Value in the Marketplace for Grass-Fed Dairy Products

A report for

NUFFIELD IRELAND

Farming Scholarships

By Joseph Lyng

2018 Nuffield Scholar

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Scholar Contact Details

Joseph Lyng,
Cluen, Inistioge, Co Kilkenny.

Phone: +353-86-0080638
Email: jlyng@glanbia.ie

In submitting this report, the Scholar has agreed to Nuffield Ireland publishing this material in its edited form.

NUFFIELD IRELAND Contact Details

John Tyrrell
Executive Secretary, Nuffield Ireland
Phone: +353-87-256 3501
Email: exec@nuffield.ie

Executive Summary

The Irish dairy industry has never been so important to the Irish economy contributing 33% of all food exports in 2018. To put this into context, the agri-food sector accounted for 10.3% of total exports in 2018. Between the periods 2009-2016 agri-food exports increased by 56% and currently makes up 8.6% of total employment on average (Department of Agriculture, Food and the Marine, 2018). With such growth it has never been so important to diversify the increasing Irish milk pool to create more value within the supply chain.

In recent years grass-fed has been trending as a demand consumers looked for when buying dairy, particularly in the Europe and the US. The term grass-fed in dairy has different interpretations depending on the country or region making the claim. There is no distinct definition however the difference often comes down to days at grass or percentage of grass in the cows diet. Irish dairy farming is unique in that 77% of the cows diet on a fresh matter basis comes from grazed pasture or 96% of the total diet if including grass silage. This is significantly higher than other countries or companies competing in this category outside of New Zealand.

In order to create value it is important to explore and highlight all of the positive attributes Irish dairying offers. One of the key attributes is how the composition of milk changes when cows graze pasture. There is a large amount of compositional related scientific studies demonstrating the apparent beneficial impacts of grass based feeding on the nutritional composition of milk, with increases in fat, protein, conjugated linoleic acid (CLA) and omega-3. It is also more profitable for the farmer. However clinical data linking grass-fed cows to having a positive impact on human health is currently lacking.

Having visited dairy enterprises and businesses in the US, China, Japan, New Zealand and Australia, this report looks at:

- The consumer's attitude to dairy and how grass-fed can heighten confidence in the category
- The potential health benefits of grass-fed dairy
- The opportunity grass-fed presents to the Irish dairy industry
- How technology can strengthen our claims, providing consumers with real time analysis

It is no longer acceptable to make soft claims about the food we eat. Up to now grass-fed has been a soft claim. With increased pressures, driven by the consumer's around health, the environment, animal welfare standards and traceability. I believe we are entering a new era where transparency and origin will drive the success of food businesses. Digital farming is a possible way farmers can achieve this.

If consumers relate grass-fed as something more meaningful and measurable than simply cows outside grazing pasture, then Irish dairy is well positioned to create value within the grass-fed category. Provided the message is clear, the approach is simple and all industry stakeholders buy in.

Contents

Foreword

Growing up on an Irish beef and sheep farm, and more recently an expanding dairy farm, I was lucky to get a good understanding of producing beef and dairy. One of the biggest challenges is remaining profitable. Primary producers of food generally get the lowest share of the final price and take nearly all the risk. In Ireland, we have a unique ability to work with nature to mitigate this risk. By growing our beef cattle and milking our dairy cows on a diet predominantly comprising of fresh grazed grass or grass silage, Irish dairy farmers reduce their reliance on bought in feed. Furthermore they are less exposed to the volatility of commodity trading on the world market.

Having completed my MSc in Food-Business Strategy in Smurfit Business School some of my greatest learning's were gained in our food-marketing module where we learnt what it takes to bring a food product to market and build a brand. Another key aspect was understanding what influences consumers to choose one product over another? There are numerous answers to this question. However, when consumers believe that a product is healthier than another or has health benefits associated with it, then price becomes an afterthought. Another relatively new influencing factor is how was this product produced?

- How were the people treated?
- How were the animals treated?
- Were chemicals used?
- Was the process environmentally friendly?
- Is it sustainable how this food was produced?

Consumers in developing countries or households where incomes is a limiting factor may not ask these questions, but society is asking more questions about food. There is plenty of information.

On being awarded my Nuffield Scholarship my aim was to look at these trends and see how Ireland can harness value from our unique family farm structure. With such an increase in Ireland's milk pool post quotas, finding new markets to sell dairy products was the challenge for Irish co-ops. Up to now processing and storing the raw material was the primary focus to ensure farmers could grow their business. However in order to harness margin and move away from commodity products like skim milk powder and whey powder further investment in R&D is necessary. This will bring about more end consumer products such as cheese, yogurt, butter etc.; and ultimately allow Irish dairying achieve greater returns.

One aspect of Irish dairy farming, which, answers many consumer concerns, is a grass-based system. A cow grazing in their natural environment conveys an image in consumers' minds of what dairy farming should look like. If as a result of farming in this way the end product contributes to the health of consumers, then Ireland is in a great position to take advantage of the additional value arising from grass-fed claims.

I was extremely fortunate to travel to some great countries and see how grass-fed dairy is already achieving market traction. It is fair to say that this is not something new. However can Ireland take this a step further and demonstrate to consumers a relatable health benefit.

Acknowledgments

Having completed my Nuffield Scholarship I feel extremely privileged to have been given this learning opportunity. On receiving my scholarship I was told by many that it is a life-changing experience and it proved to be just that. The opportunity to meet new like-minded people and travel with a purpose is rare and I am very grateful to Nuffield Ireland and the Board for awarding me this scholarship. In particular I would like to thank John Tyrrell, Secretary of Nuffield Ireland who has been a great support, giving comprehensive advice from start to finish.

Over the past two years of the Nuffield Scholarship program many people helped and encouraged me. Firstly my parents Anne Maire and Tom and two sisters Christine and Andrea who have always supported my endeavours and this was no different. I would like to especially thank my two Uncles Brendan and James Cummins and cousin Sean Cummins for giving me a foundation in farming and constant guidance over the years.

Secondly, Glanbia Ireland for facilitating and allowing me time to complete my Nuffield. I would like to say a special thanks to my manager Martin Power who saw merit in what I was doing and encouraged my thinking. Furthermore my colleagues in South Wexford area Eamonn, Evian, Robert, Michael and particularly Niamh for making sure the day to day running of my role ran smoothly.

I would also like to thank my mentor Brian Rushe. Having recently completed his own Nuffield, Brian has excelled in the Irish Ag Industry. Brian gave me great confidence and advice about what was in store, which ultimately aided my personal development throughout this whole experience.

Being surrounded by good people is what has been a highlight during my two years. My fellow Irish 2018 Nuffield Scholars Karol, Tommy, Klaus and Colm formed as a group but we will go forward as great friends. I would also like to give a special mention to my GFP group who travelled with me for 6 weeks around the globe. Kate, Bisi, Barry, Archie, Grant, Sarah, Rick, Sarina and Stewart are all incredible people and it was a privilege to learn and travel together with them.

I also wish to thank Karen Brosnan and Roberta McDonald for co-ordinating and facilitating the CSC in The Netherlands. They did an incredible job during the week-long conference and represented the Irish organisation with immense competence and proficiency.

Finally I would like to thank all those who helped me during my individual travels. I went to five different countries and in each one I was welcomed and accommodated. I was blown away by the hospitality I received and willingness to help with my project, be it individual farms, dairy companies, research institutions or industry organisations.

Abbreviations

CLA -Conjugated linoleic acid

FO -Fair Oaks

GDP -Global Dairy Platform (USA)

FO -Fair Oaks (Dairy Farm in Chicago)

MH -Maple Hill Creamery

OV -Organic Valley

PCO -Pennsylvania Certified Organic

SCC -Somatic Cell Count

SMP -Skim Milk Powder

WMP -Whole Milk Powder

Objectives

- Show how consumer trends are changing and how dairy fits into these trends
- Highlight the nutritional value of dairy and its importance to global food consumption
- Explain in detail the science behind grass-fed dairy products and why they can be differentiated from confined systems in the marketplace
- Show the growing trends towards grass-fed and highlight the countries who are achieving additional value
- Explain how new technologies can play an essential role ensuring consumer confidence around traceability and the diet of Irish dairy cows
- Highlight how Ireland is positioned to take advantage of grass-based claims and explain what it could potentially mean to the Irish dairy industry.

Introduction

Growing up in rural Ireland you become accustomed to farming and farms as part of a community. Even if you speak to citizens living in urban areas, you won't have to go back many generations before you find a connection to the land. That connection is the foundation of the Irish economy and what has propelled Ireland to now be a leading global exporter of food, in particular meat and dairy. It's temperate climate and ability to produce wholesome food from lush green pastures is what makes Ireland unique.

As an export nation dairy farming plays a huge role in the Irish economy. Since 2010 dairy exports have increased by 78%, sitting at a healthy €4bn in 2018. €1bn of this came from butter exports while €800m came from cheese exports (Bord Bia, 2019).

