

Mapping the dairy supply chain on the island of Ireland

An addendum to the report 'The impact of climate change
on dairy production'



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Foreword

This is the report of a research project carried out on behalf of **safefood** in conjunction with the Food Safety Authority of Ireland, the Food Standards Agency in Northern Ireland and the Department of Agriculture, Food and Marine. The purpose of the research was to analyse the dairy supply chain in both jurisdictions on the island of Ireland to provide a comprehensive description of all stakeholders involved in the production, processing and marketing of dairy products into and out of the island. This included an outline of the business and regulatory controls in place along the supply chain.

The report contributes to a wider project that involves a food chain vulnerability analysis of the dairy sector on the island of Ireland to enhance consumer protection. This is being led by the Food Safety Authority of Ireland in conjunction with the aforementioned agencies. The project will produce a documented analysis of the dairy supply chain, its vulnerabilities and a range of control strategies that could be applied to prevent or mitigate the impact of fraudulent activities on consumers' health and/or interests. The project is proactive and will derive benefit for industry and regulators by identifying potential vulnerabilities in the dairy supply chain.

The research reported here was carried out by Prof Thia Hennessy, Professor and Chair of Agri-Food Economics and Head of the Department of Food Business and Development at Cork University Business School, University College Cork in association with Dr Trevor Donnellan, Teagasc. The authors would like to thank the dairy industry stakeholders who made themselves available for interview as part of this study and who also provided additional data and feedback to the project team over the course of the project.

Executive summary

Context of the research

The importance of the dairy sector at both farm and processing level on the island of Ireland (IOI) is well established. It is by some distance the most profitable of farm systems on the IOI and the value of dairy exports is growing year on year. The dairy supply chain on the IOI is well integrated between Northern Ireland (NI) and the Republic of Ireland (ROI) with over one third of NI milk output being processed by processors in ROI. Reasons for this include processing capacity and seasonality in Irish milk production. For example, seasonality plays a major role in ROI milk production whereby the majority of herds are spring calving and most producers produce no milk during the winter months. This means the majority of ROI milk output is from February through to October during which processors are at full capacity. Conversely, in NI there is much less seasonality; rather producers here maintain a relatively steady milk supply all year round.

While some data is available relating to trade in milk and dairy products between the ROI and NI, data on other segments of the chain is largely not publicly available. In general, publically available data are more plentiful for the ROI as much of the data for NI are aggregated with data from the rest of the UK and disaggregation is not possible. Once milk has entered the processing chain little public information is available surrounding its movements in intermediate stages. While some raw milk may be processed at a single location and made available for retail (e.g. drinking milk) other supplies may go through several processing and packing stages at different sites.

The bulk of the milk produced in the ROI and NI is for consumption as dairy products exported to the EU and the rest of the world (ROW.) Customers for the dairy products produced by primary processors typically include retailers, food service industry and secondary processors. However, detailed data on where this produce ends up is limited. Secondary processors typically incorporate the output of primary processors in the production of higher value added secondary products (e.g. infant formula). However, the availability of such information is limited. Given the limited public availability of data on the dairy supply chain on the IOI, a number of dairy industry stakeholders were interviewed to collect additional information about the quantity of raw milk collected, the collection process, the products processed, the typical supply chain including logistical information, etc.

Objectives

The overall objective of this project was to describe the dairy supply chain on the IOI in order to facilitate the identification of areas of strength and potential weakness along the chain with a view to ensuring the safety, quality and integrity of food produced from it. The specific stage of the project addressed in this report included a review of the dairy supply chain on the IOI. To this end, a documented analysis of the dairy supply chain was produced. Where gaps were identified, following an extensive data and literature review, these gaps were addressed by conducting semi-structured

interviews with 11 dairy industry stakeholders. These included executives from primary dairy processors (n=5), secondary dairy processors (n=1), exporting agency (n=1), representative bodies (n=2) and academic experts (n=2). The aim of these interviews was to seek data to fill data gaps across the chain, which were identified during the primary stages of the study.

Main findings

- Most of the dairy products produced on the IOI are for export. The domestic market represent a small share of total milk utilisation.
- Official data on total product production for the ROI and NI is limited to a range of commodity type products. Official data on the production level of more niche type dairy products does not exist.
- Trade data is generally available at a greater degree of product detail than production data. Data on export destinations is available at a country level, but for the purposes of the report it is collated and presented according to principal destination.
- The data shows that there is significant dairy trade between the ROI and NI, but this trade is mainly associated with milk in liquid form.
- The largest single export destination for other dairy products from the ROI and NI is Great Britain (GB).
- Trade in fresh dairy products is very limited and these are mainly produced for the home market
- The UK is the main export market for the ROI cheese exports (which are mainly of the cheddar variety), cream exports and yogurt exports.
- Other EU countries are the main market for the ROI butter exports.
- ROI skim milk powder (SMP) and whole milk product exports are mainly to ROW destinations.
- ROW exports have become increasingly important for the sector in the ROI, driven mainly by infant formula exports to Asia.
- The ROI dairy exports are generally carried out by Ornuia in the case of smaller processors. Larger processors use Ornuia in combination with their own export channels.
- Milk collection from farms is generally outsourced to private transport operators who own and maintain their own vehicles. However, the maintenance and hygiene aspects of milk tankers on these vehicles remain under the control of processors.

- Some dairy processors have facilities in GB where bulk products are cut and packaged for distribution throughout GB and in some cases the ROI and NI.
- Ownership and control of dairy products for ROW export markets usually ends at the destination port where payment is received and ownership transfers to local distributors.
- The interviews with stakeholders revealed a generally low level of concern about the potential for and implications of food fraud in the dairy supply chain.
- The processors interviewed for the purposes of this project are responsible for over 80% of the milk pool in the ROI and almost 30% in NI.
- In general, the interviewees expressed a view that once a product is delivered to the customer in a safe condition, that responsibility for the product ends at that point and any deliberation adulteration of the product that may occur at a later stage of the supply chain is not their responsibility.
- It proved difficult to extract detailed and precise data from the interviewees about their various “types” of customers, in general interviewees expressed a lack of knowledge or indeed interest about whether customers were secondary processors, re-formatters, retailers and/or traders.
- In general interviewees reported a low level of engagement in small deals with “unknown” trade partners. The reluctance to enter such deals was, in general, economically motivated, i.e. fear of not being paid, rather than food fraud related.
- Sufficient data were garnered from the interviews to provide an overview of the main dairy products.
- A quarter of all butter is traded through Ornuia, up to 43% is traded directly to secondary processors with a number of very large confectionary companies in this category (company names are withheld), 11% goes directly to the Irish retail market, 6% goes to EU retail but not through Ornuia and 14% goes to trading houses (2 to 3 large established trading houses).
- In terms of the butter traded by Ornuia, over half goes to branded sales in Germany, 13% to branded sales in the US, 6% is reformatted for a French retailer and 7% goes to a food service company in the UK.
- In relation to cheese, over 40% is traded through Ornuia, a further 30% goes to Food Service and secondary processing companies in the EU (with a shortlist of 5 very large customers in this segment (names withheld)), 7% is sold under brand for the Irish retail market, 10% goes to trading houses (2 to 3 large established trading houses), 11% is traded through subsidiaries of the processors for the Food Service market.

- In terms of the cheese traded by Ornuu, a quarter goes for reformatting for the EU retail market, 17% goes for food service in the UK (burger Slice Company), 7% is sold under brand in the US, 5% is sold to a food ingredients company in North Africa and the remaining 45% goes to a long list of smaller customers.
- Powders was the most challenging product on which to gain a comprehensive overview. There is a growing range of powders with different supply chains and there was no consistent pattern across the processors interviewed. For example, one processor sold all of their powders to Ornuu while another processor was dealing with up to 80 customers for Whole Milk Powder (WMP) alone.

Glossary of abbreviations

CSO	Central Statistics Office
DAFM	Department of Agriculture, Food and the Marine
FFMP	Fat filled milk powders
FSA	Food Standards Agency
FSAI	Food Safety Authority of Ireland
GB	Great Britain
IOI	island of Ireland
NI	Northern Ireland
ROI	Republic of Ireland
ROW	Rest of the world
SMP	Skim Milk Powder
WMP	Whole Milk Powder

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1 Introduction & background

Motivation for the study

The Irish dairy sector is well established across the island of Ireland (IOI) and is recognised as the most profitable farm system on the IOI. Between the Republic of Ireland (ROI) and Northern Ireland (NI), there is a symbiotic relationship across the dairy supply chain. While the dairy processing sector is characterised by an ever decreasing number of players, some processors rely on milk supplies from cross border trade, mostly from north to south. To create a true picture of the dairy supply chain an all island approach is appropriate. Therefore, this report aims to present an overview of the Irish dairy supply chain on the IOI to understand each stage of the chain including the level of inputs, the production characteristics, primary and secondary processing, and sales and distribution. It is important to note that official data on dairy productions, products, trade and supply chain are more accessible for the ROI than NI. Accessibility of data for NI is hampered by the fact that in many cases the data for NI is merged with that of Great Britain (GB) and it is not possible to disaggregate by region. Extensive efforts have been made to provide equivalent data for NI and ROI but inevitably the information provided in this report is much richer for the ROI.

Data collection for this report involved a two stage approach. Primarily a desk based review of data was undertaken. Data is largely publicly available on the quantities of milk produced per region (the ROI and NI) with respect to volumes of milk produced and dairy farm numbers. However, on entering the latter sections of the chain including primary and secondary processing, data availability is an issue. A limited quantity of data is publicly available on the amount of milk processed by individual dairy processors; the volume and type of output; and their end use or destination. Dairy products by and large end up in retail, the food service industry, or being bought by secondary processors for further processing. However, on a case by case basis this data is not divulged publicly by individual processors.

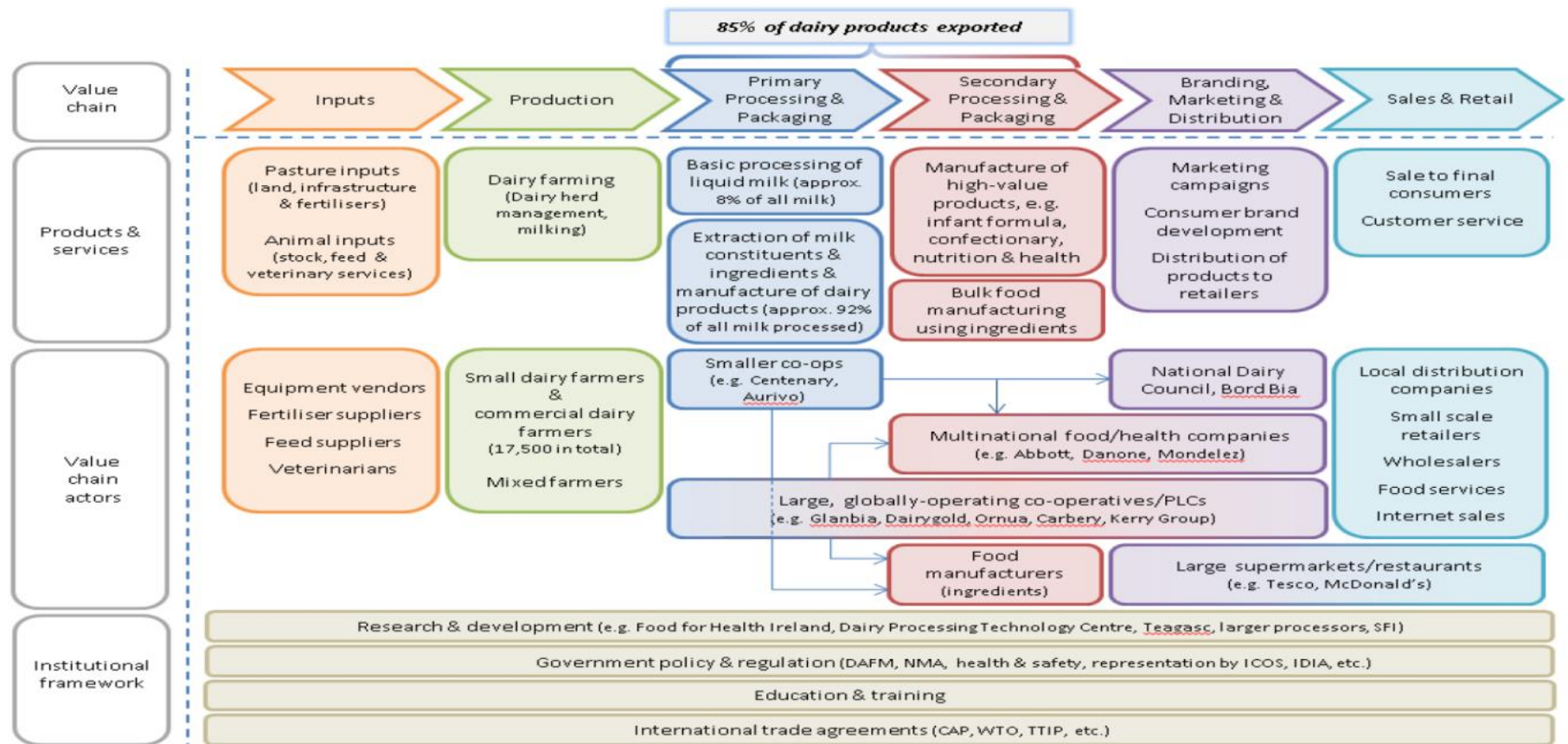
After an initial review of publicly available data, gaps of data were identified across the chain. Following on from the identification of the data gaps, interviews were undertaken with key dairy industry stakeholders in an attempt to fill these gaps. Therefore, this report relies on data that is publicly available and interview accounts to provide a detailed overview of the dairy supply chain on the IOI. Interview accounts are based on key representatives of dairy processors and other stakeholders in both the ROI and NI. Given the commercial sensitivity issues surrounding data

collection much of the data collected is based on approximations and interviewee identities are kept anonymous throughout this report. Therefore, this report presents an overview of the dairy supply chain by building on data that is publicly available and data that was gathered through the interviewing process. It is also important to note that some of the data being sought for this project was highly detailed. For reasons of both confidentiality and practicality, in terms of the time required to assemble such specific information, it was not always possible to secure the ideal level of detail and hence the description of some parts of the supply chain is more aggregated than others.

Report structure

This report commences by firstly presenting a brief background to the dairy sector on the IOI. Building on the chain segments shown in figure 1 which are detailed in Heery et al., (2016), the report is largely structured to include details on production level data, the processing sector, both primary and secondary, and also tries to gain insight into scope of dairy outputs in terms of sales and exports.

Figure 1. Overview of the dairy supply chain in the ROI



Source: Heery et al., 2016

Section 2 of the report present the aims and objectives of the study. Section 3 of the report commences by presenting production level data on the IOI. Specifically data on farm numbers and cow numbers are presented along with the associated level of milk production. The milk processing sector and the details of the main products produced by the ROI and NI dairy processors are presented. Following on from this, export data from the ROI is utilised to present an overview of the main export destinations of the ROI dairy produce. Dairy imports are also presented with a focus on the relationship between the ROI and NI dairy trade. Given that NI is part of the UK, it is not possible to describe the NI dairy export trade in the same level of detail as that for the ROI, due to the lack of official data. Then there is a summary of the information obtained from the interview phase of the project. Given that much of the information provide by interviewees is commercially sensitive, the fine detail with respect to these interviews is not available in the report and is contained in a confidential annex supplied to **safefood** and the FSAI. Section 5 provides the conclusions.

2 Project aims and objectives

The overall objective of this project was to describe the dairy supply chain to facilitate the identification of areas of strength and potential weakness in the integrity of the chain. This is important so as to identify issues that could threaten the safety, quality and integrity of food derived from the dairy supply chain on the IOI. The specific stage of the project addressed in this report, included a review of the dairy supply chain on the IOI. To this end, a documented analysis of the dairy supply chain was produced. Where gaps were identified, following an extensive data and literature review, these gaps were addressed by conducting semi-structured interviews with 11 dairy industry stakeholders. These stakeholders included executives from primary dairy processors (n=5), secondary dairy processors (n=1), exporting agency (n=1), representative bodies (n=2) and academic experts (n=2). The aim of these interviews was to seek data to fill data gaps across the chain, which were established during the primary stages of the study.

3 Dairy supply chain statistics

The dairy sector is one of the most important sectors within the agri-food industry on the IOI. The dairy sector in particular is one of the most valuable sectors in terms of its total outputs, exports and its profitability at farm-level. Between the ROI and NI total production was over 8 billion litres of milk in 2016. Dairy exports in the ROI for 2016 were valued at €3.38 billion (Bord Bia, 2016) and just over £390 million for NI, in the previous year (Hennessy *et al.*, 2017). The dairy sector in the ROI and NI is largely interdependent, as cross border trade of milk supplies is significant. Currently, over one third of the NI milk supply is processed in the ROI and several processors based in the South have suppliers in NI and some have processing facilities in NI. Therefore, the dairy sector on the IOI is well integrated between North and South (Hennessy *et al.*, 2017).

Primary production activity

Dairy farms

Focusing on dairy farm numbers, in table 1, the ROI dairy sector is substantially larger in terms of overall numbers of farmers involved totalling 17,266 compared to 2,694 in NI in 2016. This can be attributed in part to the considerable size differences between the two regions and to the larger average size of dairy farms in NI.

