# *TEAGASC TECHNOLOGY FORESIGHT 2030*

## *Agriculture 2030 and beyond: Considerations for the future path of Irish agriculture*

### 1. Introduction

This paper examines the current position of Irish agriculture, particularly in the context of growth targets that have been set out in Food Harvest 2020 and potential growth targets that might be set for the next 10 to 15 years. The purpose of the paper is twofold, to reflect on the potential for growth in the various sectors of Irish agriculture and to explore key areas of concern for stakeholders which might hinder its future development.

**Context**

We know that global food demand is rising, driven predominantly by rising population, but also by rising real incomes, with the strongest rates of growth anticipated to be in developing countries. In the period to 2030, we would expect a continuation of growth in global food demand. It is projected that the global population will exceed 8.5 billion by 2030, with most of the population growth occurring in developing countries.

However, we also know that fertility rates will continue to drop and that while life expectancy is increasing, the rate of increase is slowing. On the one hand, rising incomes will allow people in developing countries to spend more on food, making food more affordable, but on the other, we should expect that the portion of that increased income that is spent on food will decline (Engel's law). In the context of an inevitable rise in global food demand, the path of future nominal agricultural commodity prices will depend in large part on the extent of global agricultural productivity improvements, with geopolitical stability, perhaps, the other most important factor. Due to economic growth, real income levels will continue to increase, giving consumers in developing countries opportunities to consume higher quantities of meat and dairy products. In terms of meat demand, there will be stronger growth in consumption for pork and poultry than for beef. This reflects the fact that beef will remain expensive relative to pork and poultry and also because consumer preferences in many developing countries continue to favour pork and poultry over beef for cultural and religious reasons. It is likely that much of the global growth in food consumption in developing countries will be satisfied by growth in food production in developing countries, but opportunities will also exist for countries in the developed world to gain a share of these growing markets.

The effect of global economic and population growth will also impact the demand for other commodities, such as energy and industrial raw materials. This will create inflationary pressures

which will be passed on to the agriculture sector through higher input prices. Whether ultimately real agricultural commodity prices will rise in future will depend on supply and demand factors in the agricultural commodity, energy and industrial raw materials markets.

When commodities become more expensive, the search for usage efficiencies and consumption substitutes intensifies. For example, when oil becomes more expensive, energy efficiency becomes more important, as does the search for less expensive energy sources. Taking a longer term view, we can be relatively confident that no substitutes will emerge for food, but changes in income and relative prices will have an effect on consumer demand. Having established that demand will clearly increase, the question that next arises is where in the world the additional production will be achieved. Given the limited capacity of the developed world to increase production (in general, the developed world is already intensively farmed), much of the production increase will need to be achieved by closing some of the gap that exists between the efficiency of developing country agriculture and agriculture in the developed world. In short, most of the world's additional food needs will be produced in the regions of the world where the demand for food is rising.

In this paper we explore where agriculture in Ireland could expect to be in 2030. To provide a context for this forward looking analysis, we need to consider what we do and don't know about the future. We will need to consider the drivers shaping the future and how they might affect Irish agriculture. These drivers will be both domestic and international in origin. We need to identify which of these known drivers will become more important. We need to consider whether we are ignoring new drivers that will also become critical concerns. In thinking about the future of Irish agriculture over the next 15 to 20 years, we also need to consider the broader challenges and the impediments the sector will face.

**Models**

This paper relies in part on insight developed from economic models. Therefore, it is worthwhile making a few simple statements about models. There are both benefits and limitations that come with the use of models relating to any type of process, be they economic models, biological models or environmental models. Models are used by researchers because real world processes are complex. Economists use models in the knowledge that they lack the data to describe or develop a fundamental understanding of some parts of the economic process under study. Models capture the essence of complex issues. But models are by design imperfect, and the analysis they produce will be wrong to some degree.

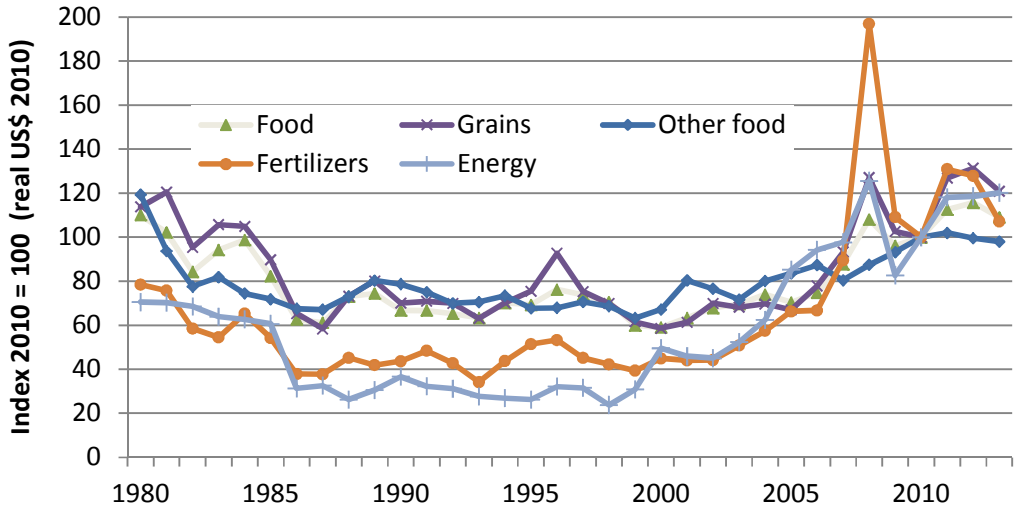
Models are better at indicating direction of change and less good at forecasting magnitude of change. The accuracy of economic models decreases as the time horizon extends. Predicting the future is fraught with uncertainty and we do so using the best information available to us, knowing that new information which may affect our analysis may be just around the corner. In noting the limitations of models, this should not be considered as a justification for dismissing the insights they provide. Alternatives to models involve rudimentary analysis, which abstracts even further from reality and, in all likelihood, will be more susceptible to inaccuracy. Worse still would be to rely on gut feeling or to seek comfort in a form of group think.

## 1. Historical Global Agricultural Commodity Price and Production Developments

Figure 1 shows the development in prices for a range of food and inputs since 1980. For much of the period the trend in output and input prices was downward, but an upward trend began to emerge in the 2000s. Given the projected 9 billion global population by 2050, much emphasis has been placed on the need to increase future global food production due to the anticipated increase in global food demand in the coming decades. This price increase therefore was heralded by some as a turning point in the fortunes of agriculture.

It was argued that the relegation of agriculture to the status of a sunset industry towards the end of the last century had led to systematic public under-investment in agricultural research and development. In turn, this had led to a slowdown in the capacity of global agriculture to meet the world's increasing food needs. The result was a decline in global food stocks followed by a dramatic peak in commodity prices in the late 2000s. It was further argued that the phenomenon of rising real prices would persist as the capacity of world agriculture to respond to rising prices would be muted.

