



# Innovation in Animal Nutrition Feeding the World within the Limits of our Planet

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# World Population

Projected world population until 2100

1990



5.3  
billion

2017



7.6  
billion

2030



8.6  
billion

2050



9.8  
billion

2100



11.2  
billion

Source: United Nations Department of Economic and Social Affairs,  
Population Division, *World Population Prospects: The 2017 Revision*  
Produced by: United Nations Department of Public Information

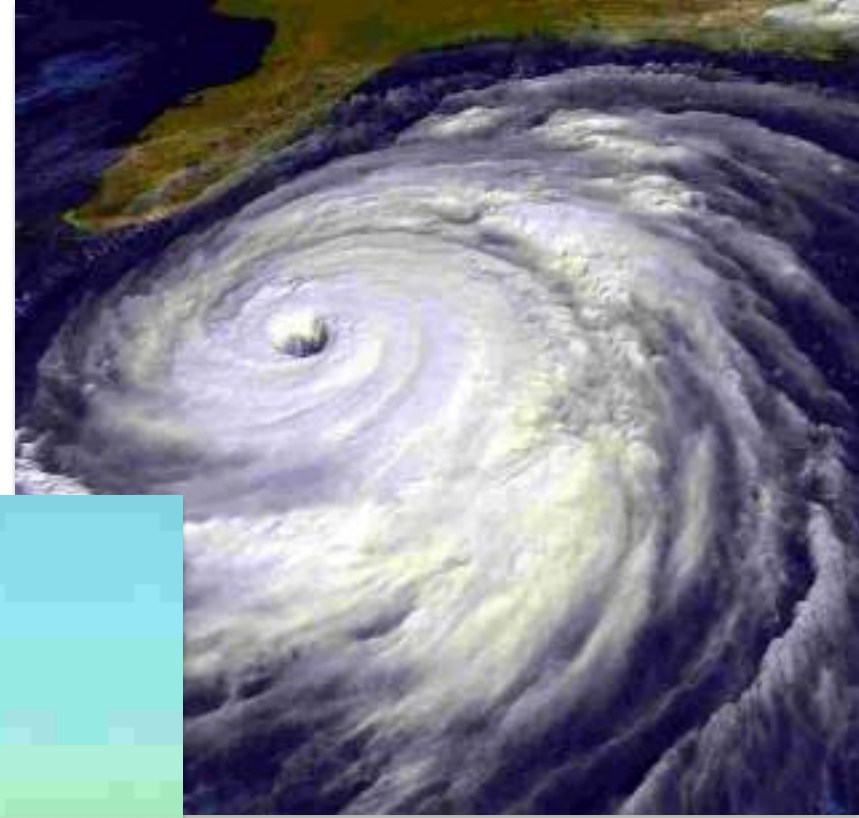






resource  
depletion

emission &  
pollution



risking the basis  
of our existence



A graphic for Earth Overshoot Day 2018. It features a dark blue background with a satellite in the top left, a small orange planet, and a large, stylized Earth with green continents and blue oceans. The text 'AUGUST 1' is prominently displayed in white.

# AUGUST 1

*Earth Overshoot Day 2018*

1.7 earths are needed to support current humanity's demand on the planet's ecosystem



# UN Sustainable Development Goals

## People, Planet, Prosperity



end poverty  
protect the planet  
ensure prosperity for all

# DSM takes a leading role advancing the sustainability goals of the United Nations

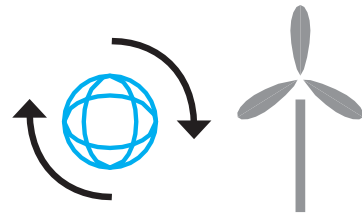
## UN Sustainable Development Goals



## DSM Sustainable Growth Areas



Nutrition and Health



Climate change and renewable energy



Resources and circular economy

"The United Nations Sustainable Development Goals set out the global strategy for the world in order to tackle some of the most challenging issues. At DSM we proudly take a leading role in advancing the SDGs as part of our business strategy."

