Striking the balance

Food, farming and the countryside

Nature Friendly Farming Network

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Contents

IMAGE BY ADOBE STOCK

Farming in a climate of change

Farming is one of the cornerstones of Northern Irish society, having shaped our landscapes, heritage and culture for centuries.

Agriculture and managing land are uniquely important in delivering much of society's needs, from food production to providing various services for a resilient and prosperous economy.

Yet, in recent decades, our food system's narrow fixation on food production as farming's only output has created detrimental trade-offs between farm practices and the farmed environment. Considerations around the impacts on nature and climate have become secondary in decision-making processes and to the disadvantage of individual farm businesses.

Despite gains in efficiency and output, farmers in Northern Ireland face growing challenges on multiple fronts. Profit margins are squeezed as the costs of inputs rise in response to the war in Ukraine and the global energy crisis that followed. As fuel, fertiliser, and feed prices rise[1], many farm businesses struggle to profit.

The environmental costs of our current farming systems are well known, and recent years have demonstrated that these are increasingly felt at a farm level. We know the sector's overreliance on chemical fertilisers and pesticides compromises soil health and damages long-term productivity[2].

We are losing valuable species and habitats from our landscapes, depriving farms of the vital (and free) services that food production needs, such as healthy soil, pollination[3], pest control[4] and adaptation to extreme weather[5].

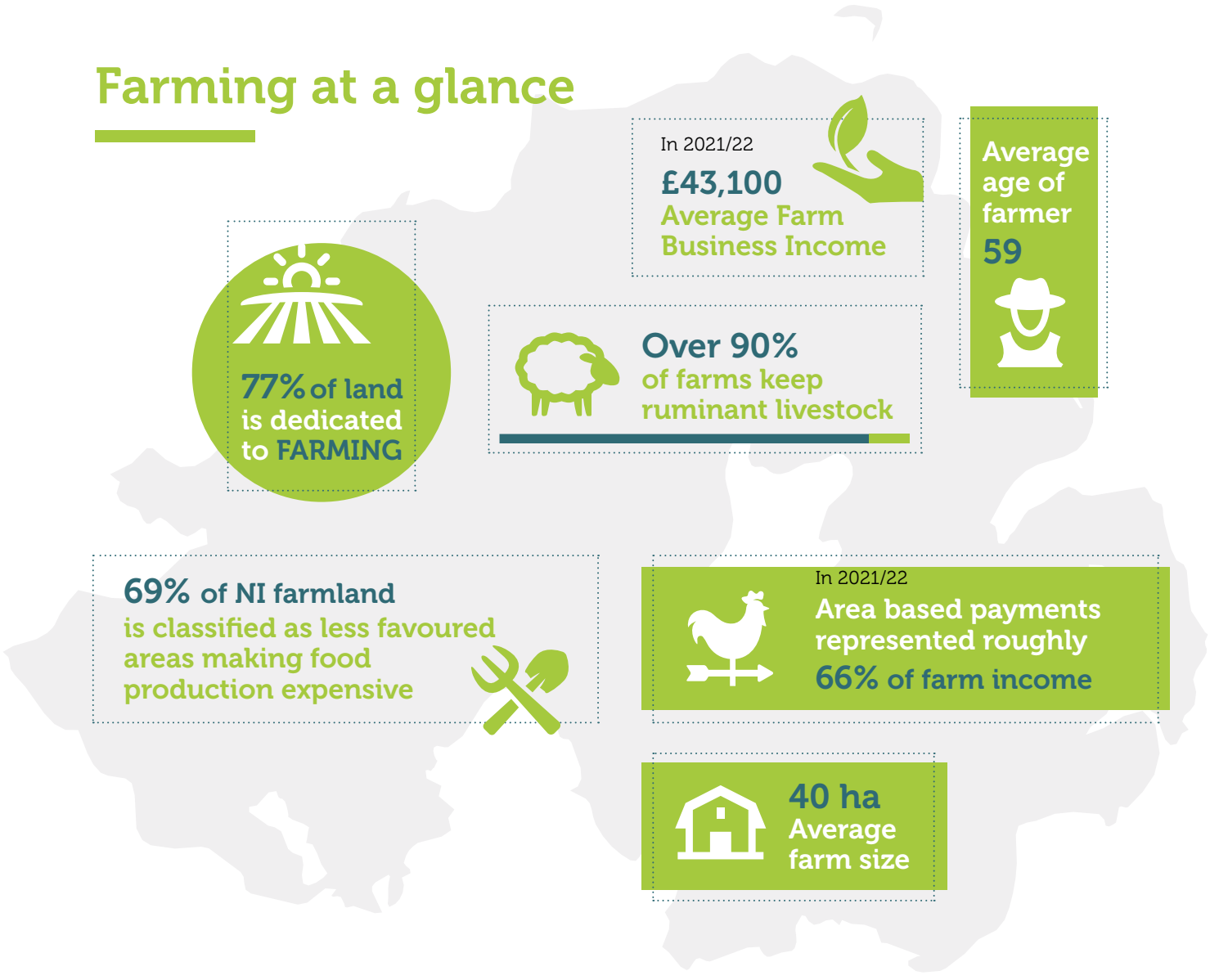
Unpredictable and volatile weather patterns are driving up farm business costs and hindering production by necessitating that farming substitutes what nature could otherwise provide for free[6], deepening reliance on costly artificial inputs, such as chemical fertilisers and pesticides.

The triple challenge of flatlining farm profitability, ecosystem decline and climate breakdown is taking place in a time of upheaval and uncertainty within food, farming and land use policy in Northern Ireland. Following the UK's decision to leave the European Union, bespoke farming policies are in development.

A refershed approach to farm payments aims to better deliver a more diverse set of outcomes from Northern Ireland's farmland.

As part of this, there is increasing emphasis on improving the environmental sustainability of farming and land management. This will inevitably bring challenges to many farm businesses as the priorities of farm payments evolve.

