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# FACTORY FARMING: WHO BENEFITS?

## How a ruinous system is kept afloat

## *The Four Myths and the Big Seven Input Providers of Factory Farming*

**"Agro-industrial systems, consisting of input-intensive monocultures and industrial-scale feedlots currently dominate farming landscapes. The uniformity at the heart of these systems and their reliance on chemical fertilizers, pesticides and preventive use of antibiotics, systematically yields negative outcomes and vulnerabilities. …**
**The environmental impacts, including water, soil and air pollution, of intensive livestock production are significant"**

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019

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# HOW A RUINOUS SYSTEM IS KEPT AFLOAT

## Executive Summary

Factory farming – industrial livestock production – is a key driver of multiple harms. Its crowded, stressful conditions can lead to the emergence, spread and amplification of pathogens, including zoonoses. It heightens the risk of further pandemics. It is dependent on the routine use of antimicrobials. Its huge demand for cereals and soy as animal feed leads to soil degradation, overuse and pollution of water, air pollution, biodiversity loss and deforestation. It places several of the UN Sustainable Development Goals out of reach and contributes to making it difficult to meeting the Paris Climate Agreement targets.

How did we get to the point where factory farming so dominates global animal agriculture?

This report examines a number of self-serving myths that help perpetuate factory farming. It then looks at the big input providers whose profitability is dependent on animal agriculture continuing to be industrial. They cling like leeches to factory farming.

### The twin myths that factory farming is necessary and efficient

A key myth is that factory farming is necessary to feed the growing world population. However, we already produce much more food than is needed to feed the world population of 9.7 billion people that is predicted for 2050. We produce sufficient food; the problem is that over half is lost or wasted in various ways.

Food is lost post-harvest and discarded by consumers and food businesses. Food is wasted by being used as biofuels and through overconsumption beyond people's nutritional requirements. Massive amounts of grain are lost through being fed to farmed animals who convert these crops very inefficiently into meat and milk. This totally undermines the myth that factory farming of animals is efficient; in fact it is profoundly inefficient and is a massive drain on the world's food supply. If all the above forms of food loss and waste were halved, an extra 3.55 billion people could be fed; this is more than the anticipated 1.8 billion increase in world population by 2050. Globally we do not need to produce more food. We simply need to use the food we produce more wisely.

### The myth of cheap food

The industry claims that factory farming gives us cheap food. Industrially produced meat and milk are indeed cheap at the supermarket checkout. But the low price of these products ignores the massive costs arising from the detrimental impact of industrial agriculture on the environment and human health. These various harmful impacts are referred to as 'negative externalities'. The costs arising from them are borne by third parties or society as a whole and are not included in the costs paid by farmers for inputs or the prices paid by consumers. In some cases the costs are borne by no-one and key resources such as soil and biodiversity are allowed to deteriorate thereby undermining the ability of future generations to feed themselves. Factory farmed food, with its immense environmental and health costs, does not remotely qualify as being cheap.

## The myth of Paris alignment

Some argue that pigs and poultry, the species most commonly associated with industrial farming, have low greenhouse gas (GHG) emissions and so are 'Paris aligned'. However, pig and poultry production entail substantial GHG emissions.

The International Panel on Climate Change and a range of research show that pigs and poultry produce much greater GHG emissions than plant-based foods.

**The role of the large meat producers – big meat -** in driving large-scale factory farming is to a degree well recognised. However, the role of the big input providers largely escapes attention. A substantial proportion of the power that shapes our food system lies with the large corporations that provide inputs for industrial agriculture such as livestock feed.

These companies' business model depends on agriculture being industrial. If we moved to regenerative agriculture, farmers would still be needed but the demand for the products of these input providers would fall very substantially. Accordingly, they endeavour to protect industrial agriculture from criticism.

These companies have immense political power which they use to influence policymakers and regulators and to obstruct reforms. They are able to shape the narratives that entrench the status quo, e.g. "industrial agriculture gives us cheap food and is vital to feed the world". Hilal Elver, former UN Special Rapporteur on the right to food, says: "Political will is needed to re-evaluate and challenge the vested interests, incentives and power relations that keep industrial agrochemical-dependent farming in place".

## The big grain traders

Four firms dominate the global trade in grain. Known as the ABCD companies, they comprise Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus. Recently COFCO International, a Chinese company, has also emerged as a major grain trader. A significant part of the soy and grain traded by the ABCD companies is destined to feed factory farmed animals and thus an important portion of their profits is dependent on the continued existence of a large industrial livestock sector. The ABCD companies came into the spotlight earlier this year when it was revealed that they were making massive profits at a time when an increasing number of people are facing hunger due to soaring food prices.

## The compound animal feed producers

Compound feed comprises energy-rich grains such as wheat, maize and barley; protein-rich oil meal such as soybean meal and sunflower meal; and vitamin and mineral supplements.

Compound animal feed producers provide feed for industrially farmed animals. In the EU just 23-33% of cereals are used as human food, with almost two thirds being used as animal feed. The global compound animal feed industry produced 1,171 million tonnes of feed in 2020. This is projected to rise to 1,379 million tonnes by 2027.

In the EU 67% of compound animal feed is used for pigs and poultry, with 28% being fed to cattle. Globally around 70% of compound feed is used in the pig and poultry sectors which in much of the world are highly industrial.

Worldwide 74% of compound feed consists of cereals and oilseed meals and cakes, mainly soybean meal. It is questionable for the compound feed sector to be garnering huge revenues from the use of cereals as animal feed when, as pointed out by the UN Food and Agriculture Organization (FAO), this reduces the amount of food energy and protein available for human consumption. This sector is undermining food security and pushing up the price of grains in the human food market.

With an annual revenue of over US$ 400 billion, it has the highest revenue of all the input sectors. Some of the main grain traders, such as Cargill and Archer Daniels Midland, also produce compound feed.

## The animal genetics sector

A small number of companies dominate the animal genetics sector, providing fast growing, high yielding animals many of whom experience painful, debilitating health and welfare problems. Suffering is built into the bodies, indeed into the DNA, of these animals. A significant portion of the profits of the farmed animal genetics sector are derived from the production of animals who are destined to suffer.

## The manufacturers of cages and crates

Providing cages and crates to confine factory farmed animals is a booming industry worth millions. And it's not just cages and crates. The catalogues of equipment manufacturers are packed with all the paraphernalia needed to operate large-scale factory farms.

Some EU manufacturers, such as Big Dutchman, provide barren battery cages for laying hens and cages for meat chickens even though the use of such cages is illegal in the EU. In our view it is unethical for an EU company to produce an animal housing system for sale outside the EU when that system has been banned in the EU on animal welfare grounds.

## The animal pharmaceuticals sector

Pharmaceuticals of course play a vital role in improving the health, productivity and longevity of farmed animals. However, they are also used to prop up factory farming by preventing and treating the diseases that are inevitable when animals are kept in crowded, stressful conditions.

This can be seen most clearly in the high use of antimicrobials in the industrial livestock sector. Industrial production is dependent on the routine use of antimicrobials which leads to antimicrobial resistance in animals which can then be transferred to people, so undermining some of the key medicines on which human health depends. Given the threats to human medicine posed by the high use of antimicrobials in livestock farming, it is disturbing to find the animal pharmaceuticals sector viewing the projected increase in the use of antimicrobials in the livestock sector as a welcome business opportunity. Clearly increased profits are more important to the sector than preserving the efficacy of antimicrobials for human health.

## The pesticides sector

At first sight, the pesticide and fertiliser sectors are not implicated in the industrial livestock sector. However, chemical pesticides and synthetic fertilisers are used to grow the 40% of global cereals and 76% of world soy production that are used to feed farmed animals. So a large part of the market for these agro-chemicals is dependent on the continuation of industrial livestock production.

The big pesticide manufacturers claim their products are necessary to feed the growing world population. However, the FAO points out that “extensive use of pesticides tends to reduce soil biodiversity, unbalance the ecosystem with an oversimplification of the species present and pave the way for pathogenic organisms to prevail”; in effect pesticides contribute to the very problem they are intended to address.

A report by Hilal Elver, former UN Special Rapporteur on the right to food, states that these problems are “exacerbated by a systematic denial, fuelled by the pesticide and agroindustry, of the magnitude of the damage inflicted by these chemicals, and aggressive, unethical marketing tactics remain unchallenged”. It adds: “The pesticide industry’s efforts to influence policymakers and regulators have obstructed reforms and paralysed global pesticide restrictions globally”.

## The fertilisers sector

Nitrogen fertilisers have substantial adverse effects on the environment, human health and climate change. Although nutrient inputs such as nitrogen are needed to grow crops, nutrient loss from agricultural areas is a major source of pollution. Crops only take up 30-60% of the reactive nitrogen in fertilisers; the rest is lost to water or the atmosphere. This unabsorbed nitrogen pollutes groundwater, rivers and marine ecosystems. It undermines biodiversity, impairs air quality and produces emissions of nitrous oxide, the most aggressive GHG.

Moreover, synthetic nitrogen fertilisers, while boosting yields in the short term, lead to declines in the amount of humus and organic matter in soils, to loss of soil biodiversity, and to soil acidification. These effects cause long-term damage to soil health and quality.

# FACTORY FARMING: WHO BENEFITS?
# How a ruinous system is kept afloat

## *The Four Myths*
## *and the Big Seven Input Providers of Factory Farming*

## Introduction

Factory farming – industrial livestock production – is a key driver of multiple harms. Its crowded, stressful conditions can lead to the emergence, spread and amplification of pathogens, including zoonoses.[1] [2] It heightens the risk of further pandemics.[3] [4] It routinely uses antimicrobials to prevent the diseases that would otherwise be inevitable when animals are confined in poor conditions.[5] This leads to antimicrobial resistance which can then be transferred to people.[6]

Industrial production's huge demand for cereals - e.g. wheat, maize and barley - as animal feed has been a key factor fuelling the intensification of crop production. This, with its use of monocultures and agro-chemicals, has led to soil degradation,[7] [8] biodiversity loss,[9] overuse and pollution of water,[10] and air pollution.[11] In addition, 76% of global soy production is used as animal feed, mainly in the intensive pig and poultry sectors.[12] This is a key factor driving deforestation.