Contributing to this was the EU's abolition of milk quotas in 2015, bringing about an increase in production of almost 50%. This brings about huge opportunities but also challenges to create value-added products, ultimately differentiating Ireland from countries trading in commodities such as whole milk powder (WMP) and skim milk powder (SMP).

Throughout this report it is important to understand just how small Ireland is in terms of milk production on a global scale. Ireland accounts for just over 1% of world milk production. We have 18,500 family-owned dairy farms producing in the region of 7.4 billion kg of milk annually (Enterprise Ireland, 2018). Compare this to the US with 91.3 billion kg, China 35.7 billion kg, New Zealand 18.9 kg and the UK 13.6 billion kg of milk annually.

Therefore competing for market share with dairy commodities is a tough task for Ireland. In order to be successful in any market differentiation is key and it is with this reason that grass-fed dairy potentially makes Ireland a market leader, especially in the fresh dairy products category.

According to the latest OEDC report, 'world consumption of fresh dairy products and processed dairy products is poised to grow by 2.1% p.a. and 1.7% p.a. respectively, over the next decade'. The largest share of milk and dairy product consumption is in the form of fresh dairy products, taking up about 50% of the world's total milk production. This share continues to increase to 52% over the next ten years due to rising milk consumption in developing countries' (OEDC, 2018)

Dairy demand in developed countries has been shifting for several years towards butter and dairy fat and away from substitutes based on vegetable oil. This trend can be attributed to a more positive health assessment of dairy fat and a change in taste. As incomes and population increase and diets become more globalised, consumption of dairy products is expected to increase in developing countries. In developed countries, per capita consumption is projected to grow from 22.2 kg in 2015-17 to 23.1 kg in 2027, compared to an increase from 10.6 kg to 13.5 kg in developing countries.

But how much is too much? The recommended daily intake of dairy for an adult is 330g per day, accounting for 16% of a woman's calorie intake and 12% of a mans calorie intake. Even if per capita consumption of dairy increases to 25kg by 2027 in developed countries it still only equates to 69g of dairy per day.

This significant growth is coming timely. World population growth combined with economic development will drive increased need for food and nutrition both in developing and developed countries. By 2050 the world population will have grown so much it will be the equivalent of adding another China and India to the world. Therefore food production is expected to grow 70-80% by 2050 (FAO, 2009). This global food challenge is not just about affordable calorie intake, but it's also about diet quality. It is important that this growth remains nutrition sensitive and results in better nutritional outcomes through enhanced opportunities.

However, this trend of natural wholesome food is relatively new. It is not that long ago that low fat or no fat was trending. Faced with a landslide against fat in the 1980s, manufacturers had to adjust. Fat is dangerous, and this product has no fat; therefore it must be healthy. This was the age of SnackWells, the brand of low-fat cookies introduced by Nabisco in 1992 that within two years had surpassed the venerable Ritz cracker to become the No. 1 snack in America.

But without fat, something had to be added, and Americans ended up making a dangerous trade. "We just cut fat and added a whole lot of low-fat junk food that increased calorie intake," says Dr David Katz, the founding director of Yale University's Prevention Research Centre. "It was a diet of unintended consequences' (Walsh, 2014).

There are Library's full of books on what we should and should not eat, however almost every expert agrees we'd be healthier if more of our diet were made up of what writer Michael Pollan bluntly calls "real food". The war over fat is far from over. Consumer habits are deeply formed, and entire industries are based on demonising fat. TV teems with reality shows about losing weight. The aisles are still filled with low-fat snacks and most of us still feel a twinge of shame when we gobble down a steak or half a block of cheese.

So publishing scientific research that contradicts or questions what we have long been told about saturated fat finds it difficult to make traction. Even experts like Harvard's Frank Hu who says people shouldn't be concerned about total fat, draw the line at fully exonerating saturated fat. "I do worry that if people get the message that saturated fat is fine, they'll adopt unhealthy habits. "We should be focusing on quality of food, of real food" (Walsh, 2014).

In 2015 the United Nations announced 17 Sustainability Development Goals (SDG's). Building on the principle of "leaving no one behind", the new Agenda emphasizes a holistic approach to achieving sustainable development for all (Nations, 2015). This report highlights how grass-fed dairy farming contributes to these goals, particularly:

Goal 12: Responsible Production and Consumption - Producing milk from a grass based systems means working closely with nature. Doing so responsibly allows animals, farmers, processors, retailers and consumers reap the benefits into the future.

Goal 15: Life on Land - This goal looks at restoring degraded land and soils, aiming to achieve a land degradation-neutral world. Grass-fed dairy production promotes healthy soils and carbon synchronisation. There is less cultivation of land compared to other enterprises and organic matter is restored each season.

Goal 17: Partnerships for the Goals – Partnerships in finance, trade, technology and building capacity through knowledge sharing will help achieve this goal. Dairy farming in Ireland is an

example of partnerships working across all stages of the supply chain to produce the highest quality food, providing nutrition to families around the world.

1. The Consumer

The end consumer is the most important person in any supply chain. Understanding the consumer in order to satisfy their needs is a challenge food businesses face every day and when it comes to dairy that challenge is no different.

I visited The Global Dairy Platform (GDP) in Chicago, which is collaboration, through membership, of dairy companies, associations, scientific bodies and other partners. Their objective is to lead and build evidence on dairy's role in the diet, and show the sector's commitment to responsible food production. GDP recently completed research across the US on who are the consumers of dairy, breaking them into segments. Interestingly the segments were broken down and summarised as follows.

Dairy Lovers

- I drink, eat, and cook with dairy a lot because I love it.
- Dairy foods are my favourite-and, actually, not many other foods matter to me.
- While I don't really care about new food trends or being healthy, I try to keep an active lifestyle.

Food Lovers

- I like dairy a lot- but that's because I truly love all food.
- I want to explore all that food has to offer by trying new trends and visiting the hottest new spots.
- Food is what I live for and I would rather be eating what I love than watching what I eat.

Contented Traditionalists-

- I grew up with dairy and am ok with that, but to be honest, I don't really care that much about what I eat.
- I tend to just eat the same things I always have and don't seem to put much thought into it.
- I don't really care about eating healthy or keeping active- just let me live my life.

Conflicted Health-seekers

- I'm not really sure how I feel about dairy. On one hand it taste good but on the other hand I probably shouldn't eat a lot of it.
- I want to try and be healthy as much as I can, but it's so hard when there's so much yummy food out there.
- At the end of the day, I'm not going to diet or exercise if it means I can't eat what I love.

Unengaged Functionalists

- Food is fuel that helps me to do what I love- whether that means being physically active or just proactive.
- I don't really have feelings towards dairy one way or another because food doesn't really matter that much.

Sceptical Food Purists

- My body is a temple and I only want to have the best food- which is defiantly NOT dairy.
- If you are going to live well, you need to eat well, stay active, and avoid all those nasty additives in food.

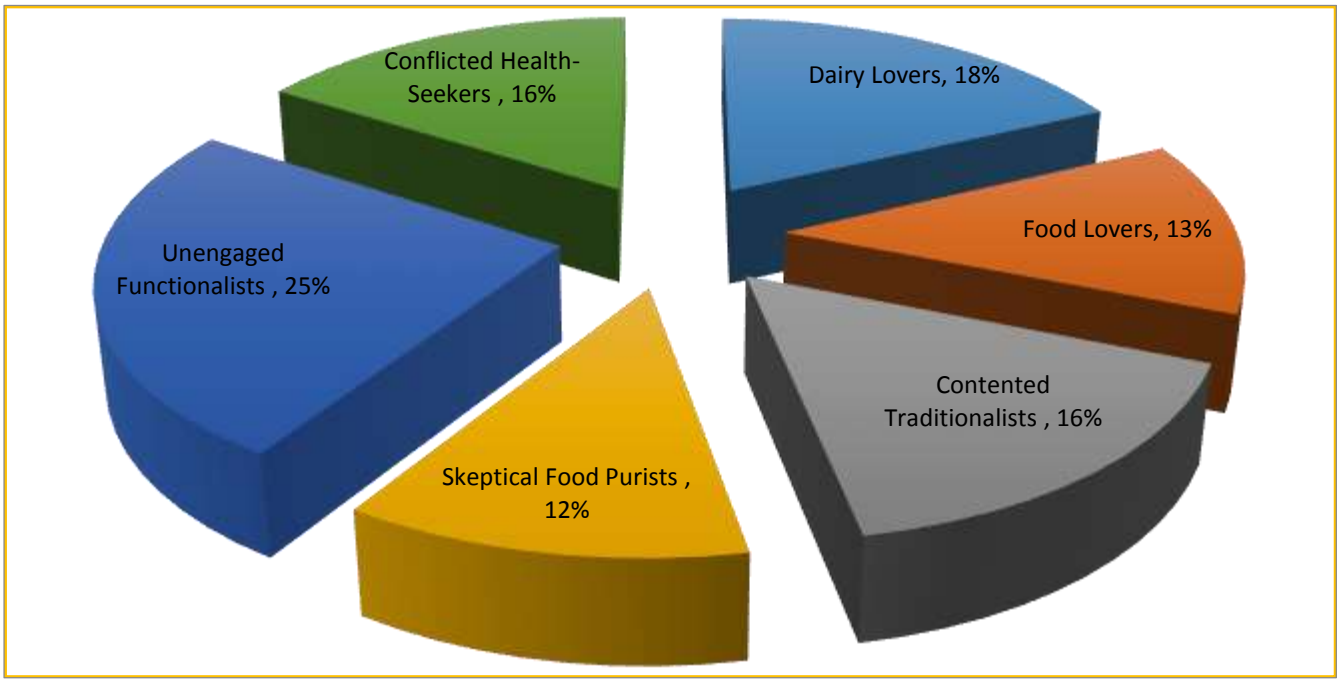

Figure 1 Market segment by consumer profile (Global Dairy Platform, 2018)

Breaking down consumers into segments provides interesting insight. The reasons why society eats the way they do is ever changing. Food is a neccessity for everyday life, however consumers are becoming increasingly influenced by how food is marketed in making their final purchasing decisions. Food can bring about a passion in people as it often draws on their emotions.