Feike Sijbesma, CEO/Chairman Managing Board



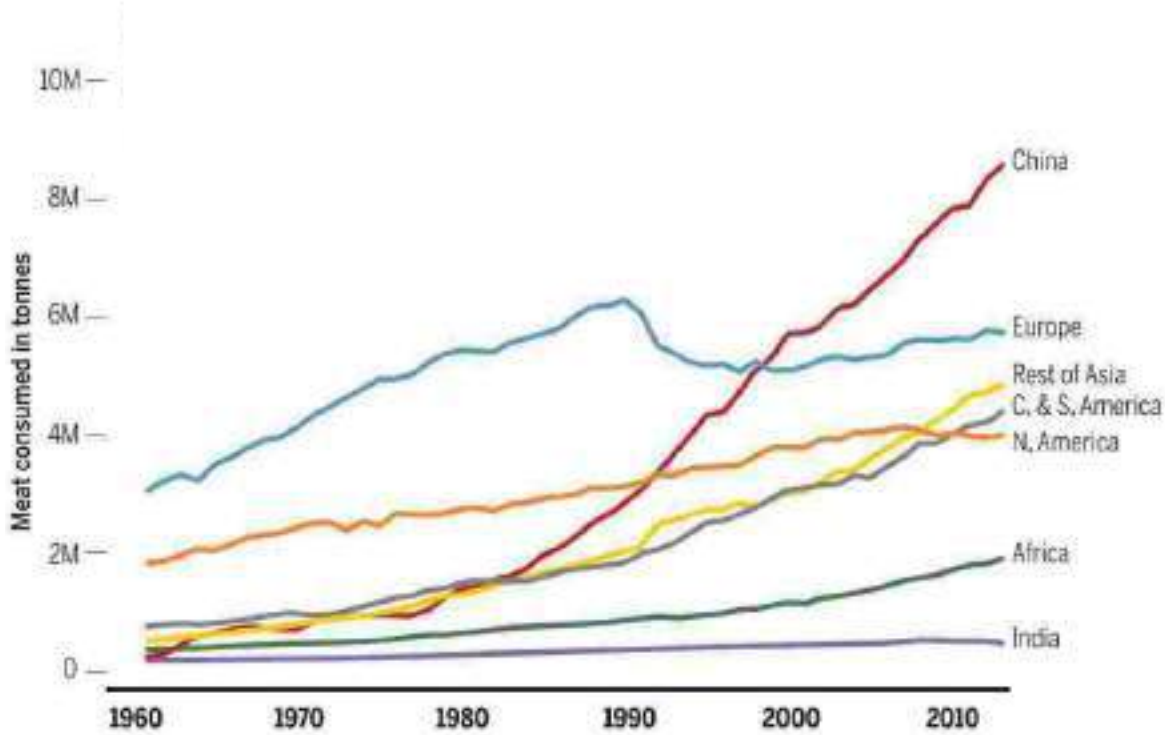
# Animal protein is part of a healthy balanced diet

## Supporting the health & wellbeing of growing populations

- Feeding the growing population has been made possible by strong growth in global food production (innovation in breeds, fertilizers, farming practices, feed additives...)
- Improved quality of nutrition contributes to increased health and longevity
- Livestock turns edible crops into highly nutritious protein rich food
- Livestock converts to food resources that cannot be used otherwise (by-products, marginal land)
- Livestock manure contributes to crop productivity
- Agricultural sector is a key component to the socio-economic status and key contributor to prosperity



# Increasing scrutiny of impact on environment, human health and animal welfare - while demand for animal protein continues to increase



Godfray et al., Science 361, 243 (2018)  
Data from [www.fao.org/faostat/en/?#data](http://www.fao.org/faostat/en/?#data)



# DSM Nutrition Mission: Healthy diets for all within planetary boundaries

## Our key nutrition goals



Advocate healthy, balanced nutrition



Increase the nutrient content & quality of feed & food



Enable the feeding of a growing population within the natural resources available



Reduce the eco-footprint of producing food (keep within planetary boundaries)

# Healthy diets for all within planetary boundaries

## Innovative solutions through six core platforms



Tackling antimicrobial resistance



Reducing our reliance on marine resources



Reducing livestock emissions



Efficient use of natural resources



Safe, quality nutrition and less waste



Lifetime performance



We work at species and country level to make tangible, measurable impacts

# Healthy diets for all within planetary boundaries

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# Human activities are a driver of climate change

