Taking stock of sustainable growth

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Summary

- The Irish dairy sector has just gone through a very successful period of expansion, with milk output increasing by 64% and dairy farm income by 70%. The carbon footprint and farm debt per kg milk have reduced compared with the period 2007–2009.
- Success in the past doesn't automatically mean success in the future. We must re-evaluate and refine the industry strategy for the future.
- Refocus efforts on profitable grass based milk production systems (the only competitive/comparative advantage for the Irish dairy industry), with significant opportunities to further increase efficiencies.
- Expansion of milk production using extra imported feed will generate a poor return, expose the farm to more risk and increase the environmental footprint.
- Continued expansion for some farmers is the right thing to do if based on increased grass utilisation and dairy farm conversions with low capital cost infrastructure.
- The recent expansion of the Irish dairy industry has reduced the global footprint of milk production by approximately 4.0 million tonnes of CO_2e, assuming that Irish milk displaced milk with a global average carbon footprint.
- Ireland is uniquely positioned to exploit the growing demand for grass fed dairy products.

Introduction

The Irish dairy sector has gone through a transformational change over the past 10 years with a 64% increase in milk output and 367,000 additional cows. Debt has not increased dramatically, and has actually reduced per unit of output quiet substantially, and farm profitability has markedly increased (circa 70% comparing 07–09 versus 16–18). This has coincided with the removal of the EU milk quota regime, which created stagnation within the industry and exposed a generation of farmers to the full impacts of the cost-price squeeze with limited tools to reduce exposure. Despite reductions in greenhouse gas (GHG) emissions intensities, total emissions have increased, which was inevitable in light of the increase in dairy cow numbers. The rapid expansion has been associated with a bottleneck of labour availability, at least partly because it coincided with the country reaching almost full employment. Within this paper, we evaluate the industry growth with reference to the Food Harvest 2020 targets, re-affirm the drivers of efficiency within pasture-based systems and finally discuss the future direction of the industry.

Expansion in the Industry

Ever since the first signals that milk quotas would be removed and that expansion would be possible, dairy farmers had flagged their intent by increasing the numbers of dairy heifer calves born, followed by replacement heifers and then the dairy cow herd increasing since 2008 (Table 1). There were 367,000 extra cows in Ireland in 2018 when compared to the Food Harvest 2020 reference period (2007–2009). During that same period, milk solids output has increased by 64%, and milk volume by 55%. Of this increased milk output, 45% was achieved through increased yield per cow and 55% by increased cow numbers. All of this expansion has been associated with relatively small increases in farm debt. Over the period, costs of milk production increased up to 2013 and then reduced with the increased output leaving an increasing margin. The value of milk has increased as a result of improved milk solids

concentration; protein content increased from 3.33 to 3.48%, and fat content increased from 3.84 to 4.14%. Average grass utilisation has increased by 1.3 t/ha (excluding 2018), and the fertility performance measured through six week calving rate has increased by almost 10%.

With reduced costs, increased output and increased value of output, there has been a substantial increase in family farm income on dairy farms (70% 07–09 versus 16–18). It has also led to increased demand for dairy farm labour; >4,500 herds have a herd size greater than 100 cows compared to 1,500 herds a decade earlier. This is putting pressure on the availability of labour, and in particular hired labour as family labour is unlikely to fully meet the requirements because of the scale involved. The increase in cow numbers has also increased GHG and ammonia emissions, for which Ireland has national emission reduction commitments. With an expanding industry and onerous targets, it will be necessary to invest in strategies to reduce ammonia and GHG emissions both on-farm and across the wider industry.