Figure 1: Index of Real Prices for Food and Agri Inputs

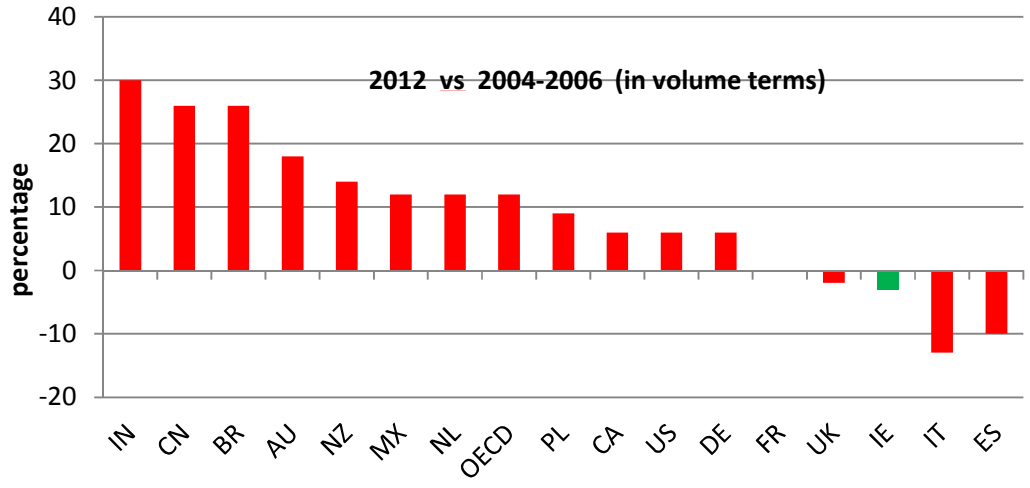



Source: World Bank

Other things being equal, rising food prices would benefit producers. However, price indices for inputs also increased rapidly and a pronounced spike in the 2007-2009 period can be observed. Most recently, prices have been in decline, albeit off a relatively higher base level. This begs the question as to what has been happening on international commodity markets over the last decade. In this context it is useful to look at developments in production in recent years.

Despite concerns that there has been an under-investment in agriculture, the growth in historic food production in the recent past has been impressive. Using the most recent data available from the World Bank, Figure 2 shows the extent of the volume increase in food production that has been achieved in selected countries and regions since the mid-2000s. It is notable that some of the largest percentage increases in production have been achieved in high population countries such as India and China. Other regions which have recorded considerable growth in production include "new world" countries with a strong tradition in food exports such as Brazil, Australia and New Zealand. It is interesting to note that production growth rate have generally been much lower in the OECD countries and lower still in individual EU MS. In fact, production has actually contracted in some EU MS, including Ireland.

Figure 2: Growth in Food Production in selected countries and regions




Source: World Bank

## 2. Current Economic Status of the Irish Agri-food sector

An ambitious plan for the development of the Irish agri-food sector was produced by agri-food industry stakeholders in 2010. Known as Food Harvest 2020, the plan includes a range of specific volume and value growth targets for the different elements of the agricultural, forestry, bio-energy, fishing and food sectors. A key target within the report is to increase the value of primary output from the agriculture, fisheries and forestry sectors by €1.5 billion. The FH2020 report was followed by the publication of reports from the Beef 2020 Activation Group (Dowling, 2012) and the Tillage Sector Development Plan (Teagasc, 2012). The latter two reports recommended revisions and additions to the FH2020 targets. However, these additional targets have never been explicitly incorporated into FH2020.

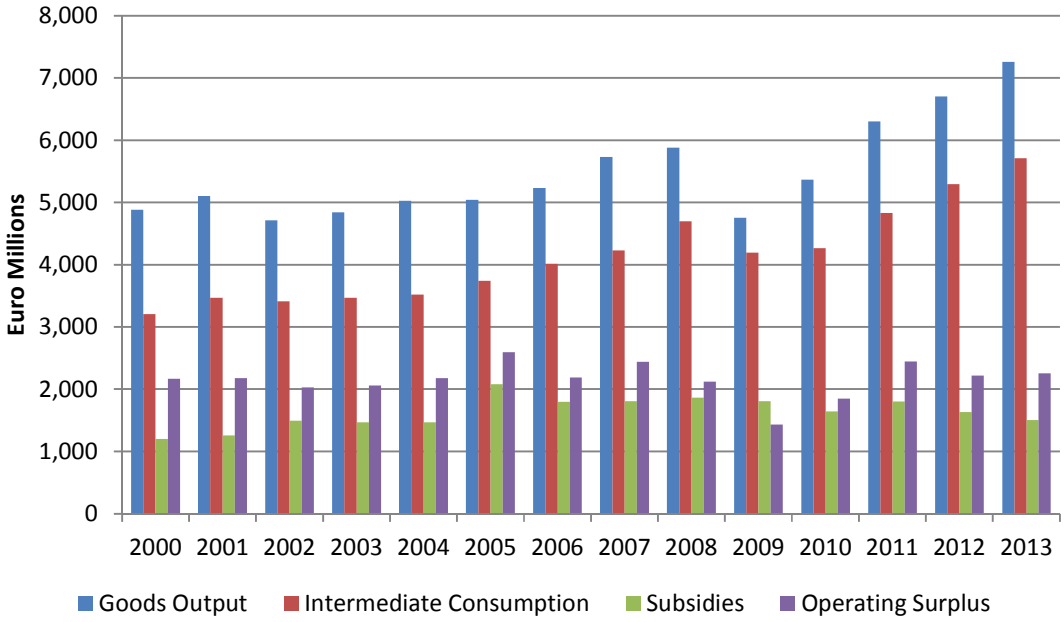
The FH2020 milk output target is an increase of 50 per cent in milk production by 2020, relative to the average volume of milk production over the period 2007-2009. No volume target was set for beef or sheep production, rather a target of increasing the output value of each of the sectors by 20 per cent by 2020 was set relative to the average of the period 2007-2009. In the case of the pig sector, the target was to increase output value by 50 per cent by 2020, again relative to the 2007-2009 base period. No specific quantitative targets were set for forestry and bioenergy crops.

It is necessary to put any growth targets in context by examining the current economic circumstance of primary agriculture in Ireland. When the value of forage, which is both an output and an input in production, is excluded, Irish agriculture had an output value of €6.1 billion in 2013. In output value terms, agriculture is dominated by beef and milk production, which together represent about 69 per cent of output value. Sheep, pigs and crop production also make a significant contribution to agricultural output, collectively amounting to a further 16 per cent of output value. The remaining output value comprises poultry, eggs, potatoes, mushrooms, vegetables and fruit.

As illustrated in Figure 3, agricultural output value in Ireland has been rising over time, up 48 per cent in the period 2000 to 2013, due in the main to increases in farm gate output prices rather than increases in the volume of output produced.

These increases in output are contributing to the achievement of some of the FH2020 targets. However, the price of agricultural inputs has also risen over this period and total expenditure on agricultural inputs (intermediate consumption) rose 78 per cent in the period 2000 to 2013. The value of subsidies has risen over the period since 2000 offsetting the declining gap between output value and input expenditure. In aggregate, this means that agricultural income at the national level has remained relatively static in spite of the considerable increase in output value.

Figure 3: Output value (incl. forage), input expenditure, subsidy receipts and income in Irish Agriculture 2000 - 2013




Source: CSO

As illustrated earlier in Figure 2, the decrease in the volume of Irish food production contrasts with increase in the value of agricultural output (goods output), which has grown strongly in recent years. The conclusion that must be reached therefore is that the increase in the value of agricultural output over the period is largely attributable to inflation in the prices of those outputs. Analysis of the data reveals that the price of milk, beef and lamb, three of the largest elements in Irish agricultural output, have increased considerably since the mid -2000s. However, Figure 3 also illustrates the rise in the expenditure on inputs (intermediate consumption) that has taken place. Again, analysis of the data indicates that much of this input expenditure increase has been due to price inflation. The key point is that the rise in output prices has been to a degree offset by rising input expenditure.