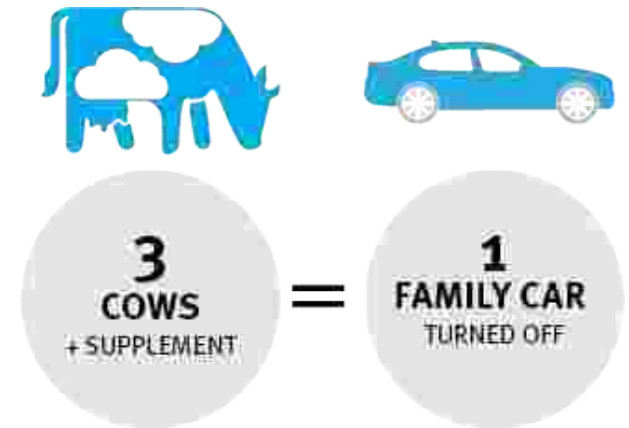
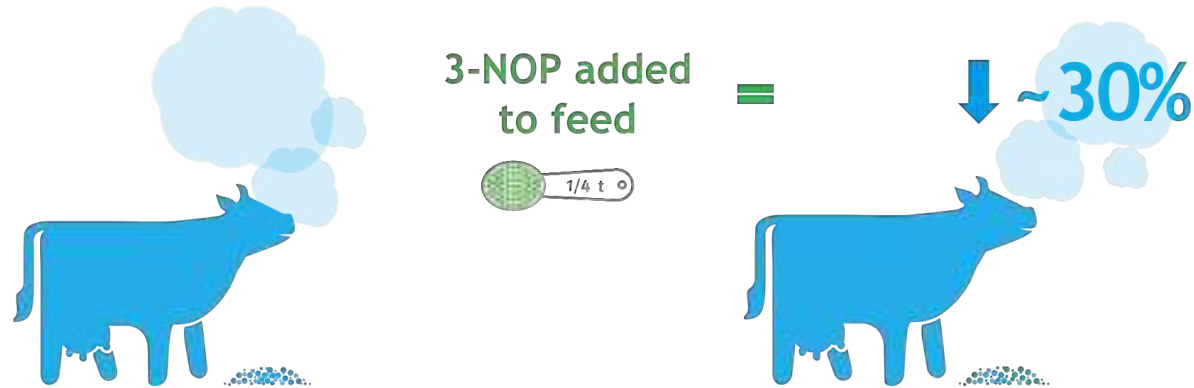
14.5% of green house gases are from livestock sector, of which 2/3 are beef & dairy cattle



Food and  
Agriculture  
Organization (FAO),  
Tackling climate  
change through  
livestock

# 3-NOP feed supplement reduces enteric methane by 30%

This reduction helps offset the greenhouse gas emissions we produce every day when driving our cars, heating our homes, and lighting our cities



Today in final stages of development

Brand naming in progress for global launch (3-NOP is the technical name)

Launching in coming years globally

N. Hristov, J. Oh, F. Giallongo, et. al., Proceedings of the National Academy of Sciences 2015, 112, 10663-10668

Greenhouse Gas Emissions from a Typical Passenger Vehicle, United States Environmental Protection Agency Office of Transportation and Air Quality, 2014