Table 1: ROI and NI dairy farm numbers

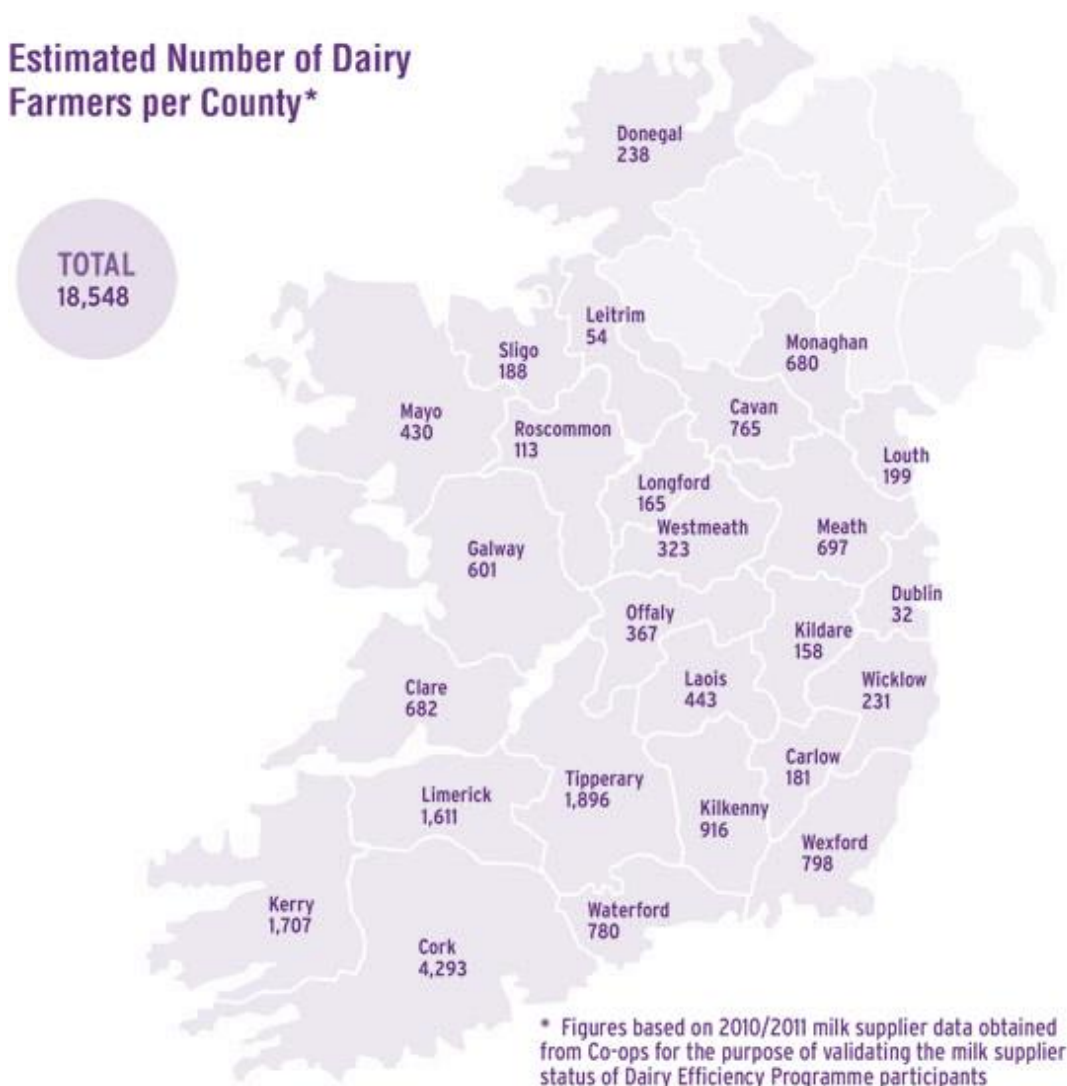
	2015	2016
ROI	17,603	17,266
NI	2,742	2,694

Source: Census of Agriculture Northern Ireland 2016/2015; DAFM, 2017

Figure 2 presents a geographical breakdown of dairy farms by county in the ROI in 2011. It is clear that the concentration of dairy farms is greatest in Munster and the south-east region. Cork has by far the largest number of dairy farms at 4,293, accounting for almost a quarter of all dairy farms in ROI.

Tipperary is next with 1,896, Kerry with 1,707 and Limerick with a further 1,611 dairy farms. Although this graphic is based on 2011 data, the distribution of dairy farms will not have changed in recent years.

Figure 2: ROI county level breakdown of dairy farms in 2011



Source: Farmers Journal, 2011

The DAERA 2016 agricultural report presents figures for the breakdown of dairy farmers by county in NI in 2016. As we can see from table 2, Tyrone has the largest number of dairy farms, accounting for over a quarter of all dairy farms in NI, followed by Antrim at 553 and Down at 542 farmers.

Table 2: County level breakdown of NI dairy farm numbers 2016

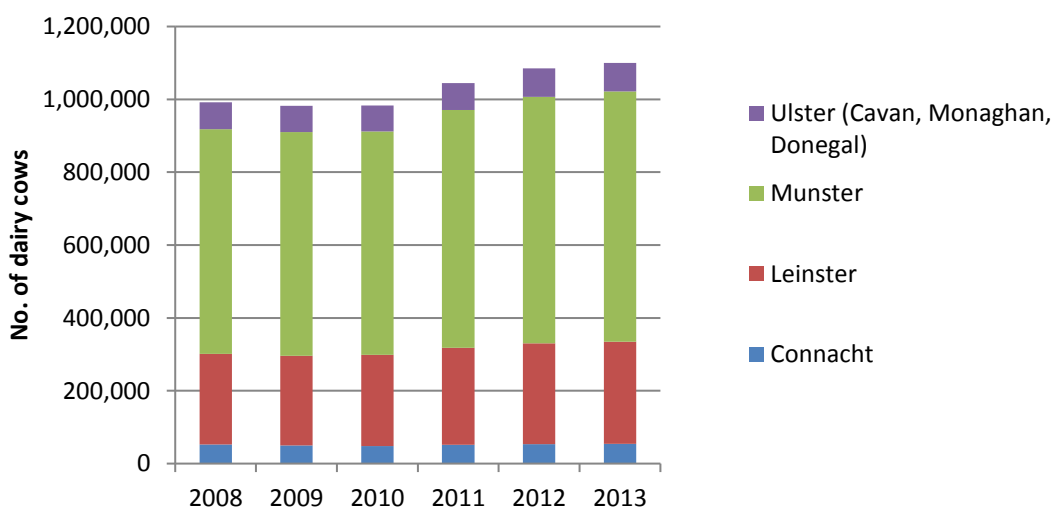
County	Antrim	Armagh	Down	Fermanagh	Derry	Tyrone	Total NI
Farms	553	315	541	278	327	680	2,694

Source: DAERA, 2016

The average dairy herd size differs between the two jurisdictions, with NI having a larger average herd size of 100 cows compared to the ROI, which had an average herd size of 72 cows (Hennessy and Moran, 2015; DAERA, 2015; Brady, 2016). Longitudinally, both have experienced a decline in dairy farm numbers, yet an increase in the average dairy herd size. The average farm size in ROI, according to the 2010 census of agriculture, is 32.7ha in comparison to the NI which stands at 40 ha (Northern Ireland Assembly, 2016).

Figure 3 below illustrates the number of dairy cows by province in the ROI from 2008 up to 2013. It is evident that dairying is concentrated in Munster which accounts for well over half of all dairy cows in the ROI over the period. Leinster is the second most important region in terms of dairy cow numbers, accounting for over 20% of dairy cows 2008-2013. It is clear that the national dairy herd in ROI began to increase substantially commencing in 2010-11 in advance of milk quota abolition. The total number of dairy cows increased from 992,374 in 2008 to over 1,100,092 in 2013, an increase of 11% over the period.

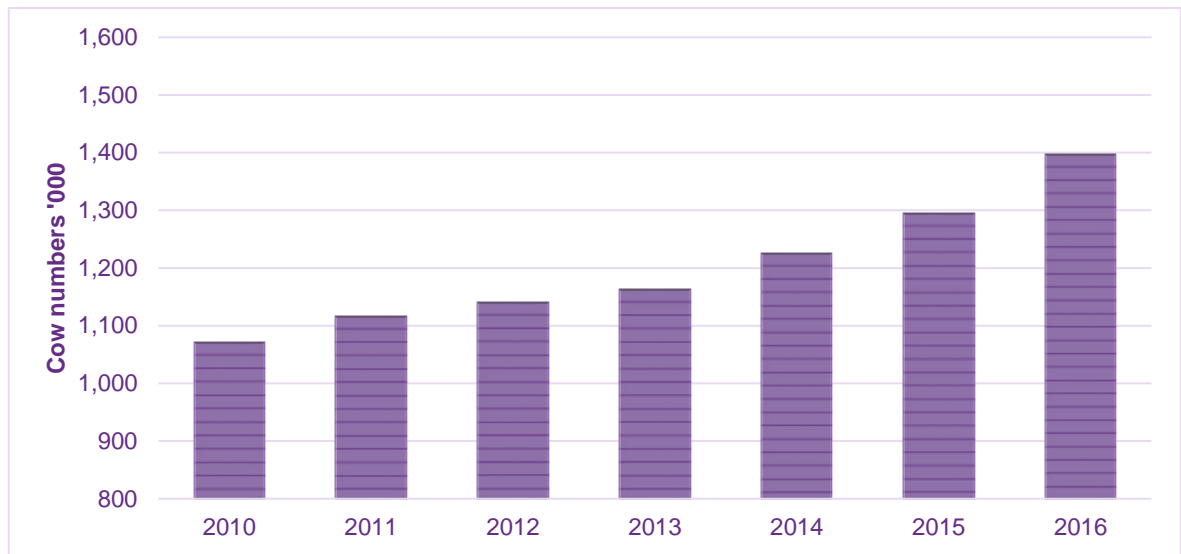
Figure 3: The ROI dairy cow numbers by province



Source: Teagasc, 2017

Based on corresponding figures from the ROI Central Statistics Office (CSO), dairy cow numbers in 2016 for the ROI stood at 1.39 million. This is an increase of 30% from a figure of 1.07 million in 2010 as outlined in figure 4 below.

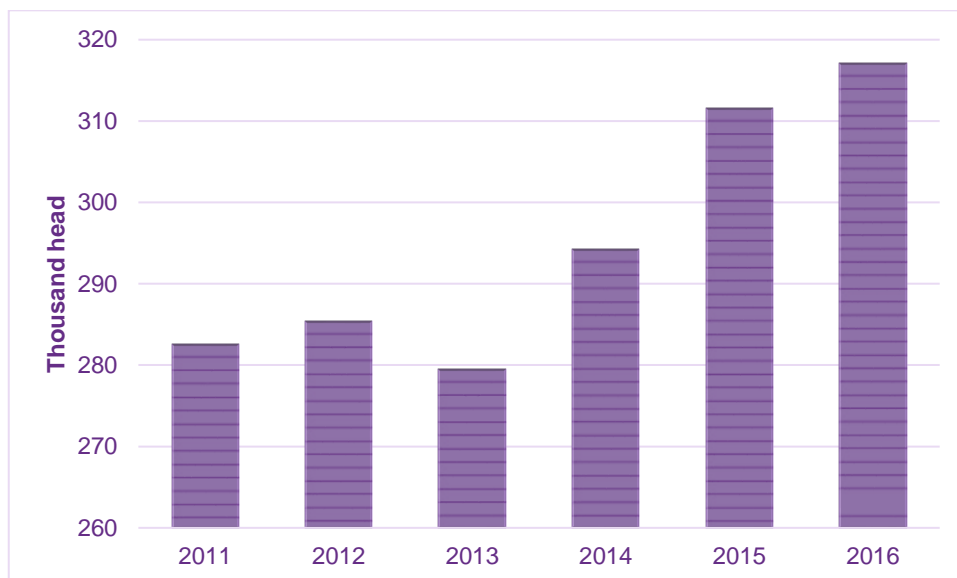
Figure 4: The ROI dairy cow numbers 2010-2016



Source: CSO, 2017

Figure 5 shows the most recent figures for NI. From 2011 to 2016 dairy cow numbers increased from 282,500 in 2011 to just over 317,000 dairy cows in 2016. This represents an increase of 12% over the period.

Figure 5: NI dairy cow numbers June 2011-2016

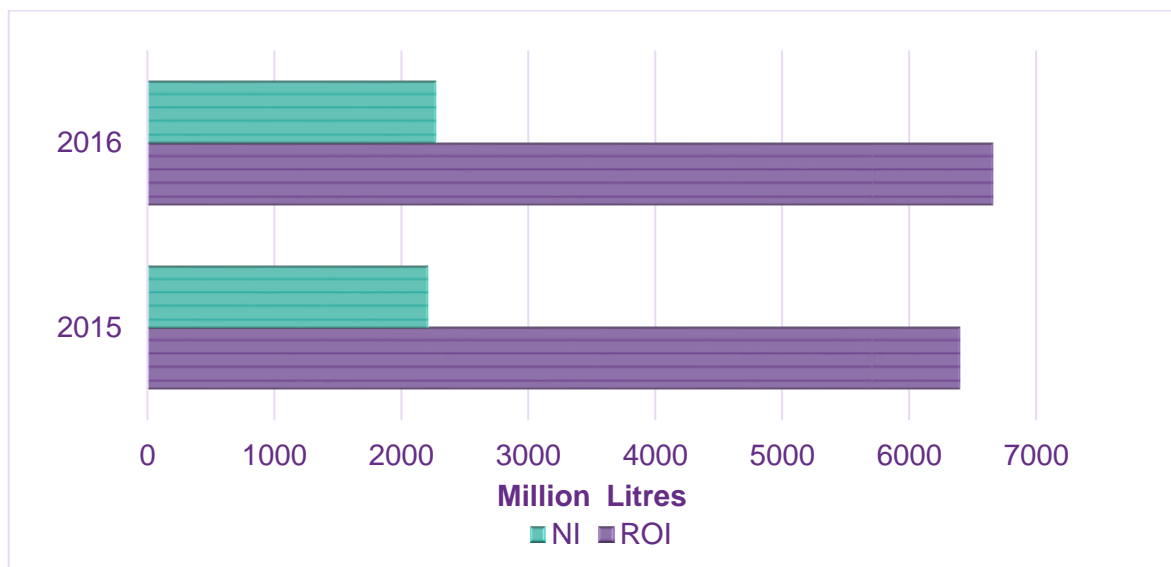


Source: DAERA, 2016

Milk output from dairy farms

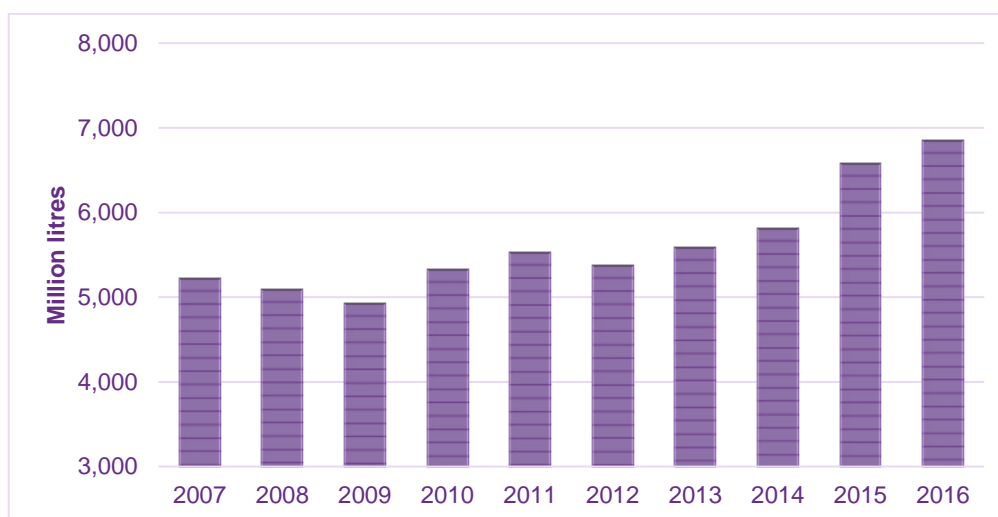
Milk output for both NI and ROI in 2015 and 2016 is illustrated in figure 6. In 2016, there was a combined output of over 8 billion litres of milk. Total milk production in ROI in 2015 was 6,395 million litres and in 2016 this increased to 6,655 million litres (an increase of 4%). For NI, milk production in 2015 reached 2,266 million and in 2016 this figure decreased to 2,209 million litres (a decrease of 2.5%). In fact, milk output has continued to expand and has more than doubled in ROI the last 40 years from over 3 billion litres in 1975 to just over 6 billion litres in 2016 (Brady, 2016).

Figure 6: The ROI and NI Milk output 2015: 2016



Source: CSO, 2017, DAERA 2017

Figure 7: The ROI milk collections 2007-2016



Source: Eurostat, 2017

It is evident that milk output is on the rise across both jurisdictions, especially in the context of quota abolition in 2015. Figure 7 illustrates milk collections in ROI between 2007 and 2016 showing the increase in milk collection that has taken place. Milk yields per cow have not increased significantly in ROI over this period, with the growth in the size of the dairy herd largely responsible for the increase

in production. Since 2010, the dairy herd in the ROI has shown an average increase of approximately 2.8% per annum (Teagasc, 2017).

A more detailed review of milk output figures in NI from 2011 to 2016 is illustrated in Table 3. As we can see from the table the total NI dairy herd in 2016 was just over 315,000 head, increasing from just over 280,000 in 2011. This represents an increase of 12.5% over the period.

Additionally, the per litre price paid to the producer has been very volatile over the period with the net price ranging from 31.44 pence per litre in 2013 to 20.18 pence per litre in 2016, representing a decline of 36%. This drop in price affected the total value of milk output over the period.

Table 3: Milk output NI 2016

	2011	2012	2013	2014	2015	2016 (Provisional)
Annual average number of dairy cows ('000 head) ¹	281.2	262.5	280.0	295.5	311.2	315.8
Average gross yield per cow (to the nearest 10litres per annum)	7,160	7,190	7,310	7,580	7,390	7,100
Total output for human consumption (million litres)	1,962	2,001	2,015	2,206	2,268	2,210
Average producer price (pence to the litre)	27.65	26.21	31.79	29.66	21.22	20.55
<ul style="list-style-type: none"> • Gross price² • Net price³ 	27.26	25.72	31.44	29.31	20.87	20.18
Market value (£m)	549.0	525.5	640.5	654.2	480.1	451.9
Value of output (£m) ²	549.0	525.5	640.5	654.2	480.1	451.9

Source: DAERA, 2016

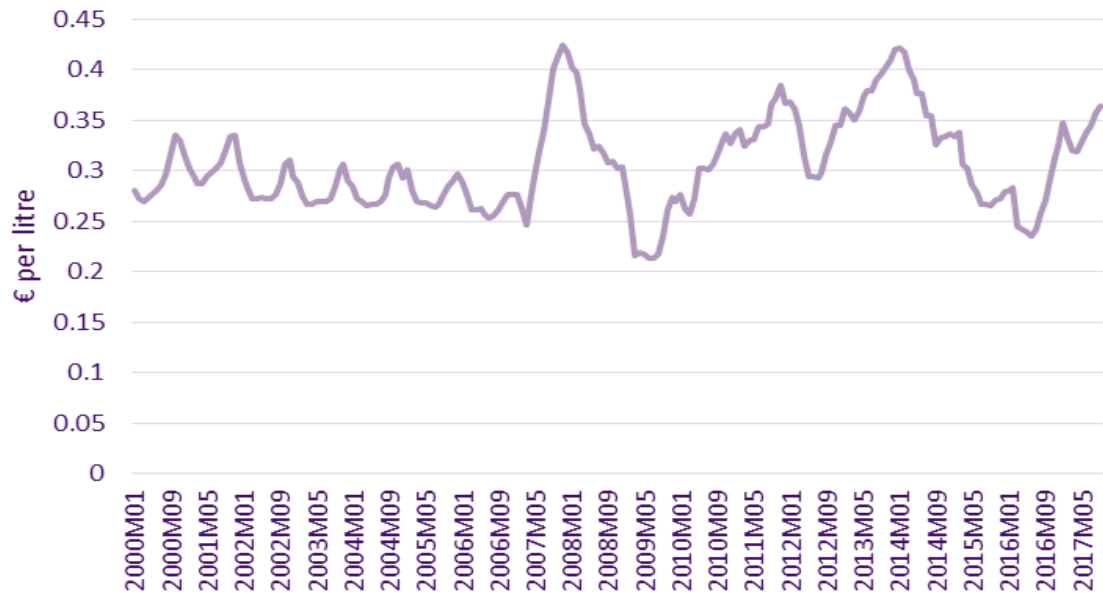
1. Comprising sales off farms, milk consumed in farm households and milk fed to other livestock.