Society was influenced in different ways, this is before social media, smart phones or Google learning, about what was good for us was very different from how we learn today. Information travelled slower and therefore trends did not gain traction as fast.

Today at the touch of a button anybody can become informed as to what is good or bad. Because of these channels, how information is disseminated has seen a complete turnaround in consumer interaction. There is no doubt that his technology has been revolutionary, however when it comes to a complex subject like the science of food it can be misleading.

Mapel Hill Creamery- Grass fed demanding a premium in New York State

Figure 1 Paul and Phyllis with their son Oliver

In upstate New York Maple Hill Creamery (MH) has been producing grass-fed dairy products since 2009. The company started when Tim and Laura Joseph purchased their first farm having had no previous farming experience. They started out with a conventional dairy, but quickly became fascinated by organic practices. Fast-forward nine years and I went to visit the creamery's largest supplier and shareholder Paul and Phyllis Vanamburagh. On arrival, Paul was filled with enthusiasm having recently bought a second block of land and was installing his new herringbone parlour, aiming to move to 260 cows.

Situated around three hours north of New York City MH has access to three major population hubs in the US; Washington, New York and Boston. These expansive high-end cities with an estimated combined population of 30 million gives MH the perfect market place to promote and sell grass-fed products. Paul was able to tell me with great pride that MH was the number **1 SKU or product in Whole Foods** for the first half of 2018 across all categories. Whole Foods is 'Americas healthiest Grocery Store'.

They own a Jersey-cross herd with an average milk yield of 3,900 litres. Average protein is 3.5%, butterfat was 4.7% and SCC is 200,000. Their cow's diet consisted of haylage (alfalfa)

Figure 3 Maple Hill Creamery Grass-fed products

sorghum and pasture. What is worth noting is how Phil and Phyllis overcome a negative energy balance when the cows calf down. They feed alfalfa and sorghum silage to bring up

the cows energy levels. The Pennsylvania Certified Organic (PCO) 100% organic grass-fed certification manual (Organic, 2018) has clear guidelines as to what farmers can and can't give their cows. It states that 'cows may not be fed grain or concentrates' unless an animal is sick and if so the farmer must notify PCO. Furthermore the certification outlines that 'pastures that contain grain or corn crops shall be managed to not intentionally allow grain or corn crops to mature past the vegetative state'. Paul acknowledged that managing negative energy balance was difficult and he hopes that in the coming years the PCO certification would allow farmers to feed alfalfa pellets to cows. Growing crops on farm was not challenging, as there was a large supply of chicken manure and pig manure, which was used as fertilizer.

Pasture made up 47% of the cows diet or 172 days at grass (2017), with the remainder coming from alfalfa and sorghum silage. The length of lactation is 280 days. Cow longevity is 10 years. No tubes were used at drying off; they simply stop milking them and put them in a different group. Mastitis rate is 4% and they used a product through the mineral called Fly-Be-Gone to keep down flies during the summer. Voluntary cull rate was 4-5%, calf mortality was 2-3% and there was no issue with lameness in the herd. Bull calves were sold at the local mart.

There was no veterinarian herd health plan and no vaccinations for disease control or for an irradiation program. Calves are injected with a mineral boost, as the fertility of the soil is quite low. The heifer rearing process was both simple and different. They keep 18-20% for replacements and they simply leave the calves on the cows to rear them. Each day the cows come into be milked the calves' come with them. There is simply no calf rearing on the farm. After 7 months the calves are taken away from the herd and would be 60% of their mature weight. They could potentially be served after 1 year. Paul commented that economically this works very well with cost of rearing a heifer far exceeding the loss in milk yield.

From a sustainability point of view MH currently do not have a sustainability program but it is something they are working on. They do an audit annually with the major parameters being body condition score, pasture quality, cull rates and days at pasture. The price paid is $36.5 per 100lbs but Paul commented that this is down 18% on last year. MH is relatively new to this space but feel research into grass-fed and its link to CLA and omega-3 will enhance their product range going forward.

A2 Milk- How consumer perception transformed milk

Many consumers across Europe may not be fully aware of A2 milk. However, where it began in New Zealand and Australia it is one of the biggest growth stories of any food category in recent times. The A2 Milk Company has divided dairy retailing and challenged it in a way many thought would never happen. It now makes up 10% of the fresh milk market in Australia and sells for about A$2.80 a litre, more than double the price of regular household milk. So what is it and why has it been so successful?

The majority of dairy cows produce two types of beta-casein protein A1 and A2. However some cows have been tested to produce only A2 protein. Scientist say that "genetic mutation occurred in northern Europe 5000 years ago and A1 protein started showing up in milk that up to then contained A2 protein" (Woodford, 2003). The theory is that A2 milk or A2 protein is easier to digest and has some health attributes.

There has been a lot of debate about this concept mainly arising from a book published by Woodford in 2007 on A1 versus A2 called 'Devil in the Milk'. The book claims that A1 protein forms a fragment when digested that can trigger inflammation in the body, potentially leading to ailments from irritable bowel syndrome and eczema to schizophrenia and autism.

However in 2005 the European Journal of Clinical Nutrition found no convincing evidence that A1 protein has an adverse effect on humans (nutrition, 2005). Furthermore the Dietitians Association of Australia say there is not enough evidence to support the claims and that A2s benefits are anecdotal.

Regardless of whether you acknowledge the theory or not the fact is that A2 milk has changed many consumers' minds primarily for health reasons. Founded in 2000 by New Zealand scientist Corran McLachlan and multimillionaire farm owner Howard Paterson, A2 Milk's market value has more than tripled to NZ$1.2 billion over the past year (Brien, 2016).

It has outstripped sales of organic milk in Australia, said Michael Harvey, a senior dairy analyst with Rabobank International in Melbourne. It entered the UK in 2012 and expanded into the US last year, where is expected to exceed the growth witnessed in Australia and New Zealand at the outset.

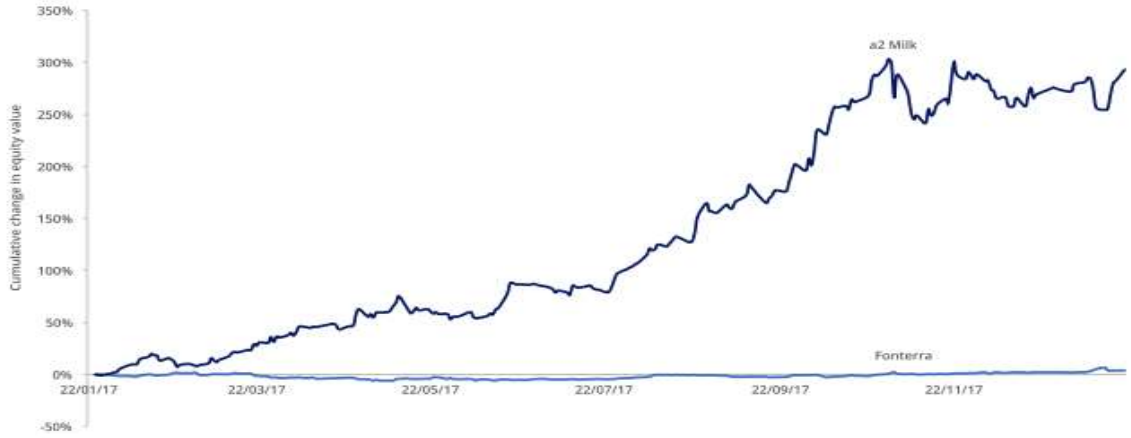

Figure 4 The percentage change in the equity of the a2 Milk Company versus Fonterra

A2 Milk company products are now selling in most high end US supermarkets including Whole Foods, Albertsons Cos, as well as Kroger, the largest US grocery chain. Along with that in 2013 they introduced A2 Platinum infant formula into the Chinese market. The first half of 2016 the sales for this product had grown by 340% to NZ$73.9 million. The company claim that their products simply "make you feel better"

You might be wondering what does this have to do with grass-fed. If you consider how it started and how it gained so much traction, it is a great example of how a health link can explode a category. Consumers were engaged about the new concept and were willing to pay more due for the perceived health benefits. There is arguably more evidence to claim a health benefit for grass-fed in terms of additional omega-3, less omega-6 and a higher level of CLA.