Farming at a glance



The rising costs of input dependency

In 2021, the sector saw a massive rise in input costs:

£184 million on fertilisers
An increase of 108%

£208 million saw machinery
A rise by 31%

58% increase in fuel and oils costs

£1.2 billion on livestock feed
An increase of 22.1%

Significant changes in land management are integral to meeting many of Northern Ireland's nature and climate commitments, including the legal requirements of the Northern Ireland Climate Act[11] and a host of targets within the Draft Environment Strategy[12], including actions to address biodiversity decline, improve soil health and reduce pollution. Farming has a crucial role in helping achieve these objectives but done so in ways conducive to more profitable farm enterprises.

Many farms are already demonstrating that it is possible to balance the needs of nature, climate and food production in ways which help build farm viability. Farmers are freeing themselves from input dependency and seeing healthier profits by adopting an approach that views nature as an ally to food production.

This report examines whether such an approach applies to all farm businesses in Northern Ireland. An in-depth analysis of 17 farm businesses reveals how transitioning to a farming system that partners with nature can help improve profitability and reduce exposure to economic and environmental volatility.

The report builds on previous research[13,14] from across the UK, demonstrating how a different metric for farm business success could significantly benefit the sector and beyond if delivered at scale.

Environmental impacts

Roughly **369,000 tonnes** of soya are imported into Northern Ireland every year for livestock feed[7].

1 in 10 species are at risk of extinction[8].

In 2017, agriculture was responsible for **949 tonnes** of phosphorus being lost to waterways[9].

Between 1990 and 2021, GHG emissions from agriculture[10]. **increased by 15%**

Maximum Sustainable Output

Maximum Sustainable Output
A new metric for success

Over the last five years, Nethergill Associates has been working on a new concept to help farmers measure business success holistically. Their core objective is to determine how the farming aspects of the business can be more profitable before accounting for support payments and other forms of revenue.

Their work shows that farm businesses can improve their commercial performance if output levels are sustained through the farm's naturally available resources. In doing so, costly inputs, such as fossil fuel-based fertilisers and imported feed concentrate, are significantly reduced or eliminated, making the farm more profitable. The Nethergill Associates team have developed a mechanism to identify the point where commercial returns are maximised for the business, coined the 'Maximum Sustainable Output' (MSO).

To calculate MSO, a farm's revenue, variable and fixed costs are assessed, and support payments and other non-farm revenue are excluded to accurately represent how the underlying farming business is performing.

A business' variable costs are split into two categories to calculate MSO.

> The findings of this work challenge the assumption that an increase in output will increase commercial returns.

IMAGE BY ADOBE STOCK

Productive Variable Costs (PVCs)
These represent essential or unavoidable costs incurred when output levels are within the boundaries of naturally available resources. These include seeds, bedding, contract labour, and essential veterinary and medication costs.

Corrective Variable Costs (CVCs)
CVCs are classified as avoidable or non-essential costs associated with production levels that overshoot what is possible using only the naturally available resources. These CVCs include artificial fertilisers, plant protection products, and bought-in feed.

The methodology determines the point at which the farm harnesses natural resources to deliver an optimum level of output. At this point, the farm's natural resource base is utilised effectively to maximise profit margins and minimise costs. Levels of output beyond this point start to incur significant costs as bought-in inputs are used to support production above MSO.

This produces a non-linear costs profile, meaning that production beyond the MSO point fails to cover its own costs.

As more inputs are used, costs start to outpace revenues, leading to an increasing reduction in profitability.

It is important to note that farm profitability is also influenced by the proportion of fixed costs compared to sales.

Nethergill Associates has found that farms find it extremely difficult to attain profitability without support when fixed costs exceed 40% of revenue. Fixed costs could also fall into different categories, e.g., business-critical, mandatory (e.g., for legal compliance), or unnecessary (e.g., over-specified equipment).

The findings of this work challenge the assumption that an increase in output will result in a proportional rise in commercial returns. It also demonstrates that striving for gains in output will be unsuccessful if a farm relies on large volumes of external inputs.

Production that effectively harnesses natural resources will be more efficient and profitable than that which depends on corrective inputs to substitute for an asset base that is degraded or inadequate.

> MSO has a potentially transformational role to play in improving profitability for the agriculture sector in Northern Ireland.

The study

> Every £1.00 of revenue generated above MSO incurs an additional cost of £7.50.

In total, 17 farm businesses were involved in the study, including 'mixed' livestock enterprises consisting of beef and sheep (8), cattle-only farms (5), sheep-only farms (2), and dairy farms (2). The farms were selected to provide (as far as possible) a representative sample of the main farming systems found in Northern Ireland.

Farms were recruited through a number of in-person recruitment events advertised via local press channels and social media. Before joining the study, farms were asked to complete a short questionnaire to help prioritise participants. The size of farm holdings ranged from 287ha to 15ha, with an average of 96ha. The livestock accommodated on the farms ranged from 638 LSUs to 19 LSUs, averaging 112 LSUs.

As part of the study, participants provided the Nethergill team with their farm accounts and other relevant details, which were used to calculate the farm's MSO level and where the business currently sat in relation to this.

An online meeting with the Nethergill Associates team was arranged to review the initial results, followed by a more detailed face-to-face consultation. At the end of the process, each participating farmer was provided with a report, which gave an overview of the main findings and key conclusions that could be considered moving forward.

Findings

Assessing Farm profitability
Three tests are applied to farm revenues to assess performance.

First contributions:
The profitability of the enterprise is based on the value of sales minus variable costs. This quantifies the primary cash flow in the business.

Second contributions:
The subsequent profitability of the enterprise after fixed costs are deducted. This corresponds with the operating surplus in the business.

Third contributions:
The ultimate profitability of the business after support payments (e.g., BPS and agri-environment) are added in.

Profitability test	Positive	Negative
First Contributions	16	**1**
Second Contributions	8	**9**
Third Contributions	14	**3**

IMAGE BY ADOBE STOCK

The patterns of profitability on the farms differed widely, which is not unusual in a diverse group of businesses. Only one farm failed to cover its variable costs via revenue and was transitioning to a new management system. Generally, if a farm is unprofitable at this stage, securing a viable business model is extremely difficult.

One of the key tests of business performance is the ability for revenue to cover both fixed and variable costs. Although fewer than half of the farms in this study achieved this, by comparison, only 20% of farms studied in England and Wales are profitable at this stage. Interestingly, three farms move into a loss-making situation at the level of third contributions.

This indicates that for two farms, their fixed costs are so high they outweigh the public payments contribution to the business.