2. After deduction of superlevy but not marketing expenses (transport costs).

3. After deduction of marketing expenses (transport costs) but not superlevy.

Figure 8 presents the monthly farm-gate price for milk of standard fat and protein from 2000 to 2017. The increased volatility in milk price is evident from 2007 onwards. This volatility is a result of the gradual dismantling of the EU CAP protectionist policies such as export subsidies and intervention buying. These policies protected European farmers from the volatility of world dairy prices and hence the farm-level price was quite stable. As these policies were slowly reduced and removed European and Irish prices became more exposed to world market prices.

Figure 8: Monthly farm-gate milk price in the ROI 2000 to 2017



Milk processing

Milk processors

Milk processing simply involves the transformation of raw materials into finished products (Hennessy *et al.*, 2017). The European Communities Food and Feed Hygiene Regulation 2009 (S.I. 432 of 2009) (the Hygiene Package) legislates for food hygiene in relation to the production, control and marketing of products of animal origin (DAFM, 2017). This legislation includes the hygienic production and placing on the market of raw milk, heat treated milk and milk-based products. Food business operators in ROI that are primary producers of food products are required to apply to DAFM for registration. The DAFM 2017 register is categorised below in Table 4.

Table 4: Milk & dairy establishments in the ROI in 2017

Number of	Units
Drinking milk plants	15
Milk purchaser	20
Collection centres	4
Infant formula	3
Large	42
Small-medium	124
Large and drinking milk plant	1
Infant formula base powder	1
Trader	1
TOTAL	211

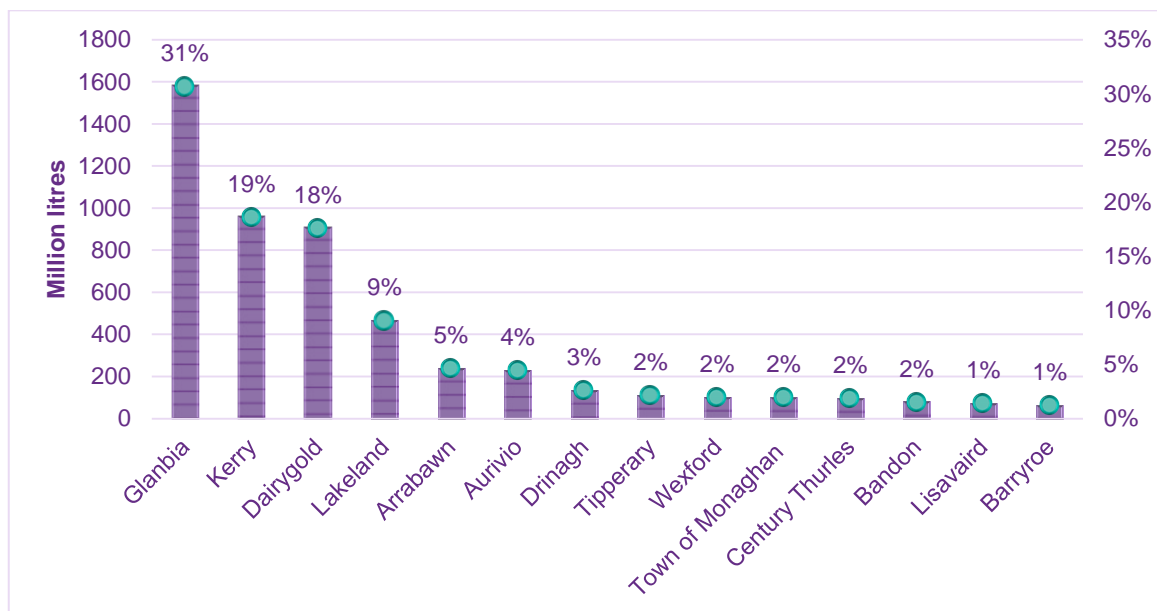
Note: approved and/or registered in 2017 under S.I. NO 423 of 2009 in ROI

Source: DAFM, 2017

However, the main actors involved in processing are the milk processing companies, the majority of which have maintained the farmer owned co-operative structure. Stemming back as far as the 19th century, dairy co-operatives were formed to allow farmers to pool milk supplies and gain access to the market. At this time there were over 800 co-operatives or creameries in existence. However, there has been much consolidation within the dairy processing sector, which now focuses mainly on international and global markets (Murtagh and Ward, 2011).

There have also been changes in co-operative structure with some opting for the Private Limited Company route. Teagasc stated that in 2013, there were just 14 processors involved in milk collection and processing in the ROI (see figure 9). While this seems like considerable consolidation within the processing sector, in comparison to the processing sectors of other major dairy exporting countries (New Zealand, Denmark, Netherlands) the ROI is still considered highly fragmented (Prospectus and Promar, 2003). For this reason the ROI dairy processing sector has often faced criticism due to its duplication of effort in areas such as IT, finance and management, product development, inefficiencies in assembly and processing and even so far as competing against each other on the international markets (Prospectus and Promar, 2003; Murphy, 2008).

Figure 9: Milk quota per processor in the ROI in 2013



Source: Teagasc, 2017

The top three ROI processors (Glanbia, Kerry and Dairygold) accounted for 68% of the total milk pool in 2013. According to Hennessy et al., 2017, there are 16 processors in the ROI and a further 12 in NI. Some processors operate in both jurisdictions and those based in NI tend to be controlled and owned by farm co-ops based in the ROI. As stated previously, almost one third of the NI milk output is processed in the ROI, in 2015 593.7 million litres of milk was imported from NI for further processing and in 2016 this increased to 813 million litres (CSO, 2017).

Table 4 outlines data on processors in both NI and ROI to ascertain their membership numbers and volumes supplied from 2014 to 2016. There is no official data source on the number and size of processors and purchasing co-operatives in either the ROI or NI. The data are compiled from publicly available information published by each individual processor in the ROI and NI and as such there are gaps for particular years.

Table 4: Processor members and volumes for the ROI and NI

Name of processor	No. of suppliers	2014	2015	2016
		Million litres		
Lakelands	2,200	468	900	1,100
Glanbia	4,800	1583	2,000	**
Kerry	4,000	980	1,100	**
Dairygold	3,000	908	1,157	1,205
Aurivio	1,000	370	350	**
Arrabawn	980	260	270	**
Lee Strand	**	**	**	**
Drinagh	630	**	**	**
Boherbue	**	365	450	470
Lisavaird	280	**	**	**
Bandon	270	**	**	**
Barryroe	205	85	**	**
North Cork	**	**	100	**
Tipperary	420	112	304	**
Centenary Thurles	380	98	**	**
LacPatrick	1,050	**	600	**
Dale Farm (NI)	**	**	**	800
Strathroy dairies	**	**	**	**
Draynes Farms	**	**	**	**
United farmers (NI)	**	**	**	**

Source: Compiled by the authors based solely on publicly available information

** Data unavailable

Processing facilities and companies' numbers in the ROI far outnumber those based in NI. However it is important to note that many of these ROI based processors also have processing activities in NI, with approximately 60% of the processing capacity in NI owned by co-operatives in the South (Hennessy *et al.*, 2017). As stated earlier some one-third of milk crosses the border from NI to the ROI for further processing.

Dairy Products

Milk supply

Milk collected has two main routes to market, being either sold on the liquid milk market or directed towards the manufacturing of commodity products including butter, cheese and milk powders. In 2015, a total of nearly 500 million litres of milk was consumed as liquid milk in the ROI. In the ROI, liquid milk is generally produced by specific farmers who have liquid milk supply contracts. In 2015, there were 1,725 liquid milk supply contracts. These are further broken down between all year round (AYR) contracts and winter milk producers (National Milk Agency, 2016). AYR contracts account for 94% of all liquid milk suppliers and 99% of the liquid milk supply. On the other hand, winter milk suppliers account for just 6% of liquid milk suppliers and 1% of the total supply. Table 5 below outlines the processing structure for liquid milk in the ROI in 2014-15. A total of 12 processors were involved. Three were processing over 40 million litres, 2 were processing between 20-40 million litres and 7 were processing 0 - 20 million litres.

Table 5: Structure of registered contracts by registered processors supply bands 2014/2015

Milk supply bands	Number of Processors	Registered contracts		Registered Supplies	
		No.	%	Millions of litres	%
0-20	7	201	12	37.5	8
20-40	2	228	13	59.8	13
Over 40	3	1,296	75	363.6	79
Total	12	1,725	100	460.9	100

Source: National Milk Agency, 2016

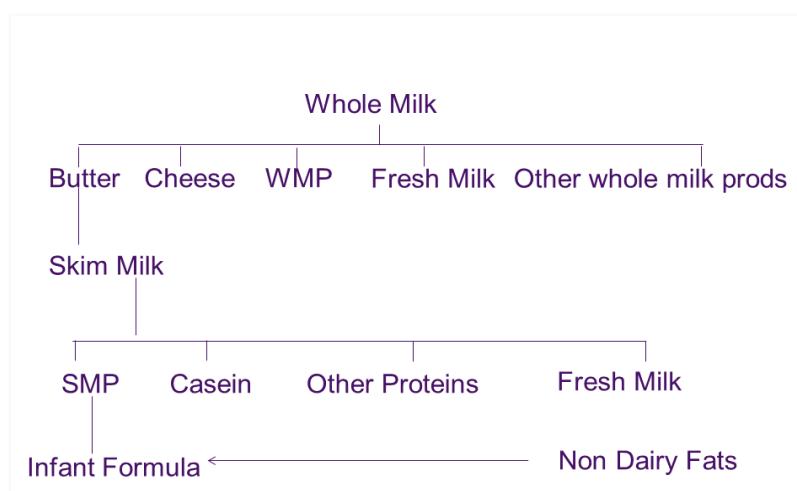
In the NI, milk supply contracts for liquid milk are not used since the conventionally produced milk supply is a lot less seasonal than in the ROI. Therefore in NI milk from the general milk pool is used for the liquid milk market. However, it is important to note that 62 million litres of milk was imported from NI for processing for liquid milk consumption in the ROI. Further to this, an additional 94 million litres also crossed the border in the form of retail packs (National Milk Agency, 2016). In fact, around one in every four litres of fresh milk consumed in the ROI Ireland is imported from NI (Dansko Foods, 2017). Retail accounts for over 79% of the ROI fresh milk sales, with a further 10% accounting for both the catering trade and doorstep deliveries.

Overall, the ROI liquid milk market accounts for a small percentage of total milk usage (less than 10%) and the rest is diverted towards the manufacturing of commodity products. According to Hennessy *et al.* (2017) over half of the manufacturing milk goes towards the manufacture of butter and cheese. A by-product of butter and cream production is skim or skimmed milk. This can be converted to skimmed milk powder (SMP), proteins such as casein and caseinates, and other skim milk products.

Product Mix

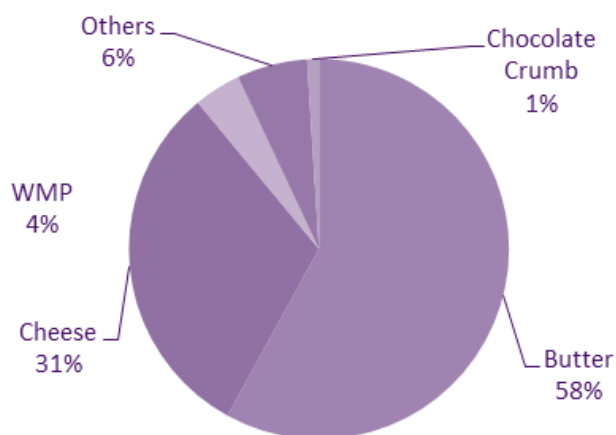
The main uses of Irish milk are detailed in Figure 10. About 10% of Irish milk production is consumed as drinking milk with the remaining 90% dedicated to manufacturing milk which is further processed into a range of dairy products.

Figure 10: Representation of Irish whole manufacturing milk & skim milk usage



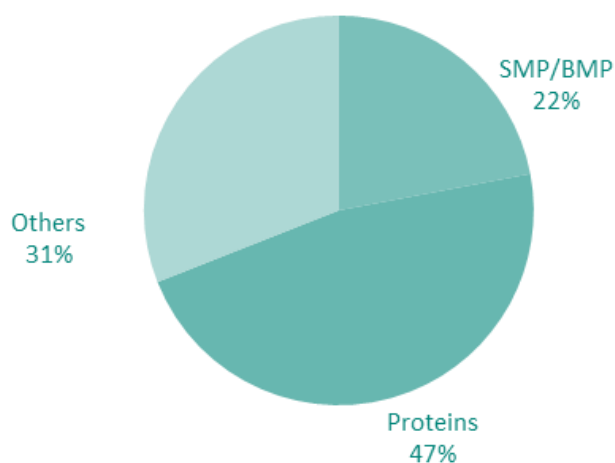
A breakdown of manufacturing whole milk utilisation is presented in figure 11. In terms of manufacturing milk utilisation, butter remains by far the main whole milk product produced in Ireland, although production is in decline. Cheese has risen in importance in milk utilisation terms in recent years. The production of WMP (for export) and other whole milk products (fresh dairy product such as yogurts, cream etc., largely destined for the home markets) remains a small proportion of whole milk utilisation.

Figure 11: Irish manufacturing whole milk use



A breakdown of skim milk utilisation is presented in figure 12. Traditionally in Ireland skim milk has been a by-product of the butter production process. Its uses fall into three categories, production of SMP and buttermilk powder, production of proteins such as casein and caseinates and finally, other skim milk products.

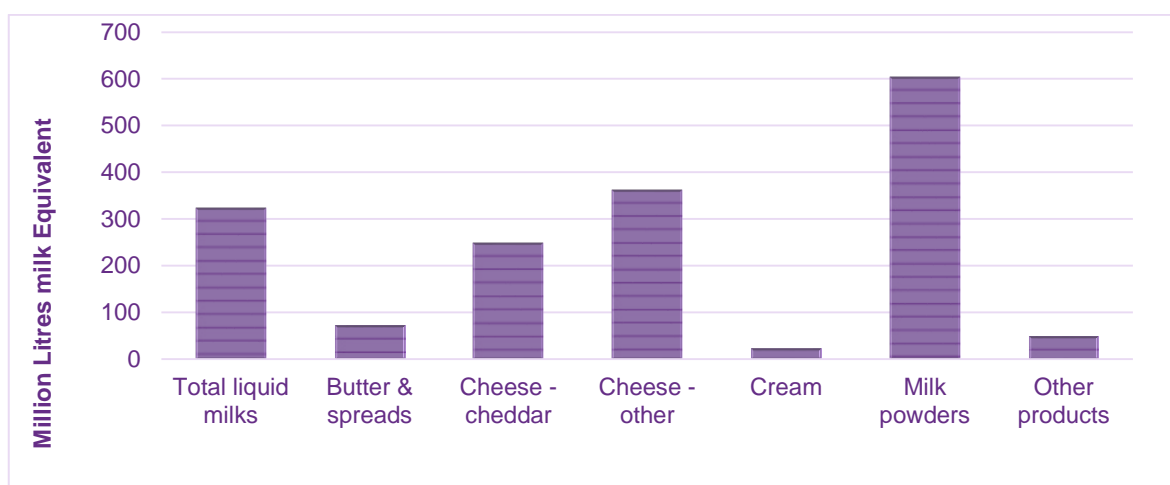
Figure 12: Irish manufacturing slim milk use



Products derived from secondary production processes, which incorporate both dairy and non-dairy ingredients, are not normally considered to be dairy products for statistical purposes and hence data on the extent of production of these products is more difficult to assemble, such as the Infant formula market.

Similar data for NI is presented in a slightly different format in Figure 3.12, which presents milk utilisation statistics in litre equivalents. Liquid milk is a more substantial component in NI, making up approximately 18% compared to less than 10% in the ROI. Butter is relatively unimportant in NI, consuming just 8% of total milk production, while powders are important in both jurisdictions with almost 36% of NI milk going into the production of powders.

Figure 13: NI milk utilisation in product production 2012



The relative value of products is best interpreted by examining the value of exports, which is discussed subsequently in the text.

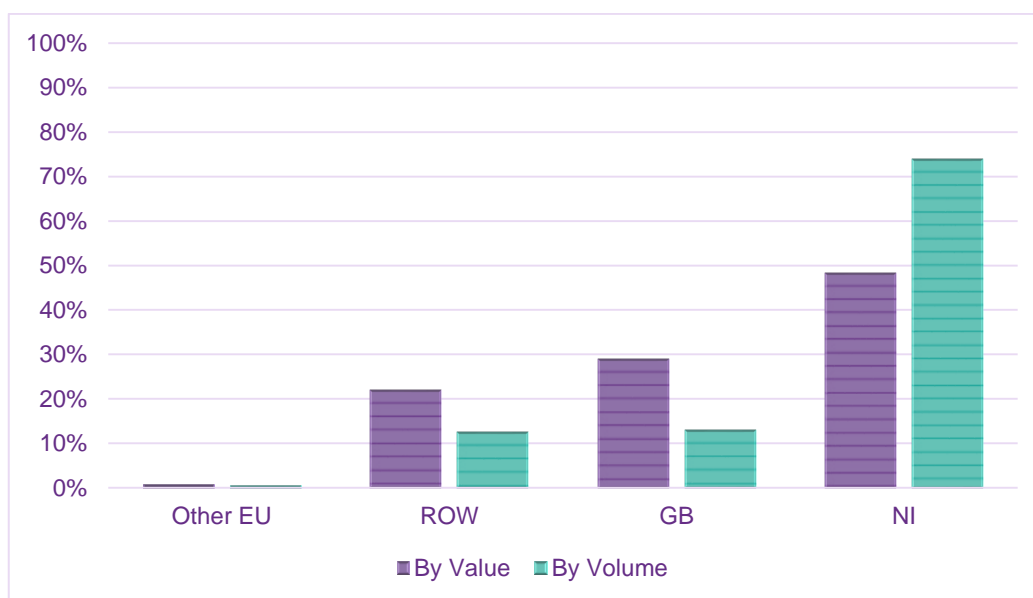
Dairy traders

There are no official data available on the number or size of dairy traders operating in the ROI. Department of Agriculture officials were contacted in relation to this and they confirmed that dairy traders do not need to be licensed or registered unless they are selling product outside of the EU. In the case of those selling product outside of the EU an export licence must be obtained but details of such licences are not stored in a publically accessible database.

