

Coller FAIRR Protein Producer Index Report Summary Version

Benchmarking intensive livestock and fish farming
on environmental, social and governance issues



Coller FAIRR Protein Producer Index

The Farm Animal Investment Risk & Return (FAIRR) Initiative has developed an index to analyse the largest global meat, dairy and aquaculture producers by combining nine environmental, social and governance (ESG) risk factors with the Sustainable Development Goals (SDGs).

The benchmark will be primarily a resource for institutional investors and other actors interested in the livestock sector.

Largest
global
companies

9
risk factors

22
KPIs

Environmental, social and governance issues



1		Greenhouse gas emissions Disproportionate amount of GHGs generated by livestock makes companies engaged in factory farming vulnerable to regulatory and social pressures to reduce emissions	
2		Deforestation and biodiversity loss Global movements tracking forest loss target factory farming companies and can lead to shareholder divestment and / or weaken customer loyalty	
3		Water scarcity and water use Beef, pork, dairy, and poultry companies consume large quantities of water both directly and indirectly via their purchase of animal feed	
4		Antibiotics Drug-resistant infections are a serious public health threat which will likely impact productivity on a national scale	
5		Waste and water pollution Companies are facing greater scrutiny about the impact of waste on surrounding communities and the environment, meaning potential fines and regulation	
6		Working conditions Operational risks, which can involve worker injuries and reputational risk, as well as food product contaminated by sick workers	
7		Food safety A series of high profile food safety incidents across the globe have focused consumer concerns on threat of food contamination and foodborne illnesses	
8		Sustainable proteins Company's reliance on animal protein sources and strategy for protein diversification	
9		Animal welfare Poor animal welfare presents operational and reputational risks for companies	

* SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 6: Clean Water and Sanitation, SDG 8: Decent Work and Economic Growth, SDG 12: Responsible Consumption & Production, SDG 13: Climate Action, SDG 14: Life Below Water, SDG 15: Life on Land

Foreword



In my 30 years as an investor I have witnessed many examples of megatrends like globalisation or technology disrupting sectors, making leading companies quickly seem outdated and unattractive.

Today, modern methods of intensive farming have helped the meat, fish and dairy sector become a profitable part of the global food supply chain. Investors know that this reality is changing as trends like climate change, food technology and a broad consumer shift towards healthier food gather pace.

The new Coller FAIRR Protein Producer Index assesses 60 of the largest livestock and aquaculture companies, with a combined market cap of close to \$300bn, on behalf of the world's largest investors. With environmental, social and governance (ESG) policies having rapidly become a vital part of investors' toolkits, it's significant that we now have the first ever Index to look holistically at the animal protein sector through the lens of ESG issues.

ESG is the investment communities equivalent to corporate social responsibility.

The first set of results for the Coller FAIRR Index, captured in this report, show the enormous risks and opportunities that are building in this area.

“Investors need ESG data and transparency to enhance shareholder value, this index helps bridge the knowledge gap”

Meeting the challenges

The Index identifies a growing suite of best practices and some remarkable innovations by meat, fish and dairy producers to meet ESG challenges. From greenhouse gas inventories to a ground breaking fund in alternative proteins, antibiotics stewardship to water management, there are best in class practices emerging in each of the nine sustainability risk factors analysed by the Index.

However it is also clear that, too often, this leadership is not being followed. Overall, 60% of the meat and fish producers in the Index – 36 large companies worth \$152 billion – are categorised as 'high risk' for investors. On the issue of antibiotics alone, three in four companies display inadequate polices or have no measures in place to reduce their excessive use of antibiotics – despite emerging regulation and public and investor pressure for them to do so.

Furthermore, 72% of Index companies performed poorly on management and disclosure of greenhouse gas emissions, putting the implementation of the Paris Agreement in jeopardy. Investors need ESG data and transparency to enhance shareholder value, this index helps bridge the knowledge gap.

Furthering a dialogue

This is the first iteration of the Coller FAIRR Index. It aims to be a useful starting point and the FAIRR team, who are to be enormously commended for their efforts putting this Index together, invite feedback from all those involved with the aim of improving the criteria, data limitations and methodology over time.

I hope the Index furthers a dialogue between investors and these important food suppliers to help both harness the upside of disruption and to manage the challenges ahead.

Jeremy Collier
Chief Investment Officer of Coller Capital; and
Founder, Farm Animal Investment Risk & Return (FAIRR) Initiative

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This report is an abbreviated version of the full Coller FAIRR Protein Producers Index report. The full report and data are only available for members of the FAIRR investor network.

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Acknowledgements

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We would like to thank the following colleagues who gave their insight and expertise to the content of this report:

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Chapter One Introduction

Context and background

Today, intensive livestock production methods are the dominant system of livestock farming. Farmed poultry today makes up 70% of all birds on the planet, and 60% of all mammals on Earth are livestock, mostly cattle and pigs (Yinon M. B. et al., 2018). This trend is increasing: many Asian countries, including China, are consolidating farming operations to reduce fragmentation and increase production efficiencies (Global Meat News 2018).

Combine this growth in intensive livestock production with current forecasts for global population rise, increasing urbanisation, and a burgeoning middle class that demands more animal protein, and it seems that meat, dairy and aquaculture companies are favourably positioned for capital investment. However, the dramatic expansion of this industry has also exacerbated climate change impacts, water scarcity, food insecurity, biodiversity loss and antimicrobial resistance (AMR). In a resource-constrained world, there is growing recognition of the inefficiencies of meat and dairy production. An analysis found that the production of animal-based foods accounted for more than three-quarters of global agricultural land use and around two-thirds of agriculture's production-related greenhouse gas emissions in 2009, while only contributing 37% of total protein consumed by people in that year (World Resources Institute, 2016). These externalities are not only incompatible with the Sustainable Development Goals (SDGs), they also present risks to capital investment.

In 2016, FAIRR's flagship report for investors, 'Factory Farming: Assessing Investment Risks', identified 28 ESG risks linked to the livestock sector. The Coller FAIRR Protein Producer Index builds on this work by analysing major protein producers on their management and disclosure of nine of the most critical risks facing the industry. As these companies are some of the largest publicly listed meat, dairy and aquaculture producers, most insitutional investors have exposure to these producers within their equity and fixed income portfolios. The aim of this pilot Index is to provide the investment community with a tool that enables them to better understand the ESG risks facing these global listed assets, and to more easily integrate these into their investment decision making process and active shareholder engagement.

The Index will provide valuable information to the market on best practice in the management of these key ESG risks. Equally, we anticipate that it will encourage companies to establish the policies and processes required to improve oversight and performance across each issue.

“As some of the largest publicly listed meat, dairy and aquaculture producers, most institutional investors are exposed to these companies.”

Coller FAIRR Protein Producer Index: The nine risk factors considered

- | | |
|--|--|
| 1.  Greenhouse gas emissions (GHGs) | 6.  Animal welfare |
| 2.  Deforestation and biodiversity | 7.  Working conditions |
| 3.  Water scarcity and use | 8.  Food safety |
| 4.  Waste and water pollution | 9.  Sustainable proteins* |
| 5.  Antibiotics | |

* We assessed companies on their exposure to alternative proteins, given the growing market opportunities in this space. However, this risk factor is not scored.

About the Collier FAIRR Protein

Producers Index

The Collier FAIRR Protein Producer Index is the world’s first comprehensive assessment of how some of the largest global intensive livestock and fish farming companies (by market capitalisation) are managing critical risks facing the sector.

The animal and fish production industry remains poorly scrutinised relative to the broader food industry. For instance, the livestock industry is under-represented within most global benchmarks, even if it is among the most over-exposed in terms of risks. Fewer than 25% of the companies in our Index are invited to participate in the Dow Jones Corporate Sustainability Assessment or represented in CDP’s (formerly Carbon Disclosure Project) risk databases.

As a result of this lack of scrutiny, the scope of this Index focuses on companies primarily involved in breeding, processing, distributing and selling meat, dairy and/or aquaculture products, rather than food manufacturers or retailers. The 60 Index companies have a combined market capitalisation of \$297 billion. Almost all of their \$300 billion worth of revenues are derived from producing and processing intensively farmed livestock and fish.

These companies play a significant role in meeting – and building – consumer demand for animal proteins. Their consolidated revenues cover approximately 20% of the global livestock and aquaculture market. They dominate their regional markets: the 16 Chinese companies in the Index, for example, represent nearly 30% of the Chinese market for animal proteins, including 100% of the domestic dairy market. They also supply some of the world’s biggest food companies, including McDonald’s, Walmart, Nestlé and Danone.

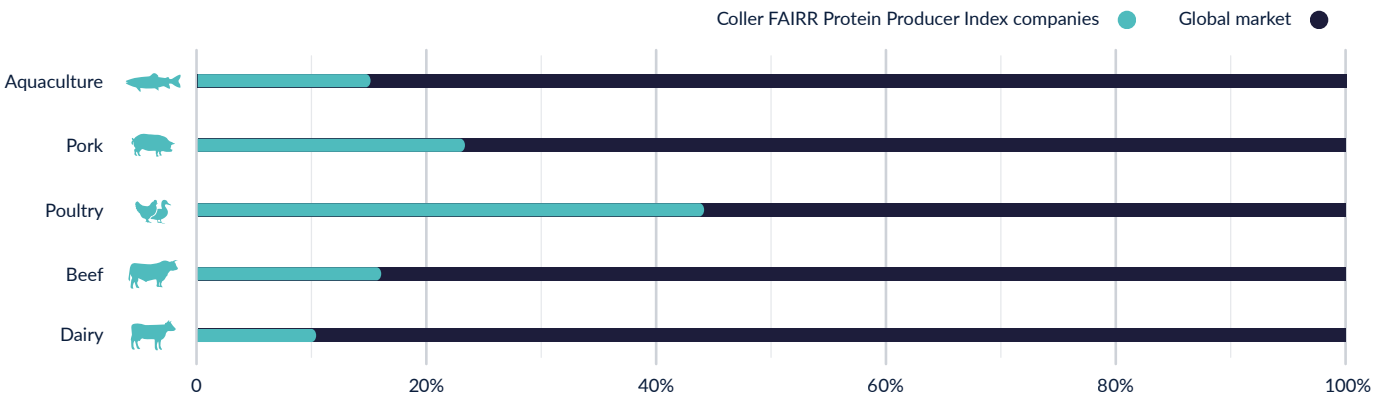


Table 1: Revenues of Index companies as a percentage of global animal protein markets, based on FAIRR calculations¹

¹ These are estimates based on calculations by FAIRR. The company revenues by proteins are calculated from 2016 company financial reports. Where available, we disaggregate revenues to specific proteins as assigned by the company. In cases where revenue distribution by protein is not provided, and the company derives revenues from multiple proteins, we disaggregate revenues based on our best understanding of the company’s business model. For data limitations on the the global protein market size, see the discussion in the Appendix on page 77.

Regional and protein distribution

More than half (52%) of companies in the Index are based in Asia, including 16 companies located in China. The concentration in Asia is significant, given the forecast growth in consumption of animal protein in the region. Inner Mongolia Yili Industrial Group, a China-based dairy producer, has the largest market capitalisation in the Index at \$27 billion (as at 28 March 2018). Brazilian meat conglomerate JBS has the largest revenues at \$52 billion (based on 2017 filings).

The 60 companies have material exposure to five main animal protein categories: beef, dairy, pork, poultry and eggs, and farmed fish. However, companies with poultry supply chains have the largest representation, at 43% of the Index. See the full list of companies in Appendix 1.

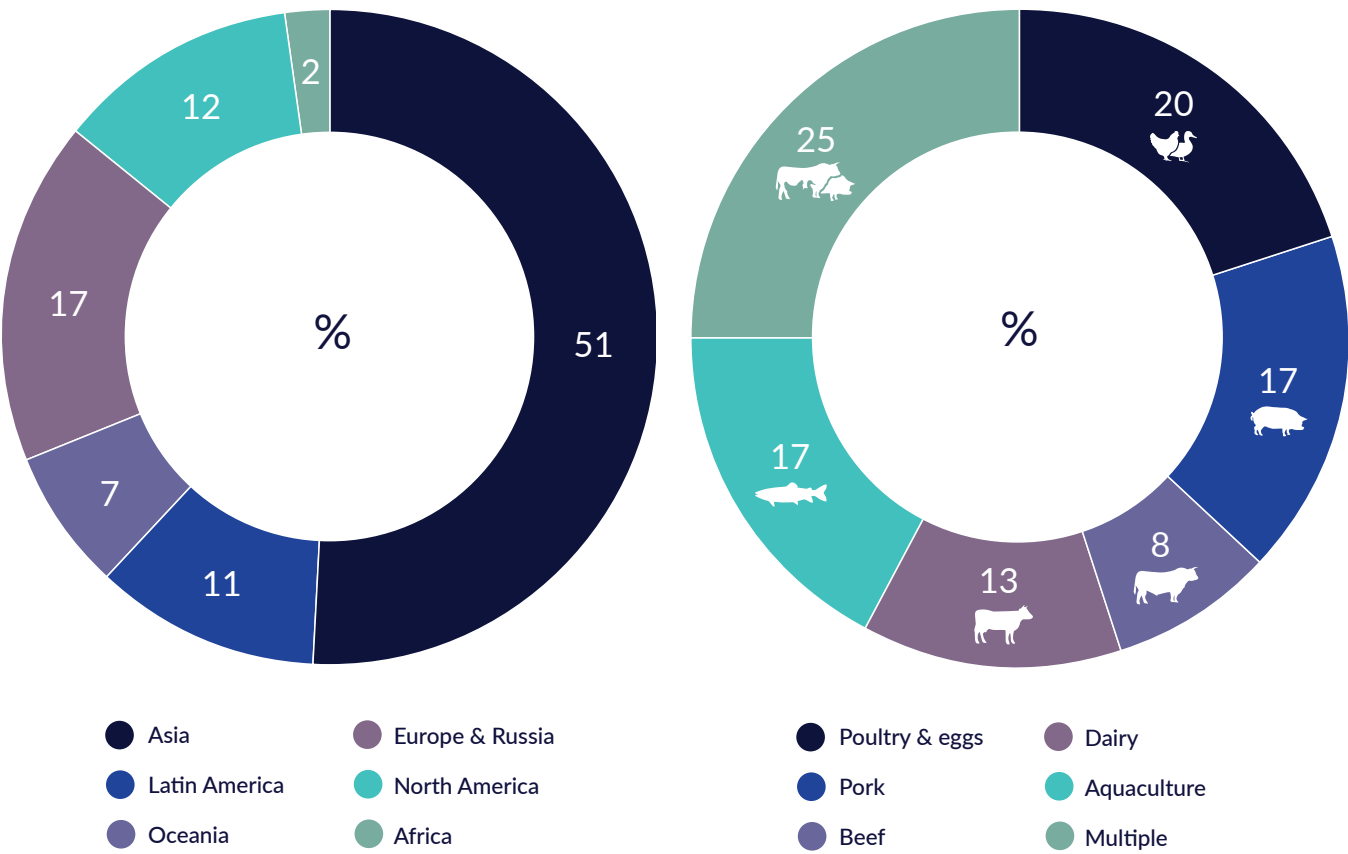


Figure 1: Regional distribution of Index companies (headquarters)

Figure 2: Protein distribution of Index companies

Risk factors and key performance indicators

We use three primary approaches to identify nine material risk factors and key performance indicators (KPIs) for the intensive livestock farming industry:

- **Previous FAIRR assessment:** FAIRR’s analysis of the 28 risks linked to intensive livestock production systems in 2016, based on detailed and extensive consultation with a range of investors, experts and industry groups.
- **Top-down analysis:** We review seven top-down analyses by investor groups and non-governmental organisations (NGOs) to determine overlapping risk factors.
- **Bottom-up analysis:** We identify risk factors and KPIs that are currently acknowledged in public filings by a representative sample of companies. We work on the assumption that disclosure is a proxy for companies’ focus on these issues.

The resulting framework, on the next page, facilitates benchmarking of the companies across risks that are widely recognised as meaningful for both the companies and their stakeholders.

Risk Factor Framework

GHGs
Targets for emissions reduction
Quality of greenhouse gas emissions inventory
Emissions intensity permformance
DEFORESTATION
Zero deforestation target (Terrestrial only)
Partnerships with NGO to address exposure to deforestation and biodiversity loss
Supplier code of conduct to address deforestation/biodiversity exposure
Escapees from fish farms (Aquaculture only)
Disease management (Aquaculture only)
WATER SCARCITY
Management of water use in direct operations
Company targets related to water use in direct operations (Terrestrial only)
Water exposure of supply chains
WASTE AND POLLUTION
Waste management (Terrestrial only)
Waste management (Aquaculture only)
Disclosure of non-compliance (penalties, fines for discharge and audits) related to environment
ANTIBIOTICS
Policy to avoid (i) routine use of antibiotics and (ii) use of medically important antibiotics
Report quantified usage of antibiotics
ANIMAL WELFARE
Policy and disclosure on animal welfare
WORKING CONDITIONS
Long term injury rates
Safe and fair working conditions
Freedom of association
FOOD SAFETY
Traceability systems
Disclosed food recalls
SUSTAINABLE PROTEINS (not scored)
Assessment of any product exposure to alternative protein sources

Table 2: The nine risk factors and 22 KPIs assessed by the FAIRR Index. Detailed descriptions of all KPIs are included within the specific sections on each risk factor.

Limitations

Given the Index’s global diversity and the general lack of transparency in the animal protein sector, we see these risk factors and indicators as only the first step towards assessing the sector’s management of its most material risks. For example, a key risk for the industry is growing awareness of the causal link between high meat consumption and non-communicable diseases such as cancer, diabetes and obesity. However, the Index does not consider health issues as part of its current risk framework, beyond an assessment of company exposure to alternative proteins.

This is primarily because health and nutrition issues are complex and dependent on local culture and social contexts. There is currently no standardised framework for assessing animal protein consumption in the context of health.

In addition, the methodology of this pilot Index primarily assesses company policies and disclosure, rather than performance. We believe the development of robust policies and management of the risk factors assessed is the first step for companies in this sector, which, as we have identified, are lagging behind the broader food industry on these issues. However, we acknowledge that this approach is not entirely reflective of the effectiveness of a company’s approach or of company performance (see case study: The conflict between commitments and performance, on page 16).

Our aim is to work with stakeholders to ensure that the framework continues to evolve with time, so it remains both comprehensive and meaningful for investors and sector companies.

Data assessment and scoring

The FAIRR team conducted company assessments using publicly available information. This included company websites and reports, CDP disclosures, and news articles. Unless indicated otherwise, all assessed data and revenues stated in this report are as of 31 March 2018. All market capitalization figures are as of 28 March 2018.

We assigned companies and rated them on a scale of 0–5 based on their commitments, policies and disclosure against relevant KPIs. The final company score is an average of scores across all KPIs and risk factors (out of 100). A high score indicates better disclosure and management, and thus a lower risk. For this iteration of the pilot Index, all risk factors and KPIs are weighted equally.

Risk factor colours:

“Low Risk”

signifies basic management of the risk

“Medium Risk”

signifies that some steps have been taken towards basic management of the risk

“High Risk”

signifies little or no action or disclosure.

In addition to this report, FAIRR members can also access the following resources on <http://index.fairr.org>:

- full interactive data sets as charts and tables with detailed company assessments,
- company profiles detailing key financial data, including revenues and customers, downloadable in Excel format,
- a risk factor assessment sheet explaining the scoring assessment with background information, downloadable in Excel format.

Focus The question of financial materiality

For the intensive livestock sector, the common perception is that most ESG risks will not impact income statements or balance sheets in the near term, but could prove significant in the long term. Based on our knowledge of the sector, we highlight the following signposts as possible indicators of financial materiality:

Short term
The following risks could become financially material in the short term because of their significance as reputational risk drivers.

Risks	Reason
Food safety	For livestock companies, food safety outbreaks and scandals can lead to large-scale animal culls, recalls, a steep drop in demand and price volatility, all in the space of a short time. In South Africa, an outbreak of listeriosis in early 2018 led to the recall of cold cut meats and caused heavy damage to the South African pork industry. Pork producers have reported a 36% drop in profits and a 75% drop in demand for processed meat products.
Animal welfare	Because of its link to food safety and drug use, animal welfare is a critical component of a comprehensive operational risk management framework for food companies. However, it can also rapidly evolve into a magnified reputation risk. For example, undercover investigations and exposés documenting animal abuse can quickly become corporate global crises through rapid social media sharing. In most cases, these may not impact the share price – but there is always the threat of the 'Blackfish effect' – a reference to the movie that caused Seaworld's profits to tank by 84% in three months (Independent 2015). For livestock producers, an added risk is the loss of corporate customers who may terminate contracts under pressure from consumers.

Medium term
The following risks could become financially material in the medium term because of their significance as business and reputational risk drivers.

Risks	Reason
Antibiotics	In the medium term, depending on the operating context, companies phasing out the routine use of antibiotics may see some cost increases. However, failure to act presents a larger risk: as more food companies transition to responsible antibiotics use, livestock companies using antibiotics routinely may lose out on valuable contracts. They are also more exposed to regulatory changes, as more governments develop action plans to manage growing antibiotic resistance.
Waste and pollution	Manure can be an important source of soil nutrients, but the scale of intensive farming today produces quantities in significant excess of what can be absorbed by the surrounding environment. For example, a feeding operation with 800,000 pigs could produce over 1.6 million tons of waste a year – one and a half times more than the annual sanitary waste produced by the city of Philadelphia (National Association of Local Boards of Health, 2010). As we detail in our report, across geographies, livestock companies are facing increasing community advocacy and litigation on poor waste management – resulting in fines and curbs on business expansion.