Profitability was heavily influenced by the type of farming activity undertaken, with trends emerging between different sectors. Specialist sheep farms struggled to achieve profitability at the second contribution level, whereas both dairy farms easily achieved this. These figures are unsurprising and are supported by Farm Business Survey data in recent years[15]. Two of the three cattle farms with negative second contributions had invested in specialist cattle, which required significant quantities of concentrates for finishing and incurred high veterinary and medical costs.

Classification	Second Contributions	
	Positive Farms	Negative Farms
Mixed	4	4
Cattle-only	2	3
Sheep-only	0	2
Dairy	2	0

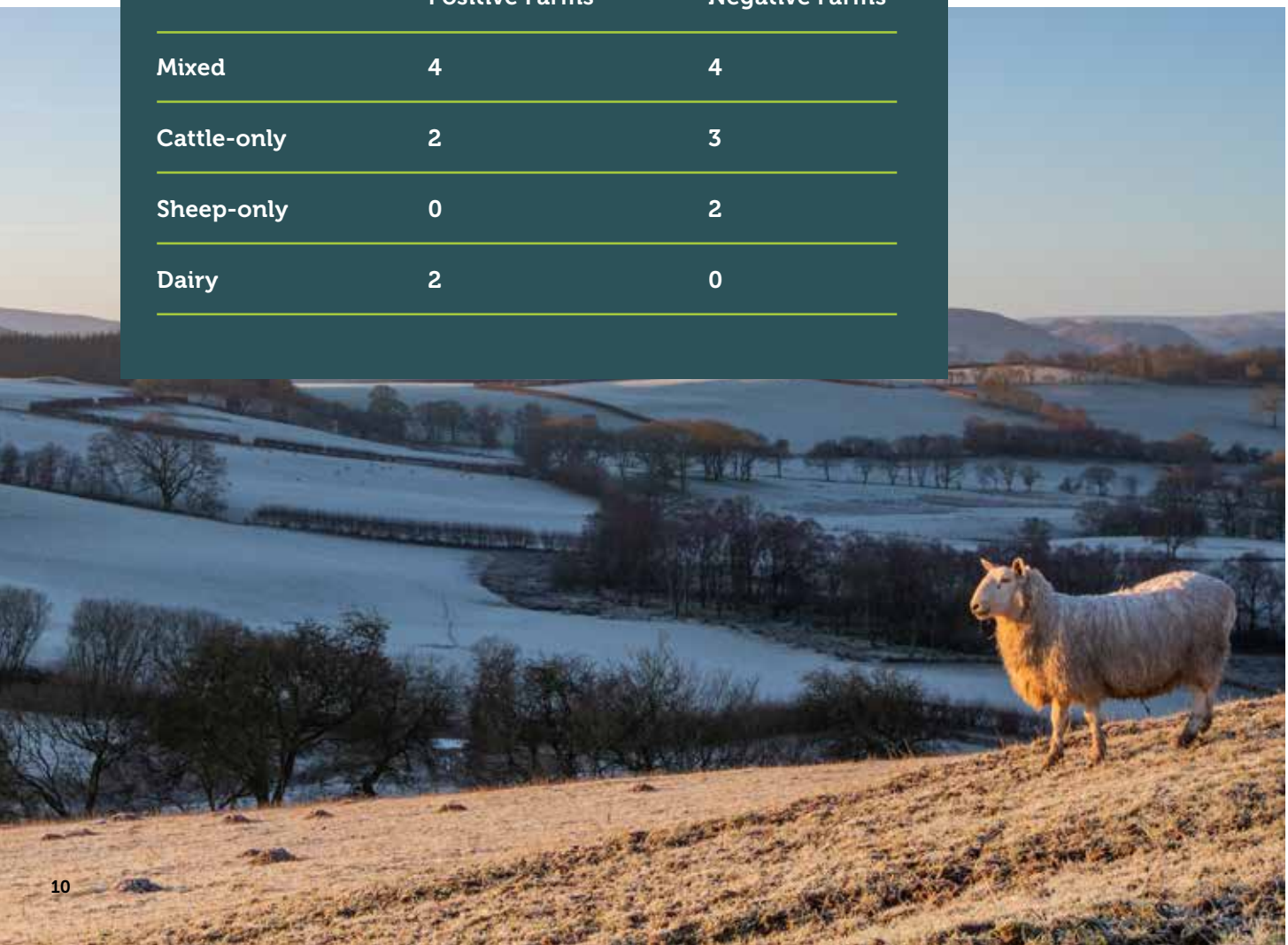


IMAGE BY ADOBE STOCK

Factors affecting farm profitability

Other factors were important in determining the profitability of many of the farms.

Support payments
Public support contributed to overall farm profitability, but its importance varied between farms. At the higher end of the scale, public support represented 75-80% of farm revenue, while some farms had much less reliance and some without any at all. On average, public support represented 43.8% of revenue for the farms involved in the study[16].

Size of business holding
The larger business units tended to have higher levels of profitability at all three stages and had the greatest potential for profit increase by moving to MSO. This is generally because larger units have a greater ability to capitalise on economies of scale and an increased ability to contain fixed costs as they are spread over a larger base. These findings support previous work, which indicates that farm size contributes to economic performance[17], with farm businesses in the top-performance quartile managing significantly larger holdings than their lower-performing counterparts.

Proportion of CVCs to total variable costs
The analysis has demonstrated that margins at the first contribution-level are impacted negatively by higher use of external inputs. Where CVCs exceed 85-90% of total variable costs, margins decline significantly.

Generally, when the proportion of CVCs exceeds 85% of total variable costs, every £1.00 of revenue generated above MSO incurs an additional cost of £7.50. This phenomenon is defined as leverage. This has been borne out in this study, where the farms with higher margins at the first contribution-level tend to keep CVCs below 80% of total variable costs. The range of values experienced varied widely within different farms, averaging £3.12 per £1.00 of revenue generation.

IMAGE BY ADOBE STOCK

Moving to MSO

If all farms moved to MSO, the overall average commercial returns would increase by an average of 35%. This would come with an average reduction in output of roughly 18% across the farms surveyed. However, it's important to note that this would not be uniform across all farm types.