Domestic Consumption

Given Ireland’s small population and thus low consumption of dairy produce, about 80% of all milk produce is destined for the export market (Figure 3.13) (Donnellan et al., 2013). Only 8% of all whole milk output is consumed domestically (Hennessy et al., 2017). Due to the seasonality of milk production in the ROI in particular the product portfolio for export oriented companies and processors can restrict the possibility for milk utilisation, considering shelf life qualities. Therefore, the majority of what’s consumed domestically is fresh produce.

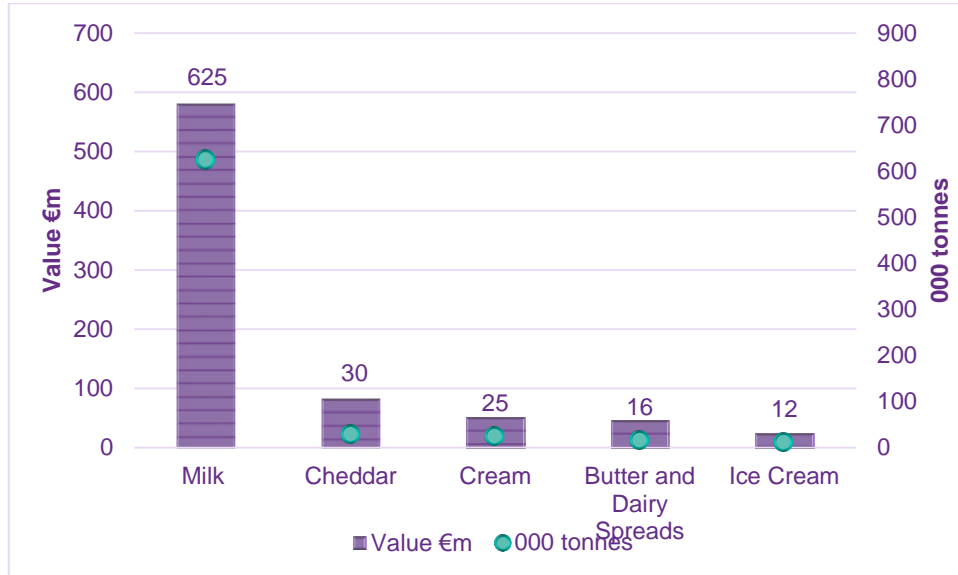
Figure 14: The ROI milk exports (fluid only) by value and volume 2016 (%)



Source: EUROSTAT Comext

Figure 15 illustrates the domestic consumption of dairy produce in 2016, in which 734,000 tonnes of dairy produce are consumed. This had a value in 2016 of €784 million. Milk, cream, yoghurt, ice-cream, butter and dairy spreads and cheddar cheese have the principal products within domestic consumption. Fresh products such as milk, cream, buttermilk, cream, yoghurt and ice cream are mainly consumed domestically, or when traded, are largely confined to the neighbouring regions of GB and NI due to the perishability of produce (Donnellan *et al.*, 2015). The quantities of fresh products and the amount of whole milk dedicated to these types of products tend to be limited due to their shorter shelf life in comparison with butter, cheese and powders.

Figure 15: The ROI domestic consumption of dairy produce 2016

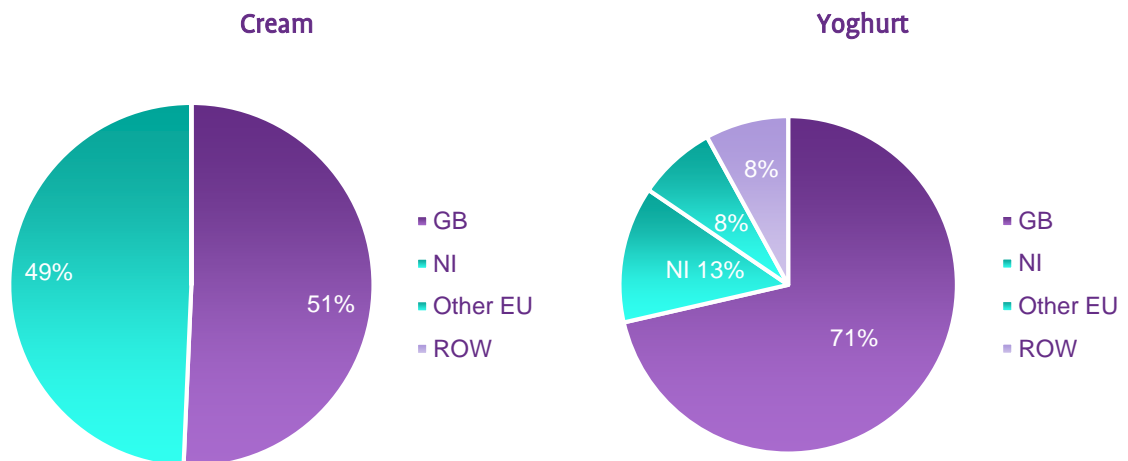


Source: CSO and authors' own estimates

Dairy Exports

NI and GB also remain the main consumers of other fresh dairy product such as cream and yoghurts (Figure 16).

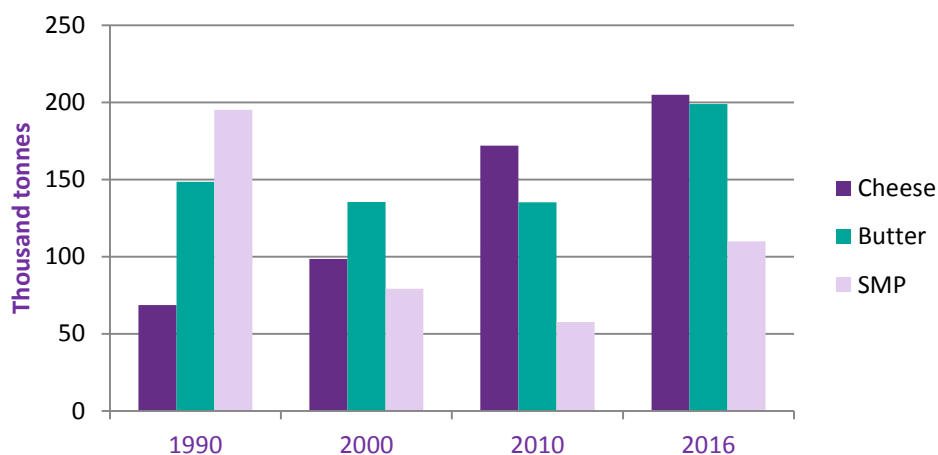
Figure 16: ROI fresh produce exports by value (%) in 2015 (a) cream (b) yoghurt



Source: Adapted from EUROSTAT Comext

The dairy products that absorb most of the manufacturing milk in the ROI are butter, cheese and milk powders (SMP, WMP and fat filled milk powders (FFMP)) (figure 17). Butter and SMP have a long history as Ireland’s main commodity exports. Butter production also increased from approximately 150,000 tonnes in 1990 to almost 200,000 tonnes in 2016. SMP however dropped from 195,000 tonnes in 1990 to 110,000 tonnes in 2016 as other uses for skimmed milk (as an ingredient in infant formula and FFMP) have emerged. Cheese has grown in importance over the last 25 years. The volume of cheese output has increased from nearly 70,000 tonnes in 1990 to nearly 205,000 in 2016. Much of this is cheddar, but there has been a gradual increase in the production of continental cheese varieties also.

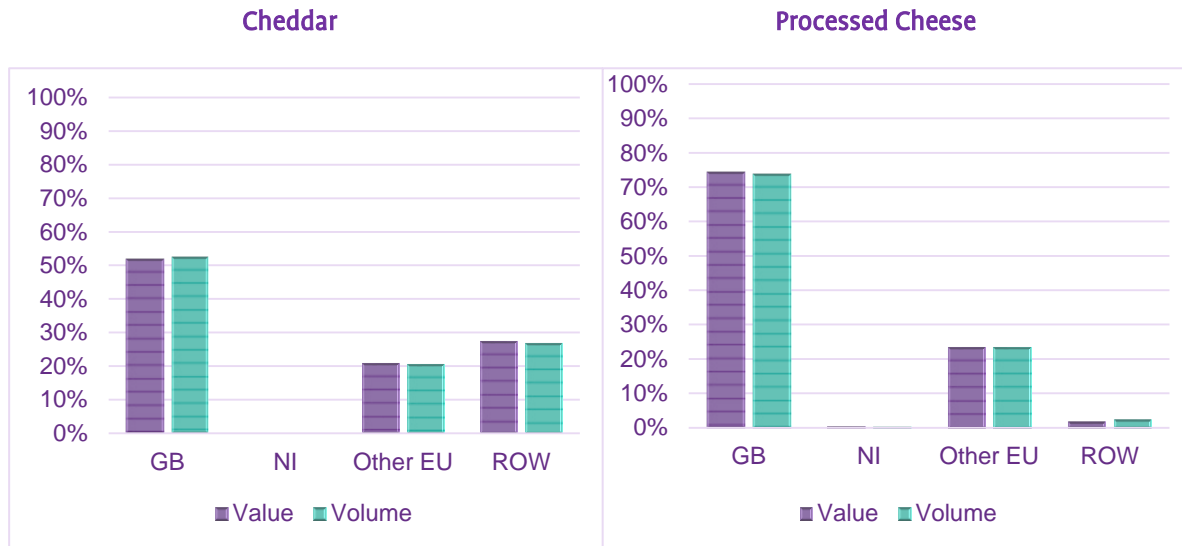
Figure 17: Breakdown of ROI cheese, butter, SMP production 1990-2016



Source: CSO, 2017

GB is the largest importer of Irish cheese. Focusing specifically on cheddar cheese, GB accounts for over half of the volume Irish cheddar exports in 2016, as illustrated in figure 18. Just over quarter goes to the ROW and a further 21% to Other EU. Additionally, GB accounts for the largest intake of the processed cheese category taking in over 74% of the volume and value. The EU accounts for another 23%, with just 2% of other processed cheese destined for the ROW.

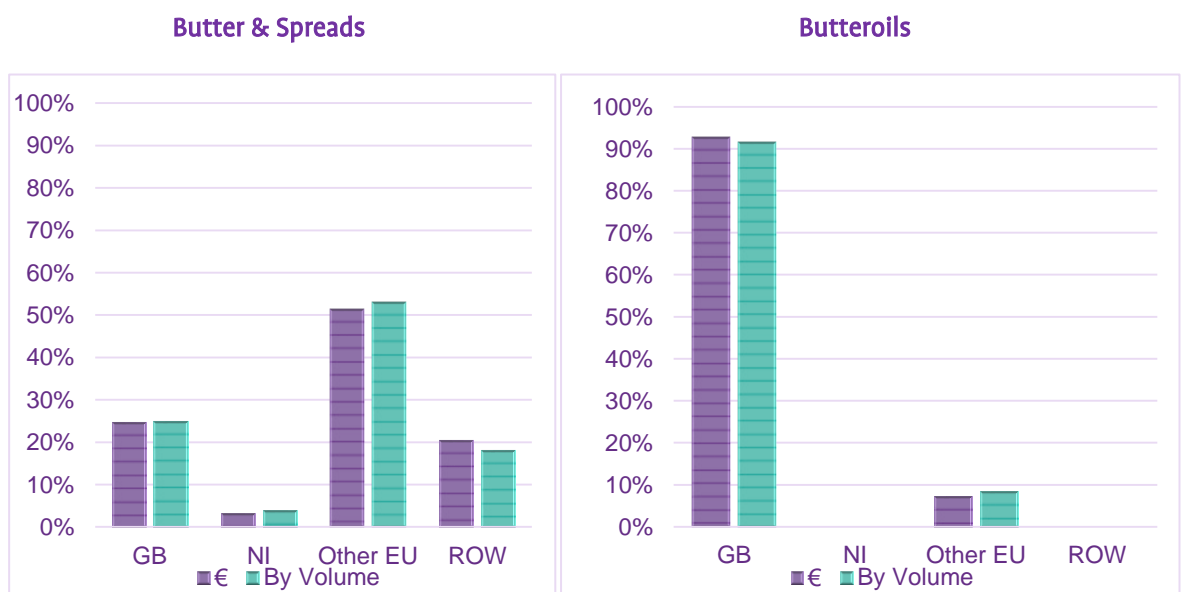
Figure 18: ROI Cheese export values 2016 (a) Cheddar (b) Processed cheese



Source: Adapted from EUROSTAT Comext

In terms of butters and spreads, GB accounts for a quarter of this category, with ‘Other EU’ being the largest market for butter exports, harbouring over 51% of the product output (53% value). GB is the destination for nearly 92% of the butteroil product volume (93% of value), Other EU is responsible for the remaining 8% of volume (figure 19)

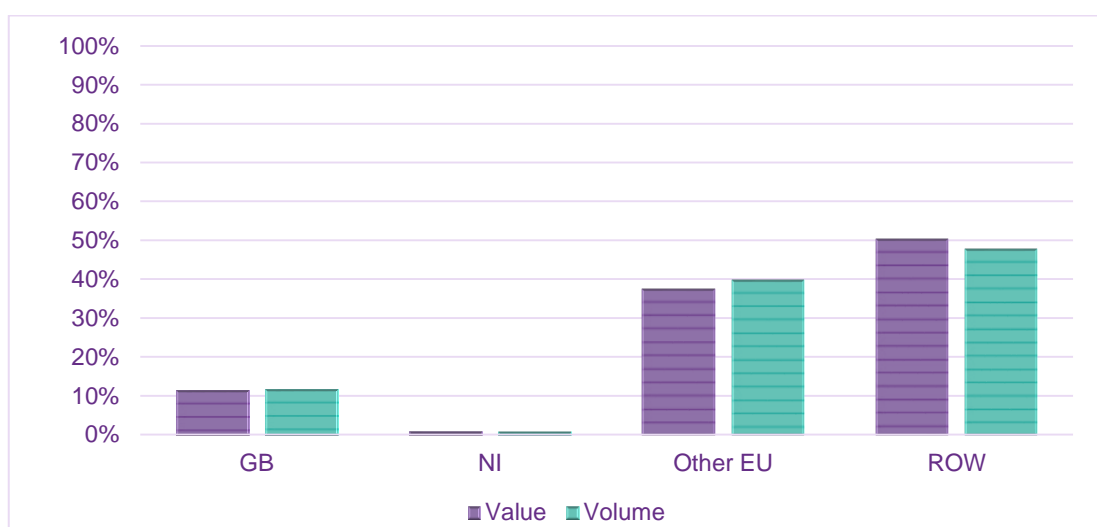
Figure 19: Volume and value of ROI butter exports (a) Butter and Spreads (b) Butteroils



Source: Adapted from EUROSTAT Comext

SMP on the other hand is mainly exported from ROI to the ROW, accounting for nearly half of all the SMP volume exported in 2016 (50% value). Other EU accounted for a further 40% in volume (37% value) with the remaining 12% in volume (11% value) to GB and just 1% (1% value) to NI (figure 20).

Figure 20: ROI SMP export values and volumes 2016



Source: EUROSTAT Comext

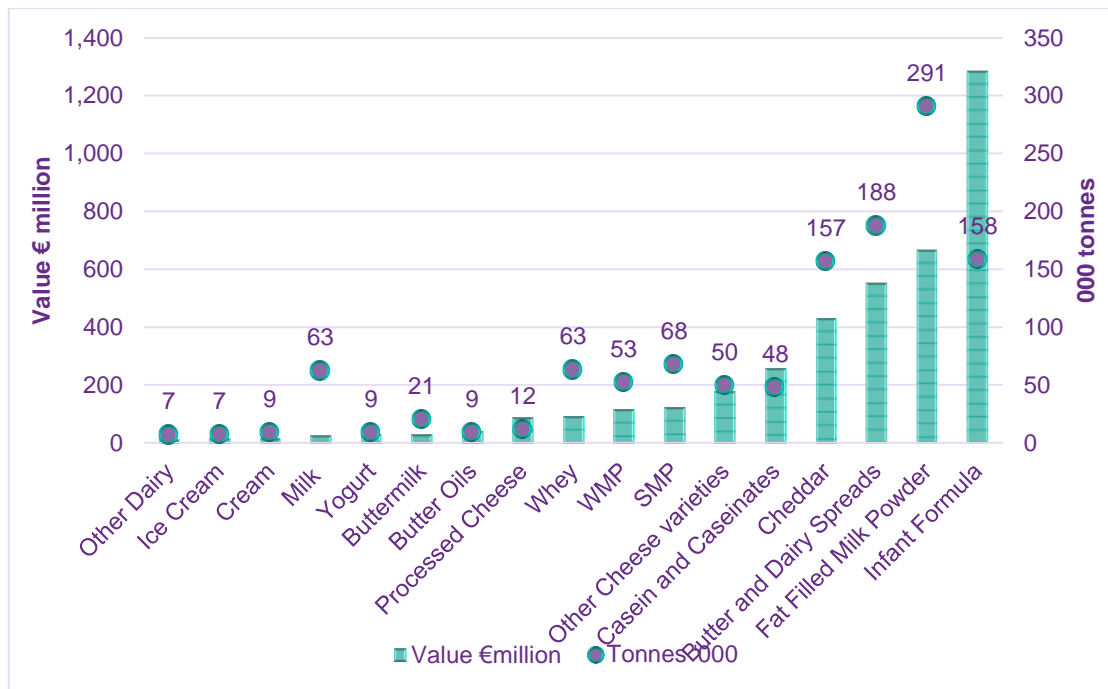
Total the ROI dairy export volume in 2016 reached over 1.2 million tonnes, having a monetary value of over €4 billion (figure 21). In 2014 ROI dairy export volume was approximately 1.1 million tonnes and had a value of 3.7 billion. Therefore, a substantial increase in export volume and value has been experienced in recent years. The milk quota abolition in April 2015 is a factor in this, as the ROI milk supply is no longer restricted, which resulted in larger volumes of milk being available for processing in 2015 and 2016.