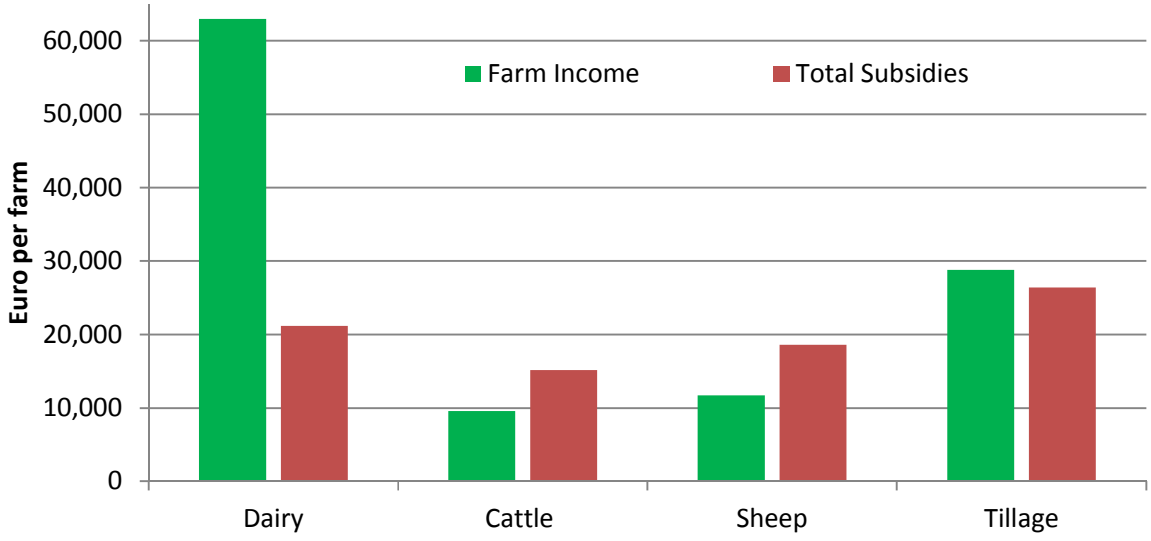
While it might appear that there is still a healthy gap between output value and intermediate consumption, importantly, intermediate consumption excludes the costs of buildings and machinery and the cost of hired labour, which, when included, further erode the margin for producers.

Figure 3 shows the total value of agricultural income (operating surplus) has changed very little in spite of the sharp rise in the value of agricultural output over the last 10 years. It is also evident that much of the income that is generated in the sector is derived from subsidy payments

and that the share of income made up by subsidy payments was higher at the end of the period than it was at the beginning.

Overall, in 2013, subsidies comprised 67 per cent of operating surplus (agricultural income) at the national level in Ireland. Looking at income for the individual subsectors, the picture is more complex than that presented for agriculture in aggregate. Ireland has a highly profitable dairy sector, and while dairy farms do receive a considerable level of support via subsidy payments, dairy incomes are mostly derived from the market place. This is in contrast to incomes in much of the rest of Irish agriculture. Notably, the drystock sector is highly dependent on CAP subsidy payments. The drystock sector is also characterised by beef farms which are small relative to the average in Ireland and which are typically lowly stocked. Many sheep farms are also lowly stocked. As a consequence of their small size and their associated high cost base, incomes on drystock farm are typically less than the associated subsidy receipts. Figure 4 shows the average level of income and subsidies for the principal systems of Irish agriculture.

Figure 4: Average family farm income and subsidy receipt by farm system in 2013

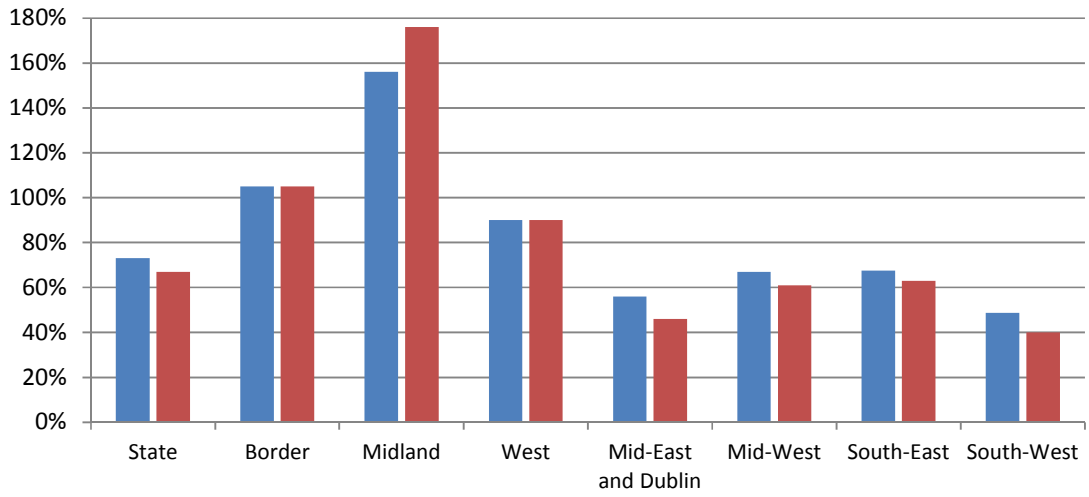



Source: Teagasc National Farm Survey

There is also a regional dimension to the dependency on support payments as illustrated in Figure 5. While, nationally, about 2/3$^{rd}$ of income is derived from support payments, this figure ranges from as low as 40% in the South West region in 2013 to as high as 175% in the Midlands region in 2013. In both the Border and Midlands regions, is can be said that no income is derived from the market place (i.e. costs of production either equal or exceed receipts from farm

sales). In both regions, a considerable share of subsidies designed to support farm income are in fact used to subsidies loss making agricultural activity.

Figure 5: Net Subsidies as a share of Agricultural Sector Income in 2012 and 2013 by NUTS III Region




*Source: CSO Regional Account for Agriculture 2012 and 2013*

The variation in the level of profitability by region can be attributed to differences in the prevalence of particular systems in certain regions. Notably, the highly profitable dairy sector is concentrated in the Mid-West, South East and South West regions, each of which tends to have a low dependence on subsidies, whereas drystock production is more prevalent in regions with higher dependencies on support payments.

Close to ten years after the introduction of decoupled support, we find that farms in a significant loss- making situation continue to operate. This has implications for the farms in question, since the income levels of those operating these farms is invariably quite low, but it also has wider implications for the profitability of Irish agriculture generally. Looking to the future, one question which arises is whether these farms could operate profitably if they were amalgamated with other farms, either through the purchase of rental of land?