# Healthy diets for all within planetary boundaries

## Innovative solutions through six core platforms



Tackling antimicrobial resistance

Reducing our reliance on marine resources

Reducing livestock emissions

Efficient use of natural resources

Safe, quality nutrition and less waste

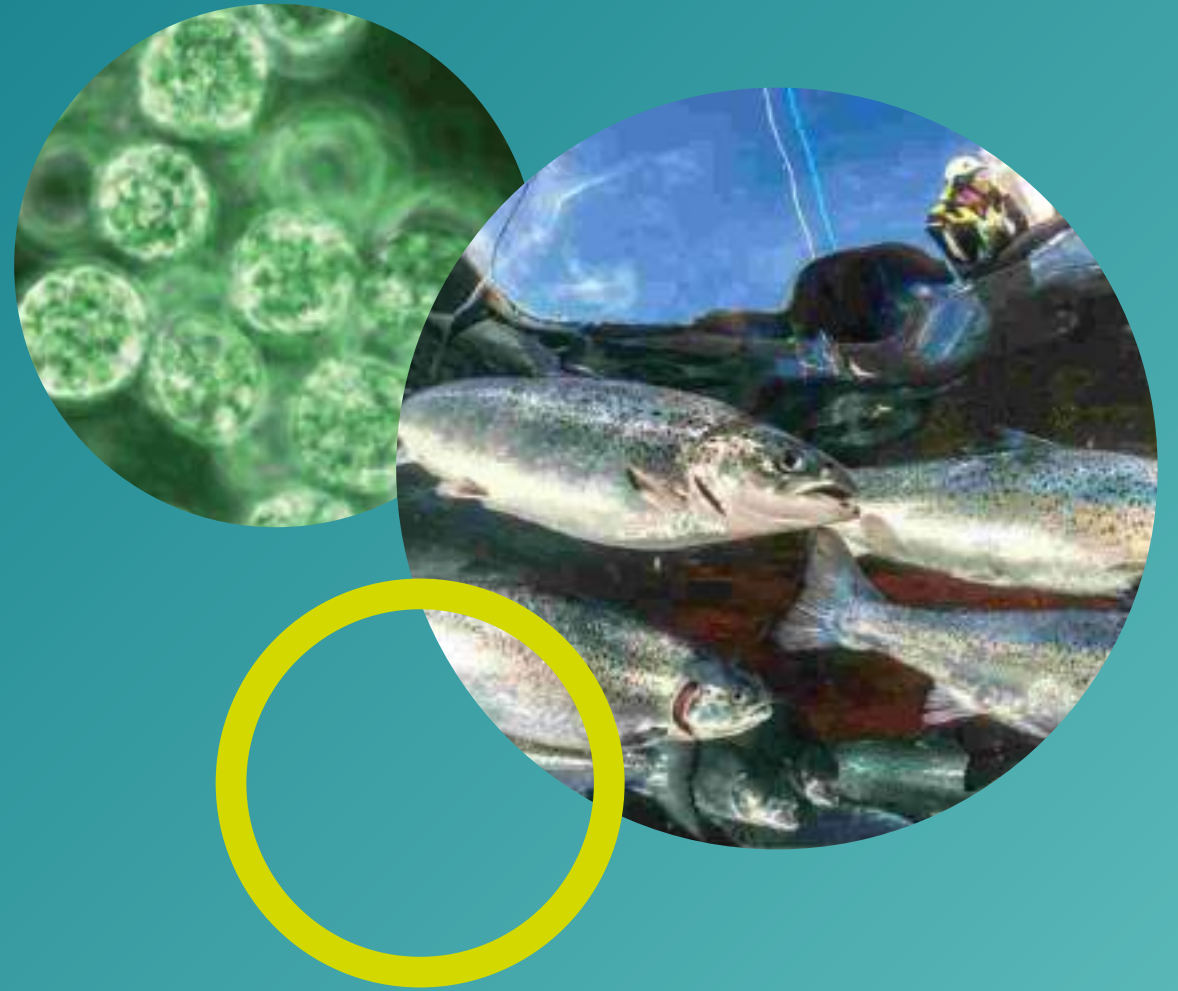
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# Veramaris

## The sustainable solution for Omega 3 EPA&DHA for Animal Nutrition



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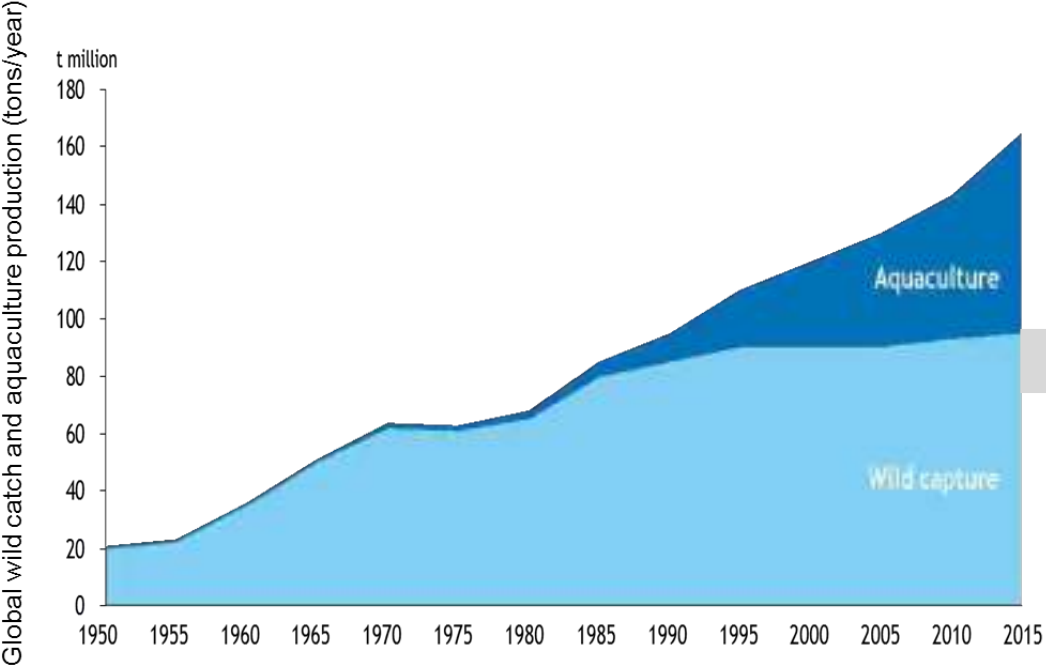
August 2018  
Günter Pappenberger