Table 1. National cow inventory and milk production statistics between 2007 and 2018												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cow numbers (*000)	1,054	1,060	1,060	1,039	1,076	1,101	1,123	1,177	1,268	1,347	1,388	1,425
Replacement heifers born	255,777	267,735	306,200	317,924	364,097	367,562	380,018	370,113	381,546	398,250	378,254	387,288
Milk Output (million L)	5,074	4,943	4,785	5,173	5,377	5,232	5,423	5,649	6,395	6,654	7,263	7,585
Fat %	3.79	3.82	3.83	3.85	3.89	3.94	3.94	3.98	4.03	4.10	4.09	4.14
Protein %	3.32	3.34	3.33	3.37	3.37	3.36	3.39	3.43	3.5	3.45	3.48	3.48
Milk solids tonnes	371,483	364,445	352,811	384,613	401,964	393,310	409,289	430,985	495,861	517,282	566,100	595,143

Table 2. Indicators of physical and financial farm performance between 2007 and 2018												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cow numbers/farm	51	54	57	56	66	67	68	69	70	74	75	83
SR (LU/ha)	1.82	1.83	1.86	1.85	1.89	1.89	1.94	1.98	2.01	2.04	2.09	2.09
Grass utilisation (tDM/ha)	6,550	6,728	7,282	6,657	7,107	6,811	6,802	7,210	7,796	8,000	8,100	7,500
Concentrate feeding (kg/cow)		1,115	895	995	881	1,022	1,158	968	931	943	1,038	1,300
Debt levels (€/farm)	40,363	62,169	57,619	59,078	63,768	67,708	66,907	68,482	75,040	60,718	62,241	71,646
Net margin (€/ha)	1,134	964	221	830	1,297	805	1,290	1,390	1,165	792	1,730	1,049
Farm Income (€)	51,000	45,732	23,684	50,192	67,036	49,750	62,936	66,762	63,931	54,035	88,829	61,273

Drivers of efficiency

Teagasc has set a target of achieving €2,500 net profit per hectare of owned land including full labour costs at a base milk price of 29c/l plus vat. The future target farm system is based on maximising the performance from the existing platform, while at the same time ensuring that the number of unproductive livestock on the farm is minimal. Achieving a net profit of €2,500/ha requires paying attention to detail across all of the components of the farm business. The rewards are huge, however, and place the business in a very positive position when dealing with milk price volatility, and realising returns from the business comparable with some of the best possible investments (on or off farm). Whether you are achieving the future target, are close to the future target or are a long way from the target, the direction of travel should be the same for the business. The future targets will be outlined in this paper under physical and financial headings, and compared to the national average performance during the period 2014 to 2016, assuming a base milk price of €0.29/l at 3.3% protein and 3.6% fat. Labour costs are included at €15/hr and all other costs are included based on the most up to date costs and prices. It is assumed that the farm operates contract rearing in the future target system and that calves leave the farm at two weeks of age, while it is assumed that calves are reared on the farm in the national average system.

Table 3 summarizes the physical farm performance on both the current national average and the future target performance systems. The physical performance required to achieve the target system include >13.0 t DM/ha of grass utilised, milk solids output of 1,344 kg/ha, while feeding <500 kg concentrate per cow. In order to achieve these targets, excellent herd fertility performance is required, with a low replacement rate (≤18%), high six week calving rate (≥90%), and a herd mean calving date of mid-February. High levels of labour efficiency are essential, where the focus is on cows and grass, thus facilitating these achievements with total labour input of <16 hours/cow/year. Within the future target system, there is an increase in stocking rate based on increased grass growth, but there is also a change in enterprise as all replacement stock are moved off the milking platform to a contract rearing enterprise. It is also assumed that the target system uses increased fertiliser inputs, and a greater proportion of the farm is reseeded annually.

Table 3. Physical performance of national average and target systems

	National average	Future target
Milk yield kg MS sold/cow	405	480
Milk yield kg/cow	5,409	5,800
Milk protein %	3.45	3.70
Milk fat %	4.06	4.60
Milk kg/ha	11,090	16,820
Milk solids kg/ha	825	1,344
Calving interval days	394	365
Mean calving date	6th March	14th Feb
Six week calving Rate %	64	90
Replacement rate %	23	18
Labour hrs/cow	30	16
SR cows/ha	2.05	2.80
Concentrate feeding kg/cow	933	500
Herbage utilised T/ha	8.0	13.0