The main exports in volume terms were FFMP (291,000 tonnes), infant formula (158,000 tonnes), butter and dairy spreads (188,000 tonnes) and cheddar cheese (157,000 tonnes). However in terms of value, infant formula (€1.2 billion) far outweighs the other produce categories. This was followed by FFMP (€665 million), butter and dairy spreads (€552 million) and cheddar cheese (€430 million).

Powders are broken down into infant formula (most valuable), whey, FFMP, SMP, WMP and caseins and caseinates. For the majority of powders, ROW accounts for nearly three quarters of all categories (figure 22). In particular the infant formula category accounted for nearly 80% of all infant formula exports, 66% casein and caseinates, 53% of FFMP and 50% of whey powder exports. Other EU imports

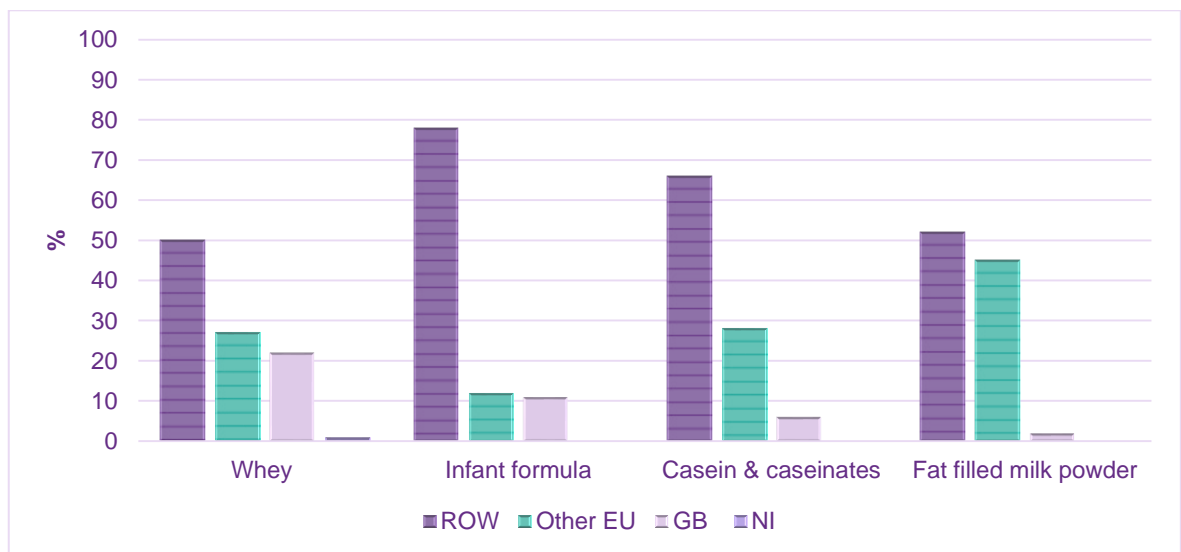
mainly FFMP, casein and caseinate, whey and infant formula. NI is the lowest importer of milk powders; however whey rates the highest accounting for 22% of whey exports in 2016

Figure 21: Total ROI dairy export volume and value 2016



Source: Adapted from EUROSTAT Comext

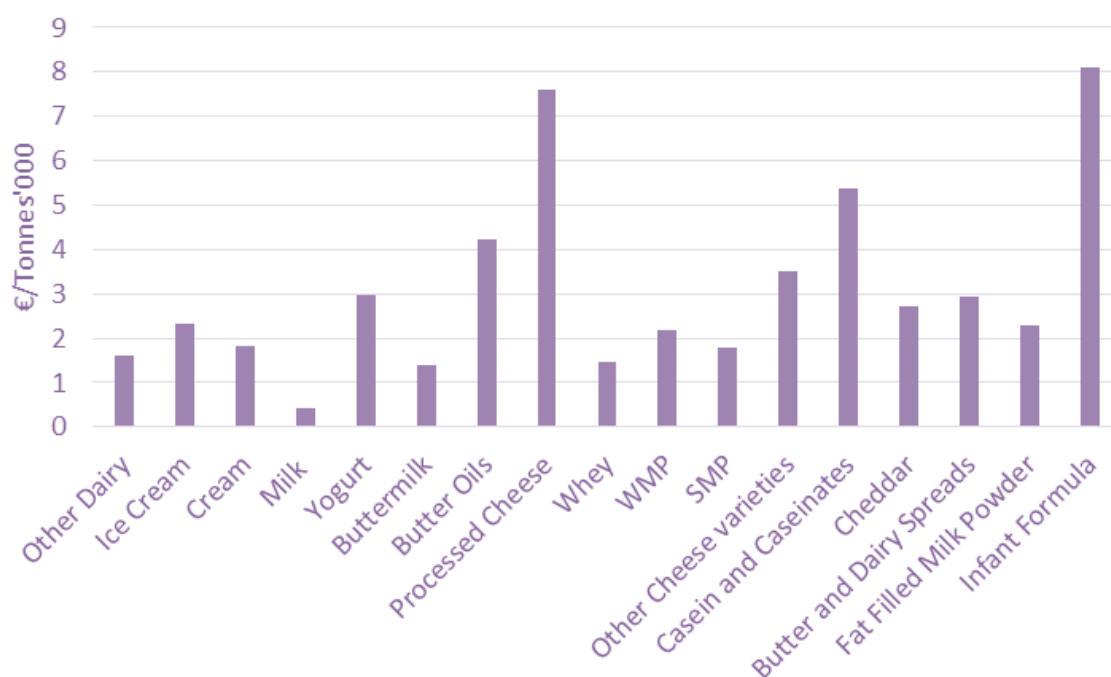
Figure 22: ROI whey, infant formula, casein & caseinates and FFMP exports by value in 2016



Source: Adapted from EUROSTAT Comext
Excludes SMP and WMP

The data in Figure 21 are used to estimate a value per tonne for each product and this is presented in Figure 23. The relatively high value of infant formula and processed cheese is evident but it must be borne in mind that these are processed products containing non-dairy ingredients. Liquid milk and buttermilk are the two lowest value products.

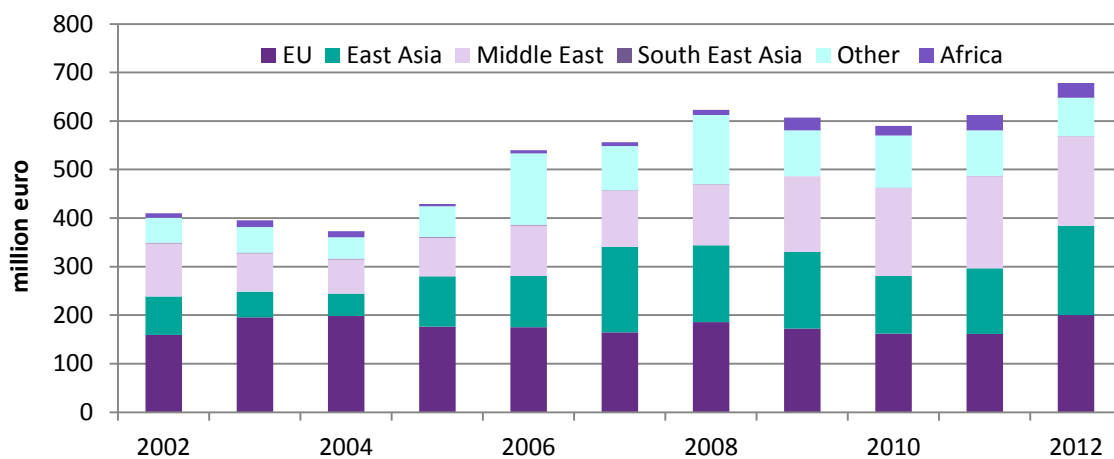
Figure 23: ROI dairy export value per unit of product 2016



Donnellan *et al.* (2013) broke down the exports of infant formula by destination. As we can see from Figure 24, until 2008 the EU was the dominant export market for the ROI infant formula exports. Towards the latter years however, the Middle East and East Asia in the later years have become important target markets for infant formula, with Africa increasing year on year. Currently, over two thirds of Irish infant formula is sold to countries outside of the EU.

Table 6 outlines the total ROI dairy exports by destination market in the period 2014-16. It shows that ROW now accounts for over 50% of the value of the ROI dairy exports. Other EU is also becoming increasingly important. The main driver for the growth in the value of export to ROW has been the emergence of the infant formula export market in Asia.

Figure 25: ROI infant formula exports by destinations 2012



Source: Donnellan *et al.*, 2013

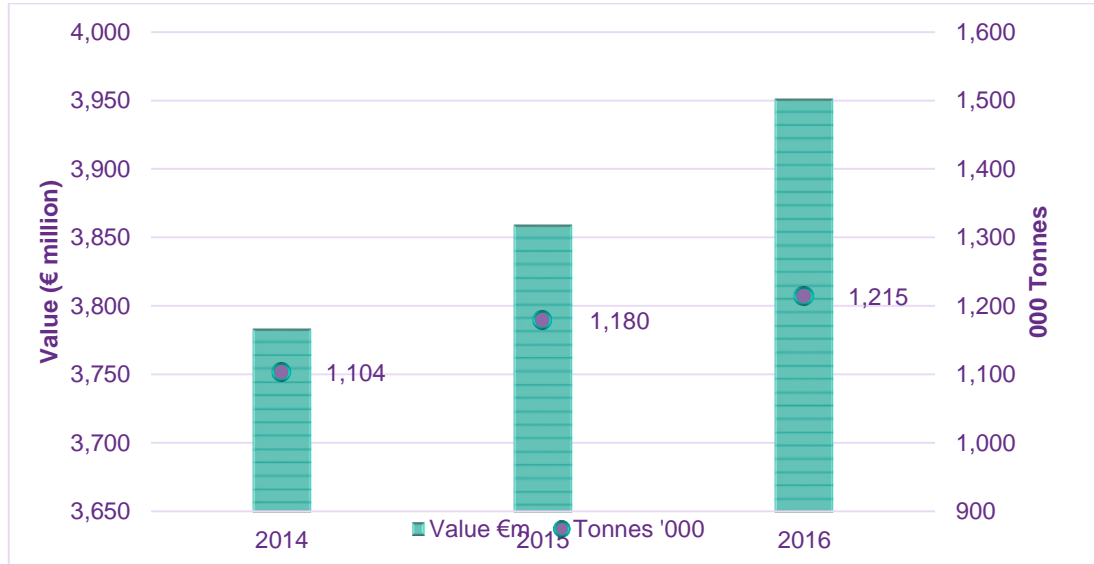
Table 7: Total ROI dairy exports decomposed by destination for 2014-2016

	2014	2015	2016
	%		
ROW	47	47	51
Other EU	26	28	28
GB	25	23	20
NI	2	2	1

Source: Adapted from EUROSTAT Comext

Figure 26 shows the total value of ROI dairy exports. Over the three year period from 2014 to 2016, the total volume of dairy exports increased by close to 5%, additionally the value of dairy exports grew from over 3.7 billion in 2014 to almost 4 billion in 2016. Growth has continued in the four main product categories FFMP, infant formula, butter and dairy spreads and cheddar cheese.

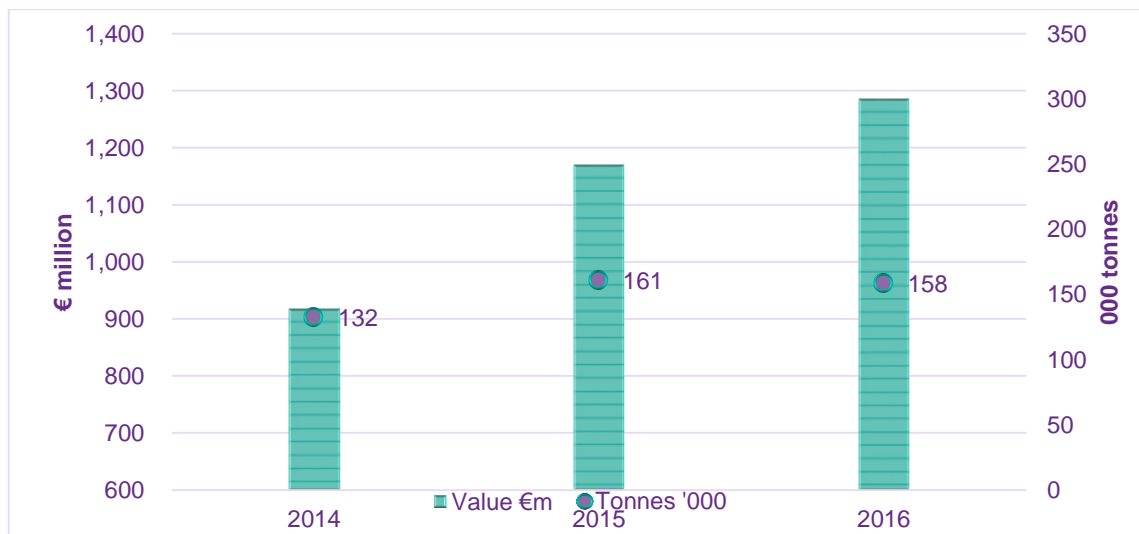
Figure 26: ROI Dairy exports value and volume 2014-2016



Source: Adapted from EUROSTAT Comext

Infant formula continues to be the front runner in terms of product value. The volume of infant formula has grown steadily (132,366 tonnes in 2014 to 158,430 tonnes in 2016) over the time period, the value of infant formula over this time has increased significantly (almost €1 billion to 1.3 billion) (figure 27).

Figure 27: Infant formula ROI export volume and value 2014-2016

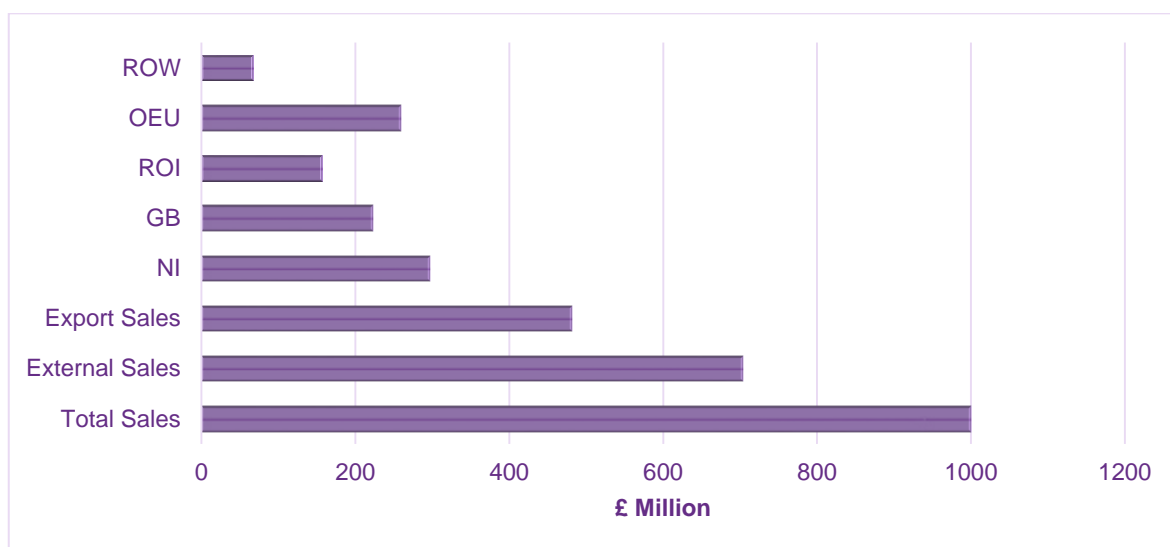


Source: Adapted from EUROSTAT Comext

The ROI and NI dairy trade and imports

Given that NI is part of the UK, it is more difficult to obtain official data on the destination of NI dairy exports. The biggest dairy trading partners for NI are ROI, GB and OEU, having a net value of over £1 billion in 2013. ROI is the largest export market for NI having a total sales value in 2012 of £695 million increasing to £705 million in 2013 (Soares and McTaggart, 2016). While the ROI accounts for over 50% of NI exports from the food and drinks processing sector, as a proportion of sales this is continuing to decline (Soares and McTaggart, 2016). Of these total exports in 2013, we can see from figure 28 that for milk and milk products the ROI accounted for over £155 million worth of NI's dairy export trade.

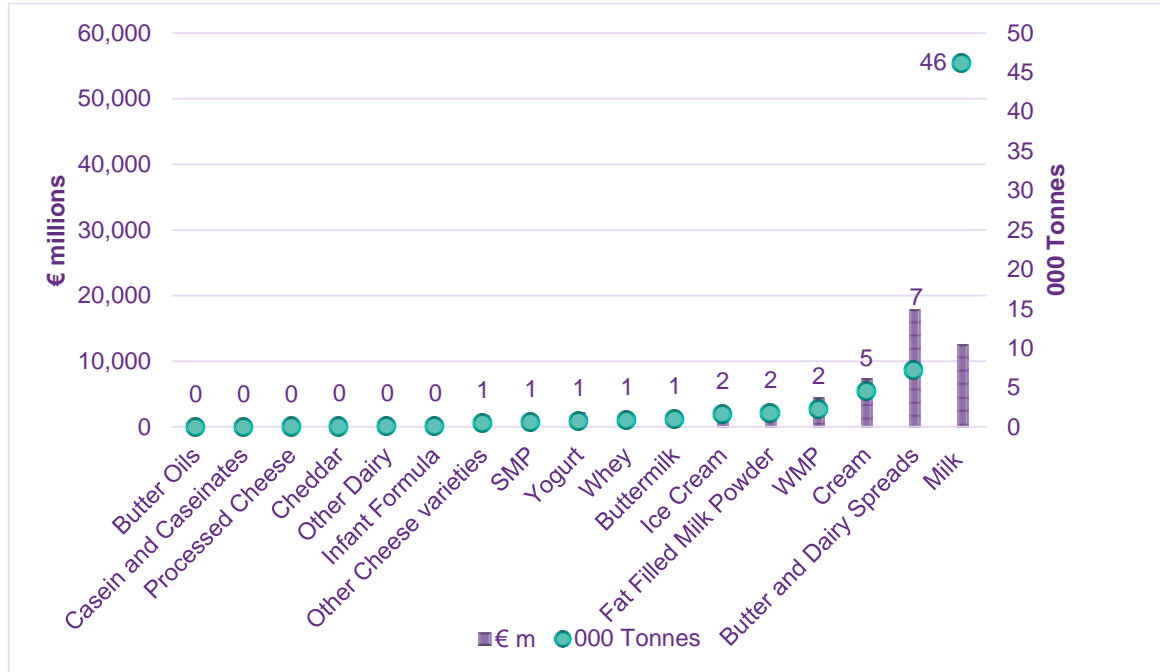
Figure 28: Destinations and value of NI Milk/Milk product sales 2013



Source: Soares and McTaggart, 2016

Likewise, NI is also an important export market for ROI, especially in terms of fresh dairy products such as milk, buttermilk, cream and yoghurts etc. The perishability and associated short shelf life of these products make proximity an imperative in terms of export markets. As we can see in figure 29, butter and dairy spreads (7,000 tonnes) and cream (4,000 tonnes) are the dominant dairy products exported from the ROI to NI. These are followed by milk powders in the form of WMP (2,300 tonnes) and FFMP (1,700 tonnes).