Water scarcity
Water is a critical ingredient for food production; meat and dairy companies require significantly more water than plant-based foods. As global pressures on freshwater sources increase, including from droughts exacerbated by climate change, companies that derive revenues primarily from water-intensive proteins like beef and dairy are exposed to feed price volatility, regulation and community protests. While this may be a medium-term risk for many companies, for some it is already a reality: in South Africa, 5% of livestock and 22% of sheep herds were slaughtered in the Western Cape in early 2018 due to the drought (Business Day 2018).

Working conditions
Unlike other industrial activities such as mining, the intensive farming sector has enjoyed limited scrutiny of its labour practices. However, as scandals in the Thai shrimp (Financial Times 2018) and US poultry (The Guardian 2016) sectors demonstrate, there is growing recognition on the potential for worker abuse in this industry, both at the meatpacking and processing level and deep in company supply chains. Companies that have limited focus on labour issues not only risk low productivity, but also face the heightened reputational threat of a publicised scandal.

Sustainable proteins
There is growing demand among consumers to better understand the provenance of their food and to avoid products deemed unnatural or unhealthy. These 'clean' eating trends, driven primarily by millennials, favour foods that are healthy, ethically sourced and less processed. Increased plant-based food consumption is a direct consequence of this shift.

For animal protein producers, failure to increase exposure to sustainable proteins thus presents the risk of not keeping up with changing consumer demand and losing an important growth opportunity. Currently, growth of plant-based meat alternatives is about twice the rate of processed meat, with annual sales of about \$2 billion (Bloomberg Intelligence 2017). An additional long-term threat is the risk of disruption from new food technologies such as advanced plant-based protein and animal cell culture technology that are developing at a rapid pace.

Long term
The following risks could become financially material in the long term because of their significance as reputational risk drivers.

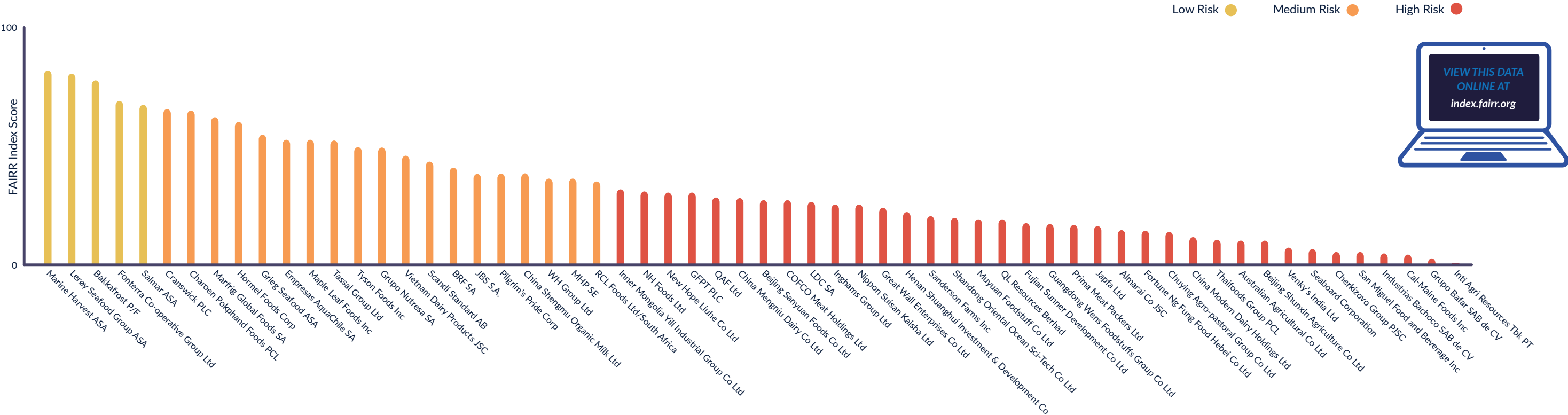
Risks	Reason
Deforestation and biodiversity	This is a direct risk for companies that source from or operate in ecologically sensitive areas like the Amazon biome. Global movements employing satellite imagery and social media can target companies perceived as having a detrimental impact on biodiverse areas, prompting a loss in supply contracts, brand damage and even regulatory fines. While the financial impact of these may be limited in the short term, livestock companies whose business models are dependent on land use changes will face constraints in the long term due to increased competition for land and growing food security concerns.
Greenhouse gas emissions	Livestock farming is responsible for 14.5% of global GHG emissions, and cattle are responsible for around 65% of these emissions. Companies with carbon-intensive portfolios – i.e., ruminants such as beef and dairy -- are most at risk in the medium term on any potential regulation or taxation targeting the livestock sector. However, all livestock companies will also increasingly face physical risks linked to climate change impacts: from lower forage quality and more droughts to negative impacts of rising temperatures on animal health and productivity. These will present long-term growth constraints for the sector.

Chapter Two

Summary of findings

Our findings show that two-thirds of these companies – 60% – are either not managing critical risks or are failing to disclose basic information.

In general, aquaculture companies lead the animal proteins sector in the quality of their reporting of critical sustainability issues. Europe-based aquaculture producers – Marine Harvest, Lerøy Seafood and Bakkafrøst – display management best practice and disclosure across all eight scored risk factors. In the terrestrial animal protein sector, Fonterra, Cranswick and Charoen Pokphand Foods achieve the highest scores for their disclosure and management.



Key takeaways

- **Thirty six companies, worth \$152 billion, rank as 'high risk' on overall management of ESG risks.** Three-quarters of these are based in Asia, which is poised to lead global trends in meat and dairy consumption.
- **Marine Harvest, the world's largest salmon farmer, is the top scoring company in our Index,** with a total score of 81.90 out of 100. Among terrestrial protein companies, New Zealand dairy producer Fonterra scored 68.75 out of 100.
- **Antibiotics mismanagement is the most poorly addressed risk** in an industry that is the primary global consumer of antibiotics.
- **Of the 22 KPIs in the Index, companies perform best on a waste and pollution indicator that assesses disclosure of penalties and fines related to the environment.** More than half (58%) of companies say that they did not incur any fines for non-compliance issues.
- **The worst-performing indicator was a deforestation and biodiversity KPI** that assesses if terrestrial protein companies had adopted a zero-deforestation target. Our analysis shows that 84% of the 50 terrestrial protein companies do not have a zero-deforestation target or even a policy.
- **Across the animal protein sector, reporting and management of GHG emissions is inadequate, unstandardised and unverified.** The livestock sector contributes to nearly 14.5% of global GHG emissions. Main sources of emissions include enteric fermentation from ruminant animals such as beef and dairy cattle, as well as manure management and production of animal feed. Over 72% of the companies in our Index showed poor or no reporting on this issue. Even among the 19 companies that do report inventories of GHG emissions to CDP, only four cover all relevant geographies and include emissions from enteric fermentation and agricultural feed in their reporting. [Learn more.](#)
- **More than three-quarters (77%) of companies in the Index classify as 'high risk' when it comes to managing and reporting on antibiotics use.** The World Health Organization (WHO) "strongly recommends an overall reduction in the use of all classes of medically important antibiotics in food-producing animals, including complete restriction of these antibiotics for growth promotion and disease prevention without diagnosis" (WHO 2017a). Yet 46 companies worth a combined \$239.51 billion have no policies or process in place to eliminate routine use of antibiotics. [Learn more.](#)
- **Waste and pollution is the best managed risk factor.** Animal waste management is a particular risk, as it is a significant source of emissions and water contamination, but still remains poorly regulated. For example, in the US, waste from hog farms is typically untreated, and is instead collected in 'lagoons' and sprayed as fertilizer on nearby fields. Companies are increasingly facing community advocacy and litigation on this issue. While companies in our Index generally have good discussion on waste management, only around 15 companies specifically reference their management of animal waste. [Learn more.](#)

36
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72%
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- Agriculture accounts for 92% of the global freshwater use, and nearly one-third of that use is for animal agriculture (Gerbens-Leenes et al. 2013). **Yet only 35% of companies in our Index report on water use from their operations.** 82% of companies do not impose any specific requirements for suppliers on water use and management. [Learn more.](#)
- **Only five of the 60 companies account for the emergence and growth of the alternative, non-meat proteins sector.** Our Index also seeks to examine the exposure of these companies to opportunities in alternative protein market, particularly given the rapid growth in this segment, which is expected to reach \$5.2 billion by 2020. This risk factor is assessed, but not scored. [Learn more.](#)

For a detailed discussion of risk factors, including company performance, see the individual sections on each factor, starting on page 17.

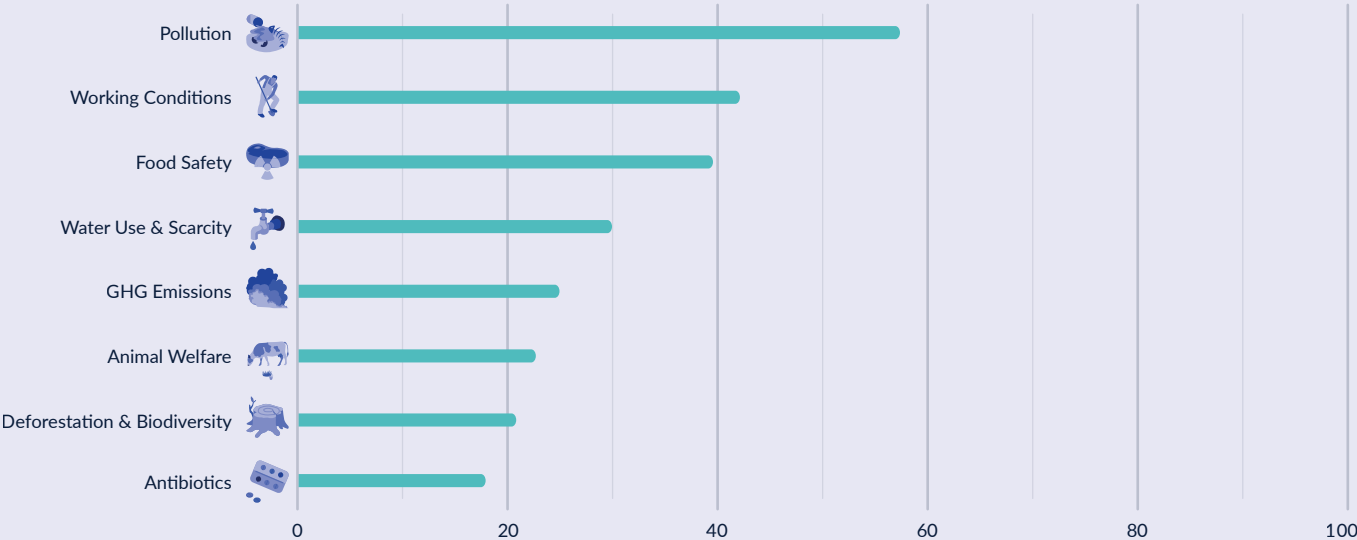


Figure 4: Average company scores across all scored risk factors (out of 100)

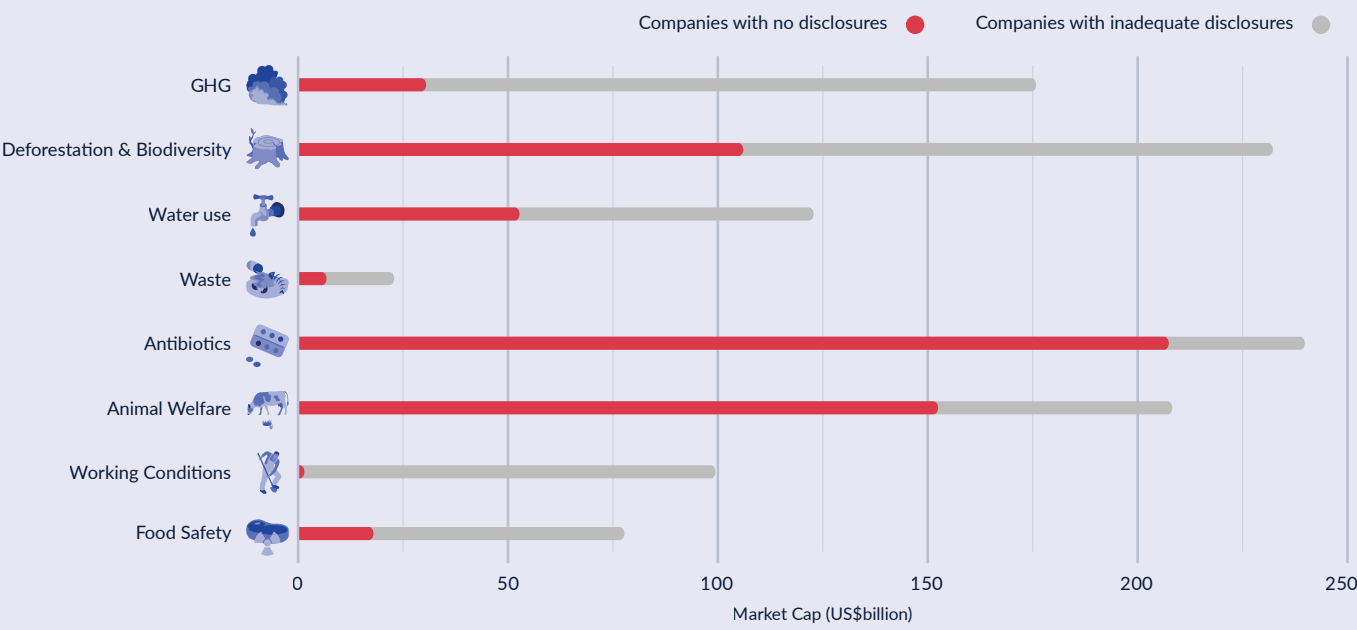


Figure 5: Consolidated market capitalisation of companies classified as high risk because they score below 33 (out of 100)

Focus How Chinese livestock and fish farming companies report on ESG issues

China already accounts for half the world's pork market and 70% of farmed marine products worldwide (Public Radio International, 2016). The country primarily produces its own animal proteins, but relies on imports for feed ingredients such as soy. By 2026, China's meat (poultry, pork, beef and sheep) consumption will be 27% of the world's total meat consumption. Its soybean imports will increase by 143 million tons – 48% more than what the current leading soybean producer (Brazil) will export (FAO-OECD and USDA 2018).

The scale of this consumption necessitates intensive farming production systems. The Chinese Government has been pushing to convert the animal protein industry from small-scale family farms to fully integrated 'mega-farms' (Independent 2017). As these trends continue, it is critical

that investors get a better understanding of how the Chinese livestock and fish sector manages and discloses key risks.

The Index includes 16 companies based in mainland China, and one company based in Taiwan. Together, they comprise over 28% of the 60 company universe. While some companies disclose ESG issues in English, others report in Mandarin. To overcome translation issues, FAIRR commissioned a Mandarin-speaking researcher to help with company assessment across all risk factors.

How Chinese companies report on ESG

- Chinese listed companies are required to issue annual reports with a standard format given by either the Shanghai or Shenzhen stock exchanges, including a section on social responsibility.
- ESG reporting is a new concept for most companies. Only a few companies provide separate and comprehensive corporate social responsibility (CSR) reports, such as Beijing Sanyuan, Guangdong Wen's Foodstuff Group and New Hope Liuhe.
- For the most part, CSR reports or sections contain qualitative descriptions rather than quantitative analysis. Most companies understand CSR mainly as charity work and poverty reduction rather than environmental and social governance.

How Chinese companies report on risks assessed by the FAIRR Index

- GHG emissions**
Companies primarily report on their energy consumption and some key emissions (nitrogen oxides or sulphur dioxide emissions), as required by state and national law. Only two companies – Great Wall Enterprises, based in Taiwan, and WH Group – report on their GHG emissions inventory (Scope 1), but with limited detail. No company reports GHG targets other than WH Group's US subsidiary.
- Deforestation and biodiversity**
Companies do not address deforestation or biodiversity issues. While most Chinese companies may not have direct deforestation risks, they are exposed to these risks in their feed supply chains.
- Water scarcity and use**
The average score on water is 29.89 out of 100. Freshwater consumption is reported by a few companies. For example, Beijing Sanyuan, a vertically integrated dairy company, reports on freshwater use as well as detailing its water recycling initiatives. The majority of water footprint occurs in feed production – in general, this is an issue that is barely addressed by intensive farming companies, including those in China.



Waste and water pollution

This is the best performing risk factor for Chinese companies, with an average score of 65 out of 100. In general, over 50% of companies reference manure and manure management – we believe this may be a consequence of regulatory intervention. In contrast, no North American company in our Index mentions manure management. An example of reporting is from Inner Mongolia Yili, which has installed rainwater and sewage diversion systems as well as manure drying systems to ensure zero discharge of manure and sewage. These systems allow water and waste to then be recycled and reused as resources for the farms. Please note that our KPIs only look for some disclosure on manure management; we do not specifically assess if these practices contribute to sustainable nutrient management.



Antibiotics

China is the largest consumer of veterinary antibiotics. A recent study has found bacteria in the country that have developed resistance to a key antibiotic of last resort: Colistin, which is widely used in Chinese farms, despite a ban (Van Boeckel et al. 2017 & Branswell 2017). Few companies mention antibiotics or animal drugs, and no company has a policy on routine use. The average score for the risk factor is 3.



Animal welfare

While awareness of farm animal welfare is increasing, the concept remains relatively new in China. Companies do not address animal welfare beyond a husbandry perspective currently.



Working conditions

Several companies follow China's Labour Law and Labour Contract Law, which are supposed to contain the four policies: (a) freely chosen employment; (b) no child labour; (c) health and safety training; and (d) no discrimination. Only two companies specifically call out all four issues, and child labour and discrimination are generally not mentioned. Workers' associations/labour unions are required by law in Chinese companies. So we do not find explicit policies on this issue. Only three companies reference long-term injury rates (reporting that none had occurred). Note that we do not award points simply for complying with legal requirements.



Food safety

Food safety is a key concern for the Chinese food industry, given the number of scandals in recent years. Not surprisingly, most companies address the issue, and eight companies report full traceability systems. However, transparency remains an issue. Only one company – Inner Mongolia Yili, which is also one of the top performers in this category – discloses its number of food recalls and its food recall management process.



Focus The conflict between commitments and performance

The methodology for this pilot Index primarily assesses company policies and disclosure, rather than performance. Companies in this sector still lag behind the broader food industry when it comes to managing and disclosing risks. They have yet to develop metrics to accurately measure policy implementation or progress on integrating these measures.

However, as we have repeatedly seen, assessing companies on policies and management alone is not entirely reflective of the effectiveness of their approach. While they indicate basic management, policies alone cannot guarantee risk reduction. Several examples from our benchmark demonstrate this point:

- **JBS** (with a portfolio that includes beef, poultry and pork) made a commitment not to purchase cattle from ranches responsible for deforestation of the Amazon Biome region after October 2009. Their commitment is reinforced with stringent oversight through an integrated dual-approach monitoring programme to ensure compliance. However, recent revelations indicate that their policies are not being implemented: “In March 2017, Brazil’s environmental protection agency, IBAMA, raided JBS meatpackers in Redenção and Santana do Araguaia, in the state of Pará. IBAMA alleged that JBS had been knowingly buying cattle that were raised on illegally deforested land for years. According to IBAMA, JBS allegedly bought 50,000 illegal cattle since 2013, blatantly violating Brazilian legislation and forest laws” (ValueWalk 2017).
- **Grieg Seafood**, one of the largest Atlantic salmon farming companies, has a strong programme to prevent fish escapes, including multiple certifications and regular inspections. However, in 2018 it disclosed that over 21,000 fish had escaped from its Scottish operations (BBC News 2018).

- **BRF** was one of the several companies implicated in the Brazilian Operation Weak Flesh investigation. Although its corporate communications include statements on food safety management, the company was found to have bribed officials to export expired meat. In March 2018, BRF’s ex-CEO Pedro Faria was arrested for his role in the process, and BRF exports to the EU were temporarily banned. The company’s shares consequently dropped by 19% in one day. A class action lawsuit against the company alleges that it misled shareholders on its operations and compliance procedures (Reuters 2018).
- **Smithfield Foods**, the US subsidiary of pork producer **WH Group**, was the first large producer to commit to phase out gestation crates for pigs and to transition to group housing for its company-owned farms. In 2007, the company set a ten-year timeline to achieve this by the end of 2017, and in January 2018 announced that it had successfully met its target (Smithfield Foods 2018). However, in 2018 an investigation by animal protection group Direct Action Everywhere published evidence that multiple Smithfield facilities were not complying with company policy, and were in fact keeping sows housed in gestation crates (Vox 2018).

For the Index, in instances where we find similar violations of policy, we reduce the number of points assigned to the company. For the next stage of the Index, we intend to incorporate KPIs that enable us to better assess practical policy implementation.

Chapter Three

Greenhouse Gas Emissions



Livestock production represents 14.5% of all global anthropogenic GHG emissions – more than the entire transport sector (FAO 2013a). The livestock farming and processing industry therefore is key to preventing global temperatures from rising above 2°C, in line with the 2015 Paris Agreement.

Intensive farming methods rely on the use of high-calorie feed, which is largely corn and soy based. This results in over one-third of global cereal harvests being used for livestock feed, which contributes to deforestation and high levels of methane emitted by animals (Rojas-Downing et al. 2017). Both of these impacts make the industry more exposed to potential upcoming legislation or market interventions aimed at creating a low-carbon economy.

The livestock sector not only contributes to climate change, but will also be adversely impacted by changing weather patterns (see blue box to the right). A recent report by the UN Food and Agriculture Organization (FAO) found that extreme weather events cost the agricultural sectors of developing economies \$96 billion in damaged or lost crop and livestock production, half of which occurred in Asia (UN News 2018).

Providing comprehensive GHG disclosure is a critical first step for companies to measure and reduce emissions, so they can then develop climate adaptation and mitigation strategies, including the shift to more sustainable product choices.