Financial

Table 4 provides a breakdown of the financial performance of a farm that is achieving the physical outputs outlined in Table 3 for both the national average and the future target systems for a 36 ha farm. The analysis is completed for the farm as a whole, and also per kg MS and per hectare farmed basis. The differences in financial performance between the national average and the future target systems are quite stark. The farm that is operating the future target system is achieving 4.2 times more profit. Is this profitability possible? It is only possible if the physical performance outlined in Table 3 is possible. If that physical performance is achieved, then the financial performance differences are real and are tangible. Analysis of data from both the EProfit Monitor and the National Farm Survey indicates that the magnitude of performance difference between farms operating at the top and bottom levels of efficiency is huge.

In order to understand the differences between the different categories of farms, it is important to evaluate where the differences are coming from in Table 4. The major change in performance is due to differences in output. Gross output increased by 78%, derived from 63% greater livestock sales and 78% greater milk receipts. The increased milk output is based on higher value milk, higher milk yield per cow and the farm carrying a higher stocking rate. Importantly, the higher stocking rate is facilitated by increased grass growth and utilisation.

On the cost side, there are increases in overall costs per farm and per hectare (~26%), but there is a marked reduction in costs per unit of output (~28%). Therefore, the increase in milk output in the future target system occurred in tandem with a reduction in costs per unit of output, resulting in substantial increases in profitability. This mirrors what has happened in the dairy industry since the removal of milk quotas (Hanrahan *et al.*, 2018). The major cost categories with reductions include concentrate feed and labour costs, while other cost category reductions were based on the growth in output per cow and per hectare and the removal of heifer rearing costs from each of the cost categories. Contract rearing costs for heifers had the opposite effect, as this was included as a new category. In reality, however, the total costs for heifer rearing have not changed markedly between the average and future target situations, because contract rearing provides a cost saving on the existing milking platform. A substantial increase in labour efficiency is assumed in the model, and some of this increase is based on the removal of heifer rearing from the labour requirements on the farm. Recent research has highlighted substantial differences in labour efficiency across farms, with more labour efficient farmers tending to be larger, using the contractor more, less likely to be rearing calves and more likely to have appropriate facilities (Deming *et al.*, 2017). Ultimately the financial performance of the farm in relation to net profit has increased substantially across all of the metrics shown, with net profit for the farm, per hectare and per kg MS increasing by 419%, 418% and 203%, respectively.

Table 4. Financial performance of the national average and target farms							
		National average			Road-map target		
		Farm €	Per kg MS €	Per ha €	Farm €	Per kg MS €	Per ha €
Receipts	Milk	113,819	4.21	3,197	204,033	4.31	5,728
	Livestock	13,620	0.50	383	22,219	0.47	623
Gross Output		**127,438**	**4.72**	**3,580**	**226,252**	**4.78**	**6,352**
Costs	Concentrate	17,552	0.65	493	9,919	0.21	278
	Fert/reseeding	10,056	0.37	282	13,967	0.29	392
	Contract heifer	-	-	-	19,624	0.41	551
	Contractor other	1,275	0.05	36	4,595	0.097	129
	Contractor silage	6,195	0.23	174	5,062	0.11	142
	Vet/AI	8,006	0.30	225	10,733	0.23	301
	Elect/phone/ car	6,747	0.25	190	7,469	0.16	210
	Hired labour	27,126	1.00	762	23,034	0.49	647
	Other	33,658	1.24	946	44,521	0.94	1,250
	Total	**110,617**	**4.09**	**3,107**	**138,924**	**2.93**	**3,900**
Net Profit		**16,821**	**0.62**	**473**	**87,328**	**1.84**	**2,452**

All of the improvements in financial performance are based on different components of the farm system that can be changed within the farm gate, at least to some extent. There are some circumstances where physical farm constraints (e.g. soil type, climatic conditions) will prevent the full achievement of the targets, but there is potential to make changes to increase key performance indicators on all farms. The focus should be on investing in the right areas on the farm to achieve those targets, and ensuring that the direction of travel is correct for the farm and not about the distance to travel. There are very few farmers that are achieving all of the metrics for the target system. Therefore, it is imperative that we continue to remind ourselves of the potential to increase profitability from investment in basic technologies at farm level. Prioritise investment in these technologies (especially when milk price is high) to reap long-term dividends (especially when milk price is low). Table 5 summarizes the net financial benefit from achieving improvements in different aspects of technical efficiency across the farm.