Industrial livestock production places several of the UN Sustainable Development Goals out of reach.[13] Current trends in global food systems will make it impossible to meet the Paris Agreement's 1.5°C target and difficult even to realise the 2°C target.[14]

Factory farming is also responsible for very poor animal welfare. Animals are confined in cages or crates or in overcrowded, barren pens or sheds. Some are kept hungry for prolonged periods. Many are subject to painful mutilations (this is the veterinary term) such as castration, tail docking, and beak trimming; usually these are carried out without any pain relief. Also, many have been genetically selected for excessively fast growth, high yields or large litters leading to a wide array of painful health problems.

### How does so harmful and inhumane a system manage to survive?

How did we get to the point where in much of the world factory farming so dominates animal agriculture? A combination of self-serving myths and powerful vested interests are at play here.

The opening lines of the programme *Chernobyl* resonate here:

"What is the cost of lies? It's not that we'll mistake them for the truth. The real danger is that if we hear enough lies, then we no longer recognise the truth at all."

So what are the lies, half-truths and obfuscations that prop up factory farming?

## The twin myths of necessity and efficiency

A key factor that drives current food policy is the assumption that food production must increase by around 60% by 2050 to feed the growing world population and accordingly that further industrialisation of livestock production is essential. For example the International Feed Industry Federation states that in 2050 "the need for food will be 60% higher than today".[15] Boehringer Ingelheim, one of the world's largest animal pharmaceutical companies, states that by 2050 "the demand for animal protein is expected to increase by 70 percent".[16]

However, estimates of the number of people that could be fed from current food production vary from 11.5 billion to around 16 billion.[17] [18] [19] We produce sufficient food; the problem is that over half is lost or wasted in various ways.

***Losses and waste post-harvest and by consumers and food businesses***
A report by the High Level Panel of Experts on Food Security and Nutrition (HLPE) states that worldwide 25% of food calories are lost or wasted post-harvest or by being discarded by consumers or food businesses. If such loss and waste could be halved, an extra 1.4 billion people could be fed.[20]

In fact this is a cautious figure. In 2021 the United Nations (UN) calculated that 31% of food is lost or wasted. The UN stated: "Globally, around 14 percent of food produced is lost between harvest and retail. Significant quantities are also wasted in retail and at the consumption level. An estimated 17 percent of total global food production is wasted (11 percent in households, 5 percent in food service and 2 percent in retail). Food that is lost and wasted accounts for 38 percent of total energy usage in the global food system."[21]

***Losses from feeding human-edible cereals to farm animals***
Animals convert cereals very inefficiently into meat and milk. Calculations based on two studies indicate that for every 100 calories fed to animals in the form of human-edible crops, we receive just 30 calories in the form of meat and dairy products.[22] [23]

A report by the United Nations Environment Programme (UNEP) suggests that the conversion rate may be even lower.[24] It estimates that a kilo of cereals provides six times as many calories if eaten directly by people than if it is fed to livestock. This indicates that for every 100 calories of human-edible crops fed to animals, we receive just 17 calories in the form of meat and dairy products.

More recent studies calculate that for meat the conversion efficiency is even poorer than the 17-30% indicated by the above studies. Cassidy *et al*. (2013) have calculated calorie and protein conversion rates for different types of animal products when human-edible grain is fed to animals.[25] They conclude that for every 100 calories of grain fed to animals, we get only about 40 new calories of milk, 22 calories of eggs, 12 of chicken, 10 of pork, or 3 of beef.

Regarding the conversion of grain protein into meat protein, Cassidy *et al*. report that for every 100 grams of grain protein fed to animals, we get only about 43 new grams of protein in milk, 35 in eggs, 40 in chicken, 10 in pork, or five in beef.

**Table 1: Livestock conversion efficiencies of human-edible grain in calories and protein**

| | Dairy | Eggs | Chicken | Pork | Beef |
|---|---|---|---|---|---|
| **Calorie conversion efficiency (%)** | 40 | 22 | 12 | 10 | 3 |
| **Protein conversion efficiency (%)** | 43 | 35 | 40 | 10 | 5 |

Source: Cassidy *et al.*, 2013 [26]

Staggeringly inefficient

Experts describe the use of cereals to feed animals as "staggeringly inefficient",[27] "colossally inefficient"[28] and "a very inefficient use of land to produce food".[29] The European Commission's Joint Research Centre has said that the "use of highly productive croplands to produce animal feedstuffs … represents a net drain on the world's potential food supply".[30]

The UN Food and Agriculture Organization (FAO) has said "When livestock are raised in intensive systems, they convert carbohydrates and protein that might otherwise be eaten directly by humans and use them to produce a smaller quantity of energy and protein. In these situations, livestock can be said to reduce the food balance".[31] The FAO warns that further use of cereals as animal feed could threaten food security by reducing the grain available for human consumption.[32]

UNEP's 2022 GAP Emissions Report states that "more efficient use of resource is essential to fight food insecurity and malnutrition … Reducing the use of much of the world's grain production to feed animals and producing more food for direct human consumption can significantly contribute to this objective".[33]

The very poor conversion of human-edible cereals into meat and milk totally undermines the myth that factory farming of animals is efficient; in fact it is profoundly inefficient and is a massive drain on the world's food supply.

How many more people could be fed if use of cereals as animal feed were halved?

UNEP calculates that the cereals which, on a business-as-usual basis, are expected to be fed to livestock by 2050, could, if they were instead used to feed people directly, provide the necessary food energy for over 3.5 billion people.[34] If a target were adopted of halving the use of cereals for feed, an extra 1.75 billion people could be fed each year.

Another study produces a similar figure. It calculates that shifting the crop calories used for animal feed and other uses (biofuels and other industrial uses) to direct human consumption could potentially feed an additional ~ 4 billion people annually.[35]

***Use of grain as biofuels***

Globally, 10% of all grain is turned into biofuels.[36] A Danish climate think tank, Concito, calculates that if the crops used as biofuels in the EU were instead used for human consumption, an extra 150 million people could be fed each year.[37] A recent calculation suggests that if the crops used globally as biofuels were instead used to feed people, an extra 1.9 billion people could be fed.[38]

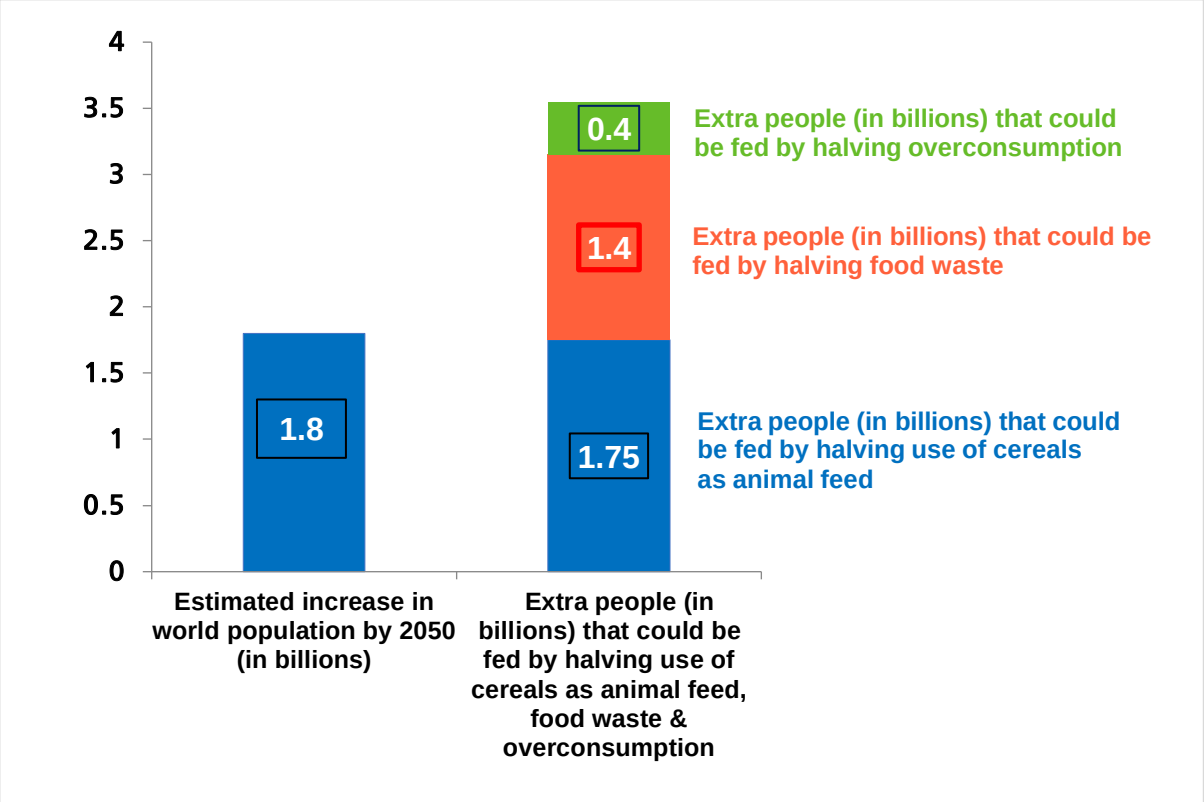
### *Overconsumption*

Alexander *et al*. (2017) calculate that 2.9 EJ (exajoules) are lost each year through overconsumption i.e. consumption in excess of nutritional requirements.[39] An extra 400 million people could be fed if such overconsumption was halved.

### Halving all forms of food loss and waste

If all the above steps were taken (i.e. if all forms of food loss and waste were halved), an extra 3.55 billion people could be fed; this is more than the anticipated 1.8 billion increase in world population by 2050[40] [41] (see Figure 1). We do not need to produce large amounts of extra food; we simply need to use our food more wisely. This said, increased production is needed in certain regions such as sub-Saharan Africa and South Asia but this must be achieved in a genuinely sustainable manner.

## Figure 1. Feeding the 1.8 billion extra people anticipated by 2050




Based on data from: UNEP, 2009; Cassidy *et al.*, 2013, High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2014 & Alexander *et al.*, 2017

## *How the world's crop calories are used*

As indicated earlier, globally at least 25% of calories are lost or wasted post-harvest or at the retail, foodservice or consumer level.