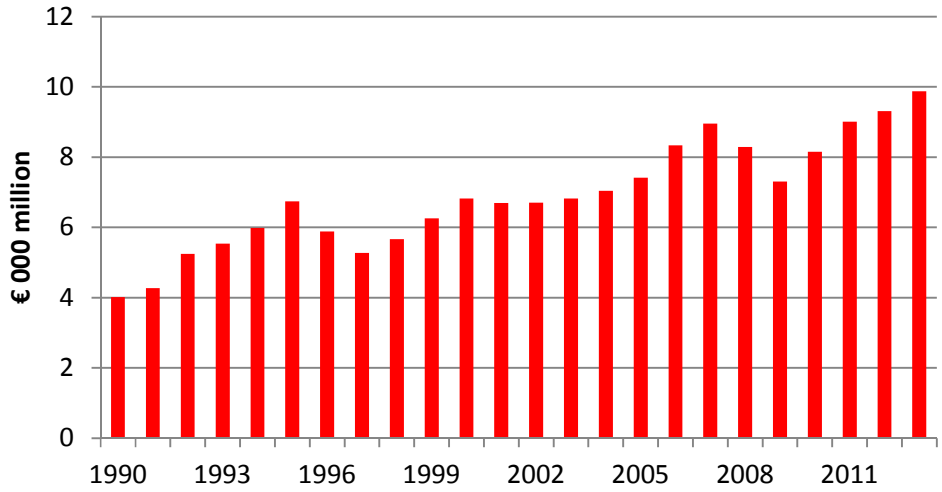
The agricultural support payments received by Irish farmers are fixed in value and will remain fixed in value in nominal terms. This means that any future increase in agricultural income will need to come from the profit achieved in the market place, which requires that the price wedge between farm output prices and the cost of production is increased and or that the volume of production increases. Irish farmers can be considered to be prices takers in both output and input markets. Due to market power in the food chain, our farmers have little control over the price at which they sell their products. The same is true in respect of the agri-input markets, with farmers having no control of the supply and demand conditions which dictate the price of fertilisers, fuel, electricity, labour and other cost elements.

Ultimately increases in income at the farm level can only be achieved by:

a) improvements in farm productivity, i.e. where the farmer uses fewer inputs to achieve a given level of output;
b) increased farm levels of activity, (larger or more intensive farms) assuming the additional output produced generates a positive margin for the farmer;
c) upward movement in the value chain on the part of food processors, where some element of the greater price premium that is achieved by the processor is passed on to the farmer in the form of higher farm output prices.

The strong rise in the value of Irish agricultural output over the last decade is mirrored in the increase in the value of agri-food exports, as illustrated in Figure 6. The trend has been particularly strong in the last four years. This increase in the value of exports is driven in large part by higher prices for the products that are exported, rather than any increase in the volume exported.

Figure 6: Value of Irish Agri-Produce Exports

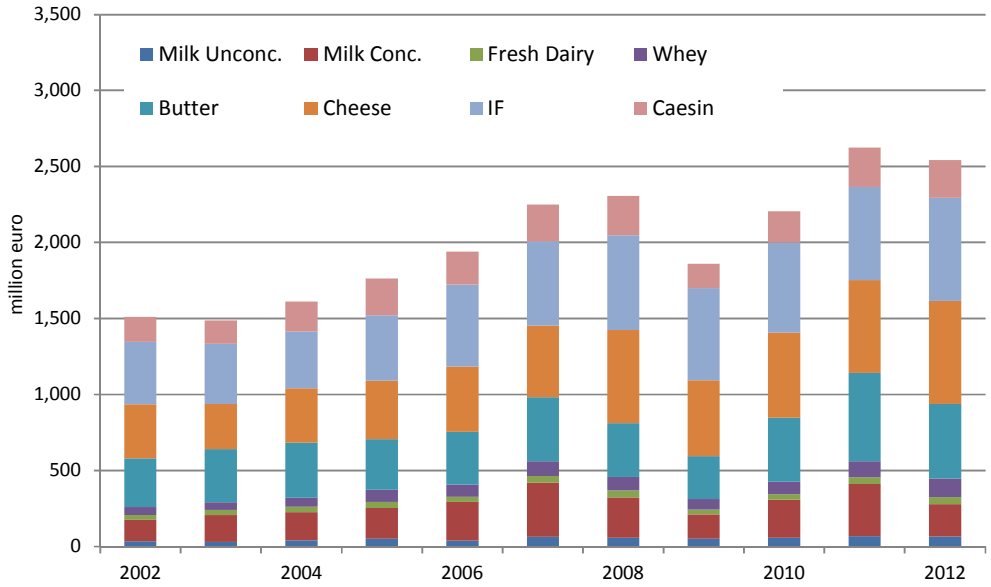



Source: CSO

However, the growth in the value of exports has outpaced the growth in the value of agricultural output and this is suggestive of an increase in the value added of Irish food exports, notably in the dairy sector. For example, the value and volume of infant formula exported has increased considerably and it now represents a larger share of Irish agri-food exports than would previously have been the case. Figure 7 shows that infant formula exports increased from just over €400m to almost €700m over the period 2002 to 2012, while a similar increase was recorded in the value of cheese exports. The value of whey exports doubled in the same period.

The value of Irish meat exports has also increased and again this is due to inflation in output prices rather than any substantive change in the volume exported.

Figure 7: Value of Irish Dairy Exports 2002 to 2012




*Source: Eurostat*

## 3. Looking to the Future: A Story of Certainty and Uncertainty

In thinking about the future of Irish agriculture of the next 15 to 20 years, three levels of ambiguity can be defined, and while they are presented here as being discrete categories, it should be understood that particular issues may not necessarily be easily labelled as belonging to any one category.

### Known Knowns

We can identify a number of *Known Knowns* in the period to 2025. At present, about 90 per cent of the land base in Irish agriculture supports grassland enterprises. There is no evidence to suggest that this will change.

- As a general statement, we can say that in 2030 Irish agriculture will continue to be predominately based on pasture-fed bovine and ovine production.

Following a number of years of gradual relaxation, milk quotas have been eliminated in 2015. At present, between 20 and 25 per cent of the agricultural land base is used for milk production, which is by some distance the most profitable mainstream agricultural enterprise.

- The removal of milk quotas will facilitate an increasing orientation towards milk production.

A feature of the drystock sector is the large number of part-time farms and the high share of support payments in the income that these farms generate. Many of these farms are smaller than the average farm and there is a tendency for many of them to be located in areas which are disadvantaged in terms of soil quality and climate.

- Assuming that the next CAP reform largely perpetuates the current support system, the drystock sector will continue to be reliant on support payments for a major share of its income.

Irish cereal yields per hectare are among the highest in the world. Tillage farms are generally larger than the average farm size, but these farms would not be considered large when compared with tillage farms elsewhere in the world. The profitability of these tillage farms in many cases is dependent on support payments.

- The crop sector will continue to occupy a small share (<10%) of the total agricultural area in the country.

The pig and poultry sectors receive little in the way of financial support from the Common Agricultural Policy (CAP). Production in both sectors is becoming increasing concentrated among a declining number of larger producers. Given that Ireland is a net grain importer,

producers are at an immediate cost disadvantage in respect of animal feed and, therefore, efficiencies in other areas of the production process are vital. The pig industry has achieved considerable progress in terms of sow productivity and finished pig cascass weight in recent years. This has allowed pig meat production to remain relatively stable despite a downward trend in sow numbers.

- Unless the decline in the sow population is arrested, any growth in pig meat production will be modest

In general, given the existing predominance of grassland agriculture and the outlook for the various sectors, it can be said that the composition of the agriculture sector will continue to remain significantly different from that of continental Europe.

**Known Unknowns**

We can further identify a number of known unknowns to 2025. In the case of agriculture, policy developments in the next 10 to 15 years will be a major factor. Thinking about the future, we must make sensible assumptions about how policy will evolve. While the outcome of the latest CAP reform is known, we cannot be sure as to how the CAP will evolve beyond 2020. The European Union (EU) has expanded its borders considerably over the last decade. A number of countries in the Balkan region and beyond have registered their interest in joining the EU and some are already formally on the path to accession. Further EU enlargement would be expected to increase the number of net beneficiaries from the EU budget. At the same time, there is little political support around the EU at the present time for an increase in the member state (MS) contributions to the EU budget. There is pressure within the EU to spend an increasing share of the budget on objectives other than agriculture. Within the CAP budget, there will be continuing pressure for a reallocation of that budget so that the disparities in the average level of support across the MS are addressed. All of above considerations can be expected to place pressure of the capacity of the Irish government to retain its share of the CAP budget at the time of the next reform. But the precise outcome remains an unknown.