# Fish wild catch production reached its limits

## Aquaculture is required to cover the increasing protein demand for human nutrition - but relies on fish oil from finite wild catch resource

- Aquaculture is required to cover increasing demand
- Salmon aquaculture relies on feeding fish oil as omega-3 source produced from wild catch fish.

**Global wild catch and aquaculture production**



**17% of global wild catch is consumed for the production of fish oil and fishmeal**



wild catch fish\*  
2.6 kg



fish meal / fish oil



farmed salmon  
1 kg

# Our natural marine algal oil is a sustainable alternative solution for EPA and DHA supply - market launch in 2019



**DSM and Evonik breakthrough – shortening the natural food chain**  
**Replacing fish oil from 1.2 million tons of wild catch**



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Safe, quality nutrition and less waste



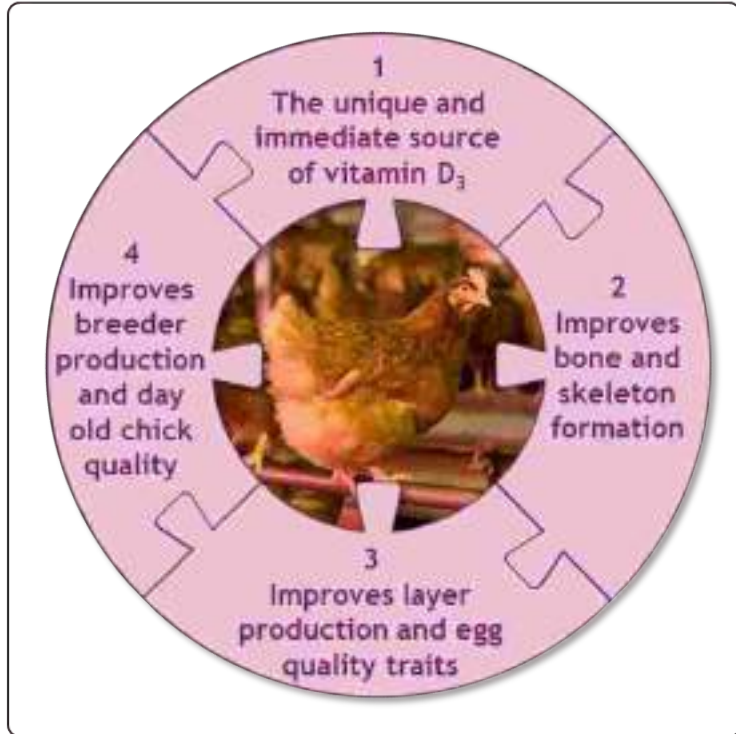
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# Safe, quality nutrition and less food loss & waste