Table 5. Potential farm benefits from increasing efficiency on a dairy farm			
	Unit change	Financial benefit	
		Farm €	€/kg MS
Increasing fat concentration	0.1%	1,195	0.04
Increasing protein concentration	0.1%	2,530	0.09
Increasing milk volume — from grass	100L	2,027	0.06
Increasing grass utilisation	1t DM/ha	4,840	0.1
Reducing replacement rate	1%	1,218	0.035
Reducing calving interval	1 day	247	0.009
Total		**12,057**	**0.34**

Take an example of a farm with 36.0 ha that makes a five year plan to improve technical efficiency. Over the five year period, grass utilisation increased by 3 t DM/ha, milk fat concentration increased from 4.05% to 4.25%, milk protein concentration increased from 3.45% to 3.65%, replacement rate declined from 23% to 20% and mean calving date advanced by one week. Collectively, these improvements will increase net profit on the farm by over €27,353, profit per kg MS by €0.71 and profit per ha by €768.

Future direction

After the initial period of growth following 31 years of stagnation, where should the industry go from here? When asking this question, one must be cognisant of the potential for further growth, environmental policy constraints, international demand for Irish grass fed dairy products and the economic considerations around enterprise shift into dairying. But most importantly, we must be cognisant of the farmer's ambition for growth, the sustainability of the system, the risks associated with further growth and the physical potential for growth.

The average stocking rate on dairy farms is just over two cows per hectare at present. As described in this paper the target system will operate at 2.8 LU/ha. There is significant potential to further intensify on existing dairy farms, by focusing on increased grass growth, investment in soil fertility, sward renewal and grazing management. This will result in significant increases in profitability at farm level and should be the focus for farmers considering further expansion. Nationally, grass utilisation is just over 8 t DM/ha, but there is potential for up to 13 t DM/ha, highlighting that further expansion is realistic and achievable. The focus of this group of farmers should be on improving efficiency of grass growth and utilisation. For farms that are currently operating at high levels of grass utilisation and efficiency, however, additional expansion using this strategy is no longer possible, and they must find an alternative strategy.

Expansion beyond the farms carrying capacity including >10% of the diet originating from bought in feed has been consistently shown to not be profitable. It is potentially the biggest risk to the Irish dairy industry and should not be considered. It might look marginally profitable, when owned labour is not included in the calculations, but when full costs are included, expansion based on additional imported feed is generally not profitable, increases risk and environmental footprint and ultimately results in the dairy farmer working a lot harder for little gain. Internationally, many industries have fallen into this trap and the Irish dairy industry must be careful to ensure that it does not follow suit. Ensuring capital costs are minimised and that the metrics affecting profitability rather than production are the focal points will ensure that we do not fall into this trap.

For the group of farmers that are currently operating at high levels of grass utilisation and efficiency, if further expansion is desired, the focus should be on replicating what they are doing on larger blocks of land, increasing the land area available for dairy cows by having heifers contract reared, trying to access land adjoining their existing operation or development of second units. This will involve the movement of land from its current

enterprise (e.g. beef, tillage, sheep) into dairying through a long term lease or some other land movement structure that allows land to move to efficient progressive enterprises that are capable of being profitable when all costs are included. The family farm income achieved from dairying, beef, sheep and tillage between 2010 and 2018 is summarized in Table 6. It is apparent that dairying is substantially more profitable than all of the other enterprises. For an individual landowner that is not a dairy farmer and who wishes to have a long term future in agriculture in a full time capacity, serious consideration should be given to evaluating the potential for that land to move into dairy farming in one form or another.