The impacts of climate change on livestock companies

Rising temperatures will hurt critical factors of livestock production, including water availability, animal reproduction and health, and forage quantity and quality (Rojas-Downing et al. 2017). Below are examples of how this risk will play out for individual companies in the Index, as reported in their CDP disclosures:

- **JBS**, which processes beef, reports that it had to partially discontinue some operations in Brazil due to the lack of water access, driven by climate change impacts (JBS CDP Report 2017).
- **BRF**, a poultry and pork processor, reports that changes in precipitation levels could impact the development of grains, leading to supply chain risks and higher costs (BRF CDP Report 2017).
- **Lerøy Seafood**, an aquaculture company, reports that increases in extreme weather activity is “leading to increasing damage to boats and fish cages due to increasing wind and precipitation”, which increases the need for insurance. The cost is expected to not exceed 10 million NOK (\$1.25m) per year (Lerøy Seafood CDP Report 2017).

Guidance on GHG reporting in the protein sector

The GHG Protocol Agricultural Guidance defines two types of emissions sources for agricultural systems: mechanical (caused by equipment/machinery operated on farmland) and non-mechanical (caused by biological processes such as enteric fermentation and manure management). Globally, non-mechanical sources are larger than mechanical sources: according to the Food and Agriculture Organization of the United Nations (FAO), feed production and processing (including land use changes) comprises 45% of total emissions from global livestock. The next largest source of emissions (39%) is enteric fermentation by ruminants (that is, the production of methane as a byproduct of digestion). Manure storage and processing represent another 10%, while the remainder consists of processing and transportation of animal products (FAO 2013b).

According to the Guidance, feed production is more important in the life cycle inventories of egg, chicken, farmed fish and pork, compared to those of milk and beef, where enteric fermentation dominates.

On a commodity basis, beef and dairy cattle (both ruminants) are responsible for the most emissions, contributing 65% of the sector’s overall GHG outputs. These are followed by pig meat (9% of emissions), poultry and eggs (8%) and aquaculture. Globally, livestock supply chains are responsible for 5% of carbon dioxide (CO₂) emissions, 44% of methane (CH₄) emissions and 53% of nitrous oxide (N₂O) emissions (FAO 2013b).

The Guidance recommends the following best practice for disaggregating GHG data in inventories across the three scopes:

Category of source or sink	Subcategory	Examples
Scope 1	Mechanical sources	Mobile equipment, stationary combustion, and refrigeration and air-conditioning systems
	Non-mechanical sources	Enteric fermentation, soil N ₂ O emissions and manure management
	CO ₂ emissions from land use change	CO ₂ emissions from the conversion of forests into ranchland or the conversion of wetlands into croplands
Scope 2	Purchased energy	Purchased electricity
Scope 3	All other indirect sources	Production of agrichemicals and purchased feed

Table 3: Best practice for disaggregating GHG data in inventories Source: GHG Protocol Agricultural Guidance

As with all sectors, the Guidance has established principles on GHG accounting and reporting in the agricultural sector, including the need for relevant, complete, consistent, transparent and accurate data.

KPIs on GHG emissions

Where available, we prioritise 2017 CDP reports as our main source. Other sources include company websites, and annual and sustainability reports.

KPI 1: Targets for emissions reduction

Companies that have clear targets to reduce GHG emissions are viewed as working to limit their exposure to this issue. Specifically, we consider companies with quantitative targets on Scope 1 and Scope 2 emissions (with a base year and target year) for their entire global operations as better positioned than companies with qualitative, partial and/or energy use only targets. We do not specifically check for targets on Scope 3 emissions – which cover agriculture – and which are a significant source of value chain emissions for livestock and aquaculture companies.

KPI 2: Quality of GHG inventory³

Given the generally low levels of disclosure in the sector, and in accordance with the Guidance, our KPI to measure Scope 1, 2 and 3 disclosures prioritises key sources that offer the most emissions-reduction potential⁴:

- for companies with ruminant (beef and dairy) supply chains: enteric fermentation included in Scope 1 or 3 emissions,
- for companies with ruminant and other livestock (pigs & poultry) supply chains: emissions associated with agriculture/feed included in Scope 1 or 3 emissions; and
- for aquaculture companies: agriculture products purchased included in Scope 1 or 3 emissions.

We do not award points for companies that report Scope 1 and 2 emissions, but with no associated explanation of emission sources.

KPI 3: Emissions intensity performance

An emissions intensity percentage reduction is an important indication that a company is following through on its policies. We assessed reported decreases in emissions intensity specifically due to emissions reduction activities with the highest scores. The remaining companies either had a decrease in emissions intensity due to revenue change, increase in emissions intensity, or provided no relevant information.

Company performance on GHG emissions

Almost three-quarters of companies – some 72% – present little or no evidence that they are measuring, managing or reporting their GHG emissions. The average score for the risk factor was 24.89 out of 100.

	KPI 1 – Reduction targets	KPI 2 – GHG inventory	KPI 3 – Emissions intensity
Low risk	12%	7%	10%
Medium risk	20%	28%	13%
High risk	68%	65%	77%

Table 4: Percentage of companies within each risk level across the three GHG KPIs

Notable findings:

- KPI 1 (targets): 32%** of companies show full or partial targets to reduce Scope 1 and Scope 2 emissions.
- KPI 2 (GHG inventory): 21 companies**, over 35% of our Index, do not report any GHG inventories.
- KPI 3 (emission intensity): Only six companies** report that their emissions intensities are specifically due to emissions-reduction activities.
- Sector performance:**
 - Aquaculture companies receive the highest average scores on this risk factor.
 - Of the 24 companies that produce beef and dairy, where GHG emissions are a notable risk, only three companies are assessed as 'low risk', indicating basic management and disclosure of this risk factor.
 - All the Chinese beef or dairy processing companies in the Index are assessed as 'high risk' due to little or no disclosure on this risk factor. While Chinese companies monitor and report on emissions of sulphur oxides (SOx) and nitrogen oxides (NOx) as well as energy use very few reports carbon emissions.

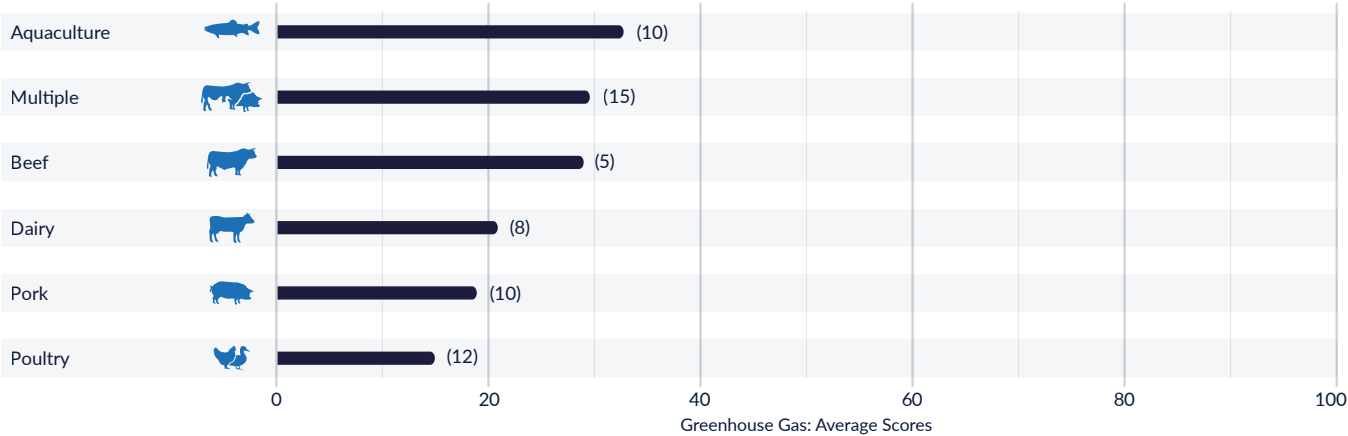


Figure 6: Average scores by protein sources. Companies with 'Multiple' proteins derive significant proportions of revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

³ GHG inventories are estimates of all emissions and removals of GHGs from given sources or sinks from a defined region in a specific period of time.

⁴ While there are other sources of emissions specific to livestock companies (manure management, land use change, biogenic carbon, etc.) we made the decision to focus the KPI on high-emission sources that were deemed to be the most significant for livestock companies. Further, we account for the fact that GHG emissions classification in this sector is highly dependent on individual company business models. For example, Fonterra, a cooperative that purchases its raw material, includes emissions related to milk production under Scope 3 (milk represents over 95% of their Scope 3 emissions). Marine Harvest, a seafood and aquaculture company, produces its own fish feed. Both farming and feed are part of its Scope 1 emissions.

Top performers

Salmar, one of the world's largest producers of farmed salmon and the world's largest producer of farmed organic salmon, was the top performing company in this category. Among land-based protein companies, Marfrig, a Brazilian beef producer, displayed best practice in its GHG strategy and reporting.

Company	Total GHG score (out of 100)
Salmar ASA	100.00
Marfrig Global Foods SA	86.67
Lerøy Seafood Group ASA	86.67
Maple Leaf Foods Inc	80.00
Marine Harvest ASA	80.00
Hormel Foods Corp	73.33
Charoem Pokphand Foods PLC	73.33
Fonterra Co-operative Group Ltd	73.33

Table 5: Companies that score at the 'low-risk' level on GHG emissions

Bottom performers

Twenty-seven companies receive a 'high risk' score (above zero) on GHG emissions, indicating poor disclosure and management. They have a combined market capitalisation of \$145 billion and revenues of over \$108 billion.


Sixteen companies receive a score of zero due to no evidence of a GHG emissions strategy. They have a combined market capitalisation of \$30 billion and revenues of over \$18 billion.



Best practice

Salmar ASA, which reports in CDP 2017, has a clear GHG intensity target, with both a target and base year, covering 100% of its operations. The company aims to reduce Scope 1 and 2 emissions intensity by 10% by 2020, against a 2013 baseline. Salmar also discloses a 14% reduction in emissions intensity due to reduction activities from the previous financial year.

The company reports its Scope 1, 2 and 3 emissions to CDP. As an aquaculture company, feed is an important source of emissions. Salmar's reporting covers all relevant operations and includes emissions related to feed in Scope 3 emissions.



The full company benchmark is available for FAIRR investor members. See index.fairr.org for the full data set.



Focus

How companies report on CDP's climate change questionnaire

Poor or no disclosure of key emission sources from the 60 companies in the Index means that we are unable to conduct any meaningful analyses on the reported data. To develop a better sense of company best practice in emissions reporting, we analyse the CDP disclosures of a subset of seven companies (out of a total of 19 in our Index that report to CDP). We chose these companies, which represent a diversity of protein sources, because of their relatively complete disclosures on the CDP platform.

Category	Protein sources	CDP climate score
Chareon Pokphand Foods PLC	Poultry, pork, aquaculture	B
Cranswick PLC	Pork, poultry, beef	D
Fonterra Co-operative Group Ltd	Dairy	C
Hormel Foods Corp	Pork, poultry (chicken & turkey), beef	C
JBS SA	Pork, poultry, beef	B
Marfrig Global Foods SA	Cattle, sheep and poultry	B
Marine Harvest ASA	Seafood and aquaculture	A-

Table 6: Index companies and their CDP climate score

We look for companies to disclose the following information on their emissions reporting:

- whether companies with ruminant (beef & dairy) supply chains included enteric fermentation in Scope 1 or 3 emissions depending on their business models,
- whether companies with ruminant and other protein (pigs, poultry, aquaculture) supply chains included emissions associated with agriculture/feed in Scope 1 or 3 emissions, depending on their business models,
- whether companies have set long-term, comprehensive, science-based targets; and
- whether companies have set an internal price on carbon to help plan their future investments.

We compare the disclosures of these seven companies to a sample of their peers in the broader food industry currently on CDP's A List (CDP's annual list of businesses leading on environmental performance): Danone, Unilever and Nestlé.

Our findings

The livestock sector is not comprehensively reporting on its GHG inventories. Given that this sector by itself contributes to 14.5% of global GHG emissions, and that these companies are particularly vulnerable to climate change impacts, the general absence of disclosure indicates an absence of external scrutiny of the sector.

- Of the six companies with international operations, three (**JBS**, **Marine Harvest**, **Marfrig**) report emissions for their entire global operations. All three companies in the A List report emissions for their entire global operations.
- Only **Marfrig**, **Marine Harvest**, **Fonterra** and **Chareon Pokphand Foods** disclose Scope 3 emissions related to agriculture/feed purchases. JBS – the largest company in the Index – does not calculate or disclose Scope 3 emissions associated with agriculture/feed. All three companies in the A List report comprehensively on their Scope 3 emissions related to purchased goods and services, with detailed explanations on methodology.

- CDP allows companies to break down their emissions by country, business division, facility, GHG type, and activity. This helps companies track and prioritise their emissions-reduction activities. Similar to the A List companies, **JBS**, **Marfrig** and **Marine Harvest** break down their emissions by at least three of the five categorisations.
- Overall, **Marfrig**, which produces and processes ruminants (cattle, sheep) and poultry, discloses the most complete information on GHG emissions. Its Scope 1 emissions include enteric fermentation, and it breaks down its emissions by geography, business division, GHG type and activity – which allows for more targeted emissions-reduction programmes. Its Scope 3 emissions include those related to purchase of cattle, sheep and poultry as well as agricultural inputs for feed production – i.e., the most significant sources of Scope 3 emissions.

- None of the seven companies we assess on their CDP reports provides independent third-party assurance of data. By contrast, all three companies in the A List independently verify their data.

Targets are partial, and primarily short or medium term. Long-term, comprehensive, science-based targets provide companies with a clearly defined pathway to future-proof growth by specifying how much and how quickly they need to reduce their GHG emissions.

- Most livestock companies have committed to only partial targets, primarily related to emissions associated with their facilities. None of these targets are science-based. The only livestock company with long-term targets is **Fonterra**. The company has committed to reducing Scope 1 and 2 emissions intensity within its New Zealand operations in 2030 by 30% from a 2008 base year.
- By contrast, **Nestlé** and **Unilever** in the A List have science-based targets, and all three A-List companies include Scope 3 emissions as part of their commitments. **Danone**, for example, has a long-term objective to achieve net zero GHG emissions by 2050 on its Scope 1, 2 and 3 emissions (direct and shared responsibility scopes).
- The livestock industry is playing catch up. In 2018, **Tyson Foods** committed to a 30% reduction in emissions for Scope 1 and Scope 2 activities, such as transportation related to product distribution, purchased electricity and energy consumed by processing facilities. It also committed to a 30% cut in intensity for Scope 3 emissions – which constitute over 90% of its total. It has also requested official approval for its targets by the Science Based Targets initiative.

No livestock company has adopted a price on carbon. An internal carbon price integrated into investment decisions can be an effective tool to address risks and build operational resilience. By October 2017, over 1,400 global companies had factored an internal price on carbon into their business plans (Climate Action 2017).

- All three companies in the A List use a long-established price on carbon. For example, **Unilever** introduced an explicit internal price of carbon of €30 per tonne in 2016. By contrast, none of the seven companies in our list has an internal carbon price.

FAIRR recommendations for livestock and aquaculture companies

Through our analysis, it is evident that there is an absence of crucial information to accurately capture the true state of play about carbon mitigation strategies. FAIRR suggests some basic recommendations to promote disclosure on proactive management of these issues:

- To ensure complete information, emissions should be reported for all business and geographical units, not just a subset of operations.
- Scope 1 and 2 emissions should be split by geography, business division, GHG type and activity – which will help companies prioritise and target emissions-reduction programmes.
- At a minimum, companies with ruminant supply chains must capture emissions related to enteric fermentation in their Scope 1 or Scope 3 emissions, depending on their business model.
- All livestock companies must capture emissions related to purchased animals and agricultural inputs.
- Companies must set targets that are long term (2030 and later) comprehensive (all relevant geographies and operations), science based, and encompass all emission scopes, especially for companies that have high Scope 3 emissions.
- Companies must adopt an evidence-based internal price on carbon to help them better model future investments.

Focus The aquaculture sector

The aquaculture industry today contributes more fish for human consumption than traditional wild-caught fisheries (Seafood Source 2018). The global industry is worth \$156 billion. Asia, including China, provides most of this output, followed by Norway, the United Kingdom, Chile and Canada.

The industry has been enjoying a boom because aquaculture is seen as a relatively low-impact and resource-efficient way to meet the protein demands for a rising global population: the ten largest aquaculture companies recorded an average return of 422% over five years (Fish Tracker Initiative 2017). The sector is being prioritised for growth by several countries, including China, Norway and Chile (Undercurrent News 2017). Given this dramatic growth, it is important that investors pay closer attention to how aquaculture companies report and manage key ESG risks.

Main risks and KPIs

Compared to other intensive animal production systems, aquaculture is more efficient at using land, water and energy resources. However, environmental impacts differ by species. Enclosed freshwater systems (e.g. Tilapia, carp, catfish) have high freshwater consumption compared to marine species, but present a lower risk on fish disease and escapes. Species such as salmon, which are farmed in open waters, use high inputs of wild catch (fishmeal) or soy protein concentrate, and can devastate wild populations when they escape. The industry is also facing a critical sea-lice challenge, which has been exacerbated with higher production volumes.

In addition to common indicators across all protein sources, the Coller FAIRR Protein Producer Index assessed the following indicators specific to this sector:

- whether scope 3 disclosure includes agricultural raw material purchases for feed production,
- whether companies assess deforestation risks as part of their soy or feed supply chains,
- escapees and disease management,
- the water exposure of feed supply chains,
- fish waste management through innovation; and
- fish welfare addressed through certifications that cover welfare plus supplemental company policies.

Company performance

The Index includes 18 companies that have aquaculture products in their protein portfolio, with ten companies specialising in aquaculture-only production. These ten businesses are on average the best performing protein category with five companies in the top ten Index performers. However, it is clear that currently only companies based in Norway are adequately reporting on critical risks, primarily as a result of a strong regulatory environment. We find little or no disclosure from the Asian-based aquaculture companies in this sector. In general, the scores for multiple protein companies such as Charoen Pokphand Foods and Japfa are related to their reporting on other protein sources, not aquaculture production.

Of the aquaculture companies with the top ten scores:

- three out of ten companies have their supply chain fully certified by at least one standard,
- four out of ten companies address soy-related deforestation risk through certifications; and
- six out of ten companies actively manage and account for fish escapees.

The list of aquaculture companies and their scores is available in the full report for FAIRR investor members. See index.fairr.org for the full data set.



Deforestation and Biodiversity Loss



Livestock production is one of the most significant drivers of deforestation and biodiversity loss worldwide. Growing demand for meat and animal feed such as soy has encouraged livestock operators to turn large swathes of forestry lands, mangroves and savannahs into farmland.

For example, Brazilian firm JBS, the world's largest meat producer, has more than 70,000 suppliers, 57% of which are based in the Amazon. However, the problem is not constrained to emerging markets. In the Australian state of Queensland, land clearance and deforestation mainly for pastoral land increased by 100,000 hectares per year to nearly 395,000 hectares in 2015–16, releasing an additional 45 million tons of GHGs into the atmosphere – equivalent to burning 163 billion pounds of coal (The Guardian 2018a).

Over the past few years, investors and advocacy groups have played a strong role in pushing companies to tackle deforestation in their supply chains. While there has been some progress, cattle and soy supply chains continue to lag behind palm oil and timber. The most recent analysis by Forest 500 found that despite cattle production being the largest driver of tropical deforestation globally, only 17% of cattle companies assessed have a policy addressing the protection of forests for cattle production or procurement. Similarly, 60% of company forest policies for soy – a key feed ingredient – are geographically limited, with the majority only covering the Amazon (Forest 500 2017).

Aquaculture production drives biodiversity loss in a similar way. Sensitive ecosystems such as mangroves and coastal wetlands are often converted to fish farms. There is the potential for farmed fish production to lead to water pollution, overfishing (to provide feed), and species loss due to escapees from fish farms. An example of the latter occurred in 2016 when salmon farm cages capsized and released nearly 300,000 Atlantic salmon into the Puget Sound near Seattle. The resulting threat to wild Pacific salmon populations prompted Washington State regulators to suspend the issuance of licences for new or expanded fish farms (The Seattle Times 2017).

Another burgeoning biodiversity issue for the aquaculture industry is sea lice infestation, which costs the sector \$1 billion a year. While sea lice occur naturally on salmon, the problem has been exacerbated due to high demand for farmed salmon. This has led to higher stocking densities, poor hygiene and increased drug use – all contributory factors to the increasing prevalence of infestation (The Guardian 2017a). Norway, the world's largest producer of farmed salmon, has suffered production losses due to the sea lice epidemic, prompting the government to constrain growth in farm quotas (Reuters 2014).

A new deforestation screening tool for investors

SCRIPT (Soft Commodity Risk Platform) is a new freely available system to help financial institutions understand and mitigate the deforestation risks associated with financing companies in soft commodity supply chains. SCRIPT offers a comprehensive company information system to generate risk assessments for portfolios. It has customisable criteria, allowing institutions to develop risk mitigation strategies tailored to the institution's portfolio and identify important issues on which to engage portfolio companies. Learn more at script.finance.



KPIs on deforestation and biodiversity loss

Where available, we prioritise 2017 CDP reports as our main source. Other sources include company websites, and annual and sustainability reports.

KPI 1: Zero-deforestation target (terrestrial only)

Companies must have a clear target to achieve zero-deforestation supply chains and/or sourcing to tackle deforestation effectively. Specifically, we consider companies with quantitative, time-bound targets in all relevant areas (cattle, soy, palm oil – which can also be used as animal feed) as better positioned than companies with 'no commitment' deforestation policies or commitments only for timber. We do not assess aquaculture companies on this risk, given their business models.

KPI 2: Partnerships with NGOs to address exposure to deforestation and biodiversity loss

Partnering with a well-regarded NGO – or obtaining a certification of product sustainability from a credible NGO – can address concerns about direct exposure to deforestation and biodiversity loss for companies engaged in intensive livestock and fish production.