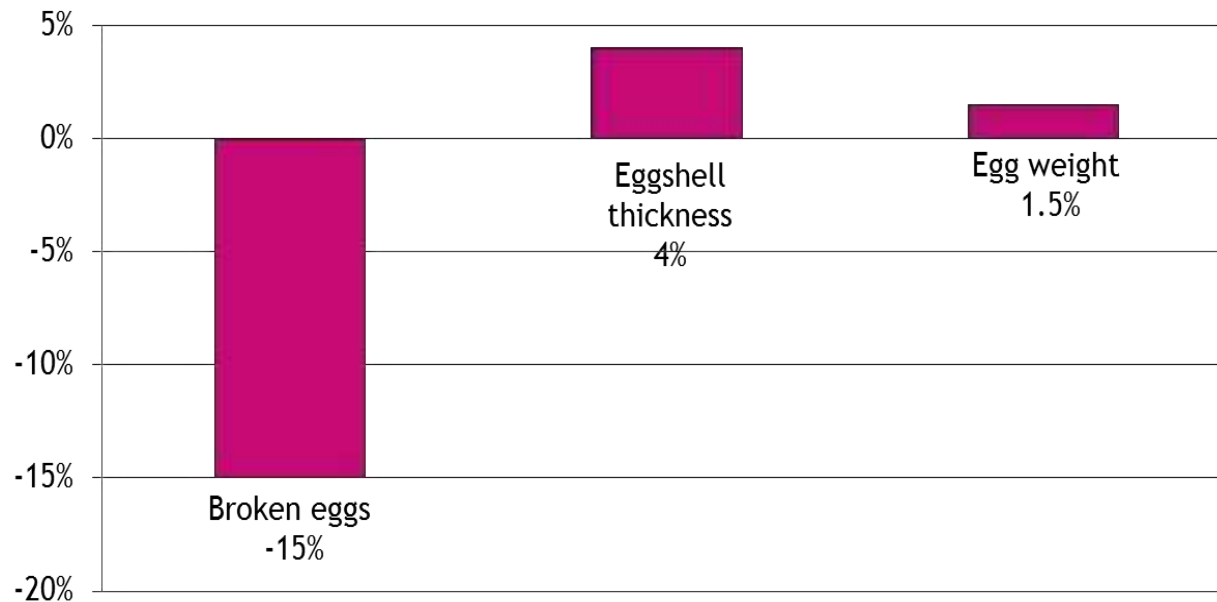
Example: How our vitamin D nutrition program contributes to improving nutrition, welfare and industry sustainability



- Improving bone strength throughout the growth of the hen, reducing incidence of bone fractures & associated welfare issues
- Improving layer productivity: more eggs, better egg shell quality. Improving sustainability aspects: more out of less; contributing to less food loss & waste
- Improving nutritional value of the egg supporting healthy, balanced diets
- Improving breeder performance & chick quality: a more sustainable production
- Improving farmer livelihood

# Food Loss & Waste is a major food sustainability issue. By improving egg shell strength we can help reduce food loss and waste (FLW)

Percentage change vs. traditional nutritional use of vitamin D<sub>3</sub>



- More effective nutrition leads to improved egg shell strength
- Highly significant reduction in broken eggs
- Tremendous value to the food chain in helping to reduce FLW

Source: Average results of experimental and field trials



# Healthy diets for all within planetary boundaries

## Innovative solutions through six core platforms



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Reducing our reliance on marine resources



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Efficient use of natural resources



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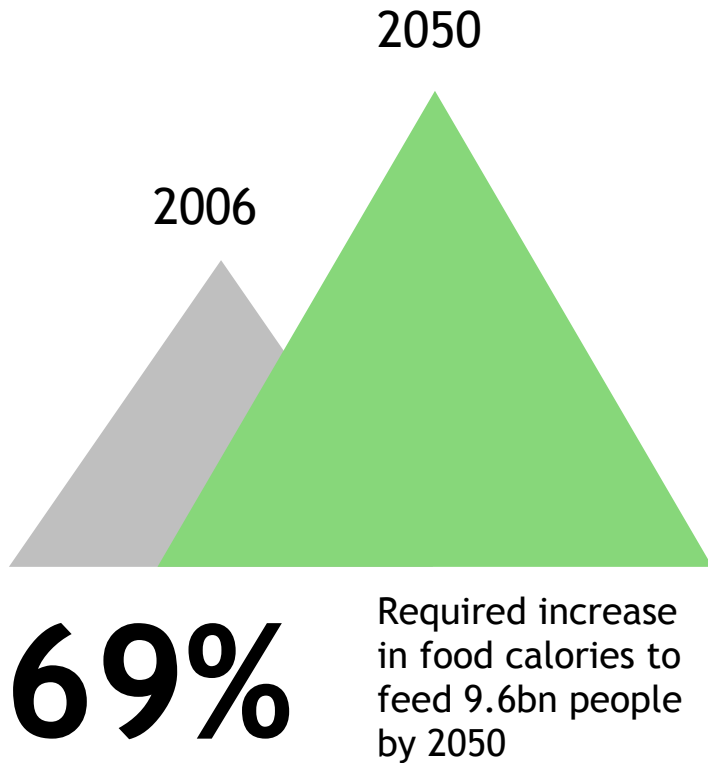


Lifetime performance



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