Equally, the future direction of trade policy is not known beyond the present. While a multilateral agreement under the umbrella of the World Trade Organisation (WTO) might arise, it is clear that some WTO members are keen to move forward towards a freer global trade environment via a succession of bilateral trade deals. The most prominent of these deals that involve the EU are with Canada and the United States (US). The Comprehensive Economic and Trade Agreement (CETA) has been agreed between the EU with Canada, but has yet to be ratified by MS parliaments. The Transatlantic Trade and Investment Partnership (TTIP) is under negotiation between the EU and the US at present. While for the EU there may be opportunities

arising from these agreements, in the wider economic sense and within agriculture, in respect of both CETA and TTIP, there are legitimate concerns that elements of EU agriculture will be subject to greater competition. In this regard, there would be particular concern in an Irish context for the international competitiveness of the specialist beef sector.

Based on the above, one might assume that:

- the existing CAP budget is maintained in nominal terms, which in turn implies a decrease in the real value of CAP due to the effect of inflation over time
- the impact of trade reform remains unknown and that depending on the negotiated outcome, it could affect the outlook for EU and Irish agriculture.

These are important caveats in respect of any assessment of future sector prospects.

**Unknown Unknowns**

Finally, we should be aware of the existence of a set of Unknown Unknowns. These are events which by their very nature cannot be anticipated either in terms of their timing or the magnitude of their effect. The experience of history tells us that these events occur, but we have no way of knowing in advance the scale of the impact which they will have or when they will arise. These events can be a mixture of upside and downside concerns. This could involve occurrences that represent supply shocks or demand shocks. Prominent examples would include the BSE crisis of the 1990s, the UK FMD outbreak of 2001, the global recession of 2009, the fodder crisis in Ireland of 2012/13 and the embargo on EU exports to Russia established in 2014.

Since these events are difficult to plan for or anticipate, we typically assume a future in which they do not happen. When projections for the future are graphed they show a smooth path for production, consumption, prices and other variables, whereas a graph of the history of any of these variables tends to be jagged, with turning points, peaks and troughs. These peaks and troughs usually represent the occurrence of particular market shocks. This is an important caveat associated with any set of future projections for the agriculture sector. We know that around that smooth path of the future there will be deviations due to events that affect the market that had not been anticipated.

The fact that there are future events which will affect markets and which we cannot predict should provide us with some lessons in respect of target setting. If targets are being set, then it would be a sensible precaution to set an end point which represents the average of more than one year, since there is the risk that a positive or negative market disturbance could otherwise lead to the over or under achievement of a target.

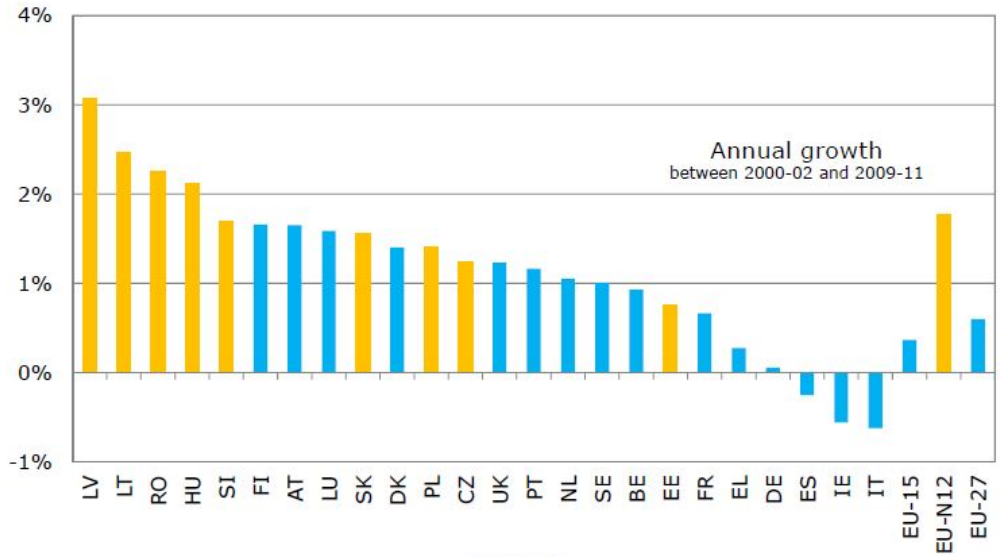
## 4. Challenges for agricultural stakeholders

In this section some of the key challenges that will be faced by stakeholders in the agri-food sector are discussed. Consideration is given to the productivity of Irish agriculture, the limitations that may be imposed on sectoral growth by the lack of liquidity in the Irish land market, the challenge of dealing with agricultural GHG emissions in the context of Ireland's 2020 Effort Sharing Decision commitments and a potential 2030 successor agreement. The final part of this section briefly examines the potential implications for the agri-food sector that would arise from a decision by the UK to leave the EU.

### 4.1 The need to address Irish agricultural productivity

In order to be internationally competitive, Irish agriculture must continue to achieve productivity improvements. Productivity growth is about producing more with the same level of resources. Productivity is challenging to measure. There are difficulties in accurately measuring output and input usage. There is also the challenge of measuring the productivity of the different factors of production (land, labour and capital). Technological change can also complicate the accurate measurement of productivity improvements. That being said, Figure 9 show a measure of annual agricultural productivity growth in the 2000s for selected EU MS developed by the European Commission.

Figure 8: Agricultural Productivity Growth (Total Factor Productivity)




Source: EU Commission 2014

The results which aggregate across all of the agricultural subsectors, suggest that agricultural productivity growth in the EU15 in general was quite low and that Irish agricultural productivity

growth was negative, placing Ireland among the lowest ranked countries in the EU during this period.

There are reasons to be concerned about the capacity for future productivity improvements in Irish agriculture. The dairy, tillage, pig and poultry sectors have a strong track record of technology adoption, but the same cannot be said for elements of the drystock sector. Schemes such as the Beef Technology Adoption Programme (BTAP), the Beef Data Programme (BDP) and the Beef Genomics Programme (BGP) aim to address the low level of technology adoption in the beef sector.

However, there is also a need to question why historically technology adoption has been lower in the beef sector than in other areas of Irish agriculture. Here one has to consider the part-time nature of many beef farms and the extent to which a financial incentive exists to adopt technology.

On many beef farms, much of the income is derived from agricultural support payments with only a small fraction derived from the profit from animal husbandry. Furthermore, the part-time nature of the drystock system means that many producers have an off-farm job which takes up a considerable portion of their time and which provides them with much of their household income. This situation contrasts strongly with the situation on dairy farms where the bulk of the farmer's income is derived from milk production, where supports payments are typically a much smaller share of farm income and where the operator is highly unlikely to have an off-farm job.