For the top score in terrestrial companies, we look for NGO partnerships as well as reporting on CDP Forests to avoid company greenwashing. We do not distinguish between NGOs. For the top score in aquaculture companies, we look for multiple certifications by leading certification providers (Aquaculture Stewardship Council (ASC), GlobalG.A.P., Best Aquacultural Practices (BAP)), with full value chain certification by at least one scheme. We look for multiple certifications because different certifications cover different aspects of the aquaculture value chain.

KPI 3: Supplier code to address deforestation/biodiversity exposure

Companies can limit their indirect effects on deforestation and biodiversity by extending their internal operational codes and policies to their suppliers. Such codes can either involve relatively stringent overview of suppliers, including requiring compliance with the supplier code, or can be less formal, such as simply encouraging compliance with the client's policies. For terrestrial companies, we look for explicit language around enforceable requirements on deforestation. For aquaculture companies, we look for how the company is sourcing fish feed as well as agricultural feed (such as soy).

KPI 4: Escapees from fish farms (aquaculture only)

Escapees from net pens are difficult to avoid as they can result from equipment damage or predator attacks. Due to the impact of farmed fish competing against wild fish for habitat and food, as well as the threat of spreading genetic mutations by mating with wild salmon species, it is imperative for farms to: (a) report specific numbers on this issue; and (b) include measures on how to reduce this risk. We do not assess terrestrial companies on this risk, given their business models. This issue is a particular threat for the salmon industry.

KPI 5: Disease management (aquaculture only)

While sea lice occur naturally, their populations grow exponentially in salmon farms with high stocking densities. Sea lice feed on the host species, such as mucus, blood and epidermal tissue. A single adult sea louse can kill juvenile fish, hence the build-up of sea lice numbers in salmon pens that then spread to wild salmon populations represents a significant risk to biodiversity. Good management of sea lice is a proxy indicator for gauging the overall management oversight of fish and environmental health. It requires good monitoring systems and action plans in case of a rise in sea lice numbers. For non-salmon farms, we look for evidence of disease management.

Company performance on deforestation and biodiversity loss

Overall, 77% of companies provide little or no evidence on deforestation and/or biodiversity management. The average score for the risk factor is 20.68 out of 100.

	KPI 1 – targets (terrestrial only)	KPI 2 – partnerships	KPI 3 – supplier code	KPI 4 – escapees (15 aquaculture companies)	KPI 5 – disease (15 aquaculture companies)
Low risk	6%	10%	10%	40%	33%
Medium risk	10%	17%	15%	7%	27%
High risk	84%	73%	75%	53%	40%

Table 8: Percentage of companies within each risk level across the five deforestation and biodiversity KPIs. Note that some companies have aquaculture and animal agriculture operations

Notable findings:

- KPI 1 (targets):** 84% of the 50 terrestrial protein companies do not have a zero-deforestation target or a deforestation policy.
- KPI 2 (partnerships):** 27% of the companies show evidence of an NGO partnership and/or independent certification on deforestation and biodiversity.
- KPI 3 (supplier code):** Only 10% of companies show evidence of a strong supplier code with enforceable requirements on deforestation.
- KPI 4 (escapees) and KPI 5 (disease):** All the Norwegian aquaculture companies receive high scores on their reporting and management of sector risks such as fish escapes and sea lice infestation. In contrast, Asian-based aquaculture companies perform poorly on sector-specific risks.
- Sector performance:**
 - Of the 24 companies that process beef and dairy, where deforestation is a particular risk, only one company (Marfrig, one of Brazil's top beef exporters) is assessed as 'low risk', indicating basic management and disclosure on deforestation issues at least on cattle.
 - While JBS has strong commitments and policies on deforestation, recent revelations suggest that the company has knowingly bought cattle raised on illegally deforested land for years – suggesting that while policies do exist on paper, they are not being implemented in practice.
 - As with GHG emissions, aquaculture companies receive the highest average scores on this risk factor. Most of the companies in the 'low risk' category are aquaculture companies.

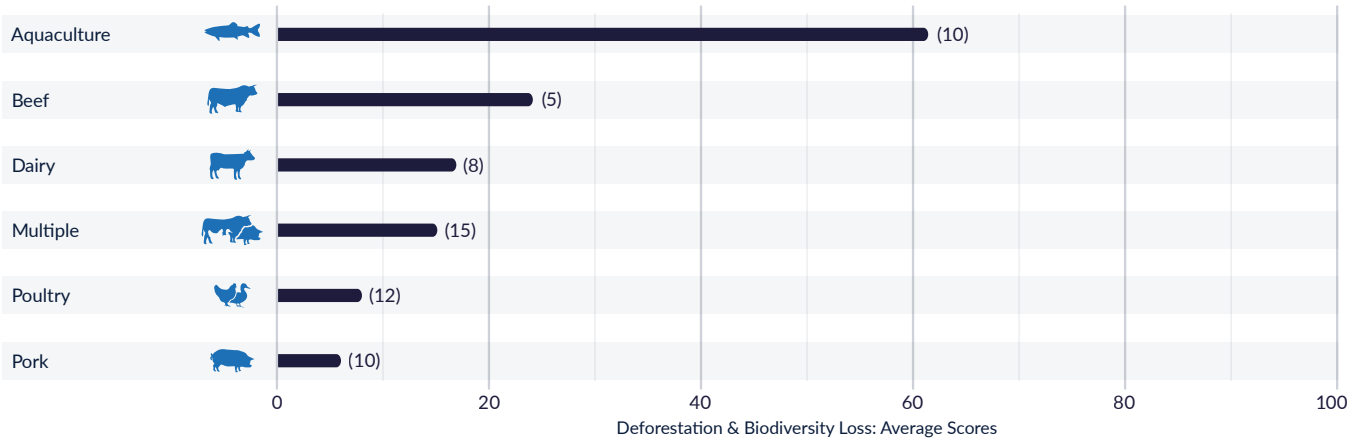


Figure 7: Average scores by protein sources. Companies with 'multiple' proteins derive significant revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

Top performers

Bakkafrost, a salmon producer, is the top performing company in this category. Among land-based protein companies, Marfrig, a Brazilian beef producer, displays best practice on its cattle-based deforestation commitments.

Company	Total deforestation and biodiversity score (out of 100)
Bakkafrost P/F	100.00
Marfrig Global Foods SA	100.00
Lerøy Seafood Group ASA	95.00
Marine Harvest ASA	85.00
Salmar ASA	85.00
Grieg Seafood	80.00
Empresas AquaChile	70.00

Table 9: Companies that score at the 'low risk' level on deforestation and biodiversity

Bottom performers

Fifteen companies received a 'high risk' score (above zero) on deforestation and/or biodiversity, indicating poor disclosure and management. They have a combined market capitalisation of \$126 billion and revenues of over \$157 billion.

Thirty-one companies received a score of zero due to no evidence of a deforestation and/or biodiversity strategy. They have a combined market capitalisation of \$105 billion and revenues of over \$78 billion.

Best practice

Bakkafrost's entire value chain – feed production, hatcheries, farming sites and the harvesting and processing plant – is certified by GlobalG.A.P. The company is also committed to having all sites certified by the Aquaculture Stewardship Council by 2020. Bakkafrost's feed business sources fishmeal and other plant-based ingredients such as soy, which is a deforestation risk. In addition to certifications that assess fish feed sustainability, Bakkafrost notes that its fishmeal and fish oil come from sustainably sourced fish with low food value and a low market demand for direct human consumption. Its soy is Proterra-certified, and it does not source palm oil.

On fish escapes, Bakkafrost operates in some of the world's harshest environments, which can result in equipment damage and fish losses. It has set a target to completely eradicate losses by 2020. In 2017, it reported that 109,515 Atlantic salmon escaped from its sites. Sea lice (and other diseases) are measured on a weekly basis and are below the limit set by authorities. The company has successfully implemented more natural strategies to tackle sea lice, including introducing 'cleaner fish' such as lumpfish, which consume sea lice. Initial trials have shown that this can combat the problem without the use of drugs.





Chapter Five Water Scarcity and Use



Agriculture is responsible for around 92% of the human water footprint, and livestock production accounts for nearly one-third of that use. For example, beef’s water footprint (on a per gram of protein basis) is six times that of pulses. Milk, eggs and poultry are around 1.5 times more. Nearly 98% of this water goes towards the production of animal feed (Water Footprint Network n.d.).

Risks from water use are contingent on the degree of water scarcity. Water consumption, while a global concern, impacts local communities and ecosystems. Companies may face less concern about the levels of their water consumption if there are abundant local resources. Conversely, local communities may push back against companies during times of drought when competition for water access is high.

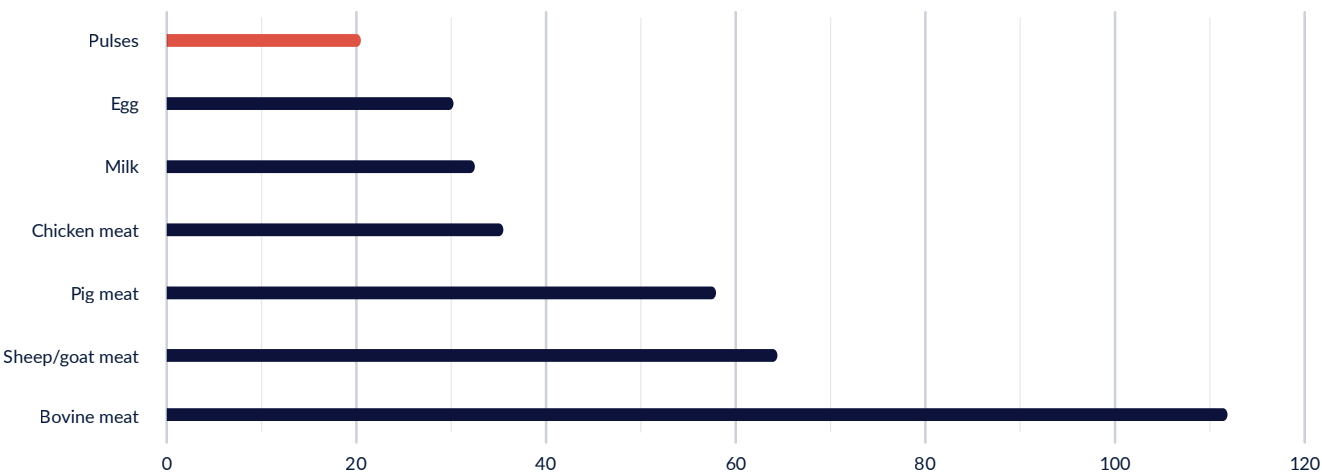


Figure 8: Water footprint of different protein sources (Source: Data from the Water Footprint Network)

While there is increasing attention on the water intensity of beef, pork, poultry and dairy production, the risks for aquaculture companies are less well known. The fact is that for most food companies, water use can be a material issue if the farms or factories operate in areas of high water stress. Nearly 90% of today’s farmed fish comes from Asia, which is at severe risk for water shortages (FAO 2016 and Reuters 2016). In addition, the reliance on crop-based feed (such as soy) in certain aquaculture systems increases the water footprint of farmed fish (Gephart et al. 2017). The feed composition for salmon farmed by Marine Harvest, one of the leading aquaculture companies in our Index, is 53% agricultural commodities.

Water is a growing business and financial risk for companies dependent on agricultural commodities. Charoen Pokphand Foods reports water scarcity as a physical climate change risk on CDP, and estimates that 38% of its production sites in Thailand are located in water-stressed areas. The percentage of cost of goods sold (COGS) of the sites located in water-stressed areas is 59% of its total COGS (Charoen Pokphand Foods 2017). Similarly, dairy giant Fonterra reports that decreases in rainfall averages may impact grass growth in New Zealand and Australia, which impact milk supply and productivity. The company estimates that its management of on-farm support for farmers and their operational water efficiency activities requires the equivalent of 15 full-time employees at a cost of over \$1 million a year (Fonterra 2017).

Despite this risk, the livestock industry has a poor record on water management. In a recent benchmark of the food industry’s management of water risks by sustainability non-profit organisation Ceres, the meat industry is the worst performing industry compared to its sector peers. None of the six US meat giants are disclosing water quality data at an operational level and none are reporting goals to reduce wastewater discharges beyond what is required by law (Ceres n.d.).

KPIs on water use and scarcity

Where available, we prioritise 2017 CDP reports as our main source. Other sources include company websites, and annual and sustainability reports.

KPI 1: Management of water use in direct operations

The first step on water risk management is to account for use in direct company operations. We look for disclosure on water use as well as an in-depth discussion, preferably through a clear policy or strategy, on water use management. Aquaculture companies use freshwater resources for bathing, hatcheries, sea lice treatment and processing. We further look for evidence that aquaculture companies are managing and recycling water in their operations.

KPI 2: Company targets related to water (terrestrial only)

Companies must have a clear target to reduce water use in direct operations. Specifically, we consider companies with quantitative, time-bound goals as better positioned than companies with qualitative or partial targets. We did not assess aquaculture companies on this risk given the relatively poor understanding of freshwater use in aquaculture operations.

KPI 3: Water exposure of supply chains

The bulk of the water footprint for livestock and fish companies occurs at the feed level, which is why assessing supplier exposure to water risks is so important. For terrestrial protein companies, we look for explicit language around enforceable supplier requirements on water use. For aquaculture companies, we look for measures to phase out agricultural commodities with alternative protein sources or current certification (Roundtable Responsible Soy – RTRS or Proterra) of agricultural commodities such as soy.



Company performance on water scarcity and use

Nearly two-thirds of companies (63%) provide little or no evidence of management on water scarcity and use. The average score for the risk factor is 29.89 out of 100.

	KPI 1 – direct use	KPI 2 – targets (50 terrestrial companies)	KPI 3 – supply chain
Low risk	35%	14%	7%
Medium risk	23%	20%	12%
High risk	42%	66%	82%

Table 10: Percentage of companies within each risk level across the three water scarcity KPIs

Notable findings:

- **No company scores 100%.** The highest score was 87 out of 100. This is primarily because very few companies are addressing water use issues at the feed level.
- **KPI 1 (direct use): Only 35% of companies** in our Index report on water use and show evidence of a clear water use management plan in their operations.
- **KPI 2 (targets): 66%** of the 50 terrestrial protein companies do not have a water use target.
- **KPI 3 (supply chain): 82%** of companies show no evidence of a supplier code with enforceable requirements on water.
- **Sector performance:**
 - While aquaculture companies receive the highest average scores on this risk factor, the top performers include several pork and poultry producers.
 - The average score of companies with beef and dairy portfolios – the most water-intensive proteins – is 36 out of 100. Nearly 58% of beef and dairy companies, mostly Asian based, are assessed as being high risk on this risk factor.

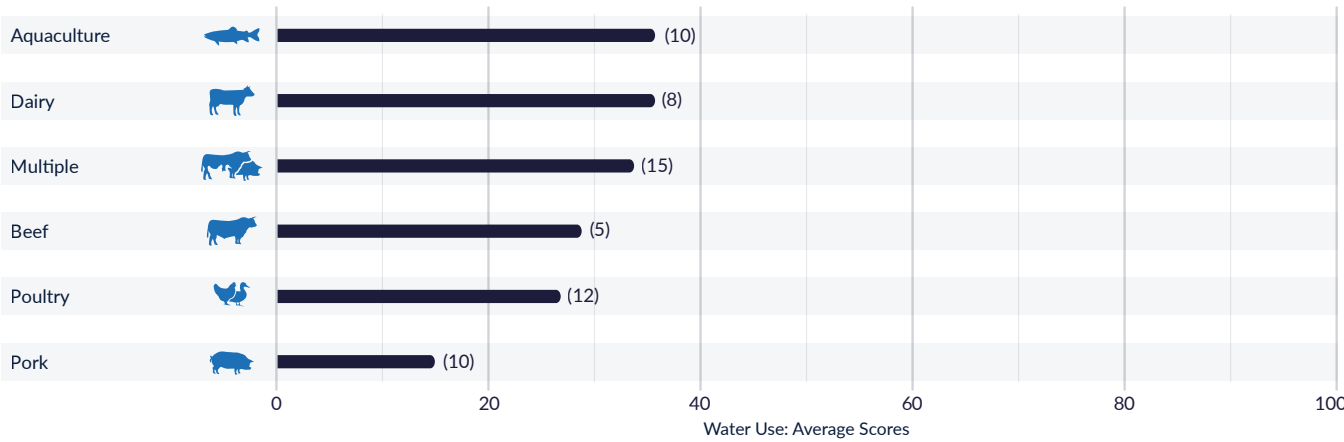


Figure 9: Average scores by protein sources. Companies with ‘multiple’ proteins derive significant revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

Top performers

Hormel, a pork, poultry and beef processor, Fonterra, a New Zealand-based dairy company, and Grupo Nutresa Corp, a Colombian food processor, are the top-performing companies in this category.

Company	Total water scarcity score (out of 100)
Fonterra Co-operative Group Ltd	86.67
Hormel Foods Corp	86.67
Grupo Nutresa SA	86.67
Lerøy Seafood Group ASA	80.00
Bakkafrost P/F	80.00
Vietnam Dairy Products JSC	73.33
Tyson Foods Inc	73.33
Charoen Pokphand Foods PCL	73.33
Pilgrim’s Pride Corp	73.33
JBS SA	73.33

Table 11: Companies that score at the ‘low risk’ level on water scarcity and use

Bottom performers

Twenty-one companies receive a ‘high risk’ score (above zero) on water scarcity and use, indicating poor disclosure and management. They have a combined market capitalisation of \$70 billion and revenues of over \$49 billion.

Seventeen companies receive a score of zero due to no evidence on water use management. They have a combined market capitalisation of \$52 billion and revenues of over \$30 billion.

Best practice



Hormel reports on its water use intensity, and has a target to reduce water use in its operations by 10% by 2020. It works with the World Resources Institute to evaluate its operations to determine the business risk associated with water scarcity. In 2016, Hormel joined the Ceres and World Wildlife Fund AgWater Challenge.

As part of this initiative, the company has committed to develop a comprehensive water stewardship policy, setting water management expectations that go beyond regulatory compliance for its major suppliers, contract animal growers and feed suppliers. This is a first for the meat industry. Hormel will also support and engage with growers in high-water-risk regions by gathering water-related data from contract growers and growers that supply animal feed – and establishing time-bound goals aimed at improving water quality in those regions.



The full company benchmark is available for FAIRR investor members. See index.fairr.org for the full data set.

Chapter Six

Waste and Pollution



A key environmental impact of intensive livestock farming is the creation of concentrated animal waste streams (from manure and animal byproducts) that require disposal. Manure can be an important soil nutrient, but the scale of intensive farming today produces quantities in significant excess (and much poorer quality) of what can be absorbed by the surrounding environment. According to the US Centers for Disease Control and Prevention (CDC), manure from concentrated feeding operations contain contaminants (including nutrients such as nitrogen and phosphorus), pathogens (such as E. coli), growth hormones, antibiotics, chemicals (used as additives to the manure or to clean equipment), animal blood, silage leachate (from corn feed) or copper sulfate (used in footbaths for cows) (National Association of Local Boards of Health 2010).

While the types of waste and their disposal methods differ among poultry, pigs, beef and aquaculture, companies face increased scrutiny about the impact of this waste on surrounding communities and the environment (see case study on the next page). Several academic studies and news reports have documented the negative impacts to health, and the deterioration of the quality of life suffered by residents living next to these facilities. Issues include childhood and adult asthma, airway obstruction and irritant-linked eye and upper airway symptoms (The Guardian 2017b).

As companies expand production, risks from waste and water pollution will grow in the medium term, and a systemic failure to manage this issue means that existing facilities may face community protests. Companies may even be blocked from building new facilities. These costs, in conjunction with possible limitations for expansion, are likely to have a greater financial impact than the direct cost of regulatory fines.

KPIs on waste and pollution

Our main sources include company websites, and annual and sustainability reports.

KPI 1: Waste management

For terrestrial companies, we look for a discussion on manure management and reference to a waste management policy based on an accepted standard such as ISO 14001. For aquaculture companies, we require ASC certification and discussion of waste management in farming operations for the top scores.

KPI 2: Disclosure of non-compliance (penalties, fines for discharge and audits) related to environment

The disclosure of penalties and fines by a company suggests that management is aware of the company's waste and pollution performance. The focus of this indicator is to understand if companies are, at a minimum, complying with local environmental regulations, particularly given the different geographical operating contexts. We believe compliance with local regulation is the first step towards developing a comprehensive waste management strategy.

