costs	£48,000.00	
Cost per litre	£ 0.02	Per litre
Grand Total Costs	£504,000.00	
	£0.21	per litre
EBITDA (earnings before interest, taxes, depreciation, amortisation and own labour)	£216,000.00	(0.06 p/ litre)
This represents a 30% return on Total Revenue of £720,000	30%	



7b. Basic financial model for converting from a sheep/beef farm to dairy

The budget below imagines that a 1,000 acres/400 ha upland sheep and beef farm is on the market for £2M. Basic details of the farm are shown below. The budget shows the budget involved if bought by an investor with the intention of converting into a NZ-system dairy farm.

- 1000 acre/400 hectare upland sheep and beef farm in Scotland
- Current stocking: 500 sheep and 100 beef cows
- It has 2 houses
- Annual EBITDA as a beef and sheep farm: (earnings before interest, taxes, depreciation and amortisation) comes in at -£22,000 (relies heavily on subsidies)
- On the market for £2,000,000

Let us assume the farm is purchased for £2,000,000 by a farmer/investor with the intention of converting it into a dairy farm, and the following capital is expended:

- 54 point rotary parlour
- Cow tracks and fencing
- Water supply and water upgrades
- Silage pit and winter accommodation facility upgrades
- 600 cows purchased

The total capital expenditure is £3,500,000 (including purchase of the farm). Details below:

Farm Purchase Price	£2,000,000.00
Capital Expenditure	
· 54 point rotary parlour	£400,000.00
· Cow tracks and fencing and re-seeding	£150,000.00
· Water supply and water upgrades	£50,000.00
· Silage pit and winter accommodation facility upgrades	£300,000.00
· 600 cows purchased	£600,000.00
Total upgrade costs	£1,500,000.00
Total Capital Expenditure	£3,500,000.00
Borrowings: 70% of total capital expenditure	£2,450,000.00
Required Deposit	£1,050,000.00
Interest Payments p.a.	£ 85,750.000
EBITDA (earnings before interest, taxes, depreciation and amortisation)	£216,000.00
Net Revenue	£ 130,250.000
Annual Return on Initial Investment (i.e. the deposit)	12%



7c. Proposed financing models

Two models are now shown. Each is based on the example shown in 7b above, where a 400 hectare upland beef and sheep farm has been purchased with a view to converting it to a dairy farm.

- The first model below shows all financing undertaken by the business owner or owners
- The second model below shows financing being shared via a sharemilking contract

7c.i. Private Investment Model where all financing of the farm is undertaken by the business owner or owners (a corporate model)

In this model the investor can be either one individual or a group of individuals whose share will be directly proportional to the amount of their investment. **In this example it is assumed that the hypothetical Investor in question has a 50% share in the business.**

This chart is based on the figures shown in Sub Chapter 7b on the previous page which demonstrates a total investment of 3.5million: that is £1,050,000 capital from investors, and 70% borrowed from the bank. The 3.5M is used to purchase a farm for £2.5M and then spend £1.5M converting, upgrading and buying cows (i.e. all the infrastructure and set-up costs). This model is a corporately run business.

The investors will receive 50% of net revenue as a profit return on investment equating to 6% of net revenue (3.1% return on investment annually). The other 50% of net revenue is retained in the business to pay management fees for the operator (over and above labour costs already considered) and for any maintenance re-investment required. In addition to receiving a net return annually the investors would (after the mortgage is paid) own the land, which will appreciate annually in value. (Savills website (www.savills.co.uk/research_articles/229130/228020-0) is quoted as saying land values over the past 100 years have on average increased by 6% per annum.)

Net Revenue received (as per chart in chapter 7b above)	£130,250.00
Required Net Investment from all investment sources : see chart in 7b above	£1,050,000.00
Investor Contribution for a 50% stake in the business.	£525,000.00
Investor Stake in Business is 50% ** - but half of this sum will be retained to pay management fees for operator and any maintenance reinvestment required – so net stake is equivalent to 25% share of profits	25%
Investor Annual Return (25% of net revenue,)	£32,562.50
Investor Return as a percentage of his net investment	6.2%

Note: the investor would also have a 50% share of the capital investment of the business. This would need to be retained in the business for a set period (say 10 or 20 years) when the farm would be sold, hopefully having attracted an increase in value of 6% a year. So the investor would have this 6% gain from that, **plus** the 6.2% shown in bottom line of chart above.

**the other 50% stake would be retained by other capital investors in the business



7c.ii. Sharemilker Model where financing and profits are shared via a sharemilker contract

In a 50/50 agreement the sharemilker would provide and buy 600 cows @ £800	£480,000
Also machinery for basic yard work – quad bikes, tractor/loader, electric fencing	£20,000
Total sharemilker investment	£500,000
The farm owner would provide land and buildings, inc. parlour, cow tracks, fencing, reseeding, water, silage pit, winter accommodation. The actual farming is undertaken by the sharemilker	£3,000,000