However countries within the EU need to follow strict rules and regulations in order to make a claim. The message got out to consumers about A2 and it took off. It was simplistic

marketing but very effective. Ireland can take huge encouragement from the A2 milk Company's story and how a dairy health benefit concept exploded.

2. The Nutritional Value of Milk

When I began researching the nutritional value of milk I was intrigued by just how much nutrition one serving provided. Was I typical of the majority of society who consume dairy products on a daily basis without fully understanding what is in it? As kids our parents tell us to 'drink milk it's good for you', and for many that's the foundation for dairy consumption.

A dairy cow simply transforms grass, straw and crop by-products, which cannot be digested by people into nutrient rich milk. Dairy cows increase the value to the food supply by converting these inedible plant materials and inferior plant proteins into higher quality proteins with greater biological value (Global Dairy Platform, 2013).

For the past 8000 years dairy products have been an important part of the human diet and are part of the official nutritional recommendations in many countries worldwide. Dairy products provide a package of key nutrients that are difficult to obtain in diets with limited or no dairy products, such as vegan or dairy restrictive diets. Indeed, dairy products are rich in calcium, protein, potassium, iodine and phosphorus.

They contribute around 52–65 % of the dietary reference intake (DRI) of calcium and 20–28 % of the protein requirement (Rozenburg et al, 2015) depending on the age of the consumer. In Western countries up to two-thirds of the population's calcium intake is supplied by dairy products (Léon Guéguen, 2013), while at the same time dairy foods represent only 9–12 % of the total energy consumption (Jean-Philippe, 2013).

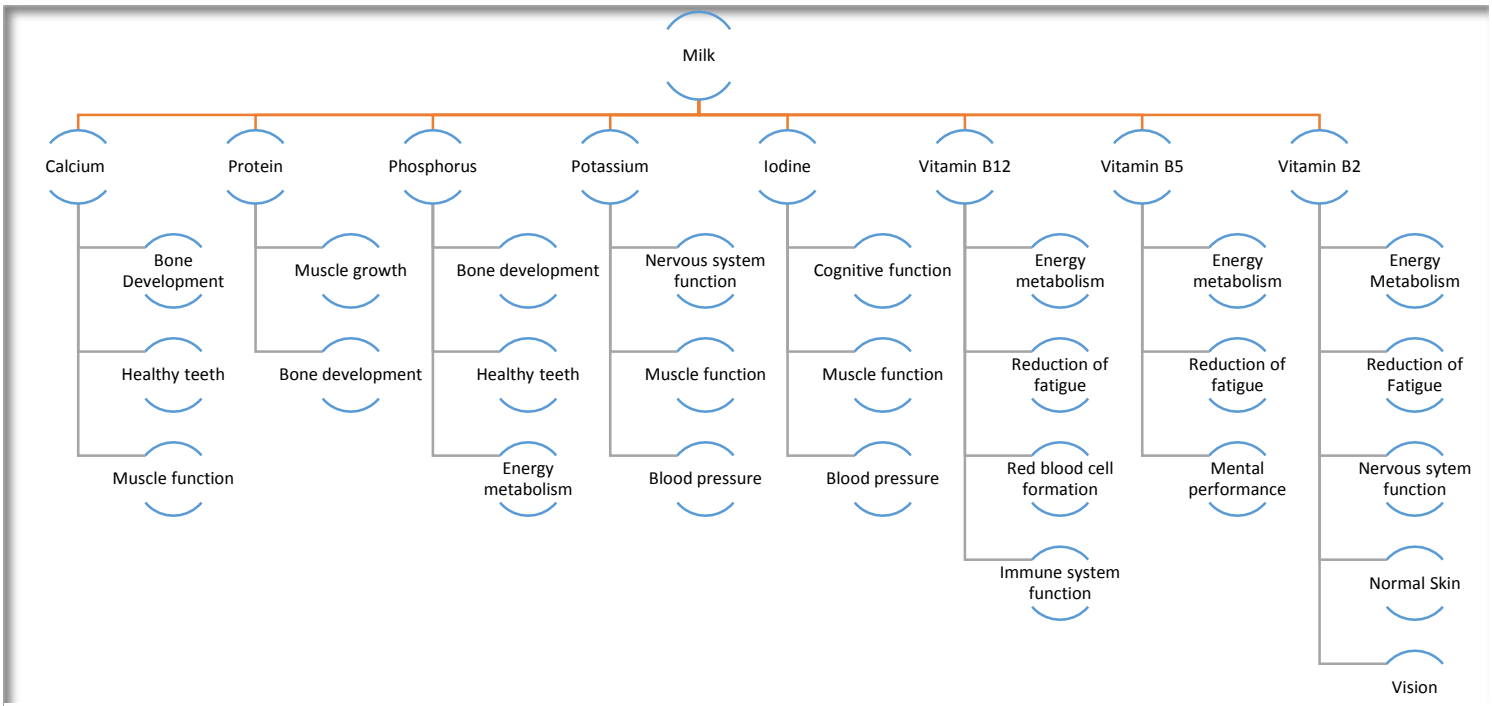

Figure 5 Breakdown of Milk: Nutritional Composition

3. Science behind Grass-Fed

Conjugated Linoleic Acid (CLA)

The fat and protein composition of milk increases when cows graze on pasture between milking. Although breed and pasture quality does play an important role, cows on pasture will show an increased level of milk solids compared with cows with indoor feeding systems. In addition to the quantity of milk solids, the actual change in fat quality under such conditions is intriguing. Milk is made up of three main fatty acids; 62% saturated, 30% monounsaturated and 4% polyunsaturated.

Conjugated Linoleic Acid (CLA) is a trans-fat (i.e. naturally occurring fat) that contributes to the 4% of polyunsaturated fatty acids found in milk. In Ireland, approximately 85% of manufacturing milk is produced from spring calving herds on pasture. In a recent study by O'Callaghan *et al* the levels of CLA in manufacturing milk were monitored over a full manufacturing season.

It was observed that the CLA content of milk varied throughout the summer season, from a low of 5.5 mg/g fat in March to a high of 16 mg/g fat in May. Highest CLA levels were observed during May and September, which coincided with periods of lush grass supply. However, in a parallel study, grass allowance was shown to have a significant effect on CLA levels.

There are numerous studies from around the world with results that show the chemistry of CLA has many 'health benefits to humans across various potent physiological functions such as anticarcinogenic, anti-obesity, antidiabetic and antihypertensive properties. This means CLA can be effective to prevent lifestyle diseases or metabolic syndromes' (Kazunori Koba, 2013).

One of these studies is from the University of Nagasaki. I came across this on my visit to Japan. It is an extensive study around the health benefits of CLA completed in 2013. The results of this study highlighted the most representative CLA isomers are 9c, 11t-18: 2 and 10t, 12c-18: 2. The report also shows that physiological effects of CLA are different between the isomers, for example the 10t,12c isomer is anticarcinogenic, antiobese and antidiabetic, whereas the 9c,11t isomer is mainly anticarcinogenic. The research showed the physiological properties of CLA including the possible mechanism and the possible to benefit human health.

Numerous papers show that when a cow's diet consists of mostly grass, the CLA concentration increases dramatically. The content of CLA in milk fat varies widely among herds. This variation may be related to factors that are associated with rumen fermentation because CLA originates from the incomplete bio- hydrogenation of unsaturated fatty acids in the rumen.

The content of CLA in milk fat is affected by a number of factors, including forage to concentrate ratio, level of intake, and intake of unsaturated fatty acids, especially plant oils that are high in linoleic acid. Seasonal variations in milk fat concentrations of CLA have also been reported; the highest concentrations are observed in summer. Previous research has also suggested that this increase during summer is related to increased consumption of lush pastures.

Consistent with this result, Timmen and Patton showed higher concentrations of CLA in milk fat of cows grazing pasture, and Dhiman et al. recently demonstrated that concentrations of CLA in milk increased as consumption of pasture increased. Banni *et al.* also showed that concentrations of CLA in the milk fat of sheep were greater when lush pasture was consumed (M. L. KELLY).