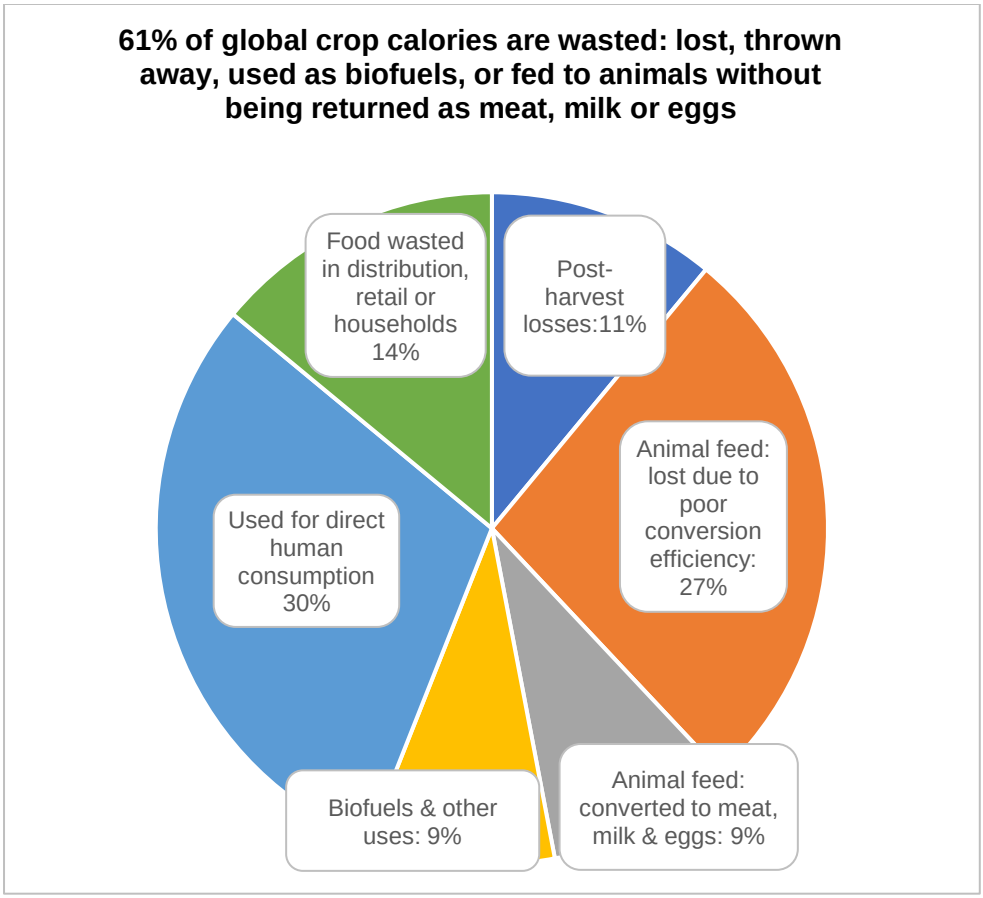
In addition, globally 36% of the world's grain is used as animal feed;[42] indeed some studies calculate the figure is even higher at 40%.[43] [44] However, as we have seen, at most only 17-30% of these calories are returned for human consumption as meat or milk. The effect of this is that 70-83% of the 36% of the world's crop calories that are used as animal feed are wasted; they produce no

food for humans. This means that 25-30% (70-83% of 36%) of the world's crop calories are being wasted by being fed to animals; the below Figure uses an approximate mid-point of 27%.
The figures used in the previous paragraph – and hence in Figure 2 – are very cautious in two respects:

- As indicated above, recent studies report that more than 36% of global crop calories are used as animal feed
- Cassidy *et al*. (2013) calculate that less than 17-30% of the calories fed to animals in the form of human-edible cereals are returned for human consumption as meat or milk. They state that only 12% of the global crop calories fed to animals contribute to the human diet (as meat and other animal products).

Figure 2 shows how the world's crop calories are used. Our calculation that 61% of global crop calories are lost or wasted in various ways is similar to that produced by a Chatham House report.[45] This states: "Once post-harvest losses, processing, livestock, consumer waste and overeating are included, losses for the global food system exceed 60 per cent of calories produced".

## Figure 2: Use - and waste - of calories produced by world's crops




Based on data from UNEP, 2009; Lundqvist *et al.*, 2008; HLPE report 8, 2014; & Cassidy *et al.*, 2013

Note: The HLPE calculates that 25% of global crop calories are lost or wasted. It is difficult to allocate these as between post-harvest losses and food wasted by consumers and food businesses. Figure 2 follows the division used by Lundqvist *et al.* who allocated 11% to post-harvest losses and 14% to food wasted by consumers and food businesses.

## The myth of cheap food

We are also told factory farming gives us cheap food. Industrially produced meat and milk are indeed cheap at the supermarket checkout. But the low price of these products is achieved only by an economic sleight of hand. We have devised a distorting economics which takes account of some costs such as housing and feeding animals, but ignores others including the detrimental impact of industrial agriculture on the environment and human health.

This problem has been recognised by the FAO which has said: “In many countries there is a worrying disconnect between the retail price of food and the true cost of its production. As a consequence, food produced at great environmental cost in the form of greenhouse gas emissions, water pollution, air pollution, and habitat destruction, can appear to be cheaper than more sustainably produced alternatives.”[46]

These various detrimental impacts are referred to as “negative externalities”. They represent a market failure as the costs associated with them are borne by third parties or society as a whole and are not included in the costs paid by farmers or the prices paid by consumers. In some cases the costs are borne by no-one and key resources such as soil and biodiversity are allowed to deteriorate thereby undermining the ability of future generations to feed themselves.

The negative externalities of our food system are immense. A range of studies have calculated the massive costs that arise from these problems.[47] [48] [49] [50] [51] The UN states: “the hidden environmental, health and economic costs of the food system are estimated at almost USD12 trillion a year and are expected to rise to USD16 trillion a year by 2050.”[52]

An editorial in the journal *Nature* stated that the global “food industry, especially, bears responsibility for the fact that 680 million people are obese, but it is largely governments and their citizens who have to pick up the costs of treatment.

“When industrial-scale farms draw copious quantities of water to irrigate crops, again it is taxpayers who foot the bill for the water scarcity that can follow. It’s the same for agrochemicals and their effects on the health of people and ecosystems. Governments find themselves shouldering the costs of biodiversity loss, and mopping up agriculture’s contribution to greenhouse-gas emissions.”[53]

An OECD report found that without action to stem antimicrobial resistance, 2.4 million people could die from superbug infections in Europe, North America and Australia between 2015-2050.[54] In the 33 countries examined in the report, infections with resistant microorganisms could in the next 30 years cost up to US$ 3.5 billion per year.

A report by the FAO examines the costs arising from diet-related health problems and GHG emissions.[55] The report calculates that on a business-as-usual basis, global diet-related health costs linked to non-communicable diseases (coronary heart disease, stroke, cancer, type-2 diabetes) will exceed $1,300 billion annually by 2030.

The report compares current dietary patterns with four healthy alternatives each including less meat and dairy. The alternative diets are flexitarian, pescatarian, vegetarian and vegan. The report states that the adoption of any of the four alternative healthy diets would reduce health costs worldwide by an average of 95% in 2030.

The global diet-related costs of GHG emissions associated with current dietary patterns are projected by the FAO report to exceed $1,700 billion annually by 2030. It states that in 2030 “any of the four alternative healthy diet patterns worldwide would reduce projected diet-related GHG emission by 41–74%”.

A recent study calculates that in the EU the costs directly attributable to pesticides - depolluting water, treating occupational disease and GHG emissions - are 2.5 times higher than the sector's profits.[56] But of course it is the taxpayer who picks up the bill for the costs, while the pesticide companies and their shareholders enjoy the profits.

A report by the Food and Land Use Coalition calculated the costs involved in (i) moving to healthy diets, (ii) moving to regenerative agriculture, and (iii) protecting and restoring nature.[57] In each case they calculate that the costs involved are hugely outweighed by the savings achieved in the form of reduced negative impacts on health and the environment and by the business opportunities generated by the transition to improved practices: see Table 2.

**Table 2: Economic Benefits of Moving to Healthy Diets & Regenerative Agriculture**: figures from Food and Land Use Coalition

| | Investment requirements by 2030 | Savings resulting from avoiding negative externalities by 2030 | Business opportunities by 2030 |
|---|---|---|---|
| Moving to healthy diets | $30 billion | $1280 billion | $2000 billion |
| Moving to regenerative agriculture | $35-40 billion | $1170 billion | $530 billion |
| Protecting & restoring nature | $45-65 billion | $895 billion | $200 billion |

## The myth of Paris Alignment

Some argue that pigs and poultry, the species most commonly associated with industrial farming, have low greenhouse gas (GHG) emissions and so are 'Paris aligned'. However, pig and poultry production entail very substantial GHG emissions.

New research carried out for World Animal Protection by Blonk Consultants[58] reports that GHG emissions:

- from broiler chicken production range from 1.8 to 2.4 kg $CO_2$eq/kg carcass weight chicken produced; this range increases from 2.6 to 5.8 kg $CO_2$eq/kg carcass weight when direct land use change emissions are included
- from pork production range from 4.1 to 4.8 kg $CO_2$eq/kg carcass weight pork produced; this range increases from 4.8 to 6.8 kg $CO_2$eq/kg carcass weight when direct land use change emissions are included.

The new research shows that generally most GHG emissions in pig and poultry production arise from the production of cereals and soy for feed, including the associated land use change.

Moreover, a report published in April 2022 by the U.S. Government's Environmental Protection Agency (EPA) states that high methane emissions arise from large-scale confined pig farms that

liquify their manure.[59] The EPA report states that methane emissions from pig manure increased by 44% between 1990 and 2010.

In its 2019 report on *Climate Change and Land Use,* the International Panel on Climate Change (IPCC) said: "Producing animal-sourced food (e.g. meat and dairy) emits larger amount of GHGs than growing crops, especially in intensive, industrial livestock systems. … Changing diets towards a lower share of animal-sourced food, once implemented at scale, reduces the need to raise livestock and changes crop production from animal feed to human food".