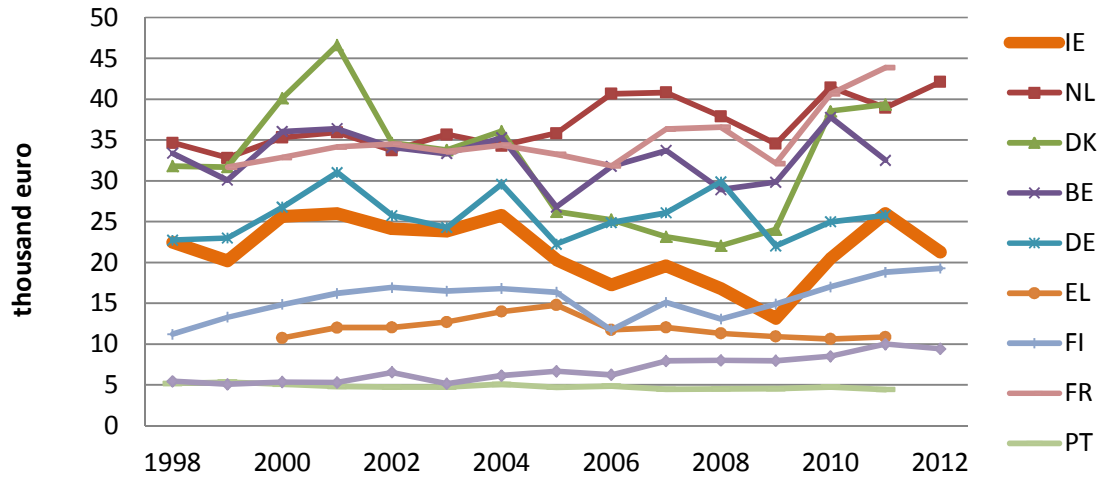
In short, comparing the circumstances of beef farmers and dairy farmers in Ireland we may conclude that on average they face very different levels of incentives to adopt technology. The additional income that might be derived from technology adoption in the case of drystock may be small when measured against the income derived from support and from off farm work. Drystock producers may be making what they perceive as a rational decision when they decide not to expend time in learning how to adopt a technology, especially if that technology has a labour component and the time which they can devote to farming is limited.

In the context of this discussion of technology adoption, one then has to ask whether the set of circumstances faced by beef farmers would be expected to change to any great extent over the next decade? Is it reasonable to accept that there will be no greater incentive to adopt technology in the beef sector over the next decade, relative to the last decade, and if so, does this present concerns for the capacity of the sector to improve its profitability?

Another means by which we can measure changes in productivity is via the value added generated per person engaged in the agriculture sector. Figure 10 shows the GVA per person engaged over the period 1998 to 2012 for a selection of EU MS, many of which would be

considered as competitors in agricultural terms with Ireland. Figure 10 illustrates that in terms of labour productivity in agriculture, historically Ireland was behind most northern European MS and that the GVA per person engaged in agriculture was closer to that of MS in southern Europe. In part, this is a reflection of the type of agricultural products produced in the countries considered. Ensuring that a greater share of your agriculture sector is devoted to the production of higher value added products means that agricultural profitability is likely to be higher and that a country is likely to have a higher level of GVA per person employed in agriculture. Figure 10 also illustrates that over time this situation has not changed and Ireland remains lowly ranked among the countries considered.

Figure 9: GVA of Agriculture (A01) per person employed (salaried and self-employed)




Source: Hanrahan 2014 Adapted from Eurostat Data

### 4.2 The requirement to create liquidity in the Irish agricultural land market

Looking first at the supply of land, we can make a number of general observations. In Ireland, the area of agricultural land sold annually represents only a fraction of 1% of the total stock of land that is farmed in the country. In some recent years, the share of land transacted has fallen as low as ¼ of one per cent. To put that in context, this is equivalent to about 10,000 hectare or about 12 times the size of Dublin's Phoenix Park. The low level of land sales demonstrates, among other things, the strong attachment to land that continues to exist in Ireland. This is reflected in the tendency for agricultural land to pass from one generation to the next by means of inheritance rather than via the open market. The sale of agricultural land is very much the exception rather than the rule.

The nature of the agricultural support system in the EU which attaches support payments to land is in marked contrast to comparator countries such as New Zealand, where there are no support payments. In contrast to New Zealand, in the EU, farms which do not make a profit from the market place, still derive an income from the subsidy system, which militates against the requirement to sell a farm which is operating at a loss.

Average Irish land sales prices are amongst the highest in the EU. The land market experienced a price bubble in the mid-2000s. The residential and commercial property price boom that existed at the time drove agricultural land prices upward for several reasons. A speculative element ensured that the potential for conversion of agricultural land to non-agricultural caused price increases in some regions. Added to that, receipts from land sales to property developers by farmers were typically reinvested in the land market. With a limited volume of land available to purchase, the price of agricultural land was bid upward. With the collapse of the property market in 2008, land prices fell considerably, but it is still the case that agricultural land prices are well in excess of the return that could be offered by agriculture to any potential purchaser.

One of the consequences of the low volume of land sales is that farmers have to make use of the land rental market if they wish to increase the area of land they farm. About 17% per cent of the agricultural land base is rented annually and about one third of farmers are engaged in the land rental market, either as a lessor or a lease, or in some cases both.

Renting out land is a means by which the title to the land can be retained, but an income can be derived from the land by the owner if he or she is not in a position to farm the land. From the perspective of those renting in land, it is often the only means to increase the farm's land base. The land rental market can also be used to address problems that arise because of farm fragmentation, such as where an out farm is remote from the home farm.

The operators of rented land have no legal entitlement to the land beyond the agreed rental term. The dominant form of land rental contract over the last 200 to 300 years has been the conacre system of 11 month rental agreements. While many of these conacre agreements are rolled over from year to year, an individual renting in such land has guaranteed use of the land for only the 11 month duration of the agreement.

Short rental periods create uncertainties in terms of future farm planning which may militate against investment on rented farms. Rented land may also be farmed by the operator less efficiently than the operator's owned land. This is because the flow of benefit of actions which would improve the agricultural potential of rented in land (such as soil testing, drainage etc.) are likely to continue beyond the agreed rental period and therefore the operator may not derive the full benefit of such measures if the land is returned to the owner or if it is rented by another

individual. Following the agri-taxation review in 2014, recent developments in terms of government policy are aimed at, amongst other things, lengthening the duration of land rental agreements to provide those operators farming rented land with greater security in terms of business planning.

Turning to the demand for land, it is likely that a number of pressures will emerge given the range of agricultural growth policy objectives which exist. The most obvious pressure point that will arise is in respect of additional land for milk production. The low level of specialisation on dairy farms should mean that many dairy farmers expanding their milk production will not be land constrained in the short term. Approximately 600,000 ha of land is currently used for milk production. Over the next ten years it is likely that another 200,000 ha will be required for increasing milk production depending on the level of dairy expansion achieved. Some of this land will become available through specialisation of existing dairy farms, but it is unclear how dairy farmers will access additional land when expansion on owned land becomes exhausted. At current rates of land sales of circa 10,000 ha per year, and making the heroic assumption that all the additional land sold over the next decade would be purchased by dairy farmers, and that all such land would be adjacent to existing dairy farms, that would make just 100,000 ha of additional land available. Initiatives such as farm partnerships and contract rearing of replacements may address some of the land access problems faced as dairy farms become more specialised, but fundamental challenges will remain and with steps to address liquidity in the land market, there is a risk that land may become the new milk quota for dairy farmers.

Other pressures on the agricultural land market may come from the need to increase afforestation rates. At present, the carbon captured by forests represents a carbon sink, but in order to avoid the future situation of forests becoming a carbon source, it is imperative that afforestation rates increase from the existing level of just 7,000 ha per annum. In this regard, the newly announced Forestry Programme 2014 -2020 may assist in increasing the rate of afforestation. Over time, the cumulative effect of afforestation measures has the potential to remove a significant area of land from agricultural use, albeit that this pressure may be more likely to be felt at the lower quality end of the land sales market.