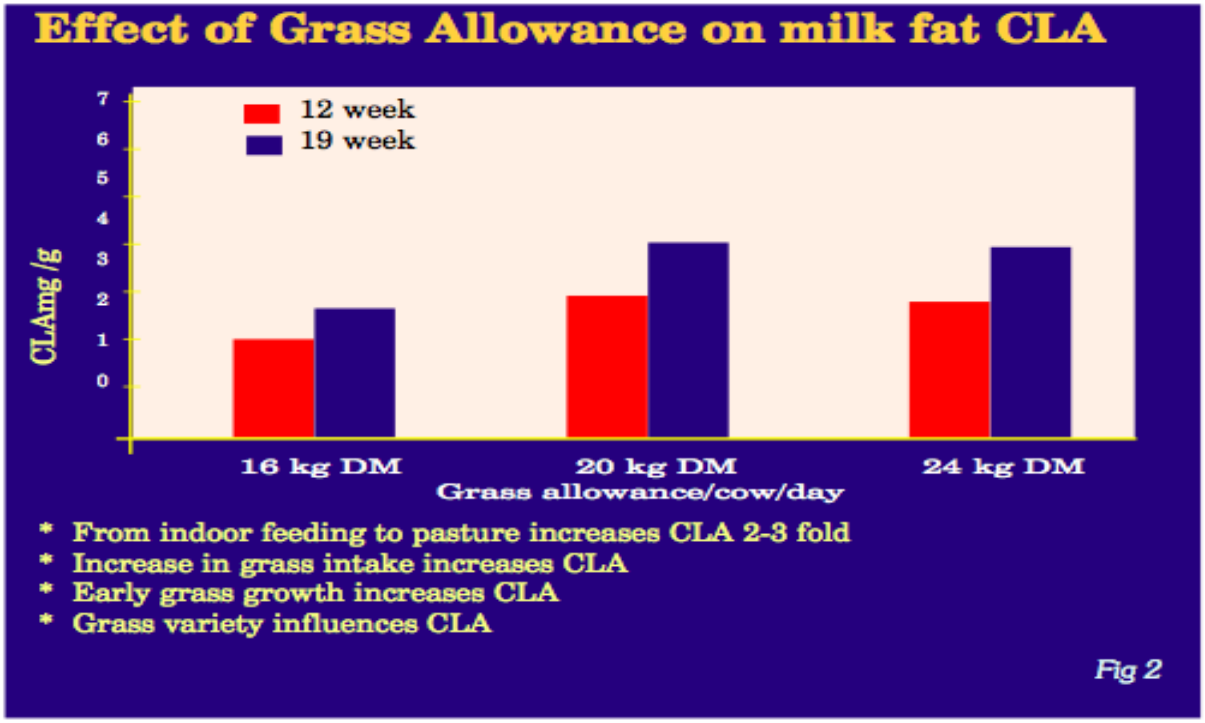

Figure 6 Effects of grass allowance on milk fat CLA

CLA was significantly lower when the grass allowance was at the lowest level (16 kg grass DM/cow/day) compared with the higher levels (20 kg and 24 kg/cow/day).

Another piece of research examined drinking skimmed milk fortified with 3 grams of CLA that led to significant body fat mass reduction among 30 healthy men and women over 12 weeks, compared to the same amount of people drinking a placebo milk. The study adds to an ever-growing body of science supporting the potential of CLA for weight management and weight loss, a category already estimated to be worth $7 billion worldwide (Daniels, 2008).

There is now an adequate amount of research on CLA and its link with human health. A positive correlation between cows grazing pasture and CLA levels has also been established. **The next step is to prove a link between both**. This will mean a clinical study to show human health benefits of consuming dairy products from pasture fed cows versus indoor TMR systems.

However in order to make such a claim EU regulation must be adhered to. The rules of the Regulation apply to nutrition claims (such as “low fat”, “high fibre”) and to health claims (such as “Vitamin D is needed for the normal growth and development of bone in children”). The objective of those rules is to ensure that any claim made on a food’s labelling, presentation or advertising in the European Union is clear, accurate and based on scientific evidence.

Food bearing claims that could mislead consumers are prohibited on the EU market. This not only protects consumers, but also promotes innovation and ensures fair competition. The rules ensure the free circulation of foods bearing claims, as any food company may use the same claims on its products anywhere in the European Union (Commision, European, 2007)

There is consistent evidence from studies around the world that CLA may have several beneficial effects on health. However, with more research looking specifically at grass-fed dairy and its correlation to the health benefits of humans will give consumers confidence when buying dairy products. It will ultimately allow Irish dairy be differentiated in the marketplace.

Organic Valley- Bringing the science of Grass Fed to family homes across North America

Organic Valley (OV) is a certified organic farmer owned cooperative that started from humble beginnings in the Coulee region in 1988. Now 30 years later the Co-op has 1,800 suppliers spread across numerous states from the mid to western region of North America. Within these 1,800 suppliers 150 of them are grass-fed only, meaning no grain of any description.

The milk from these 150 suppliers is picked up and processed separate to the other 1,650 suppliers. I visited one of those 1650 suppliers. In the heart of Iowa John Palmer is farming 430 acres. Half of this is pasture for his 120 cow Holstein herd. They milk all year round with roughly 60% calving in the autumn and 40% in the spring.

Getting into what it all actually looked like in practice was very interesting. Milk yield was 6,800l, average fat was 4.1% and protein was 3.2%. The Co-op is hoping to get to a fat figure of 4.5% over the next two years through better grass and crop management. Average SCC was 207,000. The diet of the cow was 60% forage (Grass) with the rest made up of alfalfa hay, sorghum and organic commodity feed.

It is estimated that 50% of the diet is grass on a dry matter basis. However the 150 grass-fed suppliers could only feed grass, hay of any description and forage sorghum. In other words 100% grass-fed. Days at grass in both systems was 120 days (37%) minimum and on John's farm this year that looks like it could be 200 with a lactation length of 320 days (60%).

Figure 7 Jim Wedeberg; Organic Valley, John Palmer and I at John's farm in Iowa

OV make claims of more CLA and Omega-3 on all of their products. All milk is tested every month for CLA and Omega-3 components externally (the test itself is quite expensive). They really feel that they are in the space of 'prescription agriculture'. Despite the initial outlay on marketing, OV are getting a significant return on investment.

They have created a brand around the benefits of grass-fed, organic, CLA and omega-3. Not only is the co-op getting a return, the supplier shareholders are too. The price paid to the farmer is currently $25.50 per 100lbs or 58cpl. When you compare that to the current price in Ireland of $17 per 100lbs or 39c/l that gap is quite large.

Figure 8 Organic Valley Grassmilk in Walmart stores

Explaining the Irish our production system to both John and Jim Wedeberg (Farmer Relations manager with OV), they said "their organic milk is comparable to our conventional milk and possibly inferior when you consider our grass quality". They also noted that US dairy farmers are not flexible with extremely heavy use of inputs. Inputs are becoming more expensive and they felt that most farms were driven by yield instead of profitability.

It is a different concept to the practice of Irish dairy farmers. Jim mentioned that Organic Valley ultimately would like to get into the infant formula space, but at the moment they are not making enough cheese to create the whey. The business is currently split 50/50 between milk for liquid consumption and manufacturing use.

4. How advances in technology can support our Grass Fed claims

Consumer trust is the biggest challenge within the food industry. What farmers are producing and the way it is produced has never been questioned as much. There are numerous reasons for these questions and concerns, including:

- Food Safety concerns
- Environmental concerns
- Health concerns
- Traceability concerns

Technology has now become part of everyday life. Without investing and embracing it, many businesses have failed to stay relevant. It now plays a key role in the production of food, from the primary producer right through to the end consumer. Block chain technology has the potential to ensure end-to-end traceability and give the consumer all of the information about the food they are buying.

The big challenge with grass-fed is proving it. There is no definitive definition and therefore the term can be used quite loosely. Different companies in different countries make different claims about grass-fed. For example in The Netherlands Friesland-Campina sell their premium milk as Meadow Milk claiming cows graze each day for 6 hours for 120 days.

In America Organic Valley farmers claim that the cows diet is 100% grass and they graze on average for 150 days per year. In Ireland Glanbia claim that 95% of the cows diet is grass on a fresh weight basis and cows graze for 300 days based on a three year rolling average. All of these claims are backed up and true however they are very different.

In one respect you can see why consumers begin to question claims. But what if technology could back up a claim. Imagine being able to scan a product code and see clearly all steps of the supply chain before reaching your shopping basket or table. This would take away any misconceptions and allow full transparency. That potential is real with block chain and digital farming.

The first example of it in the dairy industry came this year when French dairy cooperative Ingredia launch the first dairy ingredients to be certified, traced and audited in real time. Dairy blockchain is applied to their packaging, which will exhibit a dynamic QR code that gives the consumer access to all relevant traceability and audit information in real time.