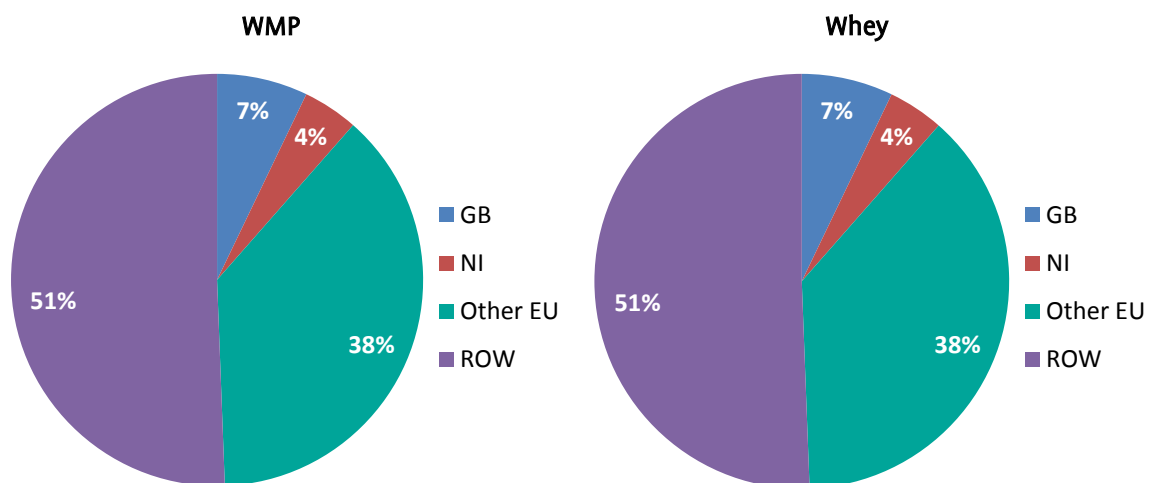
Figure 29: The ROI Dairy exports to NI (excluding milk) 2016



Source: Adapted from EUROSTAT Comext

However, NI represents a very small segment of the powder markets for ROI as can be seen in figure 30. The ROW, as mentioned above, dominates the milk powders markets.

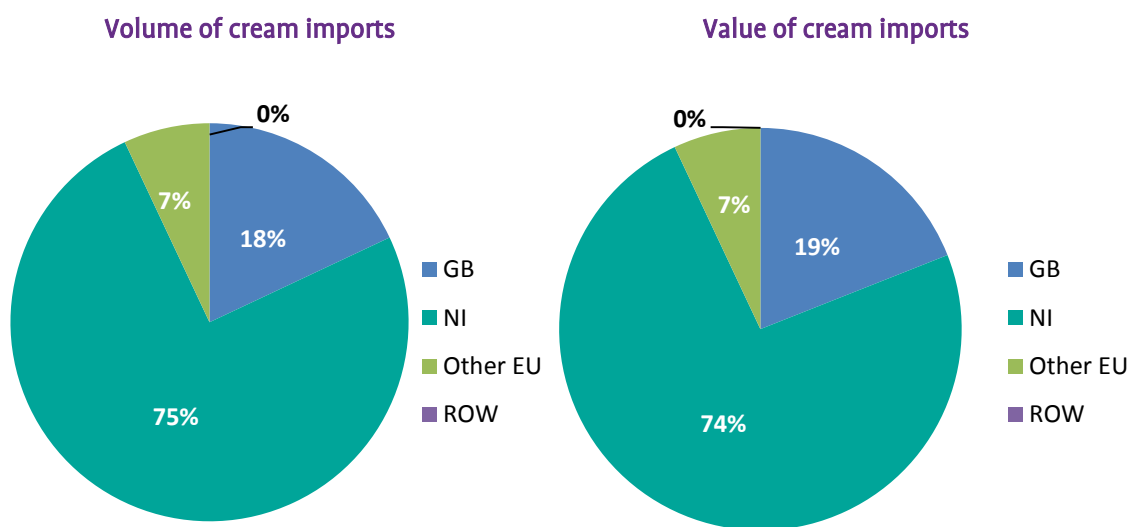
Figure 30: WMP and Whey Powder exports ROI 2016



Source: Adapted from EUROSTAT Comext

As stated previously NI is the main origin of the limited volume of fresh dairy produce coming into the ROI. Three quarters of all cream (over 4,000 tonnes) imported in 2016 for example originated from NI. In terms of value (total value €7 million) this equated to over €5 million (Figure 31).

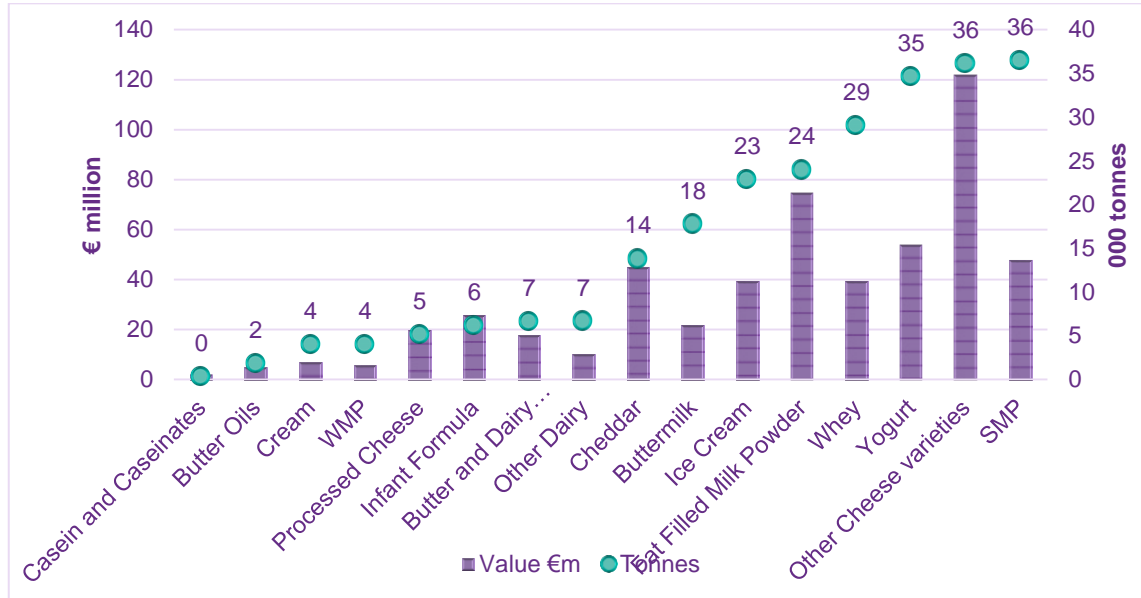
Figure 31: ROI Cream imports 2016 (%) by (a) Volume (b) Value



Source: Adapted from EUROSTAT Comext

Total imports to the ROI vary greatly with the largest volume of import (with the exception of milk) being SMP (36,000 tonnes) and other cheeses (36,000 tonnes). Yoghurt, whey and FFMP make up the next largest volumes of product accounting for 35,000, 29,000 and 24,000 tonnes respectively. In terms of value, however, the other cheese varieties far outweigh the rest with a value of €122 million (figure 32).

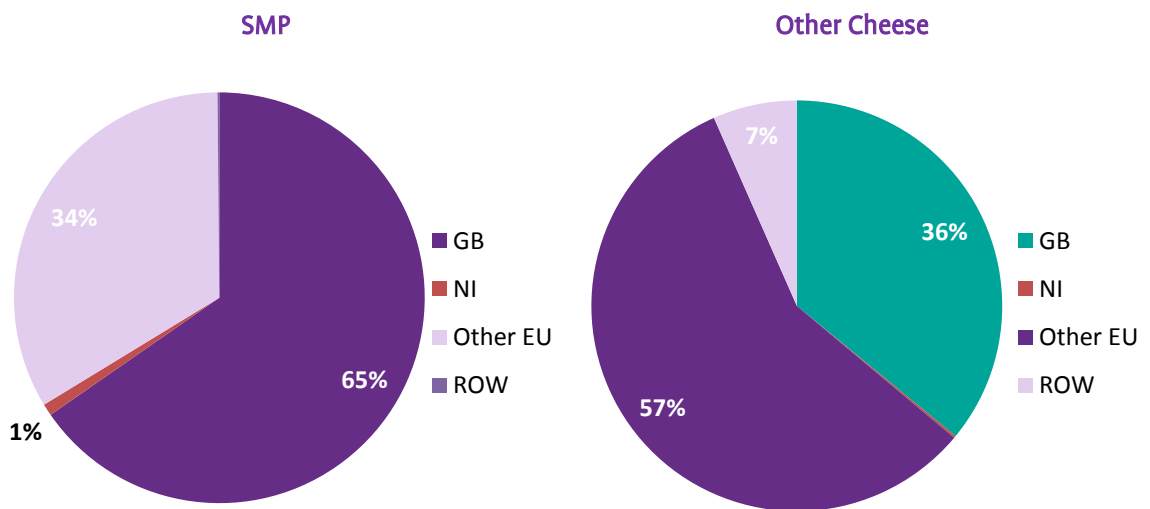
Figure 32: Value and volume of all dairy imports to the ROI in 2016 (excluding milk)



Source: Adapted from EUROSTAT Comext

While SMP and ‘Other Cheese’ varieties are the front runners in terms of imports to the ROI, NI does not feature on either of these products as an origin (figure 33).

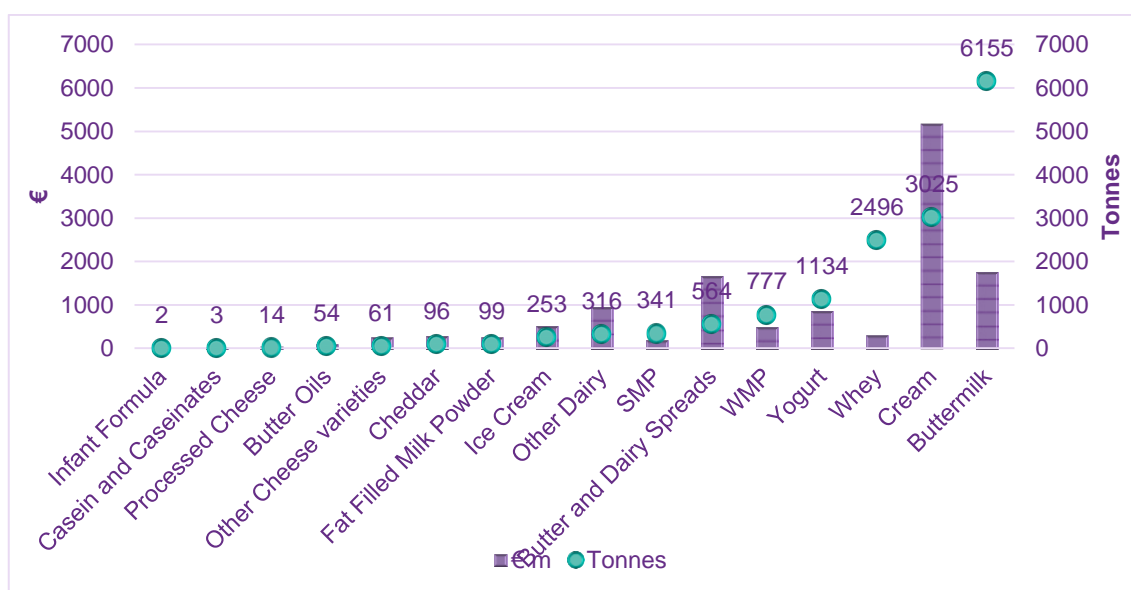
Figure 33: ROI SMP and Other cheese imports 2016 (a) SMP (b) Other cheese



Source: Adapted from EUROSTAT Comext

The second largest import from NI to ROI is buttermilk accounting for over 6,000 tonnes in 2016 increasing from just over 2,000 tonnes in 2014. Further to this cream, whey and yoghurts follow suit having respective values of 3,000 tonnes, 2,500 tonnes and over 1,000 tonnes. Cream however yields the highest in terms of product value having a net value of just over €5 million (figure 34).

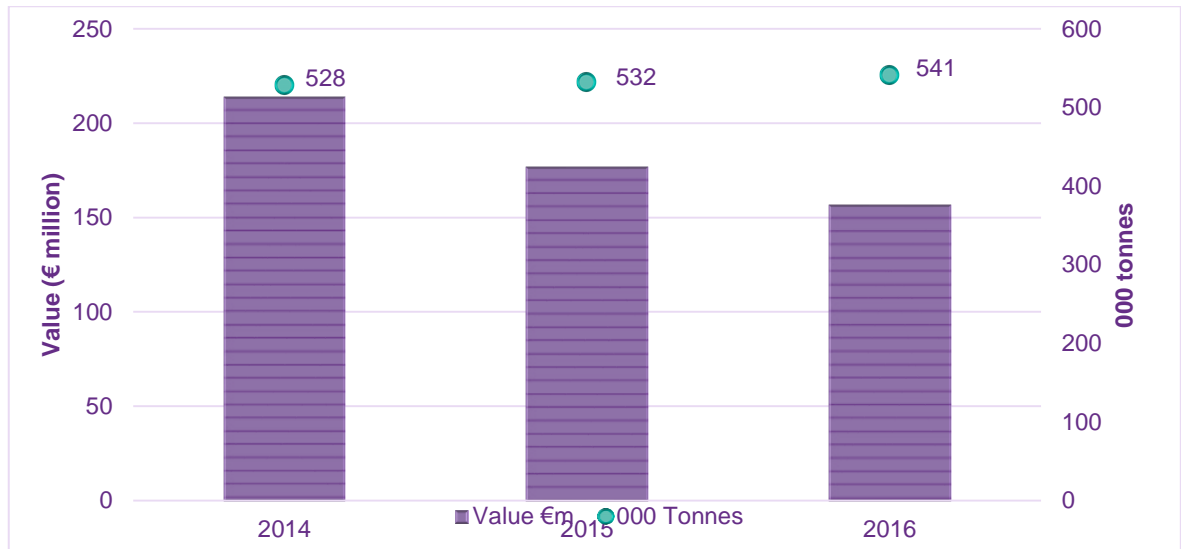
Figure 34: Value and volume of ROI dairy imports from NI 2016 (excluding milk)



Source: Adapted from EUROSTAT Comext

Milk is the main product traded between the two jurisdictions. As mentioned earlier in the discussion surrounding liquid milk processing in the ROI, liquid milk is the main product imported to ROI from NI and accounts for around one third of the NI total milk output. A further 94 million litres were imported from NI in the form of consumer packs (National Milk Agency, 2016). In 2016 the ROI imported over 541,000 tonnes of milk (value of over €156 million) growing from 528,000 in 2014 (figure 35).

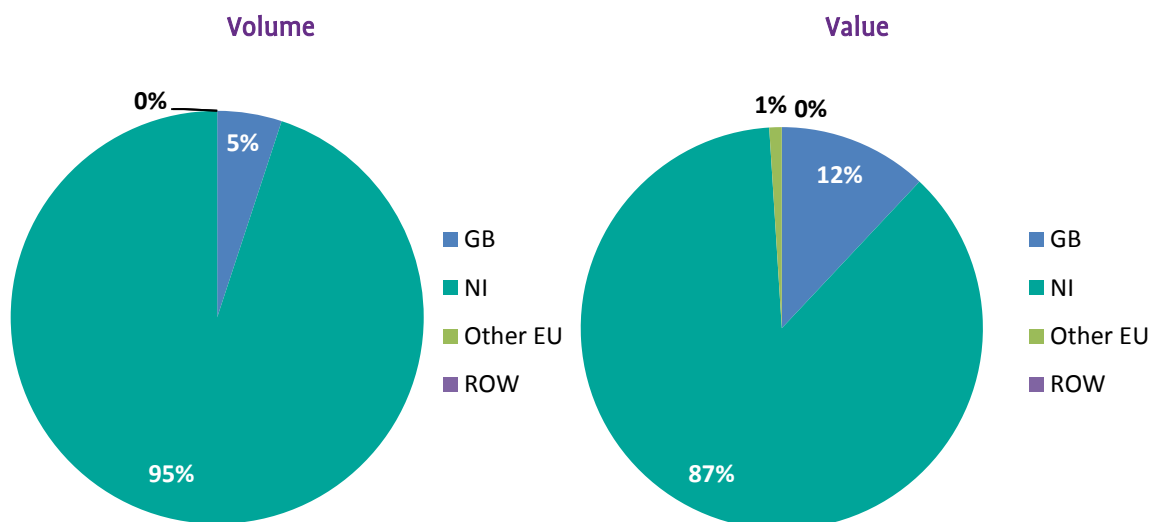
Figure 35: Total ROI milk imports 2014 -2016



Source: Adapted from EUROSTAT Comext

NI is the main origin of these milk imports followed by GB mainly due to their proximity. Over 94% of the total volume of milk imported to the ROI in 2016 came from NI and accounted for over 87% of the total value of milk imports. GB accounted for just 5% of the volume and 12% of the value (figure 36).