### 4.3 The issue of Agricultural sustainability, in particular GHG mitigation

With GHG emissions from Irish agriculture representing about 40% of the country's non-Emissions Trading Scheme (NETS) emissions, and a NETS emissions reduction target of 20% by 2020, GHG emissions from agriculture are a serious policy concern for the government. In assessing the impact of further growth in agriculture, consideration will need to be given to the general environmental impact, with a high level of emphasis on GHG emissions. Within agriculture, the effectiveness of GHG mitigation strategies in the short term is likely to be quite

limited. Therefore, any growth of one sector of agriculture would need to coincide with the contraction of another, if GHG emission from agriculture are not to increase.

A number of technologies have been developed aimed at reducing GHG emissions from agriculture. These technologies have been shown to be effective in reducing emissions in a research farm or laboratory setting and the cost of some of these technologies suggests that they might be a viable means towards reducing emissions in the medium term.

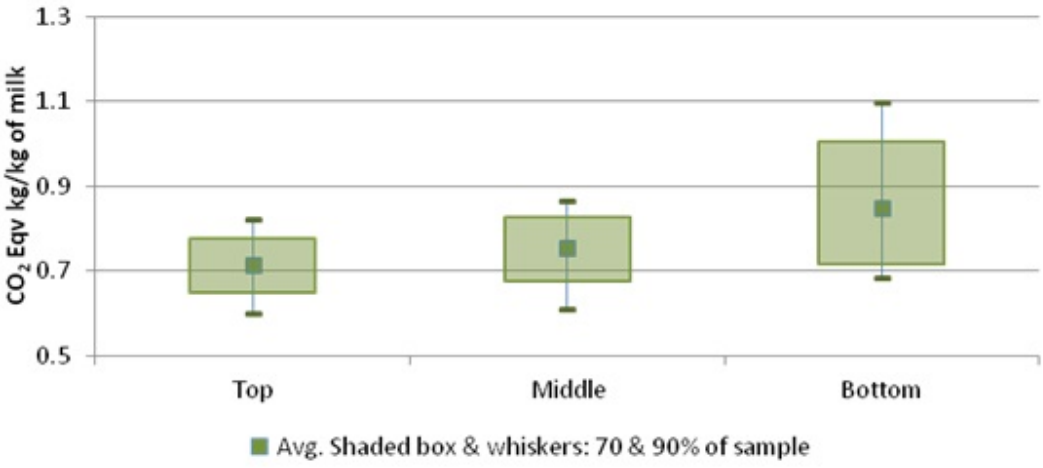
Looking at the suite of technologies available, it is notable that a number of them are deemed to be low cost and some even have a negative cost, meaning that their adoption would increase profitability. The fact that several of these mitigation technologies are deemed to be low cost or negative cost should not be considered surprising. Generally, these technologies were developed historically with the specific purpose of increasing farm productivity, so they are designed to boost production for a given level of input usage (or reduce input usage for a given level of output). This is what agricultural science has always set out to achieve and it just so happens that some of these technologies carry the added benefit of reducing GHG emissions, when measured on a per unit of output basis. Economic efficiency and environmental efficiency work in tandem for these technologies and, on the face of it, this would seem to be a win-win outcome.

However, the reality of the application of these technologies and their impact on emissions may be more complicated than suggested in the laboratory environment. Importantly, negative cost technologies, if successfully adopted, are likely to increase farm profitably which in turn may lead to increased output. So while the application of the technology may lead to reduced emissions on a unit basis, the increased profitability may motivate the operator to increase production. This would mean that while emissions per unit of output might fall, the outcome in terms of emissions per farm, or indeed at national level would depend on the extent of the increase in output that takes place. It is conceivable that for some technologies the decline in emissions per unit could be fully offset by the resulting increase in production.

It is for this reason that in international negotiations concerning GHG emissions the government has been keen to emphasise that reducing emissions per unit output should take precedence over absolute emission reductions. Teagasc is actively engaged in the development of a range of sustainability metrics for Irish agriculture, including measures associated with GHG emissions using both IPCC and LCA type approaches. Already it has been demonstrated that the more profitable dairy farms also happen to typically have a lower carbon footprint for milk production that the less profitable dairy farms, as illustrated in Figure11. It has also been shown that the average carbon footprint per litre of milk produced in Ireland is the lowest in the EU.

From an environmental perspective, these are positive findings, but the fact remains that Ireland has the most challenging of targets in terms of achieving GHG emissions reductions under the EU Effort Sharing Decision (ESD), especially when one considers the high percentage contribution of agriculture to NETS emissions. In this context, the achievement of emissions efficiencies through the adoption of mitigation strategies may not do enough to address the upward pressure on emissions that would result from increased agricultural output, in which case total GHG emission from agriculture would increase rather than decrease, adding to the pressure on other sectors of the economy to deliver GHG emission reductions.

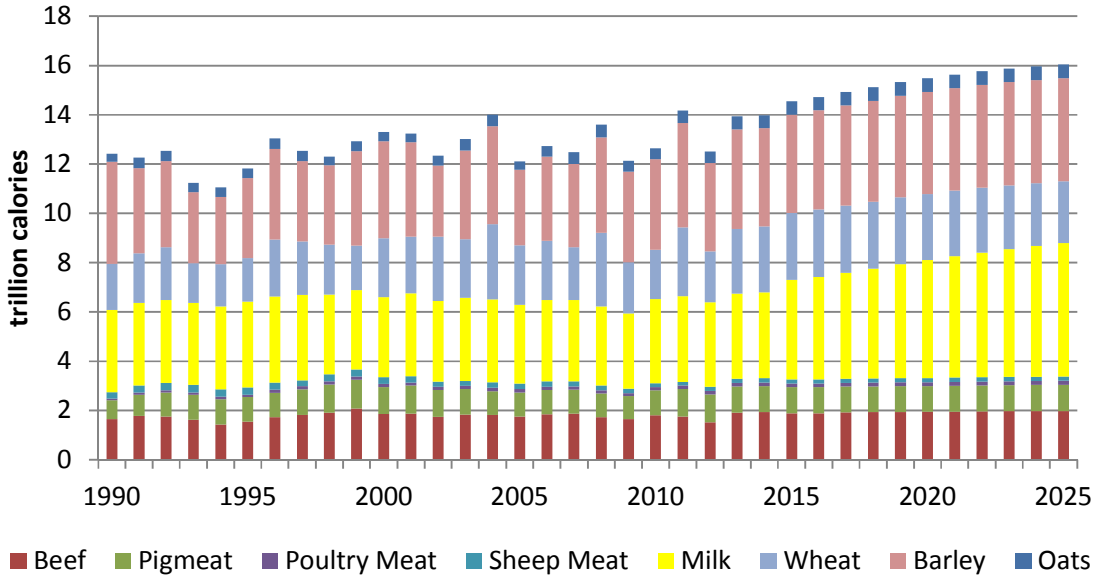
Figure 10: Emissions Efficiency of the Irish Dairy Sector at varying levels of profitability




Source: Teagasc NFS

It is useful to further explore the historical trend and projected development in the efficiency of Irish GHG emissions. Doing so is complicated by the range of agricultural products produced and the large variation in the amount of $CO_2$ equivalent emissions associated with each product. In order to bring these outputs to a common base, Figure 12 shows the total calorific output from the principal outputs of agriculture since 1990.

Figure 11: Calorific Output* of Irish Agriculture




Source: FAPRI Ireland (Donnellan and Hanrahan, 2014)
Note: * Principal outputs only

Irish agricultural output ranged from about 12 to 14 trillion calories in the period 1990 to 2013. Over the period to 2025, the output is expected to increase to 16 trillion calories, largely due to increased milk production. To put this figure is some context, 16 trillion calories would supply the annual calorific needs of about 20 million adults.