The group was then the first in the dairy sector to collect milk from an eco-responsible specification, called “Via Lacta milk from grass-fed cows,” according to the following criteria:

- Minimum surface area of 1500 m² accessible per cow
- Minimum grazing period of 170 days per year per cow
- Milk only from farms in the Hauts-de-France region
- Minimum price set annually for committed producers and production bonus. (Ferrer, 2019)

Figure 9 Ingredia's new yogurt with QR code

Block chain is simply a decentralized, distributed and public digital ledger used to record transactions across multiple devices. For it to work it needs do two things:

I. Gather and order data into blocks

II. Chain these blocks together using cryptography

What does this look like on an Irish dairy farm that wants to show the world what grass-fed means to them? That data gathered would be from everyday practices on farm. Everything from milk quality (fat, protein, CLA, SCC), herd health, diet, time spent grazing to weather status can be recorded in these data blocks. This will ultimately be the beginning of the chain for the consumer.

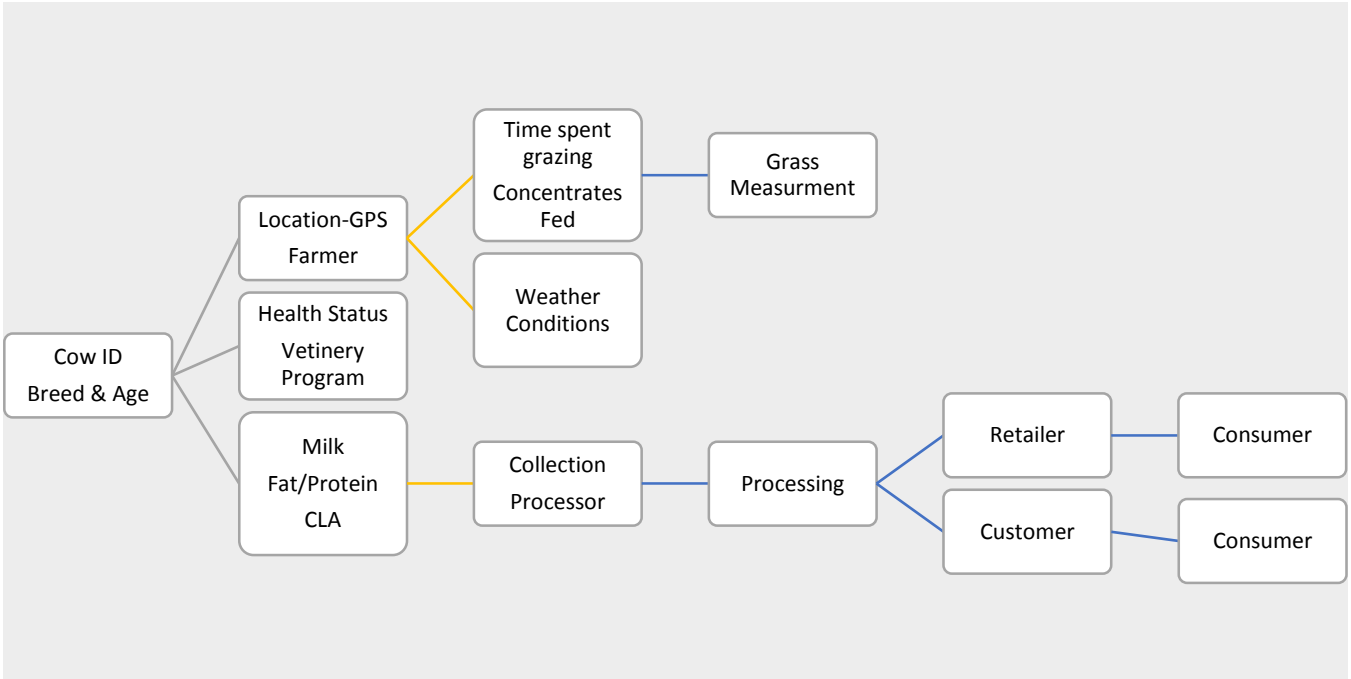

Figure 10 Blockchain example

Milk is collected using bulk milk tanks and pooled together. How will the customer know if it came from that cow or even that farm? Obviously this is a challenge and mainly an economical and logistical one. However if there was a clear value being created in the market place and consumers were seeking products with grass-fed claims then companies or co-ops would have to back them up.

Separating milk at farm level is not achievable however collecting grass-fed milk that meets the "Irish grass-fed standard" can be. Considering the levels of grass in the cow's diet in Ireland this could mean all cows from all herds. If this were linked to a bonus for a farmer then they would be rewarded for being scientists of their trade.

China & Japan exciting markets who embrace technology

China

The second week of my individual travels took me to two of the most sophisticated and densely populated cities in the world, Shanghai and Beijing. From side street halal consumers to high-end super fresh culture, I got to experience it all. The modernisation of how the Chinese consumer purchases food has already become the norm, making China a place where tech giants are part and parcel of everyday shopping across the country, even in the most rural communities. Out of the 1.3 billion people, I was one of the few who attempted to pay with cash or even credit card. Mobile was a one-stop shop for everything.

At the click of a button your fresh milk or veg would be at your doorstep that very day. The speed and efficiency was incredible thanks to the largest online store in the world Taobao which is owned by e-commerce super giant Alibaba. What also stood out was the array of different diets and food types, with most regions and provinces establishing their own unique dishes.

The dairy sector in China is an industry, which continues to grow. Although cow numbers may have dropped from 10 million cows to 7.6 million cows, consumers are still increasing their consumption of dairy based products. Since the melamine scandal in 2008 Chinese consumers lost trust in domestic products. The food safety standards and quality of imported products particularly from New Zealand, Australia and the EU has given confidence to Chinese consumers. If we think about the worlds overall traded milk pool of 73.5 billion kg. China imports 20bn kg (27%) of the overall traded milk pool. New Zealand accounts for 50% of these imports. However the EU is the leading exporter in terms of market value with close to 50%, surpassing New Zealand in 2016.

Interestingly there was a difference in market share of categories compared to Irish supermarkets. The largest markets in China are fresh, shelf-stable (UHT), yogurt and flavoured drinkable dairy. Chinese companies, particularly Yili and Mengniu hold the majority of market share for these categories. The farm gate price in Ireland multiplied by 3.5 will roughly give you the retail price. However in China it's the farm gate price multiplied by 5. This highlights that the processors in China are doing extremely well in the fresh milk category. With this in

mind Fonterra have recently tapped into the cultural norm producing the first ultra-fresh milk, which is delivered daily by online store Alibaba.

Grass-fed is not something that is as topical in China compared to the US or Europe however Yili have recently launched a campaign promoting grass-fed. There is only a small region in the south of China where grazing is viable. Almost all of China's domestic milk is produced from American style barns fed on a TMR system. I visited one of Fonterra's 4,000 cow farms in the Shandong Province, a joint venture with Abbott pharmaceutical group. Australian Nuffield Scholar Paul Niven runs the farm. Although only two years old it was the cleanest most hygienic farm I was ever on, producing high quality milk. Fonterra has two other farming hubs in China milking more than 30,000 cows in total. These hubs have proved a challenge due to low domestic milk price in China over the past four years.

The challenge for these type farms is managing slurry and water quality as spreading on the land is not permitted in China. This farm also had a bio-digester and cropping business in order to make them self-sufficient in the future. This system highlighted to me with increasing pressures around the carbon footprint of our dairy systems it is going to be crucial that farms can measure their environmental impact. This could be a key element of future contracts with Chinese customers going forward. Cows grazing pasture will have a lower environmental impact than indoor systems.

Despite the increase in dairy imports and sales, dairy consumption per capita is still much lower in China than the rest of the world, even when compared to countries like Japan, which shares similar dietary habits to China. Therefore, Chinese dairy market expansion will likely be driven more by the rising price of raw milk and increased premium product options. Surveys show that more urban Chinese consumers are willing to spend money on niche, high-end, organic, and healthier products, hence slowly shifting the dairy industry development direction from scale growth to product upgrade.

From my visit I was amazed at how technology was being applied to food shopping especially in Beijing and Shanghai. Technology that allows Chinese consumers' confidence in food safety and traceability will be embraced. This is one way grass-fed farms in Ireland can become relatable to Chinese customers and consumers. They are a sophisticated nation, who is steeped in history and tradition. Although they are now enjoying a western style diet in some areas for me China is modernizing. China is not westernizing.

Japan

After three weeks in China I headed for Tokyo, Japan. A country famous for its innovation and strategic minds, I was excited to see what the Japanese dairy industry looked like. Firstly, I attended Dairy Conference Japan. Part of this conference comprised of a comparative study of dairy 2018, comparing three very different countries in Japan, Canada and The Netherlands.

My initial thinking of Japanese dairying was of high consumer demand, high quality and a high milk price based on previous reports. I was surprised to hear that the Japanese dairy industry is struggling and speakers mentioned numerous reasons, which are contributing to a declining milk pool. The root of this problem seemed to be coming from succession. The average herd size is 53 cows per household and this figure has increased by only 25% in the last 10 years. These herds are now starting to decline with an estimated 1000 dairy farms per year leaving.

It is also a very different situation to Ireland in that beef prices are very good with many farmers making more money from beef. Some farmers are using Wagyuu sexed semen aiming to supply the high-end Japanese beef market which consumers crave.