Factors outside the farm gate may also impact the feasibility of expansion. Environmental policy is likely to affect agriculture in the coming years. There is considerable debate about the impacts of agriculture in areas of climate change policy, nitrates directive, ammonia emissions ceilings and biodiversity. These are all areas that require greater focus within the farm gate. On a positive note, the grass based system provides an advantage over high input/TMR based systems. For example a recent FAO report has highlighted that the average carbon footprint of global milk is 2.5 kg of CO_2e for each litre of fat and protein corrected milk produced. The corresponding figure for Ireland is ~1 kg of CO_2e per litre of fat and protein corrected milk when carbon sequestration is included. This does not take from the point that there is an urgent need for focus on reducing the various footprints, but in reality, if Irish or EU policy prevents sustainable dairy expansion from grass, there will be a marked increase in global emissions. The expansion of the Irish dairy industry, producing additional low (1 kg CO_2e) emission intensity milk, has reduced the global footprint of milk production by circa 4.0 million tonnes of CO_2e based on the assumption that it displaced milk from the market that would have been produced with the average emission intensity globally. While the initial starting point in Ireland from an emissions perspective is good, there needs to be a focus on continued improvement on all the environmental concerns. Luckily most of the technologies that increase efficiency and profitability will also reduce emissions. The future target system has a substantially lower carbon footprint than the current system.

Table 6. Family farm income from differing enterprises between 2010 and 2018

	Dairy		Cattle Rearing		Cattle Other		Sheep		Tillage	
	FFI €	FFI €/ha	FFI €	FFI €/ha	FFI €	FFI €/ha	FFI €	FFI €/ha	FFI €	FFI €/ha
2010	44,432	953	7,023	246	9,676	319	12,269	311	36,759	615
2011	68,570	1,282	10,453	367	14,573	454	16,805	419	35,296	559
2012	49,672	887	12,180	348	17,716	412	18,375	375	37,184	581
2013	62,994	1,137	9,576	250	15,667	389	11,731	220	28,797	460
2014	67,595	1,229	10,374	266	13,320	333	15,066	279	29,016	468
2015	62,141	1,112	12,660	329	16,319	424	16,137	323	34,303	546
2016	51,968	928	12,672	352	16,909	457	15,657	307	30,619	457
2017	86,069	1,562	12,529	358	17,199	464	16,586	325	37,020	617
2018	61,273	1,049	8,318	269	14,408	387	13,769	281	42,678	697
Average	**56,703**	**1,127**	**10,643**	**309**	**15,087**	**404**	**15,155**	**316**	**34,630**	**556**

There is a significant debate on the role that livestock will take in future food systems. Feed-food competition is said to occur if crop and land-area is used for livestock feed rather than more efficient food crop production (for human consumption). It is argued that land used for livestock feed instead of crops for human consumption reduces the global supply of human edible protein. The current ratio of human edible protein efficiency of an Irish cow suggests that for each 1 kg of human edible protein consumed, the average Irish cows produce 4.92 kg of human edible protein. In comparison even if the land used to feed the cow was converted to protein producing crops (where possible) rather than

producing milk, more edible protein would be produced than consumed by close to 50% by leaving the land under dairy cows. This is not the case with high input and TMR based systems and it is increasingly difficult to justify these systems in the allocation of scarce resources globally.

Consumer interest in the food they consume, including milk and milk products, is ever increasing. This has led to the development of milk brands that require farmers to mainly feed their cows grass (e.g. Organic Valley's Grassmilk in the USA). These dairy products are in high demand in many countries, and are sold at a market premium price. The sustained market interest in grass-based dairy products is leading to greater consumer interest to know the typical quantities of grazed pasture and forage in a dairy cow's diet. Ireland has developed a methodology to quantify the proportion of grass in the diet that is being implemented within the SDAS system. There is scope to build on this development and further develop brands and credentials to satisfy the growing market demand through producing dairy products from grass in a sustainable and efficient manner. Ireland can grow this potential further, ultimately adding value to dairy products, increasing the returns to the primary producers and satisfying the demand of consumers by producing grass-fed high value product. Ireland is uniquely positioned to capitalise on the grass fed narrative, but must continue to focus on grass based systems.

References

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