Five of the 17 farms involved in the study were currently operating below MSO, meaning there is capacity to increase livestock production from current levels without extending beyond the naturally available resources.

> Significant sums of public money are being used to support businesses that would otherwise struggle to turn a profit.

Benefits to the rural economy

The cumulative net second contribution of the 17 study farms equals £82,294, representing an average of £4,840 per farm.

This figure is positive only because the two dairy farms in the study are significantly more profitable than the others. If regarded as a community, only eight farms in the study would make a positive contribution, whereas nine would have a negative impact.

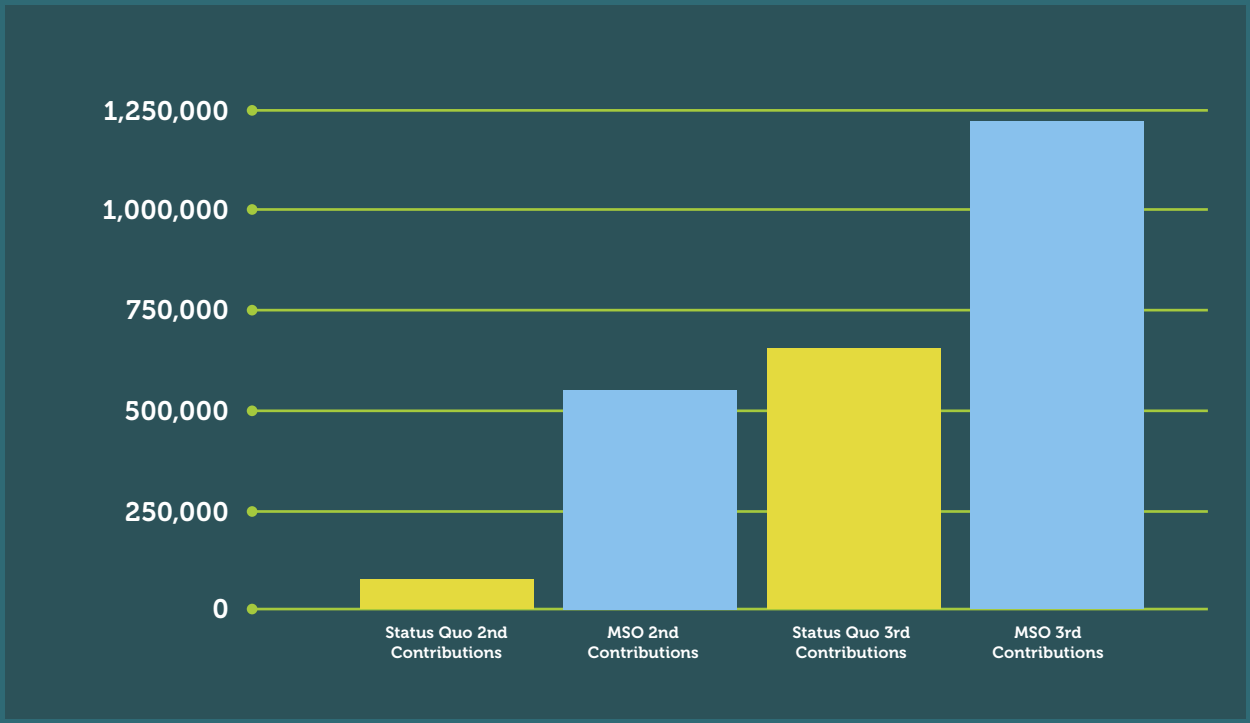
When public support payments are added, the situation changes dramatically, with total profitability moving to £651,058 and an average of £38,297 per farm. This demonstrates the current reliance on public support in maintaining farm viability for many farm businesses in Northern Ireland but also indicates that significant sums of public money are being used to support businesses that would otherwise struggle to turn a profit.

IMAGE BY ADOBE STOCK

Additionally, if all the farms were to move to MSO output levels, the cumulative contributions would increase further to £1,234,466, representing a further improvement of £592,408, and an increase in net profitability of 615%. In this case, the average profitability would increase to £72,616.

The move towards MSO thereby has a potentially transformational role to play in a pathway to improved profitability for the agriculture sector in Northern Ireland.

Cumulative net profit of study farms



Environmental benefits

The value of transitioning to farming systems that work within environmental limits extends far beyond the farm gate. When output is underpinned by a healthy, resilient natural resource base, as opposed to reliance on costly artificial inputs, it is expected that many environmental benefits will follow.

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Improved soil health
Agriculture's heavy reliance on external inputs has come at a cost to the health of our soils. Previous practices prioritising output at the expense of long-term soil health have degraded one of farming's most important assets. A growing body of evidence indicates that synthetic fertilisers negatively impact soil biology by suppressing nitrogen-fixing bacteria and reducing soil organic matter[18].

As organic matter decreases, soil structure changes, making soils less productive and resilient in the long term[19]. In livestock systems, overgrazing can have a profound effect on the health and vitality of soils. Overgrazing is recognised as one of the key contributors to accelerated soil degradation and erosion globally, which will directly affect food production[20].

A move towards MSO could be essential in reviving soil health by reducing the pressures on our soils from systems reliant on high external inputs.

Healthier freshwater ecosystems
Our rivers, lakes and streams are heavily impacted by agricultural runoff, the largest driver of poor water quality in Northern Ireland. Around 40% of nitrogen fertiliser is estimated to be lost to the environment, with much of it finding its way into our waterways.

A transition to MSO would help reduce these impacts significantly by reducing the need for artificial fertilisers to sustain production.

Improved air quality and reduced emissions
Ammonia emissions have a significant impact on the environment and public health. In Northern Ireland, agriculture is responsible for 97% of ammonia emissions[21].

On a UK scale, Northern Ireland is responsible for 12% of ammonia emissions despite only having 3% of the UK's population and 6% of its land area. Most of these emissions derive from organic manures and artificial fertilisers, which would be reduced considerably with a transition to MSO.

A move to MSO would result in reduced emissions due to decreased use of chemical fertilisers and a likely reduction in livestock output. In 2021, agriculture accounted for 80% of NI's total nitrous oxide emissions[22] and 75% of all methane emissions[23]. Most agricultural nitrous oxide emissions come from soils, particularly due to nitrogen fertiliser application, manure management and the leaching of manures into water courses[24].