Figure 36: ROI milk imports 2016 (a) Volume (b) Value



Source: Adapted from EUROSTAT Comext

Imports of milk from NI have continued to increase year on year and form the largest proportion of all milk imports to the ROI. In 2014, just over 448,000 tonnes of milk was imported from NI increasing to over 540,000 tonnes in 2016 (figure 37).

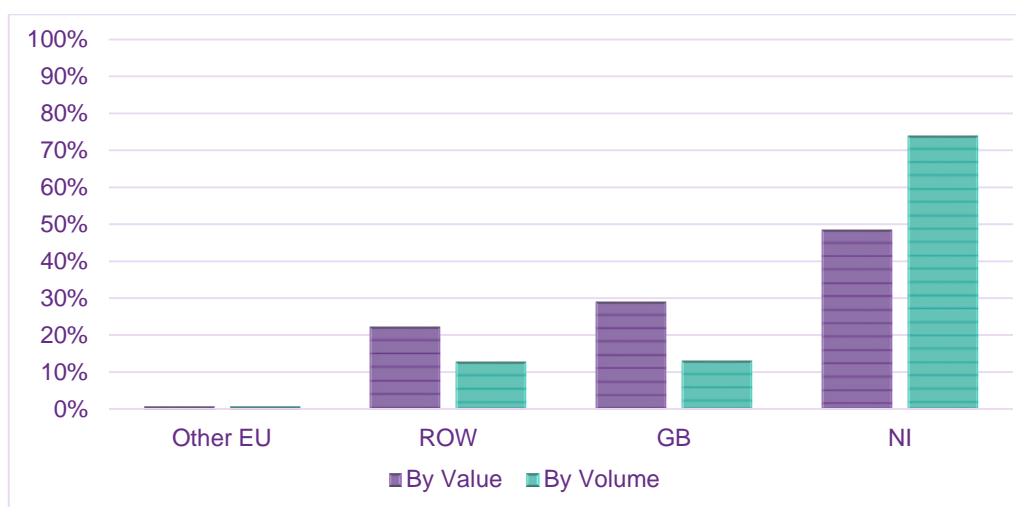
Figure 37: Total ROI milk imports and ROI milk imports from NI 2014-2016



Source: Adapted from EUROSTAT Comext

Of the total amount of milk exported from ROI in 2016 (62,566 tonnes) NI is the main destination. NI accounted for over 74% of the output and nearly half of the value of total milk exports (over €26 million) (figure 38).

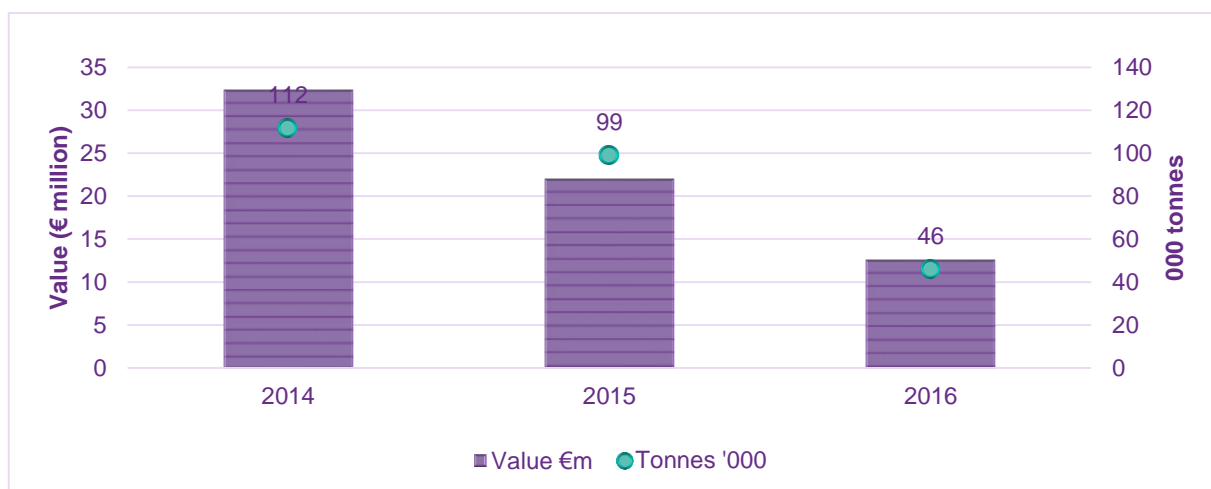
Figure 38: ROI milk exports 2016 value and volume (%)



Source: Adapted from EUROSTAT Comext

However exports of milk from ROI to NI from 2014 to 2016 have decreased over the last three years (figure 39). In 2014 milk exports to NI were over 32,000 tonnes and in 2016, have dropped to as little as 13,000 tonnes.

Figure 39: Milk exports from the ROI to NI 2014 - 2016



Source: Adapted from EUROSTAT Comext

Secondary processing

Secondary processing relies on the use of products from primary processing to create higher value added goods such as speciality cheeses, infant formula, nutrition and health products and alcoholic beverages. The main actors involved in secondary processing in the Irish dairy supply chain include the larger globally operating co-operatives and private limited or multinational companies.

Currently, infant formula is one of the most lucrative products involved in secondary processing. There is a 20% to 30% mark up on the price of infant formula versus a single digit price mark up on commodity products (Donnellan *et al.*, 2013). Currently, Ireland has over 12% of the global milk formula trade and in 2012; infant formula had an overseas sales value of €700 million. This accounted for 30% of the total value of Irish exports in 2012 which totalled €3 billion (Heery *et al.*, 2016).

The main multinational companies that are based in Ireland and involved in infant formula production are Abbott, Danone, Wyeth Nutrition and Pfizer. Three out of the five leading producers of infant formula globally are based in Ireland (Abbott, Danone and Pfizer) and their set up costs are believed to have cost around €150 million (Donnellan *et al.*, 2013). The main reason that these have established in Ireland is due to the fact that many of the base materials (SMP, whey and lactose) are

produced by Irish dairy processors and to a high standard required by these companies. To produce infant formula (see figure 40), processors require inputs from dairy processors including SMP, proteins, caseins, whey and lactose. Equally, they require inputs from a non-dairy processor source including fats in the form of coconut, sunflower and palm oil. Further additives such as vitamins and minerals are also required to make infant formula.

Figure 40: Production of infant formula



Source: Donnellan *et al.*, 2013

Table 7: Percentage breakdown of Ornuia sales value (from the ROI) by destination

	2015	2016
UK	25%	31%
EU	42%	32%
North America	12%	11%
Africa	10%	15%
ROW	11%	11%

Source: Ornuia, 2017

Another example of secondary processing in Ireland is undertaken by Ornuia. They are essentially the marketing arm of the dairy export industry in ROI (Murphy, 2008). Ornuia is the largest exporter of Irish dairy produce, exporting to over 100 countries worldwide and having sales turnover in the region of €1.75 billion annually (Ornuia, 2017). Table 7 gives the breakdown in regional exports for 2015 and 2016. They operate as a second tier commercial co-operative that packages, markets and exports dairy

products on behalf of their members. Ornuia as a second tier co-operative is effectively owned by farmers through member co-ops and is financed by farmers paying a milk levy. This financing is in the region of €4.5 million annually (Murphy, 2008). However, not all exporting processors export any or all of their produce through Ornuia.

Ornuia is responsible for the international marketing of Irish dairy produce that processors direct to these and have developed key brands in doing so, including Kerrygold butter and Pilgrims choice cheeses. However, little detail is publicly available on the volumes produced or the export destinations of each product. Therefore it was necessary to conduct interviews with executives from Ornuia and a selection of dairy processors on the IOI to obtain additional production information.

4 Interviews with dairy industry executives

Semi-structured interviews were conducted with 11 dairy industry stakeholders in the ROI and NI to gain a greater understanding of the typical supply chain for the various dairy products produced. The purpose of the interviews was to establish the typical number of steps dairy products pass through from farm to fork and the main players or actors along the chain. In particular, information about the type of supply chain actors was sought, i.e. the number of secondary processors, traders, catering outlets, re-formatters of product, wholesalers and retailers that handle product from the IOI both in the island and overseas. Again, this was easier to accomplish for ROI as a lot of data for NI is aggregated with GB and published for the UK as a whole.

The sample of those interviewed included executives from primary dairy processors (n=5), secondary dairy processors (n=1), exporting agency (n=1), dairy representative bodies (n=2) and academic experts (n=2). The primary processors interviewed collected approximately 80% of the total raw milk produced in the ROI in 2016, while those interviewed collected just 20% of the milk produced in NI. The exporting agency was responsible for 60% of all dairy exports from ROI, while the representative bodies included all dairy processors in ROI within their membership.

Throughout the interviews a number of common themes emerged. These are outlined in the first section below. Following this, the information gathered through the interviews is summarised by product type, rather than by interviewee. This approach is adopted, both to protect the anonymity of those interviewed, but also to provide an overview of the supply chain by product type rather than by company. The full details of the interviews have been provided in confidence to the funding body for this research.

Common themes emerging from the interviews

There were several common themes which reflected the reaction of the interviewees when the purpose and scope of the project was explained to them. First, interviewees questioned the value of investigating food fraud in the Irish dairy sector when there was no apparent issue or specific incident recently reported. As one interviewee said, “why look for a problem that doesn’t exist?” Interviewees also expressed the view that the industry is facing a number of pressing challenges at the moment such as Brexit, product price volatility and mitigation of greenhouse gas emissions to address climate

change policy and therefore the spectre of potential food fraud adds further to the challenges the sector currently faces. When questioned about the implications of a potential food fraud breach involving their own business, the response was common among interviewees. There was a unanimous view among industry executives that once they adhered to food quality and safety standards and delivered a quality and safe product to their customer, if that customer, be they a company or individual, deliberately adulterated that product for economic gain or through negligence then that was not the responsibility of the processor nor did it reflect badly on them.

During the course of the interviews, the example of companies trying to pass off non-Irish product as Irish was used as a hypothetical case of food fraud. One interviewee responded that such a case would be more correctly described as brand infringement rather than fraud. The respondent went on to say that their organisation is active in investigating and detecting such infringements of their brand and that they fight such cases through the relevant, local justice system. Overall, the argument that food fraud involving Irish product, regardless of how or where it occurs, may negatively damage “Brand Ireland”, and by consequence all of the stakeholders interviewed, was not one that was accepted by those interviewed.

When asked about their risk exposure to food fraud, most interviewees felt it was very limited. In terms of the farm collection process, drivers are well trained and tankers are well assessed (this is described in more detail below). In terms of their downstream trade, interviewees also felt they were sufficiently insulated from potential fraud. They explained that they normally use the same well established hauliers and that containers are sealed at source and that seal is intact when the product is delivered to the customer. Payment depends on the receipt of product with the seal intact and interviewees therefore felt confident that they were delivering a safe product. Their view was that if they were paid for a safe and quality product that their responsibility in this regard ended when ownership passed to the customer.

When approaching the interviews the primary focus of the research team was to categorise the “customers” processors deal with into secondary processing, wholesale or end use, in order to gain an understanding of how long the supply chain is for the different dairy products. It quickly became apparent that the interviewees do not think of their “customers” in this way. In fact some of them stated that they have no reason or desire to understand how, or for what purpose, their customers use the product. Where they do have this information, it is only because of the size of the customer and their place in an industry or because of a long and personal relationship with some customers. Many interviewees struggled to categorise their customers into the different segments identified in the project. Furthermore, for a large number of customers in the supply chain, the Irish processors had no information as to where the product went to after it was delivered to each customer. As such, it proved quite difficult to categorise and follow products along particular supply chains. Even where

detailed information existed, interviewees explained it would be almost impossible to categorise it in the format that was required. It was more common for records to be kept by product or country category rather than by customer type. Hence for most products interviewees were asked to rank the major customers, identify their business type (secondary processor, wholesaler, catering or retail) for each product line. When the major customers had been identified it was common for interviewees to respond that the last 10 or 20% of product goes to a range of small players and that considerable data mining would be required to categorise such players into the segments identified in the project.

The extent to which those interviewed dealt with traders and/or small players in the industry was investigated. A common theme emerged amongst all those interviewed. They stated that they typically deal with a short-list of well known, large and well established customers. They said that up to three-quarters of their trade is with the same customers on an annual basis. There is a reluctance to deal with small or new customers, regardless of whether they are traders or retailers. The reluctance is not founded on concerns regarding food fraud, rather on economic concerns. Interviewees stated that their greatest concern was being paid in a timely fashion. They went on to say that the bureaucracy involved in vetting and setting up a new customer was such that it was not worthwhile unless they were very large and/or well known. Interviewees were also questioned about their engagement with farmhouse industry, cheese producers etc, very few of those interviewed engaged in business with such producers again because of a scale issue rather than any suspicion about fraud. One processor had long-standing relationships with 2 to 3 local farmhouse cheese makers and supplied some products to them for further processing.

Finally, those interviewed differed somewhat in the degree to which they used the exporting agency Ornua. Some of those interviewed did not use Ornua at all, others used Ornua exclusively for all of their export trade, while others engaged in export independently and through the exporting agency.

Farm collection process

In total the five processors interviewed collected 5.3 billion litres of milk in the ROI and approximately 570 million litres in NI. Over 200 million litres of milk moves across the border for processing, with one of the processors interviewed bringing milk only from north to south to be processed and with another bringing milk in both directions for processing. Some of the processors interviewed also collect milk from a small number of independently operated co-operatives and then it is processed along with milk collected from their own suppliers, in all this amounts to small quantities. In total the processors interviewed collect milk from approximately 12,600 farms with approximately 800 of those based in NI.

There is some sharing of processing between the processors interviewed. This occurs where processing capacity issues arise. For example if one processor is operating at peak capacity at a particular time of year they may have an arrangement with another processor to take milk from them for processing. It was not possible to put figures on this type of arrangement as first it was very year specific and second, some processors felt it would reveal their identity and the details of the arrangements by making such information available. Furthermore, some large processors have agreements whereby they process particular products for one another. One large processor collects milk from suppliers of another processor, produces cheese and returns it to the other processor for sale. This is an indication of the collaboration and integration that exists between actors in the same stage of the supply chain.

In terms of milk collection, the process was similar across all of those interviewed. The tankers are typically owned and maintained by the processor, while the driver and the engine are contracted. Only a few of those interviewed retained drivers as direct employees and where this occurred these were still only a small portion of the total collection team. There are numerous milk collection routes, which are typically mapped using a cost minimising logistics model. Drivers regularly attend compulsory training around hygiene and safety standards. At each collection point, drivers connect to the farmers' bulk tanks and take a sample of milk at every collection before draining the bulk tank. The milk sample is barcoded and taken to a central lab for testing to ensure safety and quality.

Processing Sites and product mix

Once milk is collected it is assembled at a processing site. The processors interviewed operated 16 processing sites in total. Some processing sites are product specific and others are multi-product plants. In the case of some processors, the large number of sites was arising out of legacy issues where smaller co-operatives with their own processing plants were acquired over the years and those plants were maintained. A number of the plants are shut down for the winter months when the quantity of milk collected declines considerably.

The extent of product mix and route to market varied across the processors interviewed. Some of those interviewed produced a full array of drinking milk, butter, cheese and the variety of powders, while others were specialised in particular products. Furthermore, some of those interviewed maintained domestic brands and supplied directly into the Irish retail sector while others sold no product on the IOI. The detail of this is outlined on a product by product basis below.

Although exact quantities of product were not supplied in all cases, estimates were made using percentages of the milk pool provided and information available in annual reports and websites. Liquid (drinking) milk is not an important product for those interviewed. Collectively those interviewed processed just under 500 million litres of drinking milk, making up less than 7% of the

total milk pool collected. Collectively those interviewed processed just over 140,000 tonnes of butter, 165,000 tonnes of cheese (including cheddar and continental varieties) and a wide variety of powders including WMP, SMP, infant formula powder, Fat Enriched powders, rennet casein and acid casein which are described in more depth below.

Supply chain for drinking milk

Drinking milk is the least important, in terms of size, of the products covered during the course of the interviews. Just three of those interviewed processed milk for the liquid market. Farmers are typically contracted to supply milk for the liquid milk market and are paid a premium to ensure delivery throughout the year. One of the processors interviewed stated that they only continued in the liquid milk market because of legacy issues, having recently acquired a cooperative that already had contracts with farmers. One of the processors interviewed operated a number of drinking milk brands under their consumer foods division. They explained that milk is pasteurised and sold off to the consumer foods division, it is then sold under brand directly to retail outlets in Ireland and more is processed for private label retailers in Ireland, both Irish and foreign owned retailers. Milk is packed on site and transported directly to the retail distribution centre. One of the processors interviewed had a contract to supply drinking milk directly to a major fast-food company while another had a small contract to supply door to door deliveries. For the most part however, drinking milk was supplied directly to retail on the IOI under a brand or as a private label.

Supply chain for butter

The processors interviewed collectively supplied approximately 140,000 tonnes of butter. Butter is typically produced in 25 kilogram blocks. The distribution channels include the Irish retail market, directly to the European retail market, for the export market via Ornu, to large secondary manufacturing companies and to large trading houses.

Approximately 12% of the butter produced by those interviewed is destined for the Irish retail market. This is sold under the processors' own brand and under private label. Four of the five processors interviewed were selling butter on the Irish retail market. As with the drinking milk supply chain, retail butter is typically sold to the consumer goods division of the processor. They are then responsible for re-formatting, packaging and further sale to the Irish retail outlet. Typically external haulage companies are used to transport butter to a central retail distribution outlet. The retailer then takes possession of the butter for further sale.

Approximately 6% of the butter produced by those interviewed is sold to a European distributor who supplies the European retail network, mostly in Germany. Again this distributor takes possession of the Irish butter, reformats and re-packages it and sells it on to the European retail network.

About two-thirds of the butter produced by those interviewed goes to a range of secondary processors and large traders. One processor sells almost 10,000 tonnes of butter to a single European confectionary company. This accounts for 6% of the butter produced by all of those interviewed and it is the largest single butter transaction excluding those with Ornuia. Over a third of the total butter produced is sold to a short list of about 5 large secondary processors. Some of the typical names occurring here that arose over a number of interviews included Walker biscuits, Bel, Mondelez and Corman. Approximately 15% of the butter goes to a range of traders and small secondary manufacturers. Most of the traders dealt with are large trading houses including Greenfields and Fayrefields. As outlined earlier, there is a reluctance to deal with small traders and or secondary processors. Furthermore, as mentioned earlier transport is usually arranged with an independent and reputable haulier. All containers are sealed and the seal must be intact when the purchaser takes possession of the product.