Figure 11 Yoshinori Suxuki and I at J-Milk headquarters

Farmers are not willing to invest, as they cannot see the next generation milking cows. There seems to be an issue around poor management of dairy farms and getting new people into the industry. Physical capital, human capital and social capital were all management issues on farm particularly small scale pasture farms. Large farms do want to expand and grow, however all feed is bought in and finding labour is a constant challenge. What is keeping the Japanese dairy industry going is government supports, ultimately leading to a high domestic milk price.

Coming to Japan I was under the impression that there was huge potential for grass-fed dairy products. However I quickly realised that the Japanese diet is very different to anything else I had experienced. Fresh fish-sushi was something I became accustomed to quickly. What was noticeable was the quality of their food and its freshness. Although milk supply and the consumption of whole milk is declining, yogurt and cheese consumption is increasing. This is good news for Irish dairy exporters, especially considering the recent trade deal between the EU and Japan which came into effect on the 1st of February 2019 and will significantly reduce the price of EU food produce to Japanese consumers.

It was interesting to hear Kees de Koning from the Wageningen University speaking about the Dutch model at the dairy conference. He explained how the next generation of dairy farmers have more spare time due to innovations such as robotic milking. Kees explained how Holland does not want mega farms due to social responsibility and society perception.

“Mega farms put farmers further away from the consumer. Paints the wrong image in their minds of what a farm should be; family farms are perfect as they are part of local communities”

Kees also highlighted the importance of being transparent and to show the public what you do.

“Be good at what you do and don’t disappoint them”

These explanations led to many questions from the 150 Japanese industry leaders present, but the comment that caught most attention was when Kees explained that the Dutch cow’s diet is made up of 80% grass on a dry matter basis. “Cows are outside grazing from March/April right through to October/November and this adds to the quality of our milk and enhances animal welfare standards”. This intrigued the Japanese audience as the majority of feed in Japan is imported.

As I listened to the discussion it was interesting to hear an industry leader from The Netherlands promoting grass-fed and honing in on it as a unique selling point and also how it was grabbing the attention of the Japanese audience. For me having travelled to Holland previously, the details of the percentage level of grass in the diet and days at grass were questionable. The reaction however was very interesting considering Ireland's production system and ability to produce milk from grass. It puts Irish grass based dairy farms on a pedestal once there are measures in place to differentiate.

Japan is the oldest population of the Asian countries, and with an aging population, milk plays a part in aiding our society. The direction of domestic dairy in Japan will be worth following over the next five years. Will it be a case of more trade deals and overseas marketing to supply this population of 127 million people or can the Japanese farmers and processors revive their industry?

5. What will consumers look for beyond Grass-Fed?

Being well positioned to take advantage of current trends is an exciting place to be for any industry. This may be the case for Irish dairy when it comes to grass fed, however the fast paced every changing world we live in, consumers will ultimately look for more. So what might that be?

Never has the agricultural industry as a whole been under so much pressure to reduce greenhouse gas (GHG) emissions. Our animals are contributors to GHG emissions meaning

Figure 12 Fairlife products which capture different demograhics of consumers

policy changes in the near future could be the next quota that Irish dairy farms face. Restrictions could see overall farms being measured to see how they stand up when it comes to GHG emissions or carbon sinks. Is there an opportunity given our grass-based system to produce carbon neutral milk?

Consumers may feel detached from the day to day running of a dairy farm when purchasing dairy products, however perceived perceptions as to what happens on farm can paint the right or wrong image in a consumers mind. A farmer's social licence to farm often lies within these images. Animal welfare standards are increasingly becoming an area of concern for

consumers. If there is questions or concerns around animal welfare standards then potentially there is an opportunity to produce animal welfare milk showcasing these standards.

Visiting Fair Oaks Farm (FO) outside Chicago highlighted how consumer perception can propel your business forward or damage your image immensely. Recently through a joint venture with Coca-Cola FO successfully established a new flavoured milk called FairLife which is being sold right across the US.

With a total herd size of 36,000 cows, Fair Oaks is the second largest dairy farm in the US. Cows are kept indoors all year round and are milked three times a day. Their milk yield was 11,000 litres on average. The diet of the cows was predominantly made up of cereals. Alfalfa, corn silage, corn and distillers making up 78% of the diet.

The interesting thing for me was the focus on yield. It emphasised the fact that the traditional US dairy farmer is faced with the dilemma of get bigger or get out. The current conventional price is 39c/l which in a high input system barely covers the cost of production.

From a sustainability point of view Fair Oaks seem to be ahead of the curve. The total GHG emissions for US dairy (140 MMT) accounts for 2% of the US total GHG emissions. Astonishingly, 73% of this is at the farm gate. It takes 1.2kg on average of CO2 to make 1kg of fat and protein (milk), whereas at Fair Oaks it only takes 0.5kgs.

Their entire facility is run off cow and pig manure. They use anaerobic digesters to make compressed natural gas (CNG). This gas runs the tractors and trucks on the farm and also powers the production facility. It is estimated that they save 2million gallons of diesel a year by doing so. They are also doing trials to separate phosphorus and nitrogen from the cow manure to ensure more accuracy when growing crops for feed. The ultimate goal of the farm is to be carbon negative in the next three years. With this level of investment to reduce carbon footprint FO are well on their way to produce carbon a neutral milk.

However since visiting FO last August a controversial video was released online by Animal Recovery Mission showing animal cruelty on one of the FO farms. This video went viral and cast cloud not only over FO, but the entire US dairy industry. Although this case is not representative of all dairy farms for consumers it puts huge doubt in their minds around animal welfare standards. Can Irish farmers and processors guarantee animal welfare standards producing animal welfare milk?

6. What makes Ireland different?

The lush green pastures of Ireland are the identity of our heritage and culture. The structure in which the Irish dairy industry operates is unique. Ireland has 10 milk processors and 17 milk-purchasing co-ops. Irish farmers still own and control what started out as small local creameries in the nineteenth and twentieth centuries.

As mentioned earlier in this report New Zealand is very similar to Ireland as farms are predominantly spring calving grass based herds. The main difference on farm is irrigation systems and overall milk volume. From a processing point of view, up to recent years almost all of New Zealand's milk was processed by on co-op in Fonterra, which is very different to Ireland. New Zealand has been excellent at converting grass to kg of milk solids, creating a powerhouse industry however the public perception of the environmental impacts came under scrutiny. The carbon footprint and environmental effect of producing milk from cows is becoming more and more topical.

Dairy expansion in Ireland has been booming since the abolition of milk quotas in 2015. Processors made commitments to building new facilities to process excess milk. The result of this has been large quantities of powder, cheese and butter being manufactured, marketed and sold to different markets around the globe. It is worth noting Ireland's reliance on UK market with 50% of cheese being exported to our neighbours of which 83% is cheddar (Export Performance & Prospects, 2019).

Therefore the challenge is to innovate and create new products. As we are not near to same level of output as New Zealand, there are lessons to be learned from their experience. Fonterra grew extremely fast and ultimately became commodity traders of dairy to a certain degree.

Their challenge as a company is to develop new value-add products and to hold onto milk suppliers who are now moving to competing dairy companies that operate in the value add space. For example Synlait and Westland Co-op.

Ireland is fortunate in its structures to have many industry bodies willing to invest in order to move up the value chain and get closer to the end consumer. Be it through the sales and marketing channels of Ornua, food marketing of Bord Bia, research and innovation of Teagasc or the Co-ops themselves Irish dairying has the capabilities to create a global brand in grass-fed. There is no doubt that the consumers are seeking healthier natural products, however, to compete internationally with other EU countries, there needs to be a standard.

Ireland should set this standard as they achieve the highest grazed grass intake on a dry matter basis than any other country. If this means creating a threshold for CLA or Omega-3 then it should be done to define grass-fed. If we have to compete with claims with products from New Zealand then we must do so as their system and grass intake is close to Ireland's.

However selling high-end grass-fed products to customers or consumers in the EU, US or Asian markets must be protected by a definition. This way UK or Dutch systems that claim grass-fed on their products is not the same as Irish grass-fed.

There have been some notable success stories in achieving value in the marketplace from Irish grass-fed claims. Kerrygold butter recently became a 1 billion euro brand. It is now the number one butter in Germany and number two in the USA. A study of German consumers in 2014 from Zūhlsdorf et al Highlights grass-fed as the number two demand consumers look for when buying milk.