Implications for food production

For most farm businesses, achieving MSO is predicated on a reduction in farm output. However, a fall in output is unlikely to occur in perpetuity. Removing artificial inputs as part of a transition to MSO may incur a dip in production at the outset, but evidence suggests this is temporary, and yields start to recover as soil health improves. As this occurs, the live weight of livestock supported per hectare also starts to increase.

This is supported by a growing body of evidence that shows that in many circumstances, high output levels can be achieved alongside significant reductions (and, in some cases, total removal) of artificial fertilisers. Recent work in Wales demonstrates that fertiliser-free upland livestock farms are attaining similar levels of output to farms using high levels of synthetic fertiliser, with no statistical difference in dry matter yields and grass production of 8,500kg per hectare. Research in the Republic of Ireland shows diverse multi-species swards can achieve comparable levels of dry matter yield with zero artificial fertilisers to perennial ryegrass receiving 36 kg of nitrogen per hectare[25]. These two examples are supported by a recent meta-analysis, which found that alternative practices could substitute synthetic nitrogen fertiliser without compromising yields[26].

Management for farm system health

A predominant focus on output has led to a preference for breeds that are more dependent on bought-in cereals and feed concentrates, with many being fed on grasses which require significant quantities of artificial fertiliser. For many livestock systems, a transition to MSO will result in a greater focus on utilising grass more effectively, with less need for artificial inputs. These systems will increasingly focus on feeding livestock on grass, with little to no feed concentrate or use of artificial fertilisers. A shift to MSO may require re-evaluating what breeds are best suited to the purpose, with a greater focus on breeds best suited to the local environment and less reliant on significant quantities of grain or concentrates. Although these may produce fewer young stock or less milk per livestock unit, they will deliver higher levels of profitability as they require fewer inputs to sustain them[27]. By choosing breeds suited to the natural environment and getting the most out of the grass, housing costs can be reduced, or removed entirely, since animals will be more suited to being kept outside for more extended periods. A move to MSO will also help secure longer grazing seasons as soil health recovers over time. Already, there are a growing number of examples of farmers finishing animals only on the grass with net margins higher than the national average[28] due in part to a significant reduction in variable production costs.

In dairy systems, where it is more challenging to eliminate CVCs than beef and sheep, it is still feasible and beneficial to focus on reducing the use of fertilisers and feed concentrates to increase the margin received per unit of milk produced. This will optimise the milk output per cow over the number of lactations in its lifetime - which will generally be higher.

The transition towards MSO can be supported by changing farm management practices to help restore and better utilise the natural resources available within the system. For example, carefully tailored grazing regimes could be adopted to restore soil health, reducing the need for artificial inputs, improving trafficability and reducing housing costs[29,30]. Green infrastructure can be strategically integrated around the farm to help provide shelter for livestock and build soil biology and structure[31]. Introducing more diverse herbs and grasses can negate the need for artificial nitrogen while improving livestock health and reducing the need for chemical parasite control[32].

A greater focus on soils can help build resilience to extreme weather events, such as flooding[33] and drought, which have wrought significant costs on the sector in recent years. Although strategies will be highly context-specific, the above examples demonstrate the important role that management can play in harnessing natural processes for improved system health and in attaining MSO.

IMAGE BY ADOBE STOCK

Conclusions & recommendations

The findings of this work highlight how effectively harnessing natural processes and operating within environmental limits can generate impressive economic gains.

It demonstrates how it can be applied in a Northern Irish context to help bolster the profitability of all farm enterprises, from small to large, upland to lowland, to beef, sheep and dairy.

The findings within this report show that it is possible to transition to farming systems that are environmentally and economically sound by strategically removing corrective variable costs and moving towards production that harnesses the natural assets available at a farm level. A widespread transition towards MSO will require significant changes in both farm practices and financial management. But in doing so, it can deliver more resilient, profitable food production, which secures increased benefits for rural communities and helps restore the environment.

Supporting a widespread transition to MSO requires the following:

A new approach to farm performance:
A new approach to benchmarking and farm accounting should be applied, which measures business success based on margin instead of productivity and output. This could be trialled at the College of Agriculture Food and Rural Enterprise before being rolled out at scale via farm advisors as part of a well-managed transition.

Agri-environment schemes that harness nature's potential:
DAERA's Farming with Nature package should support farmers adopting management practices that restore natural capital and ecosystem function to benefit farm businesses and long-term food production. Similarly, schemes which risk increasing reliance on CVCs, such as bought-in feed and fertiliser, should be avoided at all costs.

Strategies to reduce fixed costs:
Although fixed costs vary significantly from business to business, DAERA should look at creative ways of reducing them. For example, through supporting collaborative machinery-sharing arrangements or group schemes for capital investment. Similarly, schemes that risk increasing fixed costs at scale should be viewed cautiously.

Increased livestock resilience and diversity:
DAERA should encourage the adoption of more mixed livestock systems and re-introducing hardier breeds as part of a variable costs reduction strategy and to better utilise grass.