Focus Manure disposal poses a significant threat to the sector's licence to operate

Across markets, factory farming operations are beginning to face litigation and community advocacy against expansion, threatening their licence to operate:

- In 2016, poultry producer **Tyson** was fined for dumping wastewater in southwestern Missouri (Talk Business & Politics 2017). Even though the size of the fine (\$2 million) was not material given Tyson's revenues of \$36 billion that year, the impact of waste and water pollution has since extended beyond the cost of fines, and is now affecting the company's 'social licence to operate' (communities' acceptance of companies' projects or presence). For example, Tyson was unable to proceed with a planned \$320 million chicken-processing facility in Tonganoxie, Kansas, after protests from residents. Members of the 3,000-person community cited, among other factors, fears that water pollution may impact the surrounding farming communities and drinking water (CBS News 2017). The \$320 million facility represents 30% of Tyson's 2016 total capital expenditure.
- In April 2018, a jury in North Carolina awarded over \$50 million to ten plaintiffs who sued **Smithfield Foods** – a subsidiary of WH Group, and one of world's largest pork producers. Residents alleged that the company's "industrial-scale operation exposed them to putrid manure smells, buzzards, swarms of flies and a steady stream of trucks laden with dead animals" (Politico 2018). The case is seen as a bellwether for similar incidents related to the hog industry's manure disposal practices.
- In Delaware, legal threats have been made against large-scale poultry producers such as **Mountaire Farms** and **Mountaire Corporation** for contaminating groundwater sources in the state (Delaware Online 2018).
- In Iowa, which has 10,000 intensive farms (four times as many as it did in 2001), lawmakers are seeking a moratorium on building or expanding concentrated animal feeding operations until Iowa's list of impaired waterways shrinks from 750 to fewer than 100 (Des Moines Register 2018).
- In the Netherlands, the world's fifth-largest exporter of dairy, a new WWF campaign is calling for a 40% cut in the number of heads of cattle within ten years. According to a recent report, about 80% of farms in the Netherlands produce more dung than they can legally use on their farm. "To get around the limits, farmers pay an estimated €550 million a year to get the manure removed. A recent investigation uncovered blatant fraudulent practices at some farms where some farmers were deceptively avoiding these removal costs altogether by transporting the manure off-farm on paper, but in reality dumping it on farm fields" (The Guardian 2018b).
- In Australia, protests and business boycotts have grown against plans to expand the aquaculture operations of **Tassal**, Tasmania's biggest salmon producer. Residents are concerned about the impacts of salmon farming on local ecosystems, including increased bacteria in the water system and a drop in water oxygen levels. In 2017, Tassal was ordered to destock a leased farm property close to a World Heritage area, after a report found that all marine fauna at least 500 metres around the property were dead (ABC News 2017).
- New Zealand, one of the world's largest dairy exporters, has seen a series of clashes between communities and the dairy industry over water pollution. Communities have opposed large irrigation schemes to expand dairy production, principally due to concerns over polluted waterways. In August 2017, legislators scrapped plans to build a \$330 million dam in the Hawke's Bay area after vocal opposition to the dam's role in expanding dairy production (New Zealand Herald 2017).



Focus Social licence to operate: lessons from the mining sector

We find little discussion relating to a social licence to operate from the 60 companies in the Index. Intensive livestock farming companies' social licence to operate may be an emerging issue, as evidenced by recent protests faced by companies such as Tyson. Intensive livestock farming companies can look to other sectors as they develop tools to engage communities.

The mining industry has faced significant community conflict for several decades. Mining companies that have under emphasised community acceptance have seen their projects stalled or stopped by community protests. For a major mine, community protests that slow project construction can cost up to \$20 million per week in Net Present Value (Davis and Franks 2014). Mining company Anglo American develops detailed assessment programmes on each community surrounding a mine, called the Socio-Economic Assessment Toolbox (SEAT). This prescribes how the company engages and monitors individual communities (Anglo American 2012). SEAT provides a range of indicators for each community, including results from town hall voting. The results of the assessments are published so that stakeholders, including investors, can monitor the company's social licence to operate in these communities.

While intensive livestock farming does not face the extreme geographical restrictions of mining, poor management of odour, waste and water use can cause local community grievances. Maintaining a social licence to operate is key to expansion and operational efficiency.



Company performance on waste and pollution

Companies in the Index demonstrate the management required to achieve the top scores on addressing waste and pollution – more than any other risk factor. The average score for the risk factor was 57.33 out of 100.

	KPI 1 – waste (Terrestrial)	KPI 1 – waste (Aquaculture)	KPI 2 – non-compliances
Low risk	24%	27%	58%
Medium risk	46%	20%	23%
High risk	30%	53%	18%

Table 12: Percentage of companies within each risk level across the waste and pollution KPIs

Notable findings:

- **KPI 1 (waste): Around a quarter of the terrestrial** companies specifically reference their management of animal waste – including several China-based companies. Note that we only looked for some discussion on manure management, and not specifically for a comprehensive nutrient management strategy.
- **KPI 2 (non-compliances): 58%** of companies say they did not incur any fines for non-compliance issues. While this indicator has the highest average company score, we caution that industry regulation and monitoring differ significantly across markets. Therefore, an absence of fines does not necessarily indicate good performance.
- **Geographical performance:**
 - a. Waste pollution is the only risk factor with a significant number of emerging market companies among the top performers. This may be indicative of both a greater recognition of licence to operate issues for these companies, as well as more stringent local requirements on waste pollution.
 - b. Only two companies (Sanderson Farms and Hormel) of the 26 ‘low risk’ companies are based in the US. In general, US-based companies do not manage their animal waste products sufficiently.

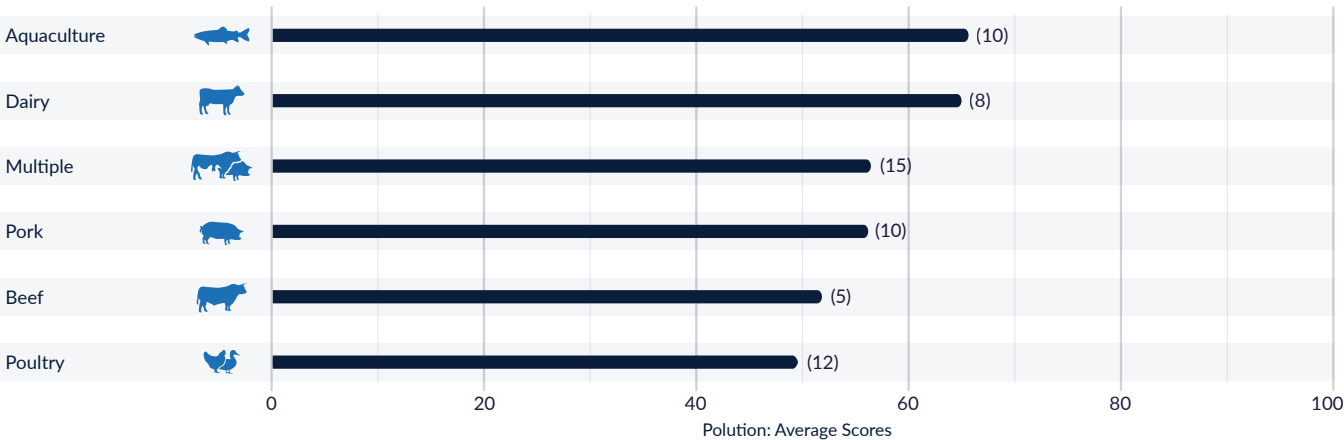


Figure 10: Average scores by protein sources. Companies with ‘multiple’ proteins derive significant revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

Top performers

Bakkafrost and AquaChile, both salmon producers, are the top performing companies in this category.

Company	Total pollution score (out of 100)
Empresas AquaChile SA	100.00
Bakkafrost P/F	100.00
NH Foods Ltd	90.00
New Hope Liuhe Co Ltd	90.00
Muyuan Foodstuff Co Ltd	90.00
Vietnam Dairy Products JSC	90.00
Fortune Ng Fung Food Hebei Co Ltd	80.00
Marine Harvest ASA	80.00
GFPT PLC	80.00
Grupo Nutresa SA	80.00
Fonterra Co-operative Group Ltd	80.00
Salmar ASA	80.00
Fujian Sunner Development Co Ltd	80.00
China Shengmu Organic Milk Ltd	80.00
Marfrig Global Foods SA	80.00
Lerøy Seafood Group ASA	80.00
Scandi Standard AB	70.00
Great Wall Enterprises Co Ltd	70.00
Cranswick PLC	70.00
MHP SE	70.00
Sanderson Farms Inc	70.00
Beijing Sanyuan Foods Co Ltd	70.00
Tassal Group Ltd	70.00
COFCO Meat Holdings Ltd	70.00
Maple Leaf Foods Inc	70.00
Hormel Foods Corp	70.00

Table 13: Companies that score at the 'low risk' level on waste and pollution

Bottom performers

Five companies receive a 'high risk' score (above zero) on waste and pollution, indicating poor disclosure and management. They have a combined market capitalisation of \$16 billion and revenues of over \$24 billion.

Five companies also receive a score of zero due to no evidence or discussion on waste and pollution. They have a combined market capitalisation of \$7 billion and revenues of over \$6 billion.

Best practice

AquaChile, a large Chilean salmon producer, reports on their water discharges by quantity and destination. It also disaggregates its waste data by treatment and reuse destinations to increase transparency. Waste treatments include non-chemical and natural solutions. Treated waste water is reused in the production of rice and sugar cane. AquaChile also has comprehensive measures to control effluents from its farms. These include developing highly digestible feeds to reduce excrements, regular third-party monitoring of the seabed and water column, and reduced stocking densities. The company reports that it had no breaches of environmental regulations.

Fonterra is New Zealand's biggest company and one of the world's largest processors of dairy products. It sources the majority of its raw milk from Fonterra farmers in New Zealand – the owners of the Co-operative. Fonterra also owns and operates farms in New Zealand and China, and sources milk from farmers in Australia and Latin America. In New Zealand, it produces a detailed Farmers Handbook that has comprehensive instructions on effluents and water use management. Almost all (95%) of its farmers submit nutrient budgets, while Fonterra's Sustainable Dairy Advisors, who are also certified nutrient management advisors, work with farmers to improve farmer performance. Within New Zealand, the company appears to be well ahead of the global market, reporting across a wide set of targets. The company reports two incidents of fines, which is why it does not receive the top score on this risk factor.



The full company benchmark is available for FAIRR investor members. See index.fairr.org for the full data set.



Antibiotics

Worldwide, significantly higher volumes of antibiotics are used in food animals than in human medicine. Overuse of antibiotics on farms is now widely recognised as a contributor to the development of antimicrobial resistance (AMR) and a cause of systemic risk both within the food industry and across the wider economy. Drug-resistant infections are now a serious public health threat, with the potential to impact productivity, mortality and healthcare costs on a global scale. A UK Government report found that by 2050 AMR could cause ten million deaths a year and cost the global economy \$100 trillion (Review on Antimicrobial Resistance 2016). Driven by growing public concern about the use of antibiotics and the potential for regulatory change and sector-wide reputational damage, investors are increasingly recognising AMR as a material risk.

Investor engagement on antibiotics stewardship

FAIRR’s collaborative investor engagement on antibiotics is supported by 74 institutional investors representing over \$2.5 trillion in assets under management (AUM) as of May 2018. The engagement asks 20 global food companies to limit antibiotic use in their supply chains to protect public health and long-term portfolio value by:

- establishing an antibiotics policy to phase out routine use across all supply chains, in line with WHO recommendations,
- specifying clear targets and timelines for implementation; and
- increasing transparency by reporting on implementation and data verification.

The antibiotics engagement is open to all FAIRR members.

[Learn more about how global restaurant chains are responding to the threat of antibiotic resistance.](#)

Around 70% of antibiotics in the US and two-thirds of antibiotics in the EU are given to farm animals. Overuse is particularly prevalent in intensive farming systems – to compensate for low animal welfare standards and to enable animals to survive in overcrowded, stressful and often unhygienic conditions.

There are three primary applications for antibiotics in livestock production:

- **Growth promotion:** The use of low-dose antibiotics in livestock has been shown to increase an animal’s ability to retain nutrients and develop greater amounts of protein. The move by certain jurisdictions, including the EU, to ban the use of the antibiotics in growth promotion arose from evidence that the broad usage of low doses in livestock promotes optimal conditions for bacteria to develop antibiotic resistance, thus driving increased resistance in humans (European Commission 2005).
- **Non-therapeutic (or prophylactic) use:** Non-therapeutic use of antibiotics means regularly giving antibiotics to healthy animals to prevent disease, rather than to treat individual, diagnosed cases of disease. Intensive production systems are more likely than traditional systems to deploy antibiotics for disease prevention. This is because it allows livestock to be reared in densely packed and often unhygienic conditions, also contributing to the threat of AMR.
- **Therapeutic use:** Therapeutic use means giving antibiotics only to animals with a diagnosed disease. This is considered acceptable use to treat disease, protect production and prevent animal suffering.

There are two classifications of antibiotics used in livestock production:

- **Medically important antibiotics (MIAs):** Sometimes referred to as ‘human use’ or ‘shared use’ antibiotics, the term refers to antimicrobial drugs that are important for medical use in people. The category contains common drugs like tetracycline and penicillin, and others more critical to human medicine – or ‘critically important antibiotics’ (CIAs) – such as cephalosporin and fluoroquinolones, one of the few available therapies to treat serious bacterial infections in humans (WHO 2017b).
- **Non-medically important antibiotics** – also referred to as ‘non-human-use antibiotics’, these drugs are not deemed as medically important as they are not used in human medicine.

Antibiotics misuse is a priority issue in emerging markets, as companies intensify production systems to meet growing demand for meat. A recent investigation revealed that large food producers in these regions dose chickens with some of the strongest antibiotics known to medicine (The Guardian 2018c). Hundreds of tons of colistin, described as an antibiotic of last resort, are shipped to countries like Vietnam, India, South Korea and Russia each year to be routinely administered to animals, without medical supervision, with the primary aim to promote growth.

Currently, some animal pharmaceutical companies openly advertise products containing colistin as growth promoters. For example, India-based producer, Venkys’, is Asia’s largest integrated poultry producer. However, it also sells veterinary medicines, produces its own chicken feed and sells colistin separately to farmers as a growth promoter. Venky’s is a supplier to fast food chains such as KFC, McDonald’s, Pizza Hut and Dominos (The Bureau of Investigative Journalism 2018).

In response to growing international concern over the emergence of antibiotic resistance, many governments have begun to take action. They have restricted the use of antibiotics in animals, particularly antibiotics used for growth promotion (see graphic on page 44). Recently, the US Food and Drug Administration (FDA) implemented guidance to prohibit use of medically important antibiotics for growth promotion, and to require authorisation from a veterinarian when these drugs are used for disease prevention. Although a voluntary ban, this move indicates awareness of the importance of addressing this issue. International agencies are also taking action. In 2017, the WHO released guidelines recommending that farmers and the food industry stop using antibiotics routinely to promote growth and to prevent disease in healthy animals (WHO 2017c.).

Consumers are also expressing concern, with 72% of respondents to a US consumer survey stating that they are extremely or very concerned about the overuse of antibiotics in animal feed, including the potential to create ‘superbugs’ that do not respond to antibiotic treatment (Consumer Reports 2012). This concern is being reflected in consumer purchasing behaviour, with sales of ‘antibiotic-free meat’ growing nearly 29% each year between 2011 and 2015, compared to growth of just under 5% for conventional meat, according to Nielsen (Nielsen 2016.).

A failure to manage antibiotic usage therefore poses a major risk to the companies in the Index. In recent years, due to both consumer advocacy and investor action, such as FAIRR’s shareholder engagement on antibiotics, 14 of the top 25 chain restaurants in the US have taken steps to restrict the routine use of antibiotics in chicken. A quarter of all chicken produced in the US is sold through fast food restaurants.

A policy tool for investors on antibiotics stewardship

FAIRR, in partnership with a range of investors, medical experts and environmental and farming groups, has developed a best practice policy on antibiotic stewardship. The policy provides guidance for protein producers and purchasers in developing their own stewardship policies.

The guidance for a protein producer’s policy consists of three elements:

- A declaration that the producer understands that increasing use of antibiotics in humans and animals drives development of antibiotic resistance and that the producer is committed to being a responsible steward of antibiotics use.
- The adoption of a set of principles for antibiotic use, including: the use of antibiotics only to treat the diagnosed presence of disease in animals; no use of antibiotics for growth promotion or routine disease prevention; tracking and reporting antibiotics use to oversight agencies and the public; and focus on animal husbandry practices to improve animal health and welfare, thereby reducing the need for antibiotics.
- A series of commitments related to the above principles. These include developing reduction targets, timelines and associated policies relating to waste and worker health, as well as engaging with the producer’s supply chain.

[Click here for FAIRR’s antibiotics policy guidance for producers. Includes suggested targets and timelines.](#)

KPIs on antibiotics

Our main sources include company websites, and annual and sustainability reports.

KPI 1: Policy to avoid (a) routine use of antibiotics and (b) use of medically important antibiotics

The avoidance of routine antibiotic use suggests a company is seeking to reduce the use of all antibiotics as a risk management mechanism, and that the company’s production practices do not require antibiotics to compensate for poor animal welfare. However, if a company only specifies reducing ‘medically important’ antibiotics, they receive partial points for fulfilling the KPI.

KPI 2: Report-quantified usage of antibiotics

The disclosure of antibiotics usage (generally expressed as an amount per volume of product) shows that a company is monitoring its usage and is willing to engage with stakeholders on this issue. In the strongest disclosure, a company reports the quantity of antibiotics used. Companies with less rigorous disclosure report either the percentage of animals receiving antibiotics or provide a comment on general usage trends.

Global Regulation on Antibiotics

Top 4 Biggest Forecast Growth

Vietnam	215%
Philippines	194%
India	82%
Turkey	70%

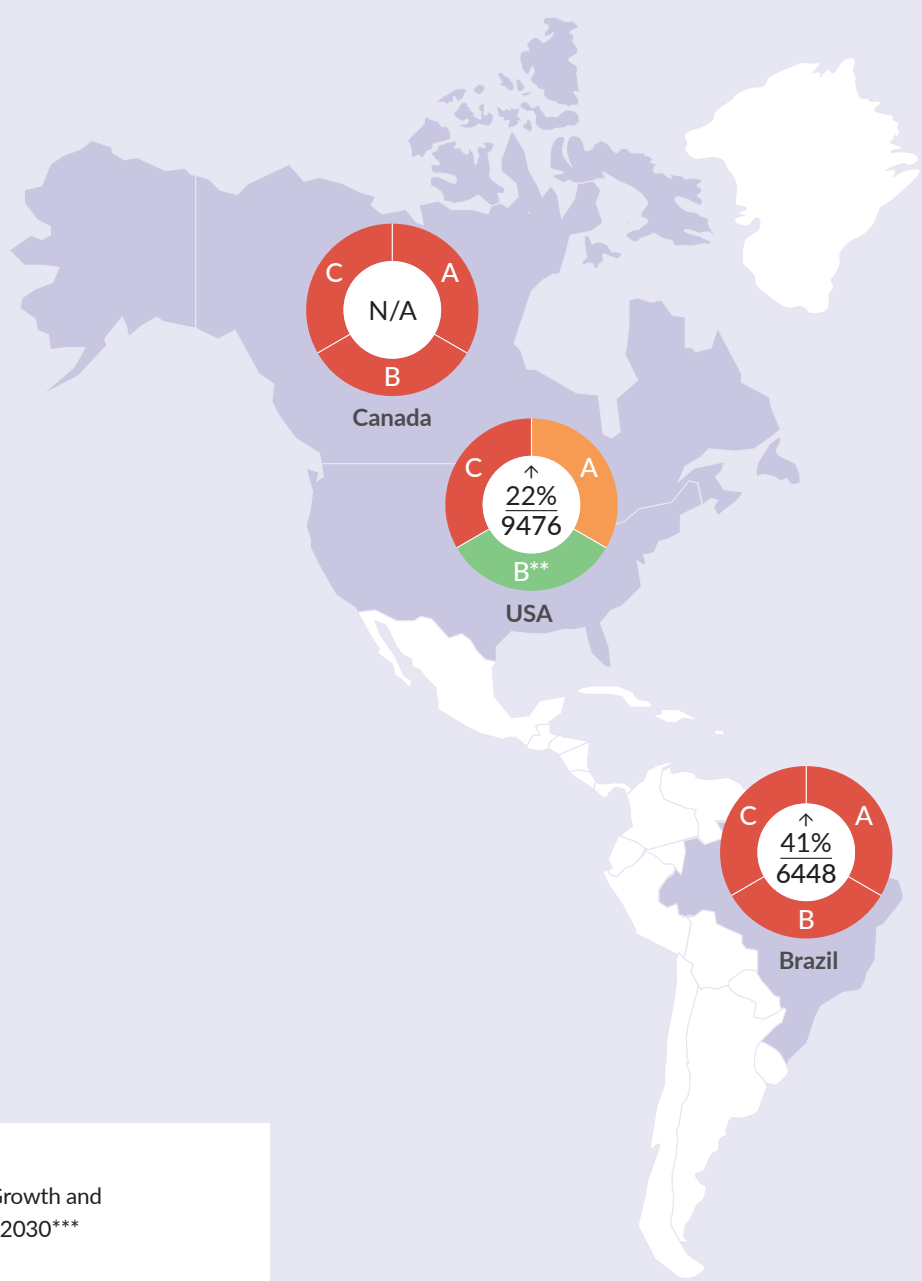
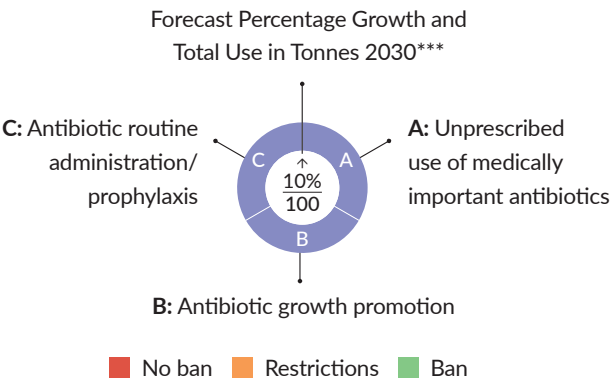
Top 4 Biggest Forecast Use (tonnes)

China	78200
USA	9476
Brazil	6448
India	2633

Top 4 Strongest Regulation

Denmark
Netherlands
Germany
Norway

Key



EU (Commission level)



Figure 11: Global regulation on antibiotics

Source: FAIRR Initiative.* Regulations exceed EU Commission level regulations. ** voluntary ban. *** From Supplementary material for "Reducing Antimicrobial Use in Food Animals" (2017), T.P. Van Boeckel et al. Available online at: <http://science.sciencemag.org/content/sci/suppl/2017/09/28/357.6358.1350.DC1/aao1496-VanBoeckel-SM.pdf>

Company performance on antibiotics

More than three-quarters (77%) of companies provide little or no evidence of antibiotics stewardship. This makes it an urgent threat and one of the most poorly addressed or managed risks by companies in the sector, despite substantial movement by retailers and restaurants on this issue. The average score for the risk factor is 18 out of 100.