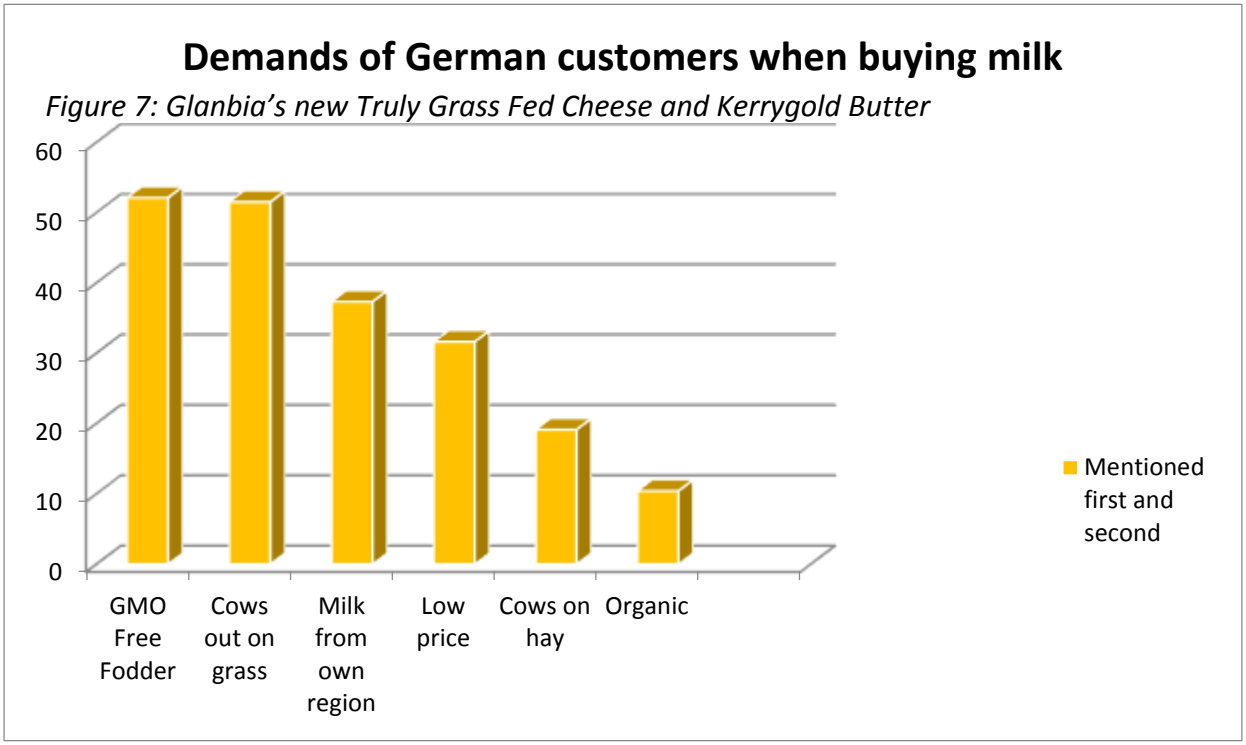

Figure 7: Glanbia's new Truly Grass Fed Cheese and Kerrygold Butter

Figure 13 Dmands of German customers when buying milk. (Zühlsdorf et al. 2018)

Figure 14 Kerrygold butter.

Irelands number 1 dairy brand

Along with Kerrygold, Glanbia recently launched the Truly Grass Fed brand into the US market. Although only one is an established brand, both highlight what is good about Irish dairying and promotes our unique production system.

Through collaboration between research institutions and processors more consumer products can be developed in order to leverage our true value for export.

Figure 15 Glanbia's Truly Grass-fed brand

Work conducted by (D. O'Brien, 2018) to quantify the diet of grazing dairy cows showed that 'on average forage, particularly pasture, was the largest component of the Irish cow diet, typically accounting for 96% of the diet on a fresh matter basis and 82% of dry matter intake over three years'.

This shows that the industry is moving in the right direction by publishing peer reviewed papers and backing up grass-fed as a science rather than a loose marketing tool.

It too, gives confidence to R&D labs that recent research is there to back up claims, ultimately giving confidence to customers and consumers.

Recommendations

Through the completion of my Nuffield travel and having visited many farms and dairy businesses around the globe it has become obvious to me that Irish dairy is in a very strong position. As a result of our strong roots and connection to the land, we have a great story that is extremely marketable. Along with this, grass-fed directly links in with the natural and wholesome diet which consumers' desire today. However, there is still a challenge to differentiate Ireland from the rest of the world and become world leaders in grass-fed dairy products. I believe we have the raw material to achieve additional value but the consumer needs to be convinced that Irish dairy is superior.

1. **Collaborative approach from all industry stakeholders to create a standard**

As the grass-fed brand is vitally important to the Irish dairy industry and the success of value add dairy products, I believe all industry bodies should come together and create a standard that companies can benchmark off. Through technology (such as block chain) a systems based approach should be implemented giving a more accurate measure of grass in the diet. Up to know there has been a historic based approach using a three-year rolling average. Furthermore given the uniqueness of the Irish grass fed system (>250 d outdoors, ~95% grass based diet {Shalloo, 2018}) there is further scope for Ireland to distinguish itself further by labelling as "Irish Grass-Fed" setting our grass fed products apart from competition – this will inherently be linked to the much needed "Irish grass fed definition".

2. **Increase Irish dairy product consumer range internationally**

With the abolishment of milk quotas the Irish dairy milk pool has considerably increased since 2015, this creates opportunity for Irish farmers to expand their business. With this increased milk pool it is essential that processors invest in research, new product development and innovation to diversify Irelands dairy product portfolio enabling access to new markets and new demographics of consumers.

3. **Commission a clinical study through Food For Health Ireland looking at the health effects of grass-fed dairy**

There are numerous steps involved in achieving a health claim. There is a plethora of compositional related scientific studies demonstrating the apparent beneficial impacts of grass based feeding on the nutritional composition of milk, however, clinical in-vivo data to back this is currently lacking. Firstly I believe it is important to get a specific claim that grass-based milk is an enriched source of CLA or other beneficial nutrients such as Omega 3 fatty acids (a nutrition claim). The proposed health claim would be around the specific health benefits of pasture fed dairy e.g. cardiovascular disease reduction and weight loss. A rigorous amount of research would need to be compiled to support the claim. I believe if Ireland is to lead this category going forward then we should bring products to market that have science to back up our story.

4. **Target high end developed markets**

From my travels it was clear that there is additional value in the marketplace for grass-fed dairy products. However, this trend is not evident in all markets. It is important that our strategies focus on high-end consumers who are willing to pay a premium.

5. **Investigate the use of schemes for grass fed dairy suppliers**

For me Irish dairy farmers are grassland experts through their knowledge of soil health, and skills they have developed over centuries. In order to encourage, the future use of grass-based feeding and maintain milks with positive consumer image and higher levels of beneficial nutrients; avenues need to be explored throughout the supply chain to create value. Ultimately, Irish dairy farmers and processors are potentially providing prescription agriculture. One way to measure this is to test at farm level and potentially have a bonus structure for milk, which meets the required threshold. Processor engagement and acknowledgement of additional value is essential.

Conclusion

On completion of this extraordinary Nuffield experience, I have come away with a far greater understanding of Global dairy and indeed Irish dairying. What is clear from visiting the USA, China, Japan, New Zealand, Netherlands and Australia, is the opportunity that grass-fed dairy presents. Consumers are seeking clean labels, which promote natural and healthy diets. Global consumption of dairy products continues to increase, in particularly cheese, butter and yogurt.

For Ireland the market for specialised nutritional powders such as infant formula continues to grow with 50% going to China in 2018. Initially, growth into Asia began in 2010 and was mainly due to having a safe nutritious product. However, now after nine years, excellent food safety and quality standards are associated with Irish dairy products. The challenge now is to meet the additional requirements around animal welfare, greenhouse gas emissions, water quality, antibiotic use and what is the new trend grass-fed.

Research in Ireland conducted by (O'Callaghan, 2018) has shown "there is significant evidence to suggest that the fatty acid profiles and ratios, in particular of pasture-fed milk, are potentially healthier for human consumption". Ireland has a relatively small milk pool compared to other EU countries such as the Netherlands, France, Germany and UK and therefore competing on a global market is an obvious challenge. It is clear from my experience that our point of differentiation is the level of grass in Irish cow diet.

Irish dairy farmers are fortunate that they operate in a climate that supports grass growth of up to 18 tonnes per hectare. Pasture management has become the key driver of profitability on Irish farms with huge investment in soil fertility, soil health and precision farming practices. This investment also plays a key role in the carbon footprint of dairy and the overall ecosystem of our soils. If these practices are resulting in a healthier cheese, butter, yogurt or nutritional powder for the consumer then I feel it is essential that this is captured and returned to Irish dairy farmers.

Such a strategy is not without its challenges, as there are many stakeholders involved in the developing, marketing and sale of Irish dairy products. In my opinion those willing to invest in R&D for new product development and clinical research should reap the rewards of grass-fed. If there is value to be extracted from the marketplace then all processors will need investment in R&D, marketing and sales to gain significant traction.

As shown in this report, Ireland will not be the first one in the marketplace claiming grass-fed. However, based on my travels, there is no country in the world better placed to produce dairy products that are fully traceable, with the highest environmental, animal welfare and grass-fed standards. Therefore this highlights a massive opportunity to be exploited leaving the industry in a better place for generations to come.

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