### 4.4 Implications for Irish agriculture arising from a potential UK exit from the EU

A UK exit from the EU, while still only a possibility, is becoming an increasing concern. UK politics has entered an uncertain phase with the erosion of support for the two main UK political parties. In the life of the incoming UK government, it is likely that voters will have their say on the so called Brexit question by way of a referendum, potentially in 2017. In the interim, some UK politicians will argue for a renegotiation of the terms of Britain's EU membership, or that Britain should take a more proactive role in trying to engineer a wider reform of the EU.

A decision by the UK to leave the EU would be a major development for the Irish economy in general given our level of trade with the UK and the high level of integration between the Irish and UK labour markets. There would be particular concerns for the Irish agriculture sector given that the UK is the number one destination for our food exports. Ireland also imports a considerable volume of food from the UK.

In circumstances where the UK would exit from the EU, the UK would be expected to continue to maintain a trading relationship with the EU, but trade in agri-food products between Ireland and the UK could become more complicated. Given its long history as a net food importer, it is unlikely that the UK would seek to place significant tariffs on food imports from the EU. However, some form of free trade arrangement between the UK and the EU would most likely need to be negotiated. At face value it might seem logical for the UK to become part of the European Economic Area, but this involves acceptance of EU regulations without having any input to their development, and also involves continuing free movement of EU citizens. Such an arrangement might be seen by UK critics of EU membership as being an even greater infringement of UK sovereignty than those perceived to arise from existing EU membership.

A further consideration would be the implications for CAP policy of the exit of the UK from the EU. The effect could be ambiguous. Historically, UK governments have been in favour of reduced spending on the CAP, and were the UK to exit, there would therefore be one less voice at the table in Brussels pushing that agenda. However, on the flip side, were the UK to leave the EU, there would also be the loss of Britain's contribution to the overall EU budget. Given that the UK is the second largest contributor to the budget, a UK exit could have implications for the size of the future CAP budget and Ireland's overall receipts from the CAP.

Depending on the circumstances, a UK exit could also open up opportunities for the UK to make its own free trade agreements with countries and trading blocs outside of the EU. This could open up the potential for greater third country competition with Irish food exporters on the UK market.

At the very least, the exit of the UK from the EU would introduce a great deal of short-term uncertainty for Irish food exporters to the UK market and over the medium term.

### 4.5 Consideration of Agricultural Growth Target Setting

While 2020 is still a few years away, it is useful to reflect on the targets that have been set in Food Harvest 2020, the degree of progress towards those targets and the implications for farm income in Ireland. Recall that the Food Harvest 2020 targets placed an emphasis on growing either the output or the output value of a range of agricultural sub sectors.

To some extent, the setting of an output value target creates a hostage to fortune, in that the achievement of the target may to some degree depend on commodity prices. Commodity prices reflect the supply and demand conditions on international commodity markets, factors outside of the control of any actors in Ireland.

The Food Harvest 2020 targets placed an emphasis on growing either the volume of production or the value of production at the farm level. As long as an enterprise is profitable, then more output should be expected to deliver more profit, but will also entail the use of more agri-inputs as well as additional labour, land, buildings and machinery. Importantly, an increase in output will not result in an increase in subsidy supports, since these payments are decoupled from production and where subsidies are a large share of income then increased output will make a small additional contribution to income. Put simply, an additional €1000 of farm output cannot deliver an additional €1000 of farm income. Nor can an additional €1000 of output deliver an additional €1000 of profit. The contribution of an additional €1000 of output may in fact reduce income in some circumstances, notably in the drystock sector, where many farms already operate with a negative net margin.

A sensible approach to target setting would be to emphasise increased value added over increased output value. In simple economic terms, in agriculture the gross value added is the sum of the profit, depreciation cost, labour cost and subsidies. Since the subsidy element is fixed in value and determined by the CAP, emphasis must therefore lie in increasing value added by increasing profit margins. Ultimately, this mean improving the productivity of the farm business to increase the wedge between farm gate prices and production cost.

## 5. Summarising the Future Outlook

Irish agriculture is dominated by dairy and beef production and these sectors will remain the principal enterprises on grassland over the next ten to fifteen years. However, Irish agriculture will begin to undergo a significant transformation with the elimination of the milk quota system, which will allow the highly profitable dairy sector to expand.

The long-term historical decline in dairy cow numbers, due to the increase in milk yields and the presence of the milk quota, will come to an end and a significant increase in milk production, milk yields and dairy cow numbers is imminent. At the same time, the lack of profitability of the beef sector, allied with the fixed value of subsidy payments, suggest that beef cow number may continue to decline. The projected rise in dairy cow numbers and the projected decline in beef cow numbers will tend to offset each other so that the total cattle population and the stocking density at a national level should not change markedly.

However, the dairy sector will intensify with much of the additional milk being produced on existing dairy farms. Land may transfer to dairy production from other enterprises, principally beef production given its low profitability, but given that the rate of land sales is as low as ¼ of a per cent per annum, this process is likely to be slow, barring a radical increase in liquidity in the Irish land market. It may be possible that additional land can be accessed for the dairy sector through land rental arrangements, but ideally this would need to be through long-term leasing rather than the traditional conacre system.

Considering the extent of the projected increase in dairy cow numbers and their associated progeny, the increase in total agricultural GHG emissions is likely to be relatively benign, due to the offsetting effect of a decline in the number of beef cows and their offspring. An alternative outcome that is perhaps worthy of consideration is that the rate of decline in suckler cows is more muted, or even that the number of suckler cows remains at current levels. Were this to be the case, then the expansion of the dairy sector would lead to an appreciable increase in the total cattle population and the increase in GHG emissions nationally would be more significant.

As the time horizon extends toward 2025, competitive tensions between dairy and beef production should begin to become more pronounced. Over the short term, dairy expansion will take place largely within the existing land base of current dairy farms, but this expansion potential will be become exhausted at some point in the medium term. The difference in the profitability between dairy farming and much of the existing beef production creates an economic incentive for the conversion of land use, but it is not clear that land owners outside the dairy sector will be willing to sell land to facilitate dairy expansion.

Overall, one can conclude that the driver of increased profitability in agriculture will come from the growth in milk production, and the extent of that growth will depend in the main on the level of future milk prices and the impediments the sector faces in accessing additional land. Due to the extent of the dependence of the other principal sector of primary agriculture on subsidy payments, it is difficult to conceive of a scenario where increased levels of activity in these sectors could make a comparable contribution to an increase in overall agricultural income.

It would seem that agriculture generally would benefit from reductions in the future impediments that dairy expansion is likely to face. However, given the structure of the agricultural support system, and the fact that it is the product of a consensus achieved in Brussels, it is not clear that Irish policy makers have the necessary policy levers at their disposal to maximise the future opportunities for dairy expansion. In the milk quota era, support payments maintained incomes in the drystock sector with minimal adverse impact on the dairy sector. However, the existence of these payments, or more specifically their attachment to land, now represent an obstacle to dairy expansion whose impact will become increasingly acute in the coming years. Increased friction between the dairy sector and the drystock sector seems inevitable. Specifically, it is not clear that a land market can be developed that would facilitate the acquisition of land by the most productive milk producers. Ultimately, this will increase the cost of dairy expansion, slow the rate of growth in the sector and lead to lower growth in the overall value of agricultural sector income.