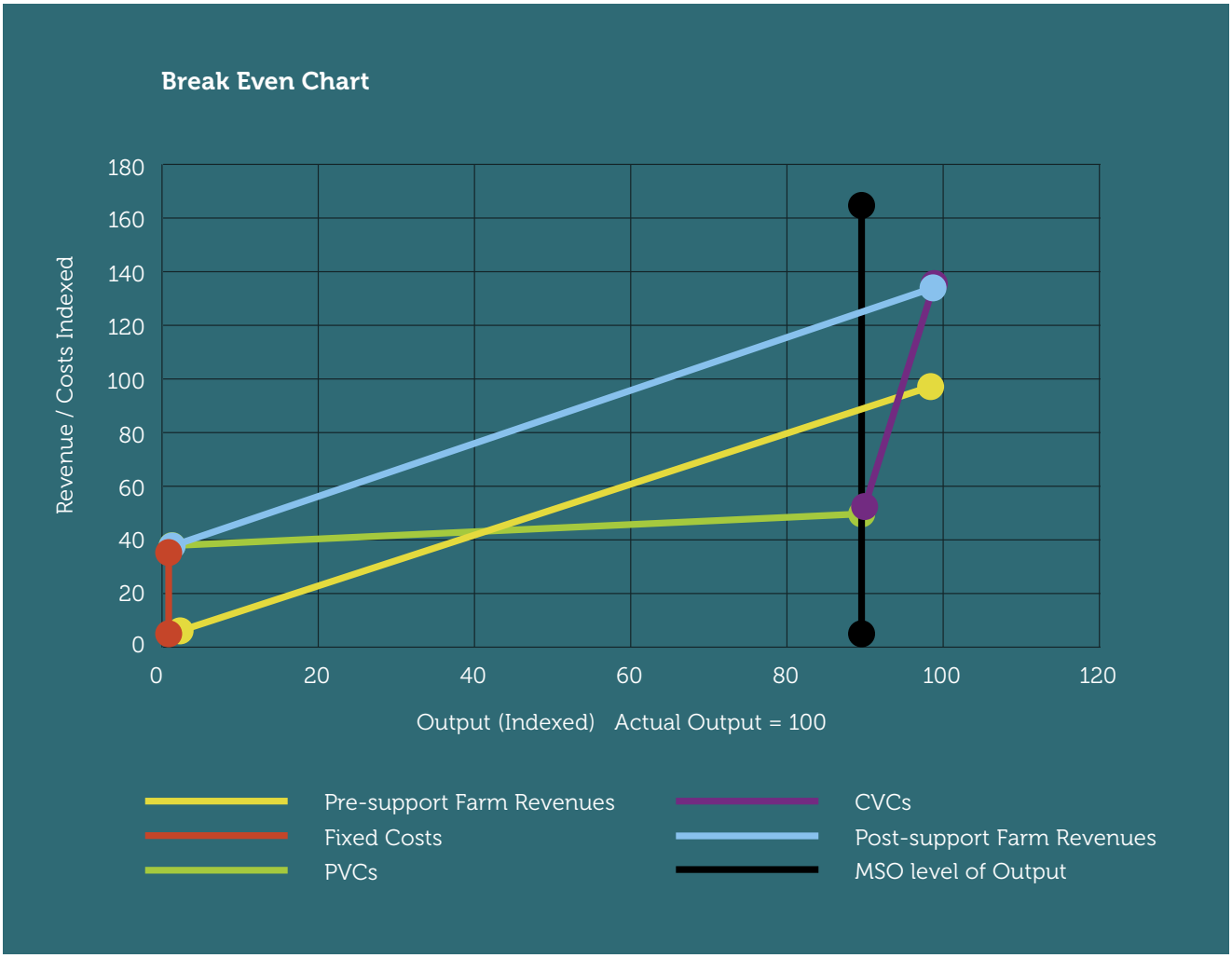
IMAGE BY ADOBE STOCK

Case Study 1: a large lowland beef farm

Achieving the Maximum Sustainable Output (MSO) would require a 9% reduction in output, representing a relatively small reduction compared to many other farm businesses. However, the farm is not profitable at the second or third contribution level due to heavy reliance on Corrective Variable Costs (CVCs), which are equal to 89% of the farm's pre-support revenues. The purchase of fertilisers and concentrates represented 60% of these, highlighting their impact on the potential profitability of the business.

The farm focuses on producing specialist cattle breeds, which rely heavily on concentrates for finishing. Changing cattle breed could result in a positive impact for the business in the long term. However, this would be costly and currently possible on the farm due to restrictions on cattle sales as a result of TB outbreaks locally. Dry matter production of 11,500 to 12,000 kg/Ha can be achieved on the farm, indicating that an all grass/silage herd could be sustained if an appropriate breed was used.

A transition to MSO can offer considerable commercial benefits. At present, every £1 of revenue generated beyond MSO is costing the business £9.74. A transition to MSO would transform this figure, moving the farm from loss to profit-making at the 2nd contribution. Fixed costs are not an issue for the farm, sitting at 39% of pre-support revenues in the top 20% of farms in the UK.



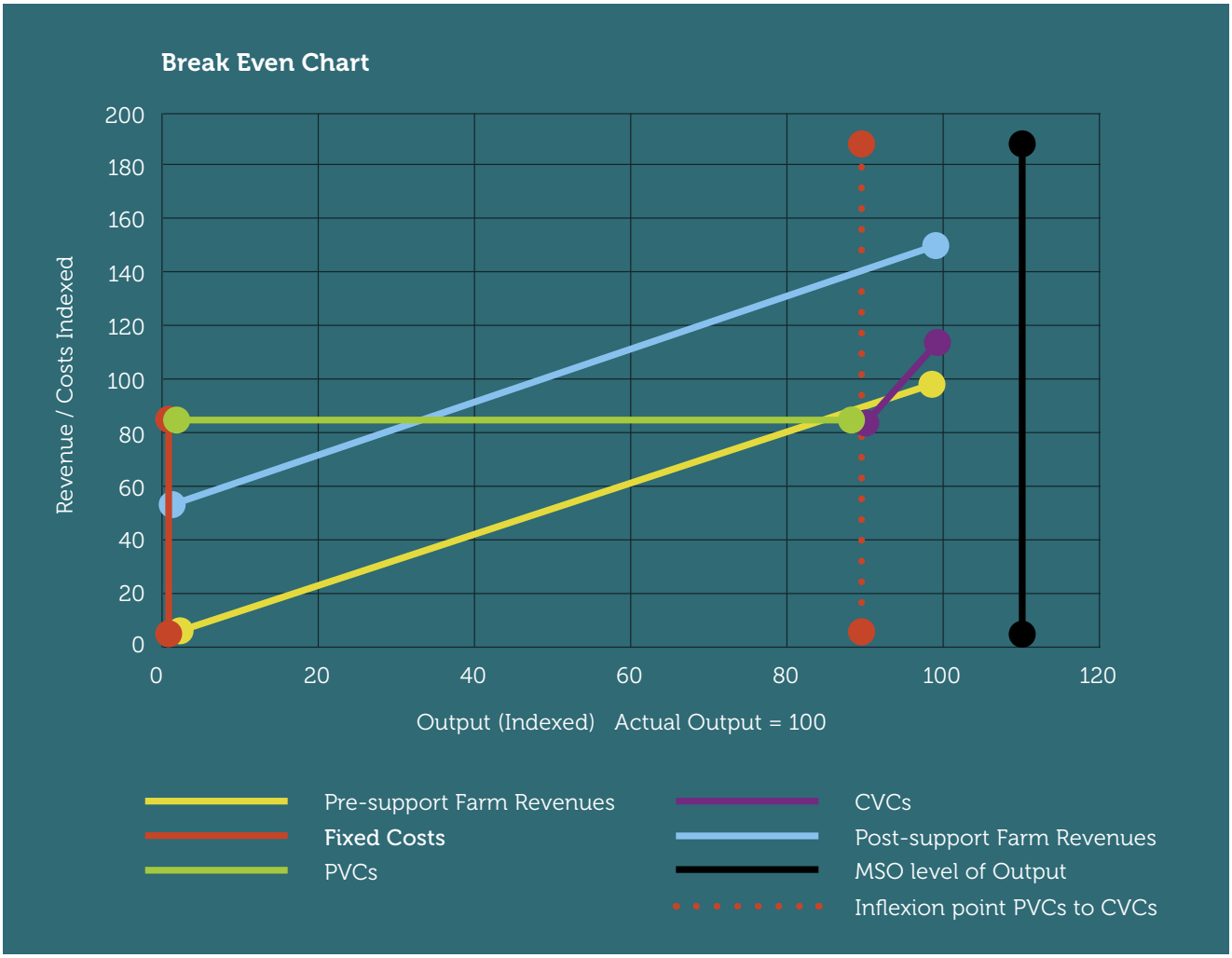
Case Study 2: a small lowland sheep farm