The IPCC report published in April 2022 states that "mitigation of agricultural $CH_4$ and $N_2O$ emissions is still constrained by … increasing demand for livestock products". It stresses that "diets high in plant protein and low in meat and dairy are associated with lower GHG emissions." Indeed, research shows that plant-based foods generally generate much lower emissions per unit of nutrition produced than meat and dairy.[60] [61]

Despite the fact that industrially farmed pigs and poultry produce substantial GHG emissions, we still hear claims that their emissions are low. For example, a technical note developed by all the major multinational development banks (MDBs) states that non-ruminant production – in effect primarily pigs and poultry – is universally Paris-aligned.[62]

## The Big Input Providers: Feeding factory farming – and dependent on it

The role of the large meat producers – Big Meat – in driving large-scale factory farming is to a degree well recognised. Corporations such as Tyson produce and slaughter huge numbers of pigs, cattle and poultry. Often these companies own some farms, but rely more heavily on contract farmers who raise animals which the company then slaughters and processes in its abattoirs. These companies often produce both fresh meat and processed meat products. Big meat producers also own warehouses and distribution facilities for delivering their products to retailers and foodservice operators.

While striving to maintain a benign public image, behind the scenes such companies work to defend factory farming from challenges. For example, Tyson, JBS and Hormel have all supported legal actions that contest California's law that prohibits the keeping of farm animals in cages and crates.

However, the role of the big input providers largely escapes attention. A substantial proportion of the power that shapes our food system lies with the huge multi-nationals who provide inputs for industrial agriculture such as livestock feed. These include:

- the producers of all the chemical pesticides, commercial seeds and fertilisers used to grow not just crops for human consumption, but also the vast amounts of cereals and soy used to feed factory farmed animals
- the manufacturers of animal pharmaceuticals including antimicrobials that are used to prop up the health of factory farmed animals
- the big breeding companies that provide fast growing broilers, high yielding cows and hens, and hyperprolific sows with huge litters
- the manufacturers of farm equipment including the cages and crates used to confine industrially farmed animals
- the big global grain traders and compound animal feed producers who provide the cereals and soy used to feed factory farmed animals.

These companies' business model depends on agriculture being industrial. If we moved to regenerative agriculture, farmers would still be needed but the demand for the products of these multi-nationals would fall very substantially. Accordingly, they endeavour to protect industrial

agriculture from criticism. Such companies wish not just to protect their markets but to keep on growing; hence their desire to see further expansion of the industrial model in the developing world. Indeed, the global South is the prime growth region for industrial agribusiness.[63]
Even those input providers with no apparent connection to industrial livestock – such as manufacturers of pesticides and fertilisers – are in fact dependent on it as 40% of global cereals[64] and 76% of the world's soy is used as animal feed.[65]

The major international grain traders also have a strong interest in the continued expansion of industrial livestock production as it is their products that are used by manufacturers of the compound animal feed that is widely used in the industrial sector.

The turnover of these companies is immense. A report by the major US bank *Citibank* shows that the global provision of compound animal feed is by far the largest of these sectors and is estimated to be worth over $400 billion per year.[66]

These companies have immense political power which they use to influence policymakers and regulators and to obstruct reforms. They are able to shape the narratives that entrench the status quo e.g. industrial agriculture gives us cheap food and is vital to feed the world. Hilal Elver, former UN Special Rapporteur on the right to food, says: "Political will is needed to re-evaluate and challenge the vested interests, incentives and power relations that keep industrial agrochemical-dependent farming in place".[67]

Mergers and acquisitions are common among the input providers, resulting in a frequently shifting array of leading players. For example, Monsanto has been acquired by Bayer, and Corteva was spun off from DowDuPont.

Although the principal business of a company may, for instance, be pesticides, it may also be involved in several other agribusiness activities. Cargill is best known as a grain trader but is also engaged in meat production, while also supplying burgers, prepared meats and egg products to the foodservice sector. In August 2022, Cargill and Continental Grain Co. bought Sanderson Farms, the third-biggest chicken producer in the U.S. for about $4.5 billion.[68]

A high degree of market concentration is a key aspect in most of the input sectors. Often just a handful of multi-nationals dominate the global market in a particular sector. IPES-Food reports that such concentration of power across the agri-food industry has made farmers increasingly reliant on a handful of suppliers and buyers, further squeezing their incomes and eroding their autonomy.[69]

**"The high and rapidly increasing levels of concentration in the agri-food sector reinforce the industrial food and farming model, exacerbating its social and environmental fallout and aggravating existing power imbalances."**

International Panel of Experts on Sustainable Food Systems, 2017
from report, *Too Big to Feed*

## 1. The Big Grain Traders

Four firms dominate the global trade in grain. Known as the ABCD companies, they comprise Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus. However, recently COFCO International, a Chinese company, has also emerged as a major grain trader. In China, COFCO is the major importer and exporter of soybean, wheat, corn, sugar and other agricultural products.[70]
The ABCD companies buy cereals and soy, shipping them to buyers across the globe. They own soybean crushing plants and storage facilities and invest heavily in ports and transport infrastructure. A sizeable proportion of their traded crops are destined for human consumption, but 40% of global cereals and 76% of the world's soy are used to feed farm animals, mainly in the industrial sectors. This indicates that a significant part of the crops traded by the ABCD companies are destined to feed factory farmed animals and thus that an important portion of their profits is dependent on the continued existence of a large industrial livestock sector.

Though starting off as grain traders in the 1800s and early 1900s, these companies have expanded and now trade in a large variety of agricultural commodities and provide a wide range of food ingredients. For example, in addition to their core grain business, Archer Daniels Midland provide sugar and sweeteners, fruit and tea extracts, flavour solutions, transportation services and industrial biomaterials.

The ABCD companies came into the spotlight earlier this year when it was revealed that they were making massive profits at a time when an increasing number of people are facing hunger due to soaring food prices.[71] Cargill is one of America's largest private companies with revenues of well over $100 billion per year.[72] The extended Cargill family controls about 87% of the company and is ranked as the eleventh richest family in the world, with a collective fortune of about $50 billion.[73] Twelve family members are billionaires as a result of the company's massive revenues.[74]

The ABCD companies' purchases of soy fuel soy production. All too often this entails deforestation, expansion into key ecosystems such as the Cerrado, and land grabbing, including the expropriation of the land of indigenous communities and peasant farmers.[75] This can lead to them being forced to migrate to other areas to seek work.

### Table 3: The world's major grain traders

| Company | Revenue |
|---|---|
| Cargill | **$165 billion** in fiscal year 1 June 2021 to 31 May 2022; this is a 23% increase from previous year [1][76] |
| ADM: Archer Daniels Midland | **$94 billion** for the twelve months ending 30 June 2022; this is a 25% increase from previous year [2][77] |
| Louis Dreyfus Company | **$36 billion in 2021 for 'Value Chain Segment'** comprising grain, oilseeds, juice, freight and storage [3][78] |
| Bunge | **$43 billion agribusiness net sales** in 2021 [4][79] |
| COFCO International | **$48 billion** in 2021[80] |

Note: Cargill and ADM do not provide revenue figures for their different divisions so the above figure relates to their total operations.

## Lobbying by the ABCD companies

Since 2011, the ABCD companies have spent $43.8 million on lobbying at the US federal level.[81] This includes $20.2 million over the past five years. Both Bunge and Cargill have lobbied on 91 pieces of legislation at the U.S. Congress over the last 15 years.

The sometimes questionable nature of the relationship between lobbyists and government can be seen in the high number of “revolving door” lobbyists (former public sector employees) used by most of the ABCD companies.[82] Since 1998 nearly two-thirds of Bunge’s lobbyists (65%) have been “revolving door” lobbyists. This type of lobbyist has comprised about half of the Cargill (48%) and Louis Dreyfus (50%) lobbying force since 1998 and 2011 respectively.

In addition to the above lobbying expenditure, grain traders and other input providers are often members of trade associations that lobby on behalf of their sector. Some are able to lobby without disclosing their donors; one such is the U.S. Chamber of Commerce (which includes, among others, Cargill and Merck). Between January 2010 and December 2016, for example, the U.S. Chamber of Commerce raised over $1 billion, but researchers were only able to determine the source of 7% of their funding.[83]

## 2. Compound animal feed producers

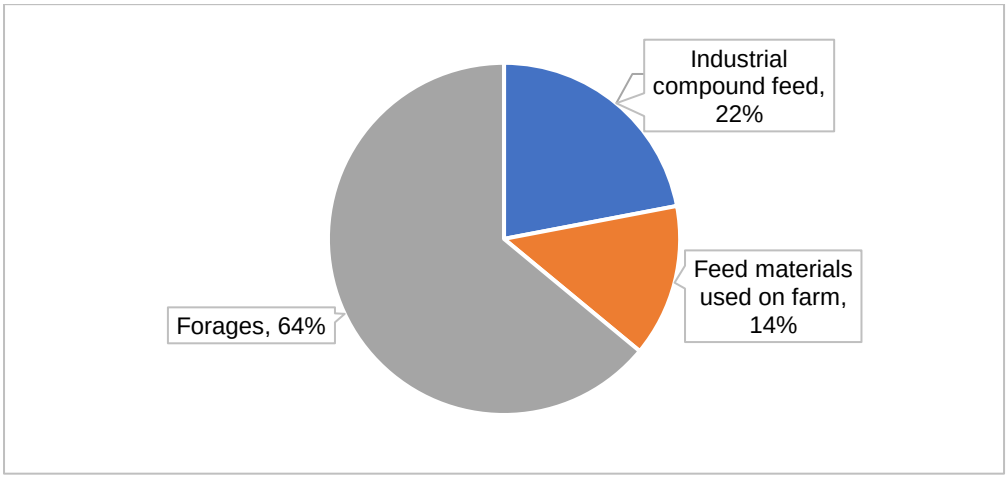
The value of the compound animal feed market eclipses all the other sectors that provide inputs for industrial livestock production.

### *The EU compound feed industry:*

**Industry data confirm the massive use of cereals as animal feed**
The Fédération Européenne des Fabricants d'Aliments Composés (FEFAC) represents the European compound feed industry. FEFAC data show that livestock feed in the EU is made up as follows:

- 22% (by weight) is compound industrial feed. This comprises energy-rich grains such as wheat, maize and barley; protein-rich oil meal such as soy meal and sunflower meal; and vitamin and mineral supplements
- 14% is feed materials used on the farm; these include cereals grown by farmers and feed bought in to mix with their crops
- 64% are forages; this is mainly fresh grass or grass conserved as hay or silage.