	KPI 1 – policy	KPI 2 – usage
Low risk	13%	12%
Medium risk	15%	5%
High risk	72%	83%

Table 14: Antibiotics KPIs: Percentage of companies within each risk level

Notable findings:

- **KPI 1 (policy):** 28% show evidence of a policy on antibiotics stewardship that prohibits routine use and are categorized as medium or low risk
- **KPI 2 (usage):** 83% of companies do not report on their antibiotics use, 70% of which are based in Asia.
- **Sector performance:**
 - Aquaculture companies receive the highest average scores on this risk factor.

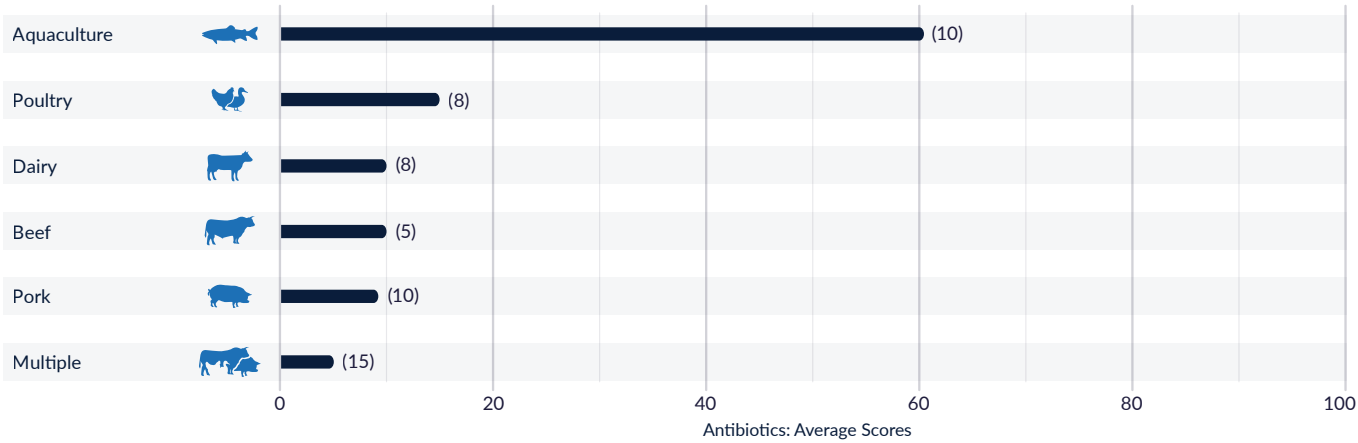


Figure 12: Average scores by protein sources. Companies with ‘multiple’ proteins derive significant revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

Best practice

Marine Harvest states that it only uses antibiotics when fish are at risk from a bacterial infection, and never prophylactically. The company has also announced that reducing antibiotic use is an “important priority” and aims to have “minimal” use of antibiotics by 2022. The company tracks usage on a gram of active substance per ton of product basis. No antibiotics are used in Ireland and the Faroe Islands, and Marine Harvest explains in detail why antibiotics are necessary in their Chile, Scotland and Norway operations. Their robust policies and performance on antibiotic use are complemented by a comprehensive discussion of fish welfare.

- Companies with beef in their supply chains scored 13 out of 100 in this category. It should be noted, that the industry has a long record of using medically important antibiotics such as tylosin in feedlots (The New York Times 2018).

Top performers

Aquaculture companies **Marine Harvest, Tassal Group, Bakkafrøst** and **Grieg Seafood** were the top performers in this category.

Company	Total antibiotics score (out of 100)
Marine Harvest ASA	100.00
Tassal Group Ltd	100.00
Grieg Seafood ASA	100.00
Bakkafrøst P/F	100.00
Salmar ASA	80.00
Lerøy Seafood Group ASA	80.00

Table 15: Companies that score at the ‘low risk’ level on antibiotics

Bottom performers

Seven companies receive a ‘high risk’ score (above zero) on antibiotics, indicating poor disclosure and management. They have a combined market capitalisation of \$32 billion and revenues of over \$94 billion.

Thirty-nine companies receive a score of zero due to no evidence or discussion on antibiotics. They have a combined market capitalisation of \$206 billion and revenues of over \$146 billion.

The full company benchmark is available for FAIRR investor members. See index.fairr.org for the full data set.

Chapter Eight

Animal Welfare



An increasing number of food companies are moving to publicly disclose their policies on farm animal welfare. The latest Business Benchmark on Farm Animal Welfare (BBFAW) report published in January 2017 found that 73% of the 99 companies surveyed had published farm animal welfare policies, compared with just 46% in 2012 (Business Benchmark on Farm Animal Welfare 2017).

This shift by companies exemplifies the fact that animal welfare is increasingly acknowledged as a critical component of a comprehensive operational risk management framework for food companies. No longer viewed solely as an ethical concern, animal welfare has emerged in recent years as a material issue for companies across the food value chain.

Specifically, animal welfare has been linked to a number of business risks:

- **Food safety issues and product recalls:** There is growing evidence of a link between (a) the poor animal welfare that results from intensive farming and unhygienic and unsanitary practices, and (b) food safety concerns (European Food Safety Authority, n.d.). Eggs are one of the most common food products to be affected: in 2016 in the US and Canada alone there were 82 recalls, up from 42 in 2015 (Food Safety Magazine 2017). During the high-profile fipronil egg scandal in 2017 in the EU, 18 Dutch farms had to be temporarily shut down (BBC News 2017). Most of these cases involved large industrial farms where animal welfare and hygiene were inadequately managed.
- **Reputational damage:** NGO campaigns and consumer demand are driving corporate commitments on animal welfare. A recent study claims that 58% of US consumers are more concerned about animal welfare in 2017 than in previous years (Packaged Facts 2017). Illustrative of this shift is the movement towards cage-free egg production. In 2015, McDonald's announced a policy to move its entire North American egg supply to be cage free (over two billion eggs a year). Since then, over 200 US-based companies have made similar commitments. All major retailers in the UK are now either cage free on their whole egg production, or have committed to achieve this standard by 2025. There is similar momentum in many European countries. In these regions, and increasingly further afield, robust corporate policies to reduce stocking densities and allow animals to express their natural behaviours have become a licence to operate issue – and must be priced into any production system. Laggard companies that prioritise production efficiency over welfare are exposed to reputational and operational risks.

- **Regulatory risk from tightening legislation:** In recent years, some US states have taken steps to protect farm animals by passing laws that ban close confinement – specifically, the use of battery cages for laying hens, gestation crates for sows and veal crates for calves. To date, 11 states including California and Massachusetts have banned one or all of these forms of extreme confinement, and a number of others are currently debating similar laws (ASPCA n.d.). At the time of writing, California is considering banning the sale of any eggs, pork or veal that come from an animal that spent its life in a cage. If passed, it would be one of the most progressive farm animal welfare laws in the world (The Guardian 2018d).
- **Link to wider risks to food sector and society:** Key issues such as water pollution, antibiotics use, sea lice infestation in fish, food safety, emissions and water scarcity are substantially influenced by how closely animals are confined. High standards for farm animal welfare are a starting point to protect against these risks.

Best practice

QAF, the parent company of Australian pork producer Rivalea, demonstrates good practice in pork husbandry through its ban on gestation crates, ear notching, teeth clipping and surgical castration. Sows are housed in social groups. There is a focus on reducing confinement, and providing environmental enrichment and pain relief.



Grieg Seafood has its entire supply chain (from hatcheries to processing and packaging facilities) certified under either GlobalG.A.P. or BAP certifications – both of which cover fish welfare. Additionally, Grieg Seafood includes a comprehensive discussion on fish health and welfare.



KPI on animal welfare

Given that company reporting on this issue is extremely underdeveloped, for this risk factor we limit our research to one KPI focused on close confinement. Our main sources include company websites, and annual and sustainability reports.

KPI 1: Policy and performance on animal welfare

For producers of terrestrial animal proteins, we award companies points for both current policies and pipeline targets or commitments on close confinement. We use close confinement as a proxy measure for animal welfare, as confinement of animals is the most relevant and measurable indicator of welfare. Production systems that allow animals to move freely, rather than confining them in cages and crates, have higher welfare potential. They allow animals to express their natural behaviours, and reduce the need for other procedures that negatively impact animal welfare, such as routine mutilations. We consider acceptable policies on close confinement to be the equivalent of EU legislative standards or higher (no gestation crates for pigs, no battery cages for egg-laying hens, and a maximum stocking density of 33kg/m²).

For the highest scores, companies primarily producing terrestrial proteins have to disclose an animal welfare policy covering close confinement for relevant species in their supply chain, with time-bound goals to achieve compliance. Companies receive top scores if they have over 90% of their animals in high-welfare systems without close confinement.

For aquaculture companies, top scores are reserved for companies with either GLOBALG.A.P. or BAP certifications (the only aquaculture standards that cover fish welfare) for the entire supply chain. In addition, we look for a comprehensive discussion on fish welfare including standards on stocking density and discussion of key welfare issues such as pre-slaughter stunning.

Focus Fish welfare in aquaculture production

Similar to terrestrial farm animal welfare, fish welfare policies and practices are also a strong indicator of sound management in food companies. Fish are sentient beings, so good fish welfare depends upon similar principles to that of terrestrial animals: meeting the animals' physical and mental needs and allowing them to express their natural behaviours. Farmed fish suffer from similar welfare issues to terrestrial animals, including overcrowding (leading to disease, stress and physical injuries) and inhumane slaughter methods such as suffocation. Meeting the physical, nutritional and environmental requirements of fish results in improved outcomes such as lower fish mortality, improved growth and good fish health.

The welfare of aquatic animals (specifically finfish) is a less developed topic for food companies. Few aquaculture certification standards have adequate focus on fish welfare. We identify two – GLOBALG.A.P. and Best Aquaculture Practices (BAP) – which do have standards encompassing specific requirements on fish welfare.

GLOBALG.A.P. is a comprehensive third-party aquaculture certification, with standards encompassing the entire production chain, including farms, processing plants and hatcheries. Certification addresses key elements of responsible aquaculture, including site management, control of chemical compounds, fish welfare management, biodiversity management and protection of high conservation areas. Examples of welfare considerations listed as a 'major must' for GlobalG.A.P. include intensity and changes of light, biotic factors, acoustic disturbances and vibrations, and water flow rates. GlobalG.A.P. also specifies that fish should be stunned

before slaughter, and requires that staff responsible for harvesting operations have appropriate training in fish welfare and handling techniques. We therefore consider GLOBALG.A.P. to provide a reasonable level of assurance of fish welfare.

A division of the Global Aquaculture Alliance, BAP is an international certification programme based on performance standards covering the entire aquaculture supply chain. By following the journey of fish from farms and hatcheries to processing plants and feed mills, BAP assures production through environmentally and socially responsible means. BAP certification is based on independent audits that evaluate compliance with the standards. BAP-certified finfish and crustacean farms take into consideration important animal welfare issues, including the stress of irregular feeding times on fish welfare. Animal welfare is most comprehensively covered in the salmon standard. For example, certified salmon farms are required to have a designated fish health professional responsible for reporting on welfare. We therefore consider BAP to provide a reasonable level of assurance of fish welfare.

Although both of these certifications provide some assurance on fish welfare, they do not directly address all key welfare issues for finfish. For both of these certifications, for instance, upper limits for stocking density depend on oxygenation levels of water and local law, as opposed to specifying company-wide maximum stocking densities with fish welfare in mind. BAP also does not include any guidance on pre-slaughter stunning for fish. For top marks we would expect an aquaculture company to have company-wide, consistent specifications on stocking density, as well as a requirement to stun finfish before slaughtering them.

Company performance on animal welfare

Overall, 63% of companies provide little or no information on animal welfare issues. The average score for the risk factor is 23 out of 100.

	KPI 1 – policy
Low risk	10%
Medium risk	27%
High risk	63%

Table 16: Percentage of companies within each risk level across the animal welfare KPI

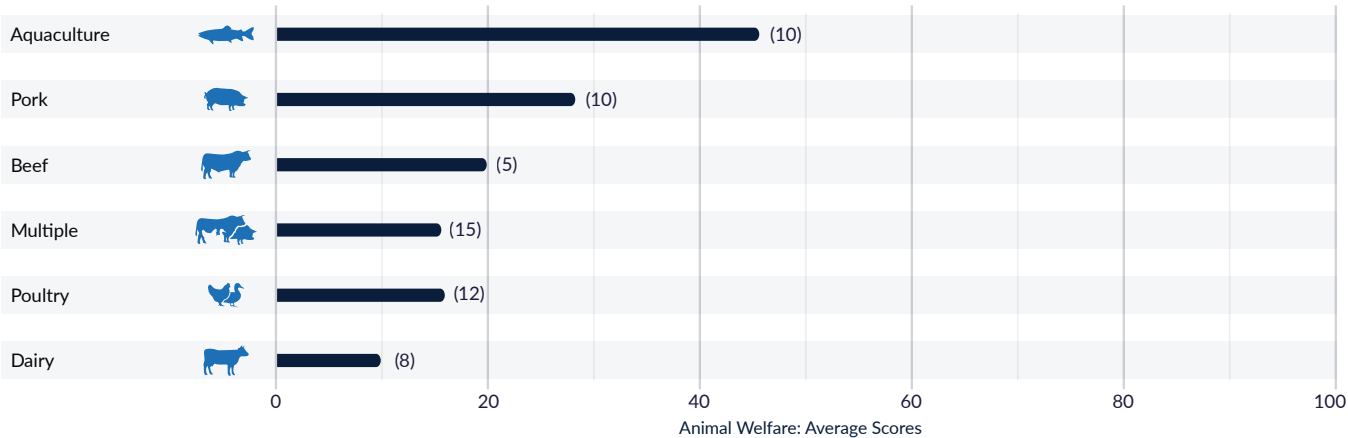


Figure 13: Average scores by protein sources. Companies with 'multiple' proteins derive significant revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

Top performers

Pork producer QAF, through its Australian subsidiary, Rivalea, is the top performer in this category.

Company	Total animal welfare score (out of 100)
QAF Ltd	100.00
Lerøy Seafood Group ASA	80.00
Marine Harvest ASA	80.00
Cranswick PLC	80.00
Bakkafrost P/F	80.00
Grieg Seafood ASA	80.00

Table 17: Companies that score at the 'low risk' level on animal welfare

Notable findings:

- Only 10% of companies achieve a 'low risk' rating.
- Aquaculture companies receive the highest average scores on this risk factor. The two terrestrial protein companies that get top scores are both large pig producers (based in the UK and Australia).
- Nearly two-thirds of the companies categorised as medium or high risk (with points below 67 but above zero) produce poultry, indicating that companies in this sector are only beginning to move towards higher welfare standards.



The full company benchmark is available for FAIRR investor members. See index.fairr.org for the full data set.



Chapter Nine

Working Conditions



Poor working conditions primarily present two types of risk to intensive livestock farming companies:

- **Operational risks:** These can involve workplace accidents resulting in long-term injuries, absence and even loss of life, as well as food product contamination from sick workers.
- **Reputational risks:** These can arise due to increased public concern around poor working conditions and human rights violations.

Companies face revenue loss from worker injuries that halt production. In the US, for example, the maximum line speed for poultry plants is capped at 140 birds per minute per line by the Department of Agriculture (US Department of Agriculture 2014.). The table below illustrates the estimated revenue per minute of poultry line production, indicating that a stoppage of just two minutes can represent over \$1,000 in lost revenues.

Chickens processed per minute	Average market size of a chicken (PennState Extension, n.d.)	Estimated kg of chicken processed per minute	Chicken commodity price (World Bank Group, 2017)	Estimated revenue per minute of processing
140	2.27kg	318kg	\$2.46 per kg	\$783

Table 18: Estimated poultry revenue per minute of production Line (source: USDA)

Most workers involved with intensive livestock farming come into close contact with animals throughout the production process, including in the processing and packaging stages. Exposure to antimicrobial-resistant pathogens in livestock and slaughterhouses raises risks for workers in this sector (Castillo Neyra, R. et al. 2012). Sick workers can then risk contaminating the protein products they are working on.

A 2016 Oxfam report found that workers faced dangerous conditions in numerous poultry processing plants (Oxfam 2016). After consumer and union pressure, Tyson Foods improved its working conditions, including adjusting line speeds and introducing safety councils in 2017 (The Salt 2017).

Specific worker issues vary by region, and companies operating in different regions face different risks. For example, in 2016, the International Labour Organization (ILO) found that the Thai seafood sector engaged in labour exploitation, including the use of forced and child labour (ILO 2016).

Following this and other reports, the EU issued warnings to the Thai government, which reacted with more stringent policy enforcement. In addition, this scandal has pushed companies to develop stronger supply chain management. Nestlé also has formed partnerships with NGOs, governments and producers to increase seafood supply chain traceability (Fishwise 2017). In 2014, Costco also reacted to significant criticism on its sourcing by helping to organise and subsequently joining the Shrimp Sustainable Supply Chain Task Force.

How we approach this risk factor

The Ethical Trading Initiative (ETI) is a leading alliance involving companies, trade unions and NGOs promoting worker rights globally. The KPIs we use are based on the ETI Base Code, which has been founded on the conventions of the ILO and is a globally recognised code of labour practice. However, our analysis finds that many companies are not disclosing their commitments to all labour practices promoted by the ETI. For instance, one factor is 'living wages', which companies across industries rarely disclose. Therefore, to offer investors meaningful analysis of this risk factor, we focus on the key issues most widely discussed with respect to working conditions – (a) freely chosen employment; (b) no child labour; (c) health and safety training; and (d) no discrimination – rather than compliance with a particular initiative or code.



KPIs on working conditions

Our main sources for analysis include company websites, codes of conduct, and annual and sustainability reports.

KPI 1: Long-term injury rates

The disclosure of annual injury-rate data is a widely reported KPI used by global companies to help monitor operational health and safety. It indicates that companies are aware of, and are to some extent addressing, the operational risks associated with poor working conditions. Best practice is defined as company disclosure of annual injury rates and evidence that action is being taken to reduce such rates.

KPI 2: Safe and fair working conditions

Companies that disclose their policies and commitments to protect labour rights for all their workers are more likely to be aware of, and to be proactively managing, the operational and reputational risks associated with poor working conditions. We look for company policies that explicitly cover: (a) freely chosen employment; (b) no child labour; (c) health and safety training; and (d) no discrimination. Best practice is defined as having policies or commitments on all four of these factors.

KPI 3: Freedom of association

Explicitly disclosing the right for workers to join a trade union and participate in collective bargaining agreements are important proxies for indicating whether a company supports and reports on its commitment to freedom of association. For example, companies with explicit public policies supporting freedom of association are more likely to pay living wages and have reasonable working hours. These are key aspects of the ETI Base Code, although companies rarely report on them. Additionally, a company that publicly supports its commitment to freedom of association is more likely to have a workplace environment where workers can freely discuss concerns around health and safety practices. Best practice is defined as having a publicly available policy or commitment about workers' freedom of association.

Company performance on working conditions

Nearly half (45%) of companies provide little or no evidence on working conditions. The average score for the risk factor is 42.22 out of 100.

	KPI 1 – injuries	KPI 2 – safety/fairness	KPI 3 – FOA
Low risk	35%	33%	18%
Medium risk	10%	37%	40%
High risk	55%	30%	42%

Table 19: Percentage of companies within each risk level across the three working conditions KPIs

Notable findings:

- **KPI 1 (injuries): 55%** of companies have no disclosure of annual injury rates.
- **KPI 2 (safety/fairness): 20 companies, including eight companies from China**, have policies that explicitly cover: (a) freely chosen employment; (b) no child labour; (c) health and safety training; and (d) no discrimination. Several Chinese companies say they follow the country's Labour Law and Labour Contract Law, which are supposed to contain the four policies. However, for consistency, we only award top scores to companies that explicitly call out these issues as part of their reporting.
- **KPI 3 (FOA): 42% of companies** have no policy on workers' association. Workers' associations/labour unions are required by law for Chinese companies, so we do not find explicit policies on this issue.
- **Sector performance:**
 - **Aquaculture companies** in the Index receive the highest average score on this risk factor. However, some of top performing constituents are also producers of other proteins. It is also interesting to note that the best in class also have significant representation from various distinct jurisdictions.

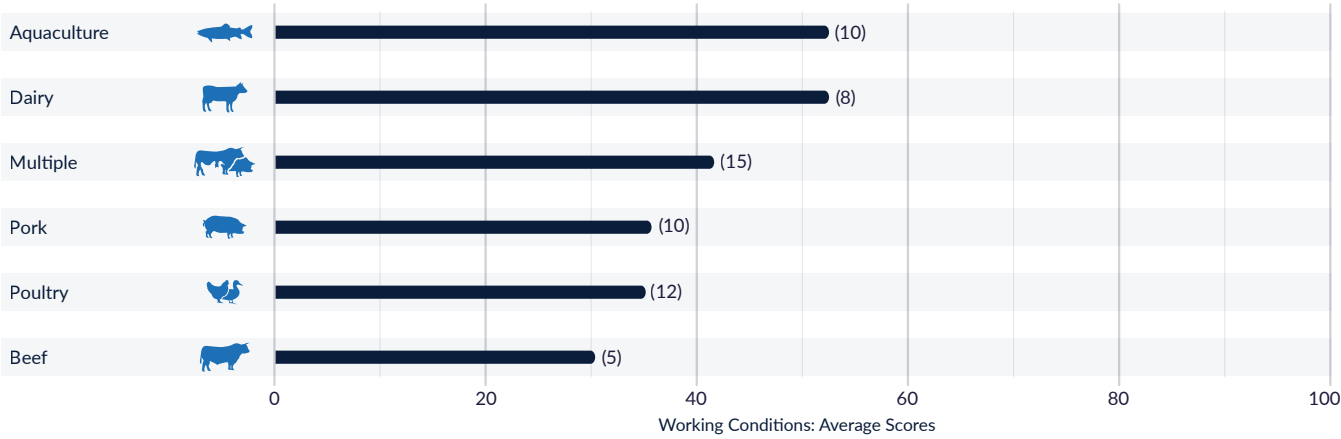


Figure 14: Average scores by protein sources. Companies with 'multiple' proteins derive significant revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

Top performers

Fonterra, New Zealand’s largest company and one of the world’s largest processors of dairy products, and **Marine Harvest**, an aquaculture company, are the top performing companies in this category.