The Maximum Sustainable Output (MSO) level for this farm was at 110% of current levels of output, meaning it is currently operating below its MSO potential. In other words, the farm can expand output by 10% without exceeding the natural resources available on the farm. The farm did not make a positive second contribution covering its full fixed costs on pre-support revenues, but it did deliver a positive third contribution after support payments.

Despite operating below its MSO point, an important issue facing the business is Corrective Variable Costs (CVCs), equal to 24% of its pre-support revenues. Purchases of concentrates accounted for 31% of these CVCs.

Moving to MSO does offer considerable commercial benefits. Every £1 of revenue beyond the inflexion point currently costs £2.02. If fully achieved, moving to MSO would transform the second contribution margin from -14% to + 19%. Fixed cost levels on the farm are a particular problem at 86% of pre-support revenues.

Machinery repair costs account for 24% of these fixed costs. The farm could consider opportunities to phase out artificial fertiliser use and consider less costly alternative machinery arrangements. Opportunities for expansion could consider the introduction of cattle to bring output to the MSO point.

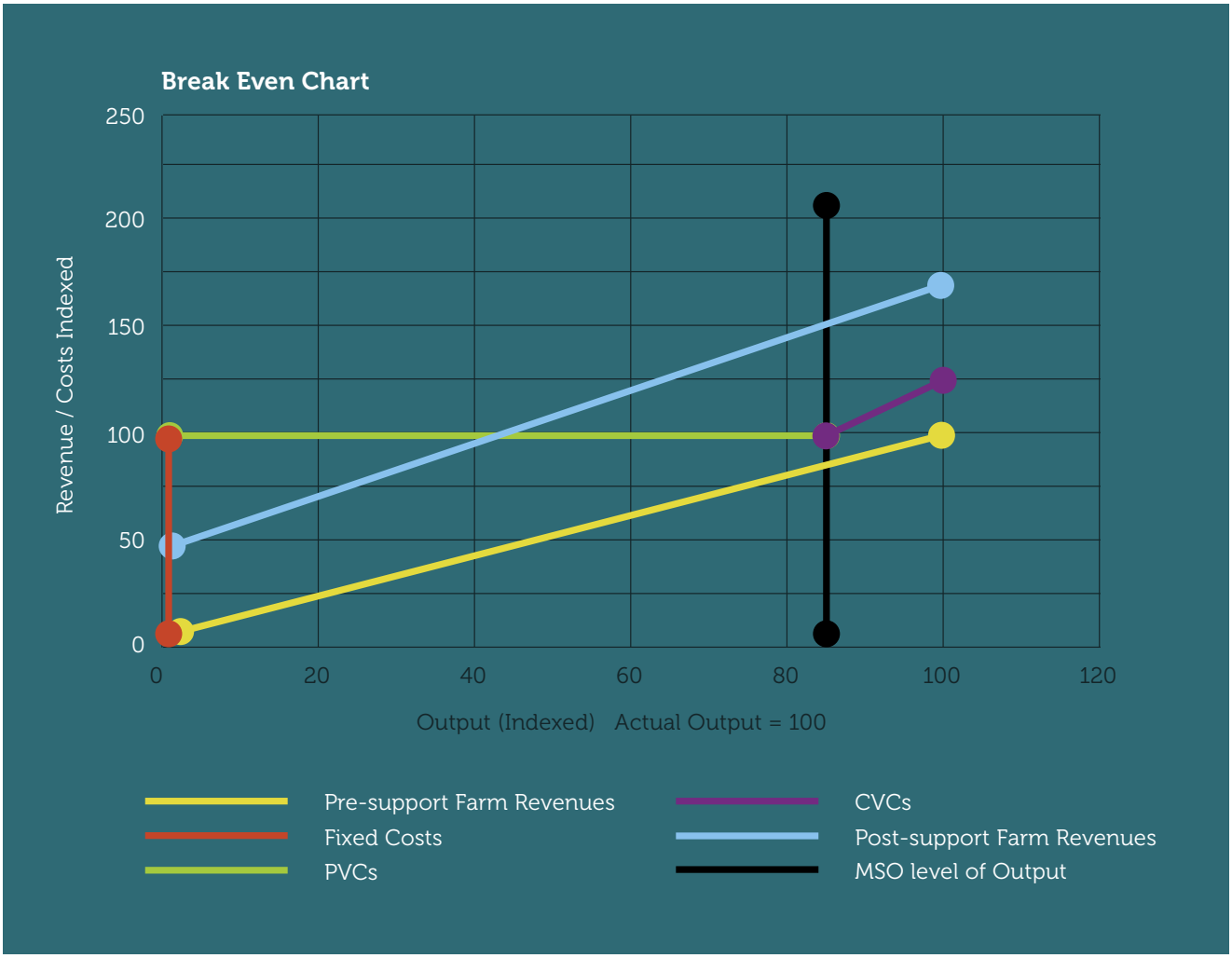


Case Study 3: a medium-sized mixed farm

The Maximum Sustainable Output (MSO) level for this farm was 82% of current output levels. The farm did not make a positive second contribution covering its full fixed costs on pre-support revenues, but it did deliver a positive third contribution after support payments.