## Figure 3: Source of livestock feed in EU, 2021



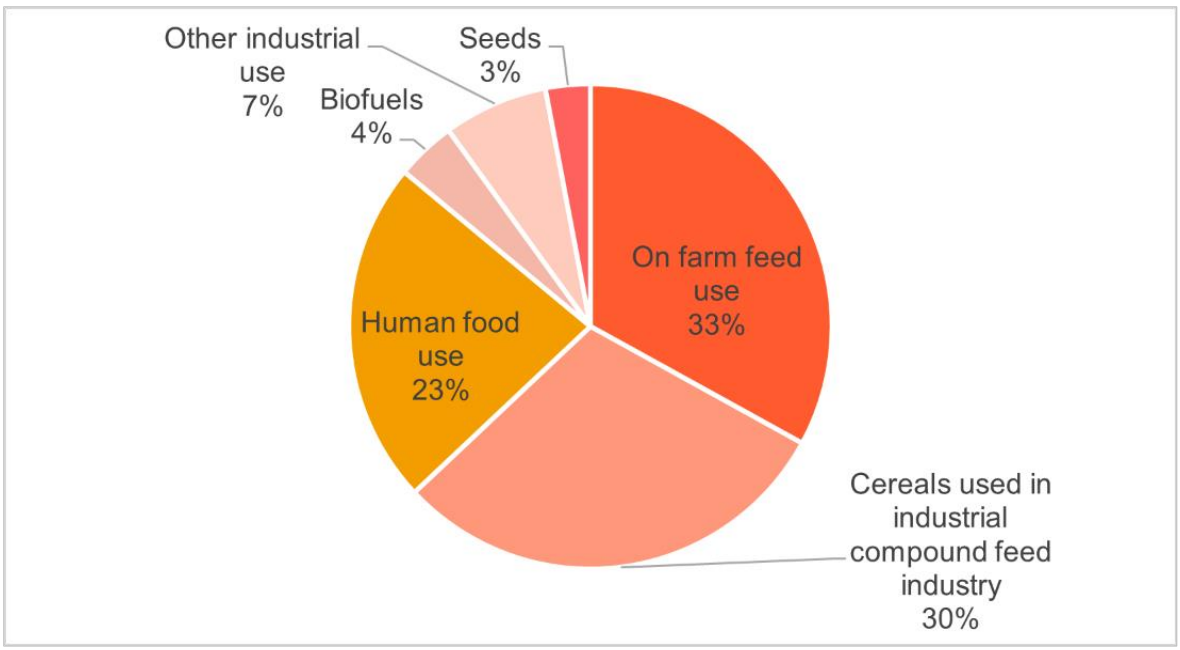

Source: FEFAC, 2021

FEFAC figures show that, in 2021, 150.6 million tonnes of compound feed was produced in the EU.[84] Of this, 67% is used for pigs and poultry, with 28% being fed to cattle.

51% of the compound feed produced in the EU in 2021 comprised cereals and 25% consisted of cakes and meals such as soybean meal.[85] The next largest component was co-products from the food and bioethanol industries at 12%.

FEFAC also provides a helpful breakdown of the use of cereals in the EU in 2020-21:

## Figure 4: Use of cereals in the EU in 2021




Source: FEFAC, 2021

The FEFAC figure showing 63% of cereals being used as animal feed is very close to European Commission data which show that almost two-thirds of EU cereals are used as animal feed.[86] In the year 2020-21 the EU used 162 million tonnes of cereals as animal feed.[87] The main cereals used as animal feed are wheat, barley and maize.[88]

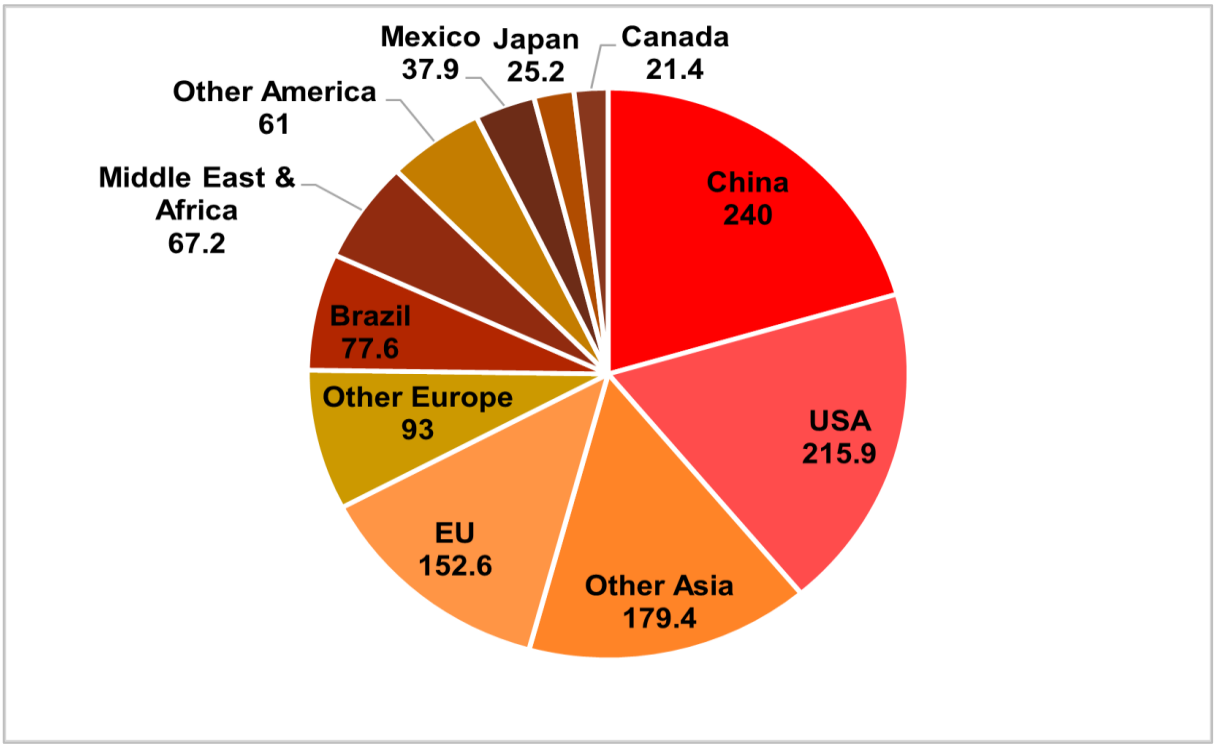
An extraordinary factor in FEFAC's data is that just 23% of EU cereals are used for human food. The European Commission provides a higher figure stating that one third of EU cereals are used for human consumption.[89]

The EU compound feed industry generates a massive income; in 2019 it had a turnover of €51 billion.[90]

### *The global compound feed industry:*

The EU industry is dwarfed by the global compound feed industry which in 2020 produced 1,171.1 million tonnes of feed.[91] The regional break-down of this is set out in Figure 5. The global industry is projected to grow to 1,379 million tonnes of feed by 2027.[92]

**Figure 5: Global production of compound feed in 2020: million tonnes**

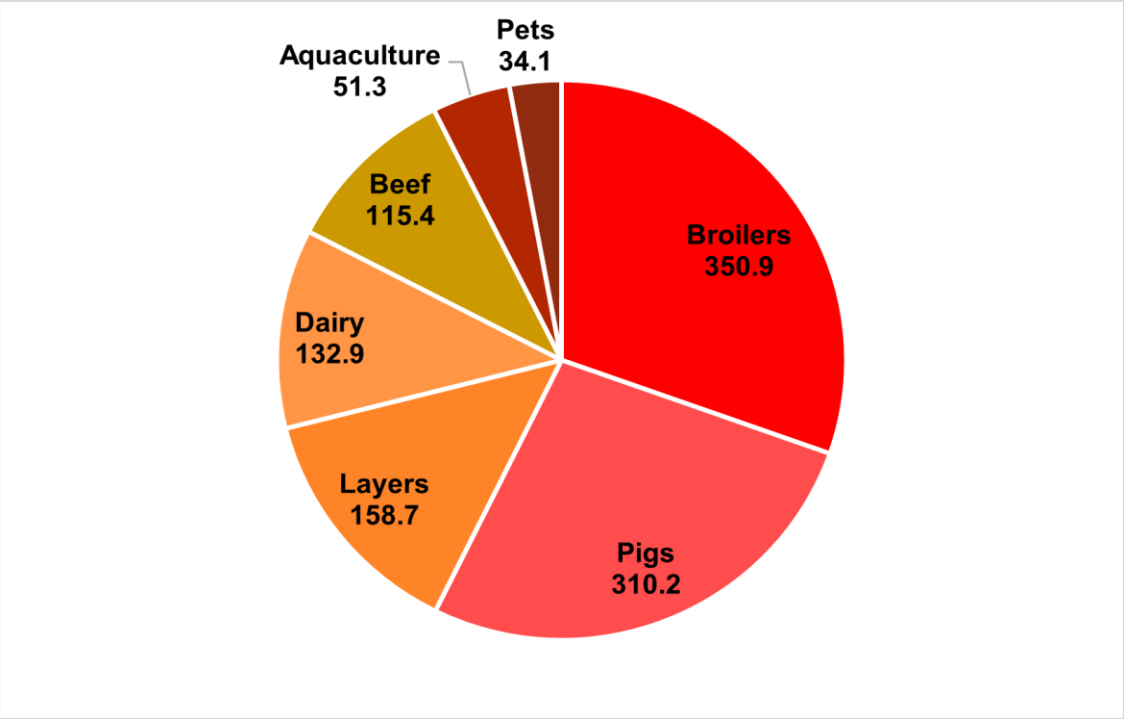



Source: International Feed Industry Federation

The International Feed Industry Federation states: "Global commercial feed manufacturing generates an estimated annual turnover of over US $400 billion".[93] A report by Mordor Intelligence indicates the value to be even higher at US$ 423 billion in 2021 and adds that it is projected to reach US$ 543 billion by 2027.[94] The largest market is Asia Pacific, with South America being the fastest growing.[95] A report by Mordor Intelligence states "the global compound feed industry is anticipated to witness substantial growth" in the years up to 2027, adding that "the compound food industry is enduring a thrilling phase of growth".[96]

The Alltech Agri-Food Outlook provides figures for global feed use per species.[97] These data are set out in Figure 6. The Alltech data show that globally 71% of compound feed is used in the pig and poultry sectors.[98] This is very close to FAO data which show that 69% of global feed grain is used in the pig and poultry sectors.[99]

### Figure 6: Global use of feed per species, 2021: million metric tonnes




Source: Alltech Agri-Food Outlook 2022

Table 4 details the ingredients used in the global compound feed industry.