Base Case Model			Share milker undertaking	Farm owner undertaking
Land Requirements	2.4	cows/ha		
Herd Size	600		Yes	
Replacement Rate	20%		Yes	
Cow Type	JerseyXFriesian			
Cost per Cow	£800.00		Yes	
Cow Weight	450	kg		
Yield	4000L	per cow	Yes	
Land	250	Ha		Yes
Total Annual Yield	2,400,000.00	litres		
Solids	240,000.00	kg		
Milk Price	27	p/l		
Annual Milk Revenue (shared equally)	£648,000.00		£324,000	£324,000
Cow Fatality Rate	5%		Yes	
Cows to cull: 90 cows @ £300	£27,000		27,000	
Calf fatality rate	5%		Yes	
Calves to sell: 450 @ £100***	£45,000		£45,000	
Calves kept for rearing: 120 @ £100	£12,000		£12,000	
Total Revenue	£732,000.00		£408,000	£324,000
Revenue / Hectare	£2,928.00	per Ha	£1,584	£1,296
Labour Requirements	20	hours/cow	Yes	
Labour cost	£10.00	per hour	Yes	
Annual Labour Cost	£120,000.00		**£80,000	
Power and Machinery Costs	£72,000.00		£72,000	
Depreciation Costs	£24,000.00		£12,000	12,000
Feed and Forage Costs	£144,000.00		£72,000	72,000
Herd Replacement Costs	£96,000.00		£96,000	
Labour Efficiency	£0.05	per litre		
Power and Machinery Cost Efficiency	£0.03	per litre		
Depreciation Cost Efficiency	£0.01	per litre		
Feed and Forage Cost Efficiency	£0.06	per litre		
Cow replacement Cost Efficiency	£0.04	per litre		
Total Direct Cost of Milk Production	£456,000.00			
	£0.19	per litre		
Indirect Costs (legal, accountants etc)	£48,000.00			£48,000
	£0.02	per litre		
Total Costs (chart continued overleaf)	£504,000.00		£332,000	£132,000



Total cost per litre	£0.21	per litre		
EBITDA (earnings before interest, taxes, depreciation and amortisation and own labour of either sharemilker or owner)	£216,000.00	total	£64,000	£192,000
	£0.06	per litre		
Earnings from Total Revenue	29.5%		15.69%	59.26%

Notes:

1. **The sharemilker does not pay himself a wage. His drawings are all wrapped up in the EBITDA calculation. It is assumed, however, that he contributes £40k of manual labour himself, and hires in £80,000 of manual labour.
2. *** 120 calves would be retained to rear for replacements. As this Model does not cover replacement stock rearing (all cows in this Model are bought-in @ £800) it is correct to credit the sharemilker with the value of 120 calves @ £100, = £12,000
3. In this Sharemilker Model the sharemilker is responsible for the management of the farm and keeps their own accounts for same.
4. In the Farmer Model (7b) the farmer is responsible for running the farm
5. In the Corporate investors' Model (7c.i) a farm manager would be employed and would be costed under the labour section. This makes the labour element of this model higher.

The CONCLUSIONS and RECOMMENDATIONS arrived at as a result of my whole study tour are shown overleaf.



8. Conclusions

1. The UK has the second largest dairy product trade deficit in the world. So the market is clearly there.
2. To supply to the dairy product market needs milk to be produced at world prices. That requires the farmer to follow a NZ-type system: maximising milk from grass, spring block calving and minimal capital expenditure.
3. Much of Scotland enjoys good conditions for grassland production: rainfall over 1000 mm a year, pH around 6.14 and temperatures permitting a grazing season of at least 200 days a year.
4. Scotland is so far bovine TB-free.
5. Scotland's subsidy system inhibits proactive farming enterprise and the tax situation discourages the transfer of land to a younger generation.
6. The subsidy position will inevitably change soon and it is unlikely that farmers will be able to rely on current LFA payments without actively taking part in environmental schemes to merit them.
7. There is an acute shortage of dairy processing facilities
8. Scotland lacks a farming ladder equivalent to NZ's sharemilker contracts



9. Recommendations

For Farmers

1. The market is there and many of you have land more suited to dairying than you realise. So assess your potential and see if a dairying enterprise would be right for you in the future climate of Scottish agriculture.
2. Lobby your Scottish Dairy Growth Board, NFU Scotland and the government hard to persuade them to encourage the building of more processing facility in Scotland.

For Scottish Dairy Growth Board (<https://dairyhub.org>) and NFU Scotland (www.nfus.org.uk)

3. Continue to develop and promote a sharemilker contract scheme for Scottish dairy farming. An excellent start was made with the Scottish Federation of Young Farmers Clubs last year. (www.sayfc.org)
4. Continue to do all you can to persuade national processors of the viability of their establishing new plant in Scotland.
5. Promote a more proactive and vibrant Scottish agricultural industry. Encourage the production of more home grown food.
6. Negotiate with national processors to attract more investment into Scotland



10. As a result of my Nuffield Farming Scholarship ...

I believe the biggest change in myself has been in self-confidence.

I used to have a very 'rural' mentality in that I was not confident driving in towns or going to conferences but now I have found an increased confidence in myself for such undertakings.

Public speaking terrified me before and still does! But having done it a few times through Nuffield Farming, I feel proud that I have managed to achieve a bit of a breakthrough in this respect. I would never have done anything like this had it not been for my Nuffield Farming Scholarship.

Nuffield Farming has given me the confidence to speak to fellow Nuffield Farming Scholars and ask for their opinions. I am more honest, and curious to question what I am doing in my own business.

Nuffield Farming has made me keen to give something back to the industry and work towards growing a stepped career pathway and corporate farming model in the UK.

- It has also made me keen to step back from farming in a day-to-day hands-on manual sense and spend more time looking at a bigger picture while managing others to do the graft in my business.
- I have learned a lot about corporate farming models particularly from time spent in Chile and am really keen to pursue this further in the future.
- I believe Dairy Co-operatives are good if run correctly.
- I have learnt that small scale farm diversification into retail can bring lucrative returns.
- I have learnt that sometimes you have to step back and look at the business from another point of view to see what others see and question why you do things in a certain way.

It has also made me appreciate how much of a team Rhona and I are in all that we do. This is something I probably hadn't noticed until I was travelling on my study tour and was reliant on Rhona running things at home. Others have commented on this same point from external observation. I am always thinking up ideas and Rhona rationalises these.

Robert Gray

March 2019



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