Company	Total working conditions score (out of 100)
Fonterra Co-operative Group Ltd	100.00
Marine Harvest ASA	100.00
Maple Leaf Foods Inc	93.33
Charoen Pokphand Foods PCL	93.33
MHP SE	93.33
Cranswick PLC	93.33
Beijing Sanyuan Foods Co Ltd	86.67
Grupo Nutresa SA	86.67
Tassal Group Ltd	80.00
Hormel Foods Corp	80.00
China Mengniu Dairy Co Ltd	73.33
Bakkafrost P/F	73.33
Salmar ASA	73.33

Table 20: Companies that score at the ‘low risk’ level on working conditions


Bottom performers

Twenty-five companies received a ‘high risk’ score (above zero) on working conditions, indicating poor disclosure and management. They have a combined market capitalisation of \$98 billion and revenues of over \$112 billion.

Two companies receive a score of zero due to no evidence or discussion of working conditions. They have a combined market capitalisation of \$1.3 billion dollars and revenues of \$330 million.

Best practice

Fonterra, has specific health, safety and wellbeing targets that include annual injury rates, which the company discloses against current and previous year performance in its sustainability report. The company also publicly discloses its commitment and approach to upholding the highest global standards of diversity, labour and human rights across the business, including for its suppliers.



The full company benchmark is available for FAIRR investor members. See index.fairr.org for the full data set.

Chapter Ten

Food Safety



The ability to provide safe, good quality food is fundamental to the business of food production, and a critical component to ensuring global food security. Given its core financial materiality, management of food safety issues is often an important proxy for overall company governance in the food sector.

Livestock companies are particularly vulnerable to food safety issues because of the added threat of livestock-related epidemics that can infect humans, such as avian influenza, swine flu, and bovine spongiform encephalopathy (commonly known as mad cow disease). In addition to high mortality rates, these incidents result in the large-scale culling of livestock, at significant cost to farmers. In 2016–17, the outbreak of a highly pathogenic avian influenza strain in South Korea wiped out at least 20 million birds – more than 10% of the country's poultry stock of chickens and ducks (Los Angeles Times 2017). Similarly, the 2009 swine flu pandemic cost the United Kingdom alone more than \$1.2 billion, despite being less severe than expected (Independent 2010.).



Even when food safety issues are not widely reported, they can still hurt companies. For example, the US FDA reports that it refused 36 shrimp shipments during the first quarter of 2018 due to high salmonella content. Once companies have suffered from a highly public food safety breach, it often requires significant time and resources to regain the trust of customers and regulators (see case study on the next page).

KPIs on food safety

Traceability systems and recalls are good indicators for how attentive a company is to the issue of food safety. We assess companies on their disclosure of food safety management practices by examining annual reports, sustainability reports and publicly available online communications.

KPI 1: Product traceability

Traceability systems allow companies to track the progress of products both further down and up the supply chain, identifying where products have been handled at each stage of the production process. The most advanced traceability systems identify and track raw materials used for feed, as well as provide data on the farm-to-customer pathway. More basic traceability systems tend to trace products one step up and one step back in the supply chain. Companies that do not disclose the use of any traceability systems receive a high-risk score.

KPI 2: Disclosed food recalls

Reporting the number of recalls in public filings acknowledges corporate accountability and enables stakeholders to better track progress in managing food safety issues. Discussion of companies' product recall management processes assures investors that a system is in place to manage events that could negatively impact the business. Companies receive a low-risk score for explicitly disclosing the number of recalls and explaining their approach to preventing or effectively managing product callbacks. We give a medium-risk score to companies that only disclose the number of product recalls. We assign a high-risk score to those that do not disclose any information about product recalls.

Focus The financial cost of food safety incidents

Livestock pandemics and food safety scandals can have significant impacts on the value of even the largest animal protein producers. Such outbreaks can damage consumer trust, lead to significant fines, and result in material value loss, as the examples below demonstrate.

- South Africa is currently facing the world's worst recorded listeria outbreak, with 193 deaths as of 9 April 2018. Public health officials have identified a **Tiger Brands** plant as the source of the outbreak. While it is too early to identify the impact on company performance, Tiger Brands is facing criticism for its poor management of the crisis. It is reported that the company knew its products contained listeria 18 days before the recall was issued. An application for a class action lawsuit has been lodged against the company. The incident has also affected the wider South African pork industry. In the three months following the outbreak, prices for South African pork have fallen by over a third. Economists estimate that it has cost the pork value chain an estimated 1 billion rand (\$81 million) in losses, nearly 20% of the industry's 5.3 billion rand (\$429 million) annual turnover.
- **Russell Hume**, a privately owned British meat producer, collapsed just one month after a product recall was issued in January 2018. The company supplied large British chain restaurants including **JD Wetherspoon** and **Marston's**, as well as caterers and hotels. Government inspectors found "serious non-compliance with food hygiene regulations" during a surprise visit in January 2018. Although no illnesses were linked to **Russell Hume** products, inspectors ordered production to be halted. The company, which previously had an annual turnover of over £50 million, went into administration in February 2018.
- In March 2017, Brazilian police launched an investigation into several meat producers following reports that companies had been bribing officials to allow them to sell and export expired meat. Several large importers including the EU, China and Hong Kong introduced import bans. **JBS**, the world's largest meat processor, saw its share price drop by 11% on the day of the announcement. Further investigations revealed extensive bribery and corruption issues beyond the expired meat scandal. **JBS'** controlling shareholder, **J&F Investimentos**, was found to have bribed nearly 2,000 Brazilian politicians, including President Michel Temer, in return for cheap credit. Its share price dropped by 46% in ten days following the accusations. The company's net income for the following quarter was more than 50% lower than analysts' forecasts and the company lost an estimated \$3.7 billion in value between March and October 2017. A planned initial public offering (IPO) of its US subsidiary **JBS Foods** was put on hold in October 2017 due to falling investor interest after the crisis. As of April 2018, no date has been set for the IPO.
- In the autumn of 2015, media outlets began reporting E. coli outbreaks at various locations of **Chipotle Mexican Grill (CMG)**. By 21 December 2015, the US CDC and CMG had confirmed 177 cases across ten states, but were unable to locate the source of the outbreak. As the stock price fell by more than 35%, the company implemented a series of measures to improve safety and regain customers. It has taken two years for sales to recover and the company continues to focus on winning back lost customers.
- In 2014, Chinese food producer **Shanghai Husi** was found to have been intentionally selling expired meat. The scandal was covered extensively by Chinese and international media, linking the company to customers including large quick-service restaurants, **Yum! China** and **McDonald's**. In the three months following the event, these two restaurant brands recorded a drop in equity of \$3.6 billion and \$7.2 billion respectively.



Company performance on food safety

On food safety, 15% of companies in the Index achieve the highest scores, including two Chinese companies. The average score for the risk factor is 39.33 out of 100.

	KPI 1 – traceability	KPI 2 – recalls
Low risk	35%	12%
Medium risk	43%	17%
High risk	22%	72%

Table 21: Percentage of companies within each risk level across the two food safety KPIs

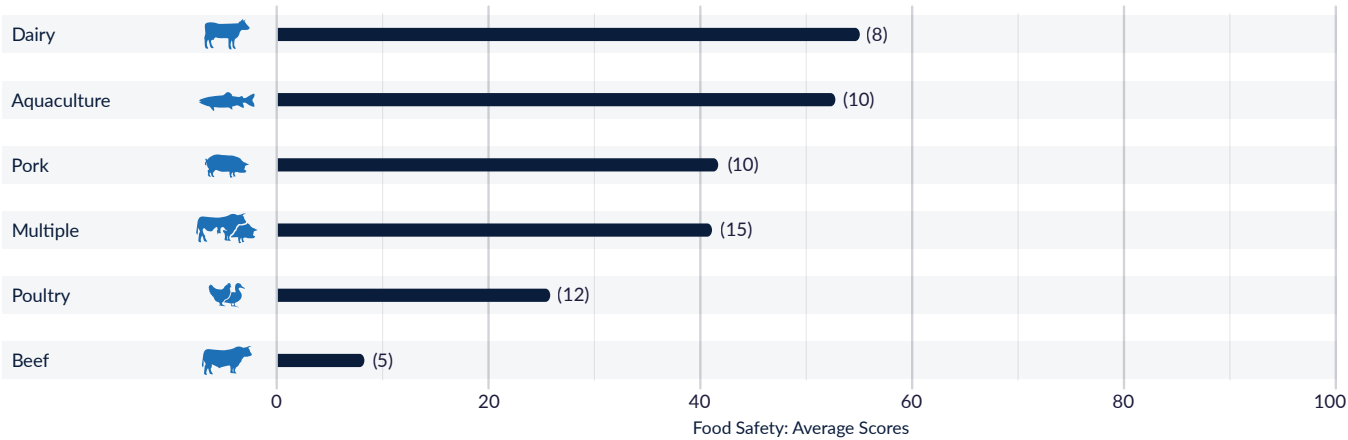


Figure 15: Average scores by protein sources. Companies with ‘multiple’ proteins derive significant revenues from more than one protein source. Figures in brackets on the bars indicate number of companies in each protein category.

Notable findings:

- **KPI 1 (traceability):** Across all indicators in this benchmark, companies perform relatively well on traceability systems, with 35% claiming full traceability systems. This is an indication that businesses tend to prioritise implementing and reporting on issues that have an immediate financial impact relative to other sustainability issues.
- **KPI 2 (recalls):** 72% of companies do not disclose the number of product recalls issued each year.
- **Sector performance:**
 - **Dairy companies** perform the best on food safety relative to other types of protein producers.

Top performers

Inner Mongolia Yili, a Chinese state-owned dairy producer, and Lerøy Seafood Group, a Norwegian aquaculture company, are the top performers in this category.

Company	Total food safety score (out of 100)
Inner Mongolia Yili Industrial Group Co Ltd	100.00
Lerøy Seafood Group ASA	100.00
Pilgrim’s Pride Corp	90.00
Vietnam Dairy Products JSC	90.00
Charoen Pokphand Foods PCL	80.00
Fonterra Co-operative Group Ltd	80.00
Marine Harvest ASA	80.00
WH Group Ltd	70.00
Hormel Foods Corp	70.00

Table 22: Companies that score at the ‘low risk’ level on food safety

Bottom performers

Twenty-one companies receive a ‘high risk’ score (above zero) on food safety, indicating poor disclosure and management. They have a combined market capitalisation of \$60 billion and revenues of over \$109 billion.

Eight companies receive a score of zero as they do not disclose any information on traceability systems or product recall management. They have a combined market capitalisation of \$18 billion and revenues of over \$20 billion.

Best practice

Inner Mongolia Yili appears to ensure full traceability of all its products and feed production. The company’s quality control system covers various stages of the value chain, from raw materials procurement and feed processing through to raw milk transportation and delivery. All the company’s subsidiaries and affiliates are compliant with the ISO 9001 quality management standards. According to its CSR report, the company is the first Chinese dairy company to have all products certified by the Food Safety System Certification 22000, a food safety management system. Inner Mongolia Yili discloses food recalls as well as the steps it takes to ensure its food recall process remains responsive and robust. The company commits to identifying and resolving the root causes behind any recall.

Lerøy Seafood demonstrates transparency on food safety management. The company has full traceability for all products from roe stage to the packaged product. Its traceability system also captures quality information such as fat content, colour and condition of each fish, as well as feed supply information. Lerøy publishes a copy of a trace information form that allows the public to see exactly what information is tracked through the traceability system, reassuring customers that its products are safe to eat.



The full company benchmark is available for FAIRR investor members. See index.fairr.org for the full data set.

Chapter Eleven

Sustainable Proteins



It is evident that traditional meat, dairy and seafood producers are under considerable sustainability pressures, and that these are likely to intensify as demand for protein grows around the world. Some of the risks assessed in this benchmark can be mitigated with the appropriate technology or change in management practices. However, resource constraints such as freshwater and arable land availability will eventually curtail the sector’s expansion.

Two peer-reviewed studies published in 2014 calculated that unless the trend of increased livestock production and consumption is substantially decreased, agricultural emissions will take up the entire world’s carbon budget by 2050, with livestock as the primary contributor. This would mean that every other sector, including energy, industry and transport, will have to be carbon neutral. Chatham House’s report on the subject concluded: “Dietary change is essential if global warming is not to exceed 2°C”.

Even the most ‘sustainable’ animal proteins such as farmed fish, which consume fewer resources than land-based animals, and has a better record of risk management and disclosure, bring significant risks with expansion, including the devastation of nearby marine ecological systems (see our case study on aquaculture).

However, innovation in food technology is accelerating, and presenting opportunities to disrupt the incumbent industry. For intensive protein producers, stagnation and lack of innovation is an increasing risk. Diversification into producing alternative (i.e. non-animal) proteins is key to managing the risks of resource-constrained supply chains and seizing opportunities for market growth.

What are alternative proteins?

‘Alternative proteins’ is a general term that covers plant-based and food-technology alternatives to animal protein.

Protein source	Description
Plants	Consuming more whole plants and crop extracts (such as grains, legumes, nuts, pulses and seeds)
Algae	Producing and harvesting protein biomass from macro and micro-alga
Insects	Introducing insect protein (such as crickets) into the westernised diet
Fermented proteins	Creating animal proteins such as casein and whey. This is done through a brewing process whereby yeast organisms are programmed to produce the proteins in a more efficient way than from animal sources
Cultured or ‘clean’ meat	Growing meat products from cells sourced from animal muscle and tissue in a laboratory, without raising and processing animals

Table 23: Examples of alternative proteins

Alternative proteins have the potential to structurally shift the intensive livestock industry, as the sector may see itself expand from a ‘meat’ industry to a broader ‘protein’ industry. These products can be used to produce protein-rich foods without animals, for a fraction of the cost and with significantly reduced external impacts. Bypassing the inherent inefficiencies of livestock production, such as plant-to-animal feed conversion, means innovation in this space could fundamentally disrupt the market.

Alternative proteins and protein diversification therefore have the potential to transform a company’s core business and value proposition: from its growth, profitability and risk exposure to its ability to compete and innovate. For these reasons, investor interest in this issue is expanding.

FAIRR identifies four key drivers that will shift the food system from its dependence on animal proteins towards alternative protein sources:

- growing market opportunity to meet demand for plant-based foods,
- accelerated innovation in food technology,
- increasing awareness of ESG impacts linked to intensive livestock production; and
- advocacy and regulation to moderate growth in the animal protein sector.

Market analysts expect that alternative protein is a medium- to long-term opportunity. In 2017, a market survey found that annual global sales of plant-based meat alternatives had grown on average 8% a year since 2010 (Nielsen 2017). Market research firm Lux Research suggests that sustainable protein is poised to make up a third of the broader protein market by 2054 (Lux Research n.d.). In the medium term, Lux Research expects soy to dominate this growth, with a shift to alternatives like algae, insects and synthetic biology occurring after 2024. However, forecasting technological progress has also been plagued by a lack of understanding of how rapidly costs and consumer demand can shift.

Company performance on alternative proteins

For this iteration of the Index, we do not formally evaluate the 60 companies in this area beyond an assessment of any product exposure to alternative protein sources. Our analysis shows that only five of the 60 companies account for the emergence and growth of the alternative proteins sector.

Company performance on this risk factor is available for FAIRR investor members. See index.fairr.org for the full data set.

Focus Engaging with the food industry to build sustainable protein supply chains

Multiple drivers are pressuring the food industry to diversify its protein sources. To protect and enhance investment value, FAIRR's collaborative investor engagement on sustainable proteins asks 16 global food companies to diversify their protein sources to drive growth, increase profitability, reduce risk exposure, and improve their ability to compete and innovate in a resource-constrained world. While companies generally acknowledge protein diversification as a material issue, many do not have any meaningful programmes to report and reduce agricultural supply chain emissions. They are still working to develop the right metrics to capture progress on increasing exposure to alternative protein sources. As of May 2018, the engagement is supported by 57 institutional investors representing over \$2.4 trillion in AUM.

See FAIRR's report, [Plant-based profits: investment risks and opportunities in sustainable food systems](#), for more information on this engagement.



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Appendix

Appendix 1: Full list of companies in the Coller FAIRR Index

Company	Description
Almarai Co JSC	Almarai is the Middle East's largest food manufacturer and distributor, and the world's largest vertically integrated dairy company. Nearly 65% of its revenues come from dairy, 10% comes from fresh poultry products, and the rest comes from fruit juice, dairy and infant nutrition.
Australian Agricultural Co Ltd	The Australian Agricultural Company is Australia's largest integrated cattle and beef producer. It specialises in both grass-fed and grain-fed beef production.
Bakkafrost P/F	Bakkafrost, based in the Faroe Islands, is a vertically integrated salmon farming company with full control and responsibility over all aspects of production. Its primary sales are to the EU (44%), Eastern Europe (21%), US (18%) and Asia (17%).
Beijing Sanyuan Foods Co Ltd (shortened version: B Sanyuan)	Beijing Sanyuan Foods produces, processes and sells dairy products, beverages, foods, cold foods and drinks, and ice creams in China.
Beijing Shunxin Agriculture Co Ltd (shortened version: B. Shunxin)	Beijing Shunxin Agriculture is a Chinese company principally engaged in the production, processing and distribution of distilled liquor and meat (hogs). It integrates hog breeding, raising, slaughtering, meat processing and cold chain distribution. With a complete industrial chain of meat processing and an annual slaughter capacity of three million hogs, Shunxin has the largest single-factory slaughter volume in China.
BRF SA	BRF SA is one of the largest producers of fresh and frozen protein (pork, poultry, egg and cattle) foods in the world. It employs over 13,000 integrated producers to grow its animals. BRF has invested in shares of COFCO Meat (an operation valued at \$20 million), which maintains 47 pig farms, two slaughter plants and two processed meat plants in China. As a result, BRF now holds 1.99% of the capital of the state-owned company, China's leader in agribusiness.
Cal-Maine Foods Inc	Cal-Maine Foods is the largest fully integrated producer and marketer of shell eggs in the US. In fiscal 2017, it sold approximately 1,031 million dozen shell eggs – 20% of US shell egg consumption.
Charoen Pokphand Foods PCL (shortened version: CPF)	Charoen Pokphand Foods is one of the world's leading listed agro-industrial and food conglomerates that operates vertically integrated businesses. The company is present in 16 countries and exports products from Thailand to over 30 countries. It operates in both the livestock (swine, broilers, layers and ducks) and aquaculture (shrimp and fish) businesses. It is involved in manufacturing animal feed; animal breeding and animal farming; meat processing; manufacturing semi-cooked and fully cooked meat; food products and ready-meal products; and the meat and food retail and restaurant businesses.
Cherkizovo Group PJSC	Cherkizovo Group is Russia's largest vertically integrated meat and feed producer. It is one of the top three companies serving Russia's chicken, pork and processed meat markets, and is the country's largest feed manufacturer.
China Mengniu Dairy Co Ltd (shortened version: C. Mengniu Dairy)	China Mengniu Dairy and its subsidiaries manufacture and distribute quality dairy products in China. It is one of the leading dairy product manufacturers in China, with MENGNIU as its core brand. Danone Group, which owns a 9.9% stake in Mengniu, is Mengniu's second largest strategic shareholder. Inner Mongolia Mengniu Danone Dairy Co Ltd ('Mengniu Danone') is a joint-equity company held 80% by Mengniu and 20% by Danone.