The first critical issue facing this business is the fixed costs equivalent to 98% of its pre-support revenues. The second critical issue facing the business is Corrective Variable Costs (CVCs), equal to 25% of pre-support revenues. Purchases of concentrates accounted for 48% of these CVCs. The cattle on the farm are only grazed outside for four months, and there was concern about whether all year-round grazing outside was realistic. Bailing costs, at £10/bale, were regarded as high.

Moving to MSO does offer commercial benefits. Every £1 of revenue beyond the MSO point currently costs £1.39. Moving to MSO would improve the second contribution margin from -29% to -22% if fully achieved and with fixed costs unchanged. The average level of fixed costs in the UK is about 65% of pre-support revenues. A further 73% would be added to profits at this level, securing a positive second contribution.



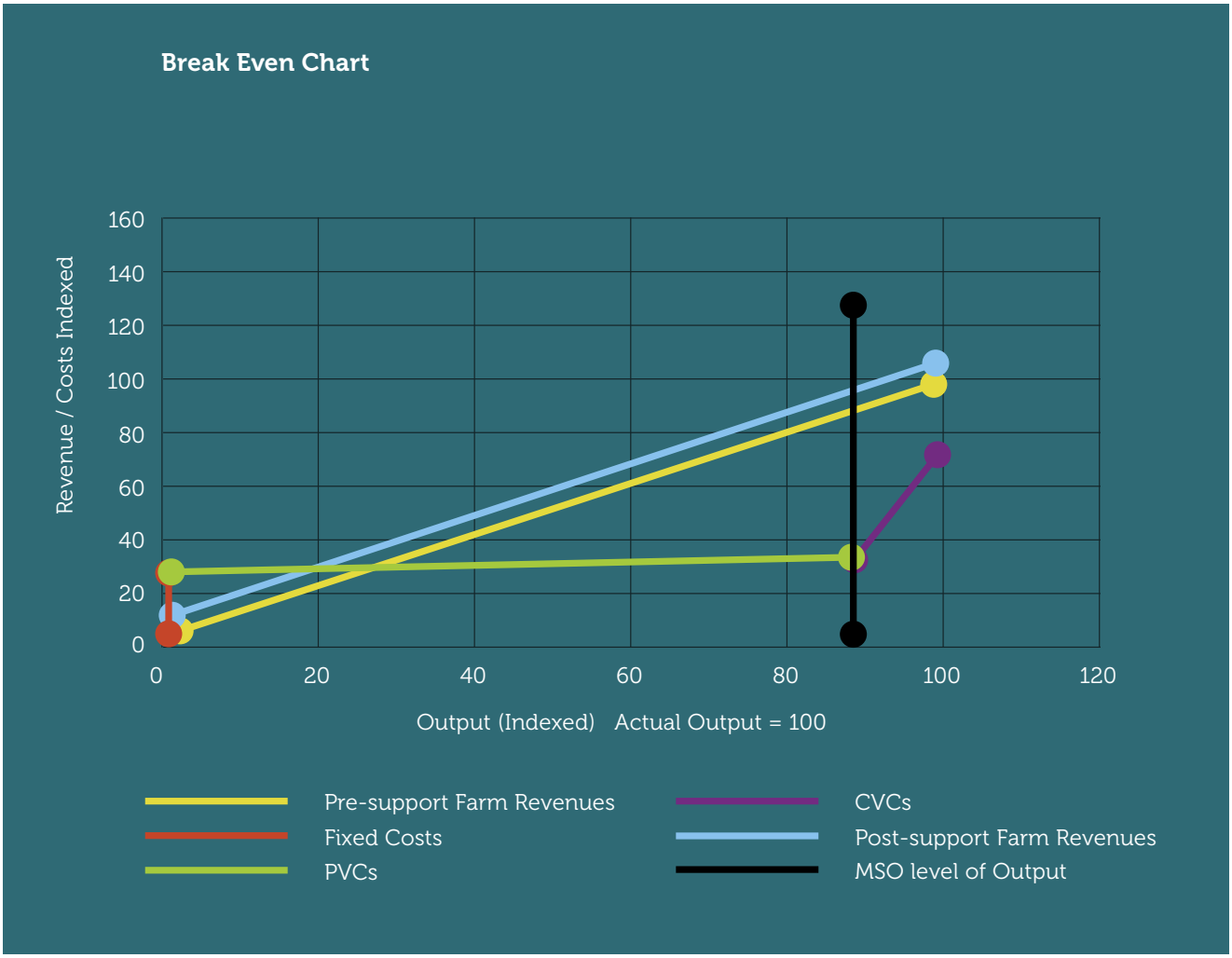
Case Study 4: a medium-sized dairy farm

The Maximum Sustainable Output (MSO) level for this farm was at 90% of current levels of output. The farm made a positive second contribution covering its full fixed costs on pre-support revenues, and it delivered an improved third contribution after support payments.

The critical issue facing the business is Corrective Variable Costs (CVCs), equivalent to 36% of its pre-support revenues. Purchases of fertilisers and concentrates accounted for 45% of these CVCs, and wintering costs represented a further 31%. However, there was a robust degree of profitability on the farm.

Moving to MSO does offer significant commercial benefits. Every £1 of revenue beyond the MSO point currently costs £3.47. If fully achieved, moving to MSO would improve the second contribution margin from -31% to 57%.

Fixed cost levels on the farm are not a problem. At 28% of pre-support revenues, which is particularly low, the farm would be in the UK's top 20% of farm businesses. The business's low fixed costs reflect not purchasing expensive machinery whenever contacting or hiring options are available.



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To read a fully referenced version of the report please visit:
https://www.nffn.org.uk/wp-content/uploads/2023/08/NFFN-Striking-the-Balance-Digital.pdf

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