### Table 4: Ingredients used in global compound feed industry, volume in thousand metric tonnes

| Ingredient | 2021 | 2027 (predicted) |
|---|---|---|
| Cereals | 519,642.2 | 680,949.4 |
| Cakes and meals | 299,567.2 | 359,123.7 |
| By-products | 193,766.4 | 217,955.0 |
| Supplements | 87,965.5 | 121,026.8 |
| Total | 1,100,945.4 | 1,379,054.9 |

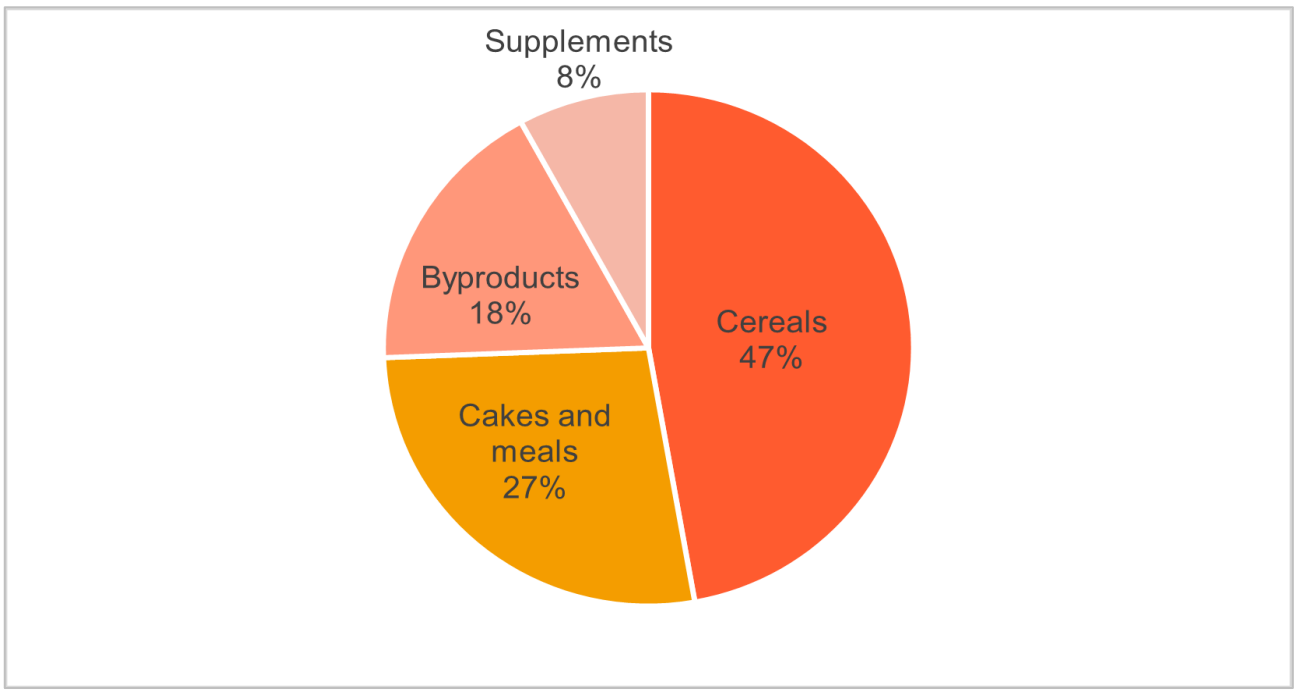
Source: Mordor Intelligence

Notes: Cakes and meals are the residues remaining after the removal of the greater parts of the oil from oilseeds such as soy. These residues are rich in protein.
Supplements include minerals, amino acids, enzymes, prebiotics and probiotics, and acidifiers.

Figure 7 sets out the proportions in which the ingredients of compound feed are used. This shows that globally compound feeds comprise 47% cereals and 27% oilseed cakes and meals such as soybean meal. These figures are very close to those in the EU where 51% of compound feed in 2021 comprised cereals and 25% consisted of cakes and meals.[100] The cakes and meals are mainly soybean meal as this makes up two-thirds of the total world output of protein feedstuffs, including all other major oil meals and fish meal.[101]

It is questionable for the compound feed sector to be garnering huge revenues from the use of cereals as animal feed when, as pointed out by the FAO, this reduces the amount of food energy and protein available for human consumption. This sector is undermining food security and pushing up the price of grains in the human food market.

**Figure 7: Global compound feed market: percentage share by ingredient**




Source: Mordor Intelligence

The compound feed sector is fragmented in nature with many small, medium, and big companies involved. The major companies operating in this sector include Cargill, New Hope Liuhe, Guangdong Haid Group, Charoen Pokphand Foods, Nutreco NV and Archer Daniels Midland.[102] Clearly some major grain traders are also involved in the production of compound feed.

The market is likely to become more consolidated in future with the main players engaged in mergers and acquisitions and also investing heavily in R&D in order to be able to launch innovative products.[103]

The market share of the main players is set out in Table 5.

## Table 5: Top players by market share in global compound feed market

| Company | Market share (%) in 2021 |
|---|---|
| Cargill | 7.93 |
| New Hope Liuhe | 2.59 |
| Guangdong Haid Group | 2.55 |
| Charoen Pokphand Foods | 0.97 |
| Nutreco NV | 0.89 |
| Archer Daniels Midland | 0.83 |
| Land O'Lakes Purina | 0.68 |
| De Hues | 0.62 |
| ForFarmers | 0.62 |
| Alltech Inc | 0.28 |
| Weston Milling Animal Nutrition | 0.23 |
| Guangdong Yeuhai Feed Group | 0.20 |
| Others | 81.61 |

Source: Mordor Intelligence

### Soaring prices and dwindling supplies of fertilisers - and rising and volatile prices of feed crops

Recent months have seen a huge rise in fertiliser prices coupled with falling supplies. This is one of the factors that have led to major increases in the price of feed crops such as wheat and maize. In light of price volatility in the cereals market and the inefficiency of using cereals as feed, a clear strategy should be developed for halving the global use of human-edible cereals as feed by 2030 and by reducing such use by 75% by 2035.

This would produce the following benefits:

***Making grain more accessible for the least well-off***
Reduced demand for cereals would lower prices, making these crops more affordable for people on low incomes.

***Reduced use of cereals as feed would produce huge environmental benefits***
It would lead to decreased use of arable land, water, energy and pesticides; lower GHG emissions; lower nitrogen and phosphorus surpluses (and hence less pollution); less deforestation and soil erosion.[104] [105] [106] [107]

***Reduced use of cereals as feed would free-up large amounts of arable land***
This would enhance the feasibility of moving to regenerative agriculture which in the Global North tends to produce lower yields per hectare than intensive crop production. However, such reduced yields would not be a crucial issue as much less grain would be needed if its use as animal feed were ended or substantially reduced. Moreover, moving to regenerative agriculture would restore soil quality and biodiversity and conserve water so ensuring a productive, healthy future for agriculture. This is crucial as the FAO points out that the current intensive model which seeks to maximise productivity leads to disruption of supporting ecosystem services and thus, says the FAO, "food production is seriously affected, the result being a vicious downward spiral".[108] In areas with low productivity, studies show that regenerative agriculture can boost productivity.[109] [110]

### What's the alternative?

Animals only make a positive contribution to food production when they convert materials we cannot consume into food we can eat. Animals should mainly be fed on grass, by-products, crop residues and unavoidable food waste.

Only feeding animals in this way would lead to a reduction of about 50% in global production and consumption of animal-based proteins. Reduced consumption of animal products must take place in OECD and other wealthy countries. Poor people in the Global South with low intakes of meat should be able to increase their consumption.

A global reduction in consumption of animal-source foods is essential if we are to meet the Paris climate targets and feed ourselves within planetary boundaries. Moreover, a decrease in the number of animals farmed would lower demand for cereals and soy as animal feed, so freeing up large amounts of arable land which would enable us to move to nature-positive regenerative agriculture. Also, reducing the number of animals farmed would make it feasible to rear animals to good welfare standards.

## 3. Animal genetics: the big breeding companies

A small number of companies dominate the market providing fast growing, high yielding animals many of whom experience painful, debilitating health and welfare problems. Suffering is built into the bodies of these animals.

### *Meat Chickens*

Traditionally, meat chickens – broilers – would take around 84 days to reach a slaughter weight of 2 kg. However, today's chickens have been bred to reach a slaughter weight of 2.2kg in just 35-38 days. Their legs, heart and circulatory system cannot properly support the rapidly growing body. As a result, globally billions of broilers suffer from painful leg disorders each year, while others succumb to heart abnormalities.[111] [112]

Shockingly, the major breeding companies continue to produce very fast growing broilers with an average daily weight gain of approximately 63g even though scientific research shows that many such fast-growing broilers suffer from serious health problems.[113]

Nor is this process necessarily at an end. Referring to the age at which broilers will reach a slaughter weight of 2 kg, the major U.S. bank Citibank states that it "is expected that this will come down to 22 days given the current trends in technology and the development of nutrition and genomics".[114]

**Table 6: Major Broiler Chicken Breeding Companies**

| Company | Turnover |
|---|---|
| Aviagen: owned by EW Group | US$ 670 million worldwide in 2021[115] |
| Cobb-Vantress; owned by Tyson Foods | US$ 660 million in 2021[116] |

### *Pigs*

Until a few decades ago, the average litter size of sows was nine, but genetic selection has now driven this up to 14 in many countries[117] [118] and to 17-18 in Denmark.[119] Large litter size is recognised as a significant cause of multiple welfare problems for both sows and piglets.[120] Piglet mortality increases with increasing litter size due to low birth weights, a high percentage of low viability piglets, more crushed piglets, and starvation caused by some piglets being unable to access a teat. [121] [122] [123] With large litter sizes, sows are at greater risk of prolonged, painful births.[124]

### Table 7: Major Pig Breeding Companies

| Company | Turnover |
|---|---|
| Genus plc: Their pig division is PIC – Pig Improvement Company | PIC revenue GBP 315.6 million in 2021[125] |
| Hendrix Genetics: Their pig division is Hypor | Zoominfo website states Hendrix Genetics' turnover is US$ 1 billion: NB this is for Hendrix Genetics as a whole[126] |
| Topigs Norsvin | Euros 209 million in 2021 [127] |

### *Egg-laying hens*

Hens have been bred to lay over 300 eggs a year – that is 15 times more than their ancestors. They have to draw on their own bone calcium to form eggshells. As a result many develop osteoporosis, making them susceptible to painful bone fractures.

### Table 8: Major Laying Hen Breeding Companies

| Company | Turnover |
|---|---|
| Hy-Line International (part of EW Group) | US$ 56 million in 2021[128] |
| Novogen (part of EW Group) | |
| Hendrix Genetics | Zoominfo website states Hendrix Genetics' turnover is US$ 1 billion: NB this is for Hendrix Genetics as a whole[129] |

As indicated in Tables 6 and 8 several of the world's leading poultry genetics companies (hens and broilers) are part of the EW Group. EW Group's net worth is US$5.1 billion.[130]

**What's the alternative?**

Animals should be bred so that their capacity for growth and to produce milk, eggs and offspring is properly balanced with their anatomy and metabolism, so enabling them to lead healthy lives.

## 4. Manufacturers of cages and crates

Providing cages and crates to confine factory farmed animals is a booming industry worth millions. And it's not just cages and crates. The catalogues of equipment manufacturers are packed with all the paraphernalia needed to operate large-scale factory farms. These firms provide the huge ventilation fans that are needed when thousands of animals are packed into overcrowded, windowless sheds. They also supply automated feeding equipment, automatic manure removal systems, and air scrubbers to tackle ammonia and dust emissions.

One company refers to its cages, crates and other equipment as "protein production systems".[131] And so the process of de-animalising the creatures who provide our food continues apace.

Big Dutchman, a German company, states it is "the world's leading provider of innovative equipment for modern egg, poultry and pig production". It adds: "Big Dutchman is the recognised market leader in the entire industry" and that it operates "across five continents and in more than 100 countries".[132] Big Dutchman had a turnover of €985 million in 2021; this has more than doubled since 2009.[133]

Big Dutchman is an EU company. The use of battery cages for egg-laying hens is prohibited in the EU. However, Big Dutchman manufactures battery cages for sale outside the EU.

Its website boasts that it has equipped Asia's largest egg-laying facility, located in China.[134] This comprises thirty closed poultry houses accommodating four million birds. The birds are kept in 18 layer and 12 rearing houses.

Big Dutchman states the cages "allow room for nine birds per cage, resulting in a cage surface area of 402 $cm^2$ per hen". In so small a space a hen cannot even stretch her wings. And in this tiny space, the hen lives out her life.

Even though the use of battery cages is prohibited in the EU, it is not illegal for these cages to be manufactured in the EU. However, in our view it is unethical for an EU company to produce an animal housing system for sale outside the EU when that system has been banned in the EU on animal welfare grounds.

Big Dutchman also produces cages for broilers (chickens used for meat production) even though the use of such cages is in effect prohibited in the EU. Council Directive 2007/43/EC provides, in Paragraph 3 of Annex I, that "All chickens shall have permanent access to litter which is dry and friable on the surface". As it is not feasible to provide litter in broiler cages, the use of such cages is in effect illegal in the EU.

However, Big Dutchman produces two versions of cages for broilers – the *Avi-Max transit* and the *Avi-Max sliding;*[135] [136] the Big Dutchman website refers to both as "broiler cages".[137] These are presumably for sale outside the EU.

Globally most broilers are housed in large sheds, usually with litter such as wood shavings on the floor. These systems are far from ideal, but they give the chickens at least some modest scope for movement. It is very troubling that an EU company is involved in spreading the use of cage systems to a sector that to date has largely not used them.

Two Italian companies, Tecno[138] and Valli[139] also produce barren battery cages for laying hens. Tecno is part of AGCO, a leading manufacturer of agricultural equipment.

### What's the alternative?

- Cages and crates should be phased out as they thwart many of animals' basic instincts: to roam, to forage, to explore;
- Animals should be kept in outdoor systems or, if they are housed, they should be kept in large barns with ample space, plenty of straw, natural light and effective ventilation;
- Husbandry systems must enable animals to express their natural behaviours;
- Genetic selection for fast growth or high yields should be avoided where this results in compromised welfare such as ill-health, pain or limits on behavioural expression;
- Systems should not be used if they require routine mutilations

## 5. Animal pharmaceuticals

The animal pharmaceuticals market was valued at $45 billion in 2020 and is likely to grow at a compound annual growth rate (CAGR) of 7.05% to reach $68 billion by 2026 due to the rise in the production of milk and meat, the growing frequency of zoonotic and foodborne disease, and the increase in pet ownership.[140] Some of the world's largest animal pharmaceutical companies are set out in Table 9.

### Table 9: World's Largest Animal Pharmaceutical Companies

| Company | Turnover in 2021 |
|---|---|
| **Zoetis** | **US$ 7.6 bn** (39% from farm animal products; 61% from companion animal products)[141] |
| **Merck Animal Health** | **US$ 5.5 bn** (59% from livestock products; 42% from companion animal products)[142] |
| **Elanco Animal Health** | **US$ 4.7 bn** (49% from livestock products; 49% from companion animal products)[143] |
| **Boehringer Ingelheim – Animal Health** | **EUR 4.7 bn**[144] |

Pharmaceuticals of course play a vital role in improving the health, productivity and longevity of farmed animals. However, they are also used to prop up factory farming by preventing and treating the diseases that are inevitable when animals are kept in crowded, stressful conditions.
This can be seen most clearly in the high use of antimicrobials in the industrial livestock sector. Industrial production is dependent on the routine use of antimicrobials which leads to antimicrobial resistance in animals. The World Health Organisation stresses that the high use of antimicrobials in farming contributes to the transfer of antimicrobial resistant bacteria to people, thereby undermining the treatment of serious human disease.[145]

Globally, around 70% of all antimicrobials are used in animals raised for food, mainly to prevent disease and to promote growth rather than to treat sick animals.[146] The global animal antibiotics and antimicrobials market achieved a revenue of $3 billion in 2021 and is forecast to grow at a CAGR of 5% between 2022 and 2030.[147]

It is widely recognised that the use of antimicrobials in livestock must be reduced to protect human medicines; indeed, the EU has prohibited the routine use of antimicrobials in farm animals and in particular has prohibited all prophylactic use of antimicrobials in groups of animals.[148]

Given the threats to human medicine posed by the high use of antimicrobials in livestock farming, it is disturbing to find the animal pharmaceuticals sector viewing the projected increase in the use of antimicrobials as a welcome business opportunity. A recent report on the antimicrobials market states: "It is expected that in the next seven years, the increase in demand for livestock products will have a positive impact on the global animal antibiotic and antimicrobial market".[149] The report continues: "The increase in the number of livestock is expected to further promote the market for antibiotics and antimicrobial agents for animals".

The manufacturers of farm animal antimicrobials clearly benefit from livestock production remaining highly intensive as there is generally a much higher use of antimicrobials per animal in the industrial sector than when animals are raised in good conditions. For example:

- Research shows that weaning of piglets at 22-25 days of age, which is common in industrial pig farming, results in 15-20 times higher use of antimicrobials than later weaning at around 35 days of age or more.[150] [151]
- Dutch data show that standard fast-growing meat chickens receive substantially more antimicrobials per bird than slower-growing birds.[152]
- A Joint Scientific Opinion by the European Medicines Agency (EMA) and the European Food Safety Authority (EFSA) states that in intensive veal farms "the disease risk is high, and there is very high on-farm use of antimicrobial agents."[153]

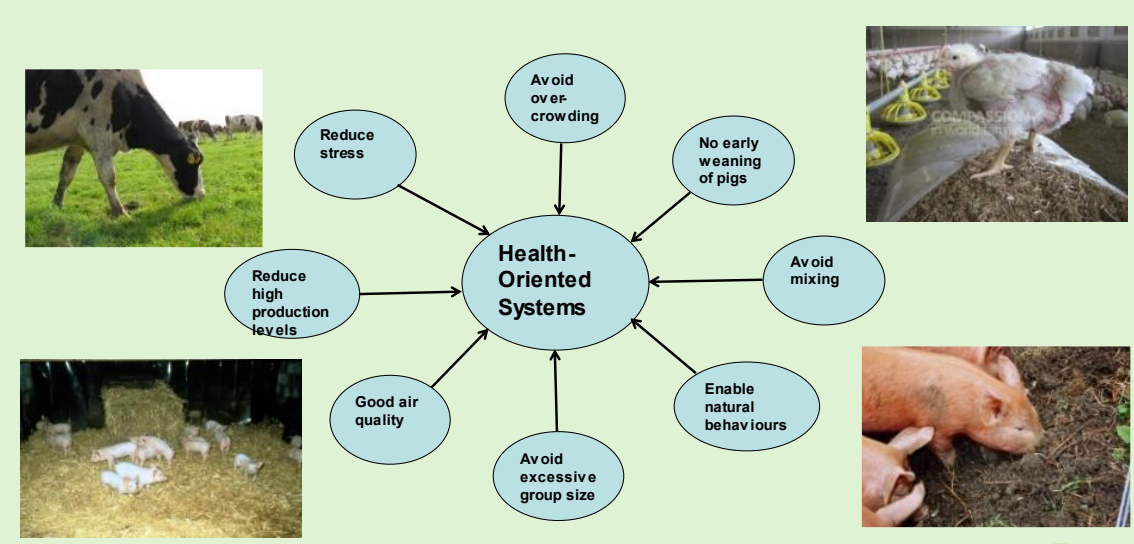
The major players in the animal antimicrobial sector are Elanco, Zoetis, Vetoquinol, Merck, Boehringer Ingelheim, Ceva Sante Animale, Bayer, Novartis AG, Virbac SA, Eli Lilly, and Sanofi.[154]

### What's the alternative?

The EMA/EFSA Scientific Opinion highlights the need for "rethinking livestock production systems to reduce inherent disease risk". It states: "measures must be implemented that improve animal health and welfare and thereby reduce the need for antimicrobials in the first place."

We need to move to 'health-oriented systems' for the rearing of animals, systems in which good health is inherent in the farming method rather than being propped up by routine use of antimicrobials and other pharmaceuticals.

So, what would these 'health-oriented systems' look like?




## 6. Pesticide manufacturers

The global pesticide market has almost doubled in the last twenty years, with sales rising to nearly US$ 65 billion in 2021.[155] Four leading companies – Bayer, BASF, Syngenta/ChemChina and Corteva – occupy more than two thirds of the pesticide market.[156]

The big pesticide manufacturers claim their products are necessary to feed the growing world population. However, the FAO points out that "extensive use of pesticides tends to reduce soil biodiversity, unbalance the ecosystem with an oversimplification of the species present and pave the way for pathogenic organisms to prevail";[157] in effect pesticides contribute to the very problem they are intended to address.

The FAO adds that monocultures, which are at the heart of intensive crop production, "result in proliferation of above-ground and below-ground pests and pathogens, which require introduction of pesticides in intensively managed fields". So, intensive farming contributes to a problem – proliferation of pathogens and pests – and then tries to tackle the problem with a solution – chemical pesticides - that in turn creates further problems.

The European Commission states: "The use of chemical pesticides in agriculture contributes to soil, water and air pollution, biodiversity loss and can harm non-target plants, insects, birds, mammals and amphibians".[158]

A report by Hilal Elver, former UN Special Rapporteur on the right to food stresses that pesticides "cause an array of harms". The report points out that pesticides harm wildlife, lead to declines in populations of bees and other pollinators, kill the beneficial insects that are the natural enemies of pests, and undermine soil biodiversity. In addition, they are linked to a range of negative impacts on human health.

The report states that these problems are "exacerbated by a systematic denial, fuelled by the pesticide and agroindustry, of the magnitude of the damage inflicted by these chemicals, and aggressive, unethical marketing tactics remain unchallenged". It adds: "The pesticide industry's efforts to influence policymakers and regulators have obstructed reforms and paralysed global pesticide restrictions globally".

Just as some EU equipment manufacturers sell cages that are banned for use in the EU to non-EU countries, some EU pesticide companies sell pesticides to non-EU countries that are banned from being applied in EU farms due to health and environmental risks.[159]

The pesticide industry spends almost €10 million per year in the EU alone on lobbying to defend their economic interests, oppose reduction targets and prevent regulatory restrictions from being placed on their products.[160] Expenditure by the leading pesticide companies on lobbying the EU institutions in 2021 is set out in Table 10.

### Table 10: Expenditure by leading pesticide companies in lobbying the EU institutions, 2021

| Company name | Amount |
|---|---|
| Bayer | 6,500,000 - 6,999,999 € |
| BASF | 3,000,000 - 3,499,999 € |
| Syngenta Crop Protection AG | 1,250,000 - 1,499,999 € |
| Corteva Agriscience International SARL | 900,000 - 999,999 € |

Source: EU Transparency Register

The pesticide industry has deployed a wide variety of techniques to try to derail the EU's *Farm to Fork Strategy* which aims to reduce the overall use of pesticides by 50% by 2030. It has:

- funded impact studies to scaremonger about economic losses while giving insufficient attention to the expected environmental and health benefits as well as ignoring the negative impact of failing to act on soils, biodiversity and climate. In some cases, no reference is made to the fact that the study was industry-funded;
- tried to undermine the Commission's targets by arguing that the focus should not be on reducing the volume of pesticides used, but rather on reducing their impact on the environment;
- employed greenwashing slogans such as 'more with less'.

**Table 11: World's Largest Pesticide Companies**

| Company | Sales in 2021 |
|---|---|
| **Bayer Crop Science;** includes pesticides & seeds | EUR 20.2 bn |
| **Syngenta,** owned by ChemChina; includes pesticides & seeds | US$ 16.7 bn |
| **Corteva Agriscience**; includes pesticides & seeds | US$ 15.6 bn |
| **BASF – Agricultural Solutions Division**; includes pesticides & seeds | EUR 8.2 bn |

**What's the alternative?**

Agroecology can minimise pests and plant diseases by ***Integrated Pest Management***. This includes, for example:

- allowing the natural enemies of pests to thrive (while pesticides tend to kill them)
- developing healthy soils which can promote strong healthy plants which are better able to resist disease and pest attacks
- the use of rotations can impede the build-up of pathogens and pests that often occurs when the same plants are continuously cropped.

## 7. Fertiliser manufacturers

The global fertiliser market amounted to US$193 billion in 2021 and is forecast to grow to US$ 241 billion by 2030.[161]

Fertilisers typically contain one or more of the three primary nutrients which play an important role in the growth of plants - nitrogen, phosphorous, and potassium. Of these, nitrogen is the most important, accounting for more than 56% of global fertiliser use in 2019.[162]

Nitrogen fertilisers have substantial adverse effects on the environment, human health and climate change. Although nutrient inputs such as nitrogen are needed to grow crops, nutrient loss from agricultural areas is a major source of pollution. Crops only take up 30-60% of the reactive nitrogen in fertilisers; the rest is lost to water or the atmosphere.[163] So what happens to this unabsorbed nitrogen? It:

- Washes into river and lakes
- Leaches from soil into groundwater
- Damages wetlands and marine ecosystems including the creation of 'dead zones'
- Undermines biodiversity and ecosystems
- Impairs air quality which causes respiratory problems and can result in reduced life expectancy
- Produces emissions of nitrous oxide, the most aggressive GHG.[164]

Moreover, synthetic nitrogen fertilisers, while boosting yields in the short term, lead to declines in the amount of humus and organic matter in soils, to loss of soil biodiversity, and to soil acidification.[165] These effects cause long-term damage to soil health and quality.

Most of the phosphorus in synthetic fertilisers is also not taken up by crops; the majority runs off to pollute waterbodies.[166]

A large proportion of synthetic fertilisers are used not to grow crops for direct human consumption, but to produce crops for animal feed. In Europe around 80% of fertiliser use is to grow feed for livestock.

**Dead zones:** In marine ecosystems excess nitrogen leads to a surge in plant growth. When these die their decomposition consumes oxygen, leaving areas largely depleted of oxygen. The body of water can no longer support fish and other life and becomes a 'dead zone', destroying the livelihoods of fisherfolk. [xiv]

The Gulf of Mexico dead zone measured over 6,300 square miles in 2021.[167] A key factor causing this dead zone is run-off of nitrogen and phosphorus from the fertilisers used to grow corn and soy in the US Midwest.[168] Much of the Midwest's corn and soymeal is used to feed factory farmed animals.[169] [170]

### Table 12: World's Largest Fertiliser Companies

| Company | Sales |
|---|---|
| Nutrien (Canada) | US$ 20.9 bn in 2020 |
| Yara (Norway) | US$ 16.6 bn in 2021 |
| Mosaic Company (US) | US$ 12.4 bn in 2021 |
| CF Industries (US, Canada, UK) | US$ 6.5 bn in 2021: net sales of ammonia & nitrogen products |
| Uralkali Group (Russia) | US$ 4.2 bn in 2021 |
| Wesfarmers Chemicals, Energy and Fertilisers Division | Australian Dollars 3 bn in fiscal year 2022 |

### What's the alternative?

In light of the falling supplies and soaring prices of fertilisers, we should substantially reduce the use of fertilisers and instead move to regenerative agriculture which builds soil fertility through the use of rotations, cover crops, animal manure, compost, and legumes which are able to 'fix' atmospheric nitrogen in soils.

However, as recent experience in Sri Lanka shows, the use of fertilisers cannot be halted abruptly. Farmers need time, training and financial support to move to new forms of farming. That is why the EU Farm to Fork Strategy has set 2030 as its target date for reducing the use of fertilisers by at least 20%.

## Conclusion

Industrial livestock production causes great harm to the environment and human health. It is responsible for immense animal suffering, denying animals the opportunity to lead satisfying lives. Through its use of cereals and soy as animal feed, it undermines food security. As much, perhaps more, food is wasted by being fed to animals as is wasted in the conventional sense of being lost post-harvest or discarded by consumers or retailers. It places several of the UN Sustainable Development Goals out of reach and contributes to making it difficult to meeting the Paris Climate Agreement targets.

So what sustains this damaging system? Four myths propagated by agri-business and the vested interests of seven sectors that provide the inputs for factory farming combine to maintain the industrial model of livestock production.

Agri-business is responsible for the twin myths of necessity and efficiency. It asserts that we need to produce 60% more food to feed the growing number of people in the world. But we already produce much more food than is needed to feed the world population predicted for 2050. The problem is that over half the world's food is lost or wasted in various ways – by being thrown away by consumers or food businesses, by grain being fed to animals who convert it very inefficiently into meat and milk, through overconsumption and the use of crops as biofuels. If all the above forms of food loss and waste were halved, an extra 3.55 billion people could be fed; this is more than the anticipated 1.8 billion increase in world population by 2050.

We are also told that factory farming is efficient, but it is not. It is profoundly inefficient. For every 100 calories of human-edible cereals fed to animals, just 17-30 calories enter the human food chain as meat or milk.[171] [172] For every 100 grams of protein in human-edible cereals fed to animals, just 43 grams of protein enter the human food chain as meat or milk. Some studies calculate that the conversion of cereals into meat and milk is even poorer than this.

We are also told factory farming gives us cheap food, but in reality it causes very costly damage to human health and the environment. If the costs of these negative externalities are factored in, factory farmed meat and milk are very expensive.

The fourth myth is that factory farming has low GHG emissions. But research shows that industrial livestock production has high emissions with most of these coming from the production of animal feed. The emissions from industrial farmed pigs and poultry are much higher than those of most plant-based foods.

A substantial proportion of the power that shapes our food system lies with the big companies who provide inputs for industrial agriculture such as livestock feed. For these companies, much of their revenue is derived from livestock production being – and remaining - industrial. So, they use public relations and a range of tactics to present themselves as good guys and burnish the industrial status quo. They utilise their considerable political power to influence governments and other policy makers, to obstruct proposed policy initiatives or regulations, to block any suggestions that global livestock production should be reduced, and to thwart moves towards regenerative agriculture or agroecology.

If we are to move away from factory farming, we need to unpick the myths that sustain it and challenge the legitimacy of the big input providers who both feed off and nurture the industrial model of livestock production in a perverse symbiotic relationship.

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