Company	Description
China Modern Dairy Holdings Ltd	China Modern Dairy is the largest dairy farming company and the largest raw milk producer in China. It is primarily engaged in two business segments: (a) dairy farming, which is 70% of its business; and (b) liquid milk products under its own brands. Modern Dairy is a long-term partner of Mengniu and is its largest raw milk supplier. In 2017, Mengniu announced the acquisition of additional shares of China Modern Dairy – Mengniu and its concert party own 61.3% of the company's issued share capital.
China Shengmu Organic Milk Ltd (shortened version: C Shengmu OM)	Shengmu is the largest organic dairy company in China and the only vertically integrated organic dairy company in the country that meets EU organic standards. It has a 54.2% market share in China based on 2013 organic raw milk production volume. It states that its vertically integrated 'grass-to-glass' organic production model covers the entire dairy industry value chain, meeting EU organic standards for all major stages of the dairy production process: forage growing, dairy farming to produce raw milk, and processing to produce high-end liquid milk products.
Chuying Agro-Pastoral Group Co Ltd	Chuying Agro-Pastoral is a China-based vertically integrated company, principally engaged in the breeding and distribution of livestock and poultry. The company primarily provides live pig products, including commodity piglets, boars and commodity hogs, as well as poultry products, including hatching eggs, chicks and meat chicken. It is also engaged in the distribution of grain, vegetables, frozen products and cooked food, as well as providing internet, banking and other services.
COFCO Meat Holdings Ltd	COFCO Meat is the pork producing unit of China's largest state food conglomerate, COFCO. The company's activities include feed processing, hog breeding, hog slaughtering and segmentation, meat product processing, product sale, and meat imports. COFCO Meat also operates and manages slaughterhouses throughout China. BRF has a minority stake in COFCO Meat.
Cranswick PLC	Cranswick is a British-based producer of fresh pork (32%) and poultry (11%), as well as convenience and gourmet products, including beef. Around three-quarters of its revenues come from retail customers, primarily through their own-label products.
Empresas AquaChile SA	Empresas AquaChile is a Chilean company that farms and processes salmon, sea trout and tilapia eggs. It has a presence in the whole production chain of the aquaculture industry. It operates in over 180 geographical locations and 63 farms in Chile and Costa Rica, as well as having sales offices in the US. Nearly 50% of sales come from Atlantic salmon. It also manufactures fish feed.
Fonterra Co-operative Group Ltd	Fonterra is New Zealand's biggest company and the world's largest processor of dairy products. It is a co-operative, owned and supplied by around 10,700 farmer shareholders in New Zealand. The co-operative collects around 18 billion litres of milk each season in New Zealand, 1.5 billion litres in Australia and 500 million litres in Chile. It also has access to 600 to 800 million litres in Europe, and produces safe, secure and high-quality milk from its farms in China.
Fortune Ng Fung Food (Hebei) Co Ltd (shortened version: Fortune NFFH)	Fortune Ng Fung Food is a China-based company, principally engaged in livestock breeding and slaughtering, and food processing businesses. Its principal products include live cattle, beef, mutton, meat (pork) products, dairy products, fast food, and beverages.
Fujian Sunner Development Co Ltd	Fujian Sunner is engaged in breeding, slaughtering, processing and selling chicken, primarily in China. It offers frozen chicken products for fast food and food manufacturing industries, meat wholesale markets and other markets.
GFPT PCL	GFPT is a fully vertically integrated producer and distributor of frozen chicken meat, processed chicken, and animal and aquatic feed for Thai and overseas markets. Almost 45% of its revenues are from fresh poultry sales and 30% from chicken farms and sales of day-old chicks.
Great Wall Enterprises Co Ltd	Great Wall Enterprises Co engages food, restaurant and livestock businesses in China. It operates feed plants, chicken slaughter houses, poultry processing plants, breeding and hatchery farms, pig farms, and a lab farm for animal nutrition research and development.

Company	Description
Grieg Seafood ASA	Grieg Seafood is one of the world's leading fish farming companies, specialising in Atlantic salmon. The group is present in Norway, British Columbia (Canada) and in Shetland (UK). Over 54% of its sales are to the EU.
Grupo Bafar SAB de CV	Grupo Bafar SAB de CV is a Mexico-based holding company principally engaged, through its subsidiaries, in the food industry. The company operates through seven business divisions: consumption products division, which is engaged in the supply of meat, processed meats and dairy products; retail, which operates the CarneMart and BIF stores; manufacturing; logistics, active in the storage and distribution of the products; cattle trade, engaged in the breeding of cattle and which supplies BIF stores with meat; poultry division, responsible for the production and sale of poultry and eggs; and exports.
Grupo Nutresa SA	Grupo Nutresa is the leader in processed foods in Colombia (61.1% market share) and a large player in Latin America. It is a highly diversified food business, with eight business units: cold cuts (21% of sales), biscuits, chocolates, Tresmontes Lucchetti, coffee, retail food, ice cream and pasta. Between 30% and 50% of Grupo Nutresa's sourced products for the retail and cold cuts segments are animal proteins.
Guangdong Wens Foodstuffs Group Co Ltd (shortened version: Guangdong WFG)	Guangdong Wens Foodstuffs Group operates as a livestock and poultry farming company, primarily in China. The company offers fresh meat and processed products, including chicken, pigs, ducks, eggs, cooked chicken, sheep, pigeons and goose. It also provides raw milk and finished milk – including pasteurised, fermented and sterilised milk, milk drinks, and four other categories of approximately 30 products. The company is also involved in breeding and cultivating deep sea fishes such as gold pomfret, military fish and grouper.
Henan Shuanghui Investment & Development Co Ltd	Henan Shuanghui Investment & Development is China's largest meat processor. According to its website its business includes meat slaughter, feed and aquaculture. Its controlling shareholder is WH Group, which also owns US-based Smithfield Foods, the world's largest pork processor and hog producer.
Hormel Foods Corp	Hormel operates through the following segments: grocery products, refrigerated foods, Jennie-O Turkey Store, specialty foods, and international & other. Its business is involved in processing, marketing and selling branded and unbranded pork, beef, chicken and turkey products for retail, foodservice and fresh product customers.
Industrias Bachoco SAB de CV	Bachoco is a vertically integrated company with operations in Mexico and the US with its headquarters located in Celaya, Guanajuato, Mexico. Its main business lines are chicken, table eggs, balanced feed, swine and others, including further process products of turkey and beef.
Inghams Group Ltd	Inghams is Australia and New Zealand's largest vertically integrated poultry producer. It is also a large stockfeed producer, supplying to the poultry, pig, dairy and equine industries.
Inner Mongolia Yili Industrial Group Co Ltd (shortened version: Inner Mongolia Yili)	Yili is China's largest dairy producer. It has large-scale and concentrated-breeding pastures that contribute to 100% of its total milk source.
Inti Agri Resources Tbk PT	Inti Agri Resources Tbk is an Indonesia-based company primarily engaged in breeding arowana fish, an ornamental fish. It also has a crab processing business.
Japfa Ltd	Japfa is a Singapore-based company that specialises in producing quality dairy, protein staples (poultry, beef, swine and aquaculture) and packaged food. Its business is vertically integrated from animal feed production and breeding to commercial farming and food processing. It is one of the two largest producers of poultry in Indonesia, and has a similar vertically integrated business model for poultry operations in Vietnam, Myanmar and India, as well as swine operations in Vietnam. Its Indonesian dairy business in China has made it one of the leading producers of premium raw milk in the country.
JBS SA	JBS is the world's second-largest food company, with an extensive product portfolio focusing mainly on fresh and frozen beef, pork and poultry, as well as prepared and processed foodstuffs.

Company	Description
LDC SA	LDC is a France-based holding company engaged in food processing. The group provides poultry products, as well as a range of delicatessen food. Its poultry division is engaged in poultry breeding, pig and cattle farming and egg production.
Lerøy Seafood Group ASA	Lerøy Seafood's core business, based in Norway, is producing salmon and trout, catches of whitefish, processing, product development, marketing, selling and distributing seafood.
Maple Leaf Foods Inc	Maple Leaf Foods is a Canadian packaged meats producer. Its portfolio includes prepared meats, ready-to-cook and ready-to-serve meals, valued-added fresh pork and poultry and plant protein products.
Marfrig Global Foods SA	Marfrig is one of the largest global animal protein companies, involved in producing, processing, manufacturing, selling and distributing animal protein (cattle, sheep and poultry) and various food products such as breaded, ready-made food, fish, frozen vegetables and desserts. It recently announced the acquisition of National Beef, making it the world's second-largest beef producer.
Marine Harvest ASA	Marine Harvest is the world's largest producer of farmed salmon, both by volume and revenue. It has feed, farming and sales and marketing divisions.
MHP SE	MHP SE is a vertically integrated company that has a market share of around 55% of the Ukrainian poultry market. Chicken meat is one of the main ingredients in its processed meat products – accounting for over 50% of its composition, the rest being beef or pork. The company also produces and sells feed grains for its own operations, as well as to third parties.
Muyuan Foodstuff Co Ltd	Muyuan Foodstuff breeds pigs in China: boars, commodity pigs and other pigs. It also produces animal feed products.
New Hope Liuhe Co Ltd	New Hope Liuhe is a leading enterprise in agricultural industrialisation in China and an affiliate of New Hope Group. New Hope Liuhe has grown its operations into animal feed, livestock breeding and raising (chicken and pigs), meat processing and financial investments. The company operates nationally across China and in 20 other countries and regions including Vietnam, the Philippines, Bangladesh, Indonesia, Cambodia, Sri Lanka, Singapore and Egypt.
NH Foods Ltd	The NH Foods Group is a vertically integrated company that raises cattle, hogs and poultry. It maintains 122 farms in Japan and 26 overseas (Australia and Middle East). The fresh meats business accounts for more than 50% of its sales. The company also has a marine and dairy products division.
Nippon Suisan Kaisha Ltd	Nippon Suisan Kaisha provides various seafood products in Japan and internationally. The company engages in the aquaculture and provision of salmon, yellowtail and bluefin tuna, as well as pollock roe products.
Pilgrim's Pride Corp	Pilgrim's Pride is one of the largest chicken producers (vertically integrated) in the world with operations in the US, the UK, Mexico, France, Puerto Rico and the Netherlands. It is primarily engaged in producing, processing, marketing and distributing fresh, frozen and value-added chicken products to retailers, distributors and foodservice operators. JBS, the world's largest protein company, owns 78.5% of Pilgrim's outstanding common stock.
Prima Meat Packers Ltd	Prima Meat Packers is a Japan-based company, principally engaged in the production and sale of meat products and processed products. The company operates in three business segments. The meat products segment is engaged in the rearing of pigs, the processing and sale of meat, as well as related logistics business.
QAF Ltd	QAF's Australian primary production business is through the Rivalea Group. Rivalea is Australia's largest pork producer and one of Australia's leading vertically integrated pork companies with a sizeable investment in pig farming, pork processing and feed milling. QAF also has a bakery business segment.

Company	Description
QL Resources Bhd	Malaysia-based QL is among Asia's largest egg producers and surimi manufacturers. The group has three principal activities: integrated livestock farming (poultry and egg), marine products manufacturing (deep-sea fishing, fishmeal and aquaculture) and palm oil activities. It operates in Malaysia, Indonesia, Vietnam and China.
RCL Foods Ltd/South Africa (shortened version: RCL Foods)	RCL is a leading African food producer based in South Africa. Its consumer division produces a wide range of quality culinary, pet food and beverage products through its five business units: chicken, grocery, pies, beverages and speciality. It also has an animal feed business. Two-fifths of its chickens are supplied by contract growers, but it owns over 180 chicken hatcheries and farms.
Salmar ASA	Salmar is one of the world's leading producers of Atlantic salmon and is integrated from broodstock, roe and smolt to value-added products (VAP) and sales. Salmar has significant farming operations in both central and northern Norway, as well as in Scotland through 50% ownership in Scottish Sea Farms and 34% in Arnarlax. Salmar also operates a comprehensive harvesting and VAP facility in central Norway at the company's headquarters at InnovaMar on Frøya and on Vikenco at Aukra.
San Miguel Food and Beverage Inc	San Miguel is one of the leading food companies in the Philippines. Its products and services span across the entire value chain – from animal feeds, fresh chicken and fresh meats to processed meats, dairy, spreads, oils, biscuits, coffee and jelly snacks. The company operates a vertically integrated business model in its meats business, ranging from plantations, breeding and contract growing to processing and marketing of chicken and hogs. The Purefoods-Hormel Company Inc, a joint venture with Hormel USA, produces and markets processed meats that account for nearly two-thirds of the processed meats market.
Sanderson Farms Inc	Sanderson Farms is the third-largest poultry producer in the US, processing over 4.2 billion pounds of meat in fiscal 2017. It is a fully vertically integrated poultry processing company engaged in producing, processing, marketing and distributing fresh and frozen chicken products.
Scandi Standard AB	Scandi Standard is the leading producer of chicken-based food products in the Nordic region and Ireland. The company is also involved in rearing, producing and hatching day-old chicks; processing slaughterhouse byproducts for use in pet food; and packing and selling eggs.
Seaboard Corporation	As an integrated food company, Seaboard Foods is the third-largest US hog producer and fourth-leading pork processor. It produces and sells fresh, frozen and processed pork products to further processors, food service operators, grocery stores, retail outlets and other distributors in the US. Internationally, Seaboard Foods sells to distributors in China, Japan, Mexico and other foreign markets. Seaboard has a 50% non-controlling voting interest in Butterball, one of the largest vertically integrated producers, processors and marketers of branded and non-branded turkey products in the US. The corporation also has an integrated agricultural commodity trading and milling division focused on soybeans, wheat and other commodities.
Shandong Oriental Ocean Sci-Tech Co Ltd (shortened version: Shandong OOST)	Shandong Oriental Ocean Sci-Tech, together with its subsidiaries, engages in seawater breeding and cultivation business in China. It is involved in the breeding and cultivation of sea cucumber, shellfishes, kelp seedling and precious marine products; proliferation of sea cucumber; and holothurian culture, fish cultivation, species improvement, and fish-raising activities. The company offers salmon, processed products, sea cucumbers, collagens, precious fishes and larval rearing products.
Tassal Group Ltd	Tassal Group is engaged in hatching, farming, processing, selling and marketing of Atlantic salmon. The company is an integrated salmon grower and salmon and seafood processor, seller and marketer.

Company	Description
Thaifoods Group PCL	Thaifoods Group is an integrated food production company. It business comprises poultry, egg, swine and animal feed in Thailand and Vietnam. Its poultry business involves chicken breeding, chicken meat production and sales, and sale of day-old chicks, live chickens and processed chicken. Its swine business involves pig breeding, sale of live pigs and pork meat. The feed business involves the manufacture and sale of feed for animals, mainly chickens and pigs.
Tyson Foods Inc	Tyson Foods is one of the world's largest food companies. It operates in four reportable segments: beef, pork, chicken and prepared foods. 'Other' primarily includes its foreign chicken production operations in China and India, third-party merger and integration costs and corporate overhead related to Tyson New Ventures, LLC. It operates a fully vertically integrated chicken production process. Its integrated operations consist of breeding stock, contract growers, feed production, processing, further processing, marketing and transportation of chicken and related products, including animal and pet food ingredients. It also processes live fed cattle and hogs and fabricates dressed beef and pork carcasses into primal and sub-primal meat cuts, case-ready beef and pork and fully cooked meats.
Venky's (India) Ltd	VH Group is the largest fully integrated poultry group in Asia. Its activities include specific pathogen-free eggs; chicken and eggs processing; broiler and layer breeding; genetic research and poultry diseases diagnostics; poultry vaccines and feed supplements; vaccine production; bio-security products; poultry feed and equipment; nutritional health products; and soya bean extracts.
Vietnam Dairy Products JSC	Vinamilk processes, manufactures, and distributes milk cake, soya milk, fresh milk, refreshment drinks, bottled milk, powdered milk, nutritious powder and other milk products. It is the largest dairy company in Vietnam.
WH Group Ltd	WH Group is the largest pork company in the world, with number one positions in China, the US and key markets in Europe. It integrates hog production, hog slaughtering and the processing and distribution of packaged meats and fresh pork. It is a majority shareholder in Henan Shuanghui Investment & Development, China's largest meat processing business. It also owns Smithfield Foods in the US.

Appendix 2: Methodology and scoring

The methodology for this Index is informed by FAIRR's internal research and feedback from key investors and ESG stakeholders. We see this Index as the first step towards developing a deeper understanding of how global protein producers disclose and manage information on nine critical risk factors. We developed the risk factors and KPIs with assistance from Cornerstone Capital.

The three key elements to the assessment are company selection, risk factors and KPIs.

Company selection

We used the Bloomberg Industry Classification System (BICS) to identify publicly listed companies with material exposure to the following industries:

- animal production and processing,
- dairy and egg products,
- meat products; and
- aquaculture.

Through further analysis of company data and input from investor stakeholders, we refined this list to companies that are involved in breeding, processing, distributing and selling meat, dairy or aquaculture products. Several companies in our list are vertically integrated, and control the full extent of their value chain, from animal feed manufacturing to the sale of proteins. Others employ production contracts with growers but retain control over the animals, and provide inputs such as feed.

As a final step, we identified companies with the largest market capitalisation:

- all listed companies with market capitalisation in excess of \$450 million; and
- Shanghai-listed companies with market capitalisation in excess of \$750 million (a higher baseline due to limitations in disclosure or translation).

This process resulted in a list of 60 global companies with significant material exposure to the five main animal protein categories: beef, dairy, pork, poultry and eggs, and aquaculture. Some companies derive their most significant source of revenues from one protein category, while others produce multiple protein categories.

Risk factors and KPIs

We selected the nine critical risks in this Index through consultation with a range of stakeholders including investor groups, NGOs and companies. The risks are representative of the key sustainability issues facing the animal protein production industry.

We used three primary approaches to identify the nine material risk factors and KPIs for the intensive livestock farming industry:

Previous FAIRR assessment: FAIRR's analysis of the 28 risks linked to intensive livestock production systems in 2016, based on detailed and extensive consultation with a range of investors, experts and industry groups.

Environmental	Social	Governance
Air pollution	Changing consumer preferences	Corporate governance
Climate change	Community health impacts	Policy changes
Deforestation and biodiversity loss	Excessive antibiotics use	Sustainability disclosure
Disease outbreaks	Human rights	Weak oversight
GHG emissions	Infectious diseases	–
High water use	Land rights	–
Natural hazards	Loss of rural jobs	–
Poor animal welfare	Poor working conditions	–
Resource scarcity	Shrinking labour pool	–
Soil degradation	Social backlash	–
Waste	Social licence to operate	–
Water pollution	–	–
Water scarcity	–	–

Figure 16: Intensive livestock farming's exposure to 28 ESG risks

Top-down analysis: We reviewed seven top-down analyses by investor groups and NGOs to determine overlapping risk factors.

The top-down analysis involved the cataloguing of the risk factors listed in widely referenced investor frameworks and frameworks. We considered the risk to be a ‘top down’ issue if one of the 28 ESG risks was addressed by over five of the frameworks.

Bottom-up analysis: We identified risk factors and KPIs that are currently acknowledged in public filings by a representative sample of companies, with the assumption that disclosure is a proxy for companies’ focus on these issues.

We conducted the bottom-up assessment to determine which risks are material from a corporate perspective on a sample set of 15 companies. We chose these 15 companies to represent the following criteria:

- geographically diverse to account for differing regulatory systems,
- differing market capitalisation to account for different levels of resources and investor scrutiny; and
- different livestock species to account for the impacts of specific animals.

If most of these companies report on one of the 28 ESG risk factors from FAIRR’s analysis, we considered that to be ‘bottom-up’ confirmation of the indicator’s significance and suitability for benchmarking. For this iteration of the pilot Index, all risk factors and KPIs were weighted equally.

Assessment and scoring methodology

Given the global diversity of our companies and the complexity of identifying the materiality of each risk factor for companies based on their location, proteins and business models, we did not seek to rank companies against each other. To understand relative performance, however, we devised a simple assessment and scoring system to develop a final score for each company across the risk factors.

We assigned each company a risk colour and rated them on a scale of 0–5 based on their commitments, policies and disclosure against the risk factor KPIs. All eight risk factors and KPIs were weighted equally. Sustainable proteins are not scored.

We sent all companies their preliminary assessments in November and December 2017 for their feedback. Company responses have been integrated into our assessments.

Risk factor colours:

- **Yellow** ('low risk') signifies basic management of the issue,
- **Orange** ('medium risk') signifies some steps towards management of the risk; and
- **Red** ('high risk') signifies little or no action or disclosure.

The FAIRR team assigned scores based on the following criteria:

KPI assessment	Possible scores	What the scores mean
Criteria for high risk	0 or 1	0 signifies no disclosure or discussion 1 signifies some level of disclosure or discussion, but clearly not at a sufficient level
Criteria for medium risk	2 or 3	2 signifies meeting the KPI, but with limited detail 3 signifies meeting the KPI, but with more discussion and detail
Criteria for low risk	4 or 5	4 signifies meeting the KPI, but with limited detail 5 signifies meeting the KPI, but with more discussion and detail

A score of zero indicates that no disclosure was found for the KPI. A score of 5 indicates basic management and best practice against the KPI criteria. It is important to note that we specifically devised high-level KPIs given the low levels of disclosure in the sector and the global diversity of our company ‘universe’.

In instances where we found high-profile violations of companies’ self-reported policies, we reduced the number of points assigned to the company. For the next stage of the Index, we intend to incorporate KPIs that enable us to better assess practical policy implementation.

The company scores across each KPI for the risk factor are averaged for that risk factor score. Company final scores are simple averages of the risk factor scores.

Appendix 3: Limitations in estimating the size of the global and regional protein market

To estimate the global and regional size of the animal protein market, we use the [OECD-FAO Agricultural Outlook 2017–2026 and Aquaculture Production statistics datasets](#). We use the latest actual production data for meat (beef, veal, lamb, poultry and pork) and dairy (milk and dairy products) available for 2015. The world price data for meat (beef, veal, lamb, poultry and pork) and certain dairy products (cheese, butter, skim and whole milk powder, whey powder and casein) are based on the average world prices for 2015 as provided by the dataset. The world price for milk is calculated independently using the average spot price for raw milk in 2015.

Our estimates indicate that the global production of meat and dairy has a market value of approximately \$1.3 trillion, of which meat is \$891.6 billion and dairy is \$407.2 billion. Global aquaculture is estimated to be approximately \$156.4 billion.

This is the first step towards estimating the global size of the animal protein market using publicly available production data. There are, however, several limitations to this approach. The production data for meat does not capture processed animal-derived products, and it is based on carcass weight equivalent, which does not include heads, feet, entrails and gut fill (e.g. kidneys, livers and hearts). For the dairy industry, our data includes raw milk production and processed dairy products (i.e. cheese, butter, skim milk powder, whey powder and casein). However, we do not include fresh dairy due to inconsistent data. Our methodology also does not include the egg industry or trade data and is therefore an underestimate of the real size and value of the market.

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Intensive livestock farming's exposure to 28 ESG risks



About FAIRR

Established by the Jeremy Collier Foundation, the FAIRR Initiative is a collaborative investor network that raises awareness of the material ESG risks and opportunities caused by intensive livestock production.

FAIRR helps investors to identify and prioritise these factors through cutting-edge research that investors can then integrate into their investment decision-making and active stewardship processes. FAIRR also runs collaborative investor engagements with global food companies to improve performance on selected ESG issues in intensive livestock production.