Just over a quarter, approximately 26% of the butter produced by those interviewed is sold to Ornuia for the export market. This excludes the butter that Ornuia manufactures itself in its Mitchelstown site. For some of those interviewed, all of their butter is sold either on the Irish retail market or directly to Ornuia. Others have no dealing with Ornuia for butter trade.

In separate interviews with Ornuia representatives it was established that Ornuia traded over 110,000 tonnes of butter in 2016, this includes butter produced by processors not interviewed during the course of this project. The Ornuia representative supplied detail on the major destinations of this butter. This is outlined in Table 8. Over two-thirds of all the butter traded by Ornuia is pre-packed and sold to retailers through their own subsidiaries in Germany, the US, the UK and Ireland. This butter is typically sold under the Kerrygold brand. It is sold directly to retail outlets or to wholesalers. The Ornuia subsidiaries take responsibility for this sale. Detail is also provided on a shortlist of other important customers. Ornuia also deals with four very large customers, a foodservice company in the UK, a French customer engaged in re-formatting for the French retail market, a Dutch trading company, which is well established and with which Ornuia has been dealing for many years and a group of 9 Egyptian food ingredient companies. The remaining 15% of butter goes to an array of smaller customers, however in all cases Ornuia tends to deal with larger and well established companies. The reputation of all business and trading partners is of concern to Ornuia and all suppliers and customers are verified, and prepayment or letters of credit are obtained for all new customers. The representative stated that Ornuia's internal customer/consignee verification processes and prepayment requirements greatly minimise the risk of fraud.

In general those interviewed described the supply chain for butter as up to a quarter going to Ornuia, 10 to 15% going to Irish retail, up to a third or more going to three or four large secondary manufacturers,

10 to 15% going to large trading houses, price dependent and the remainder (about 15%) going to a range of smaller secondary processors.

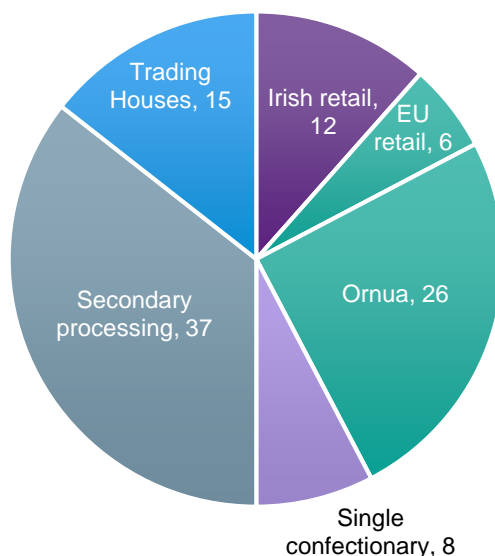
Table 8: Breakdown of Ornu trade in butter

	Tonnes
Pre-packed and sold to retailers by Own Subsidiary Germany	54,700
Pre-packed and sold to retailers by Own Subsidiary US	13,600
UK Ingredients Customer (food service)	6,600
French customer (retail packing)	5,700
Dutch Trader (large customer long established partnership)	4,400
Pre-packed and sold to retailers by Own Subsidiary UK	4,200
A group of 9 Egyptian customers (food ingredients)	3,950
Pre-packed and sold to retailers Ireland	2,500
All others	16,500

Source: Ornu, 2017

Figure 41 presents an overview of the supply chain for butter as garnered from the interviews. A quarter of all butter is traded through Ornu, up to 43% is traded directly to secondary processors with a number of very large confectionary companies in this category (company names are withheld), 11% goes directly to the Irish retail market, 6% goes to EU retail but not through Ornu and 14% goes to trading houses (2 to 3 large established trading houses).

Figure 41: Overview of supply chain for butter



Supply chain for cheese

The vast bulk of cheese produced is cheddar with some continental varieties manufactured at a smaller scale. The supply chain for cheese includes cheese sold under the processors’ own brand and under private label for the domestic retail market, cheese further processed by subsidiaries of the processors interviewed in NI and GB that is re-formatted for retail elsewhere or further processed for the food service sector, such as shredding, grating and dicing, cheese sold to Ornuu for the export market, cheese sold to secondary processors and finally cheese sold to large trading houses.

Of the processors interviewed just about 7% of the cheese produced is sold under a brand name in the Irish market. Most of this is sold directly to the retail sector (through the consumer foods division) but some is also sold directly into the food service sector under a brand name, such as cheese for the fast-food restaurant sector as well as retail consumer brands. A further 10% of the cheese produced by those interviewed goes for further processing by wholly owned subsidiaries in the UK. This cheese is reformatted, grated, shredded and diced and is sold directly to the EU retail sector or to the food service sector for pizza toppings etc. About 30% of the cheese produced is sold to a shortlist of 5 or 6 very large customers, none of which is going directly for retail, it is all going for further formatting or into the secondary processing sector. Customers in this category include Almari in the Middle East, Lacto Japan and also some formatters for the European retail sector including the German discounters. Some processors have also developed speciality cheese under joint ventures with other cheese producers internationally. Almost 10% of the total cheese produced is sold to trading houses, but well established ones such as Fayrefields and FIT France.

Over 40% of the cheese produced by the processors interviewed is sold through Ornuu. In total just over 86,000 tonnes of cheese is traded by Ornuu, this includes cheese that was produced by processors that were not interviewed during the course of this project. The main market channels used by Ornuu to sell this cheese are described in table 9.

Almost 30% of all of Ornuu’s cheese trade goes to a single Ingredients Subsidiary that engages in block slicing and grating for the retail market. A further almost 20% goes to a single British customer in the food service sector mostly for use as cheese slices for burgers for the fast-food sector. About 7% of the cheese is pre-packed and sold to retailers by Ornuu’s own subsidiary in the US.

Similar amounts of cheese go to Egypt, Saudi Arabia and Algeria. In most cases the cheese is going for further processing and is used in the food ingredients business. In the case of Egypt 11 main customers are dealt with, while in Algeria the number of customers is approximately seven. The last 30,000 tonnes of cheese or approximately one-third goes to a range of smaller outlets including pre-packed for the retail market in Greece, prepack and sold to retailers by Ornuu’s own subsidiary in Germany (just 3,000 tonnes) and a range of other smaller outlets.

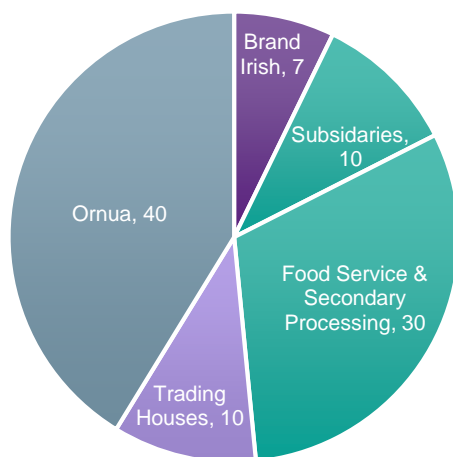
Table 9: Breakdown of Ornuu trade in cheese

	Tonnes
Ornuu Ingredients Subsidiary (block slicing for retail and food service)	22,900
UK Ingredients Customer (food service)	15,000
Pre-packed and sold to retailers by Own Subsidiary US	5,600
Ornuu International (Egypt)	4,000
Ornuu International (Saudi Arabia)	3,500
Ornuu International (Algeria)	3,400
All others	32,000

Source: Ornuu, 2017

Figure 42 presents an overview of the supply chain for cheese. Over 40% is traded through Ornuu, a further 30% goes to Food Service and secondary processing companies in the EU (with a shortlist of 5 very large customers in this segment (names withheld)), 7% is sold under brand for the Irish retail market, 10% goes to trading houses (2 to 3 large established trading houses), 11% is traded through subsidiaries of the processors for the Food Service market

Figure 42: Overview of supply chain for cheese



Supply chain for powders

The supply chain for powders was the most difficult to disentangle, first because of the large variety of powder products produced by all of those interviewed and because in many cases powder is produced as a by-product it was more difficult to establish quantities of the various types of powders produced. Second, the supply chain for powders seems more fragmented than drinking milk, butter or cheese and hence was more difficult for those interviewed to summarise. The processors interviewed produced a range of powder products including; WMP, SMP, fat enriched powders, casein, milk protein concentrate (MPC) and whey. SMP, fat-enriched powder and WMP are the most commonly produced products. One of the processors interviewed deals exclusively with Ornuu and all of the powders produced are solely for the export market via Ornuu, while another processor interviewed does not deal with Ornuu for any powder trade.

The sales channels for powders are more fragmented than the other products and varied quite considerably across the processors. Price in a given year is a big factor in powder sales. Depending on the year, considerable volumes of powder may be going to intervention. One processor stated that they sell WMP directly to between 70 and 80 customers in any given year and SMP to between 30 and 40 customers. They declined to put any estimate on the size of their top 3 to 5 customers as they said the trade was too fragmented and varied by powder type. Another processor interviewed stated that almost all of their SMP and WMP goes directly for IF manufacturing to between 3 and 4 IF manufacturers, while yet another stated that all of their powder production is sold directly to Ornuu. Clearly there was no common pattern in powder sales across the processors, hence making a general description of the powder supply chain extremely challenging.

Infant formula production is a major outlet for both SMP and WMP with most processors making powders to infant formula standards. Four of the world's largest producers of infant formula, Danone, Abbott, Mead Johnson and Wyatt, have manufacturing facilities in Ireland and many of the processors interviewed sold powders directly to those infant formula manufacturers. However it was quite difficult to secure exact quantities of this trade. One of the processors interviewed manufactured and canned infant formula for a private label IF product for a retailer based in Ireland. This consumed over 15% of their powder business and the other 85% of powders was also going to infant formula production to all four of the major infant formula companies operating in Ireland.

Fat enriched powders was a very important specialist product for one processor interviewed. The majority of the fat enriched powder trade was going to six main trading partners in West Africa and the Middle East. These trading partners are mostly engaged in repackaging of the product into sachets. Other processors also reported selling fat enriched powders to the African market through dedicated partnerships with a small number of traders and re-formatters. For many of those interviewed casein and whey products were used in cheese production in their own manufacture process or were sold to sister companies for performance nutrition products.

Again Ornuia supplied data on the main market channels for powder. All of the powder products sold by Ornuia were aggregated for the purposes of this analysis as it proved extremely difficult and data intensive to disaggregate the data by powder type. In total Ornuia traded over 100,000 tonnes of milk powders. The details of powder trade by Ornuia are outlined in table 10 as with the processors interviewed the trade in powders proved fragmented with major customers accounting for less than 50% of the total trade. Furthermore, there was relatively little information provided about the type of customer in each market and what they were using the powder product for, this may be reflective of the very large number of customers active in this sector.

Table 10: Breakdown of Ornuu trade in milk powders

	Tonnes
DTI (key accounts US)	10,900
DTI (key accounts Nigeria)	10,200
DTI (key accounts UAE)	8,300
DTI (key accounts Mexico)	5,000
DTI (key accounts Senegal)	4,200
DTI Subsidiary sale – UK Ingredients	3,600
DTI (key accounts Burkina Faso)	3,200
All others	55,600

Source: Ornuu, 2017

Dairy Trading and Ingredients (DTI) is a division of Ornuu. Ornuu's annual report states that DTI is focused on building a sustainable future through the investment in route to market acquisitions, in-market resources, innovation, lean manufacturing, volatility management and manufacturing capacity and capability. These strategic investments will ensure that Ornuu is adding value and building volume outlets for the post quota increased dairy volumes. DTI dealing with key accounts in the US and Nigeria account for just over 20% of all powder trade. Within the US the key accounts include bulk food ingredients customers, selling chocolate crumb and casein to blue chip customers. In Nigeria DTI typically deal with 10 key customers for the sale of fat enriched powders. In Mexico most of the trade is in casein and it is used for analogue cheese manufacture. Trade in Senegal is mostly in fat enriched powders and most is sold to the point of end-use. In the UK, most trade is in SMP and whey and it is mostly used in secondary processing outlets for blending other powders. The approximate 3% of powders going to Burkina Faso is fat enriched powders and is being sold to end-use customers, however the number of customers was not revealed.

5 Conclusions

In general, reasonably good data are available on the dairy supply chain in the ROI in terms of the number of farmers, processors, product mix and so forth. Public data for NI is complicated by the fact that for many variables data are aggregated with GB and published for the UK as a whole. In both jurisdictions, significant gaps remain in our knowledge about the length of the supply chain and the number of actors involved. In order to address these information gaps a number of interviews were conducted with industry representatives to garner further information.

In general the interviews with stakeholders revealed a generally low level of concern about the potential for and implications of food fraud in the dairy supply chain. It proved difficult to extract detailed and precise data from the interviewees about their various “types” of customers and about the final destination of products that were going for further processing. In general, interviewees expressed a lack of knowledge or indeed interest about whether customers were secondary processors, re-formatters, retailers and/or traders. They also reported a low level of engagement in small deals with “unknown” trade partners and in particular with trading houses. The reluctance to enter such deals was in general economically motivated, i.e. fear of not being paid, rather than food fraud related. As reported here, sufficient data were garnered from the interviews to provide an overview of the supply chain for the main dairy products with powders proving the most difficult because of the heterogeneous trading patterns pursued by the various companies participating in the survey.

6 Bibliography

Bord Bia (2016). Export Performance and Prospects 2015–2016 – Irish Food, Drink and Horticulture, Bord Bia, Dublin. Available at:

<https://www.bordbia.ie/industry/manufacturers/insight/publications/MarketReviews/Documents/ExportPerformance-and-Prospects-2016.pdf>. [Accessed June 13 2017].

Brady, M. (2016). 'Average herd size set to reach 100 cows by 2018'. The Independent, published online September 21 2016.

Central Statistics Office (CSO), (2017). StatBank – Agriculture and Fishing. CSO, Cork.

Dansko Foods, 2017. Available at: <http://danskofoods.com/ireland-liquid-milk-supplies-being-eroded/>. [Accessed 28 June 2017].

Department of Agriculture, Environment and Rural Affairs (DAERA) (2015). Statistical Review of Northern Ireland Agriculture – 2015. DAERA Policy and Economics Division, Belfast.

Department of Agriculture Environment and Rural Affairs (DAERA), (2017) Northern Ireland Milk Utilisation Statistics 2012. Available at: <https://www.daera-ni.gov.uk/publications/milk-utilisation-statistics-2009>. [Accessed 30 June 2017].

Department of Agriculture Environment and Rural Affairs (DAERA), (2017) The Agricultural Census in Northern Ireland: Results for June 2016. DAERA CAP policy, Economics and Statistics Division.

Department of Agriculture Environment and Rural Affairs (DAERA), (2016) The Agricultural Census in Northern Ireland: Results for June 2015.

Department of Agriculture Food and the Marine (DAFM), (2017). Available at www.dafm.ie. [Accessed 22 June].

Department of Agriculture, Environment and Rural Affairs (DAERA) (2016). Northern Ireland Agri-Food – Key Statistics June 2016. DAERA CAP Policy, Economics and Statistics Division.

Donnellan, T., Hanrahan, K., Hennessy, T. and Dillon, E. (2013) A Cost-Benefit Analysis of a Johne's Disease Control Programme for Ireland. Agricultural Economics and Farm Surveys Department, Teagasc, Ireland.

Donnellan, T., Hennessy, T. and Thorne, F. (2015) The End of the Quota Era: A History of the Irish Dairy Sector and Its Future Prospects. Agricultural Economics and Farm Surveys Department, Teagasc, Ireland.

Eurostat, 2017. Database- Milk and Milk products. European Commission, Brussels.

Heery, D., O'Donoghue, C. and Fathartaigh, M. Ó. (2016). Pursuing added value in the Irish agrifood sector: An application of the Global Value Chain methodology. *Proceedings in Food System Dynamics*, pp.161–179.

Hennessy, T. and Moran, B., (2015) National Farm Survey Results 2015. Agricultural Economics and Farm Surveys Department, Teagasc, Ireland.

Hennessy, T., Donnellan, T., Henschion, M., Brennan, M., Cullen, P. and Campbell, K. (2017) The impact of climate change on dairy production. Available at:

<http://www.safefood.eu/SafeFood/media/SafeFoodLibrary/Documents/Publications/Research%20Re>

[ports/M10039-SAFEFood_Climate-Change-on-the-Dairy-Production-Report-24-02-2017.pdf](#).
[Accessed 13 June 2017].

Murphy, J. (2008) The Structure of the Irish Dairy Industry: A Constraint to Profitable Dairy Expansion. A report for Nuttfield Ireland Farming Scholarships, Nenagh.

Murtagh, A. and Ward, M. (2011) Structure and Culture: The Evolution of Irish Agricultural Cooperation. *Journal of Rural Cooperation*, 39:2, pp.151.

Northern Assembly (2016) Agri-Food and Brexit. Available at:
[https://www.oireachtas.ie/parliament/media/housesoftheoireachtas/libraryresearch/others/final---NSIPA_AgrifoodandBrexit_v10combined_18112016tm-\(002\).pdf](https://www.oireachtas.ie/parliament/media/housesoftheoireachtas/libraryresearch/others/final---NSIPA_AgrifoodandBrexit_v10combined_18112016tm-(002).pdf). [Accessed 3 July 2017].

National Milk Agency (2016). Annual Report and Accounts (2015). Available at:
<https://www.nationalmilkagency.ie/uploads/files/annualreports/2015/annualreport2015.pdf>.
[Accessed 20 June 2017]

Ornua (2017). Annual Report 2016. Ornua Co-operative Limited, Dublin.

Prospectus and Promar (2003) Dairy Industry Prospectus Report 2003 - Strategic Development Plan for the Irish Dairy Processing Sector. Dublin: Department of Agriculture and Food. Available at:
<https://www.agriculture.gov.ie/publications/2000-2003/dairyindustryprospectusreport2003/>.
[Accessed 21 June 2017].

Soares, A. and McTaggart, M. (2016) A Study of Cross-Border flows within the Agri-Food Sector. A Snapshot of Four Border Counties. The Centre for Cross border Studies, Armagh. Available at:
<http://crossborder.ie/site2015/wp-content/uploads/2016/02/A-Study-of-Cross-Border-Flows-within-the-Agri-Food-Sector.pdf>. [Accessed 16 June 2017].

Teagasc, 2017. Dairy Industry Compendium. Available at:
<https://www.teagasc.ie/animals/dairy/statistics-and-links/dairy-industry-compendium> [Accessed 27 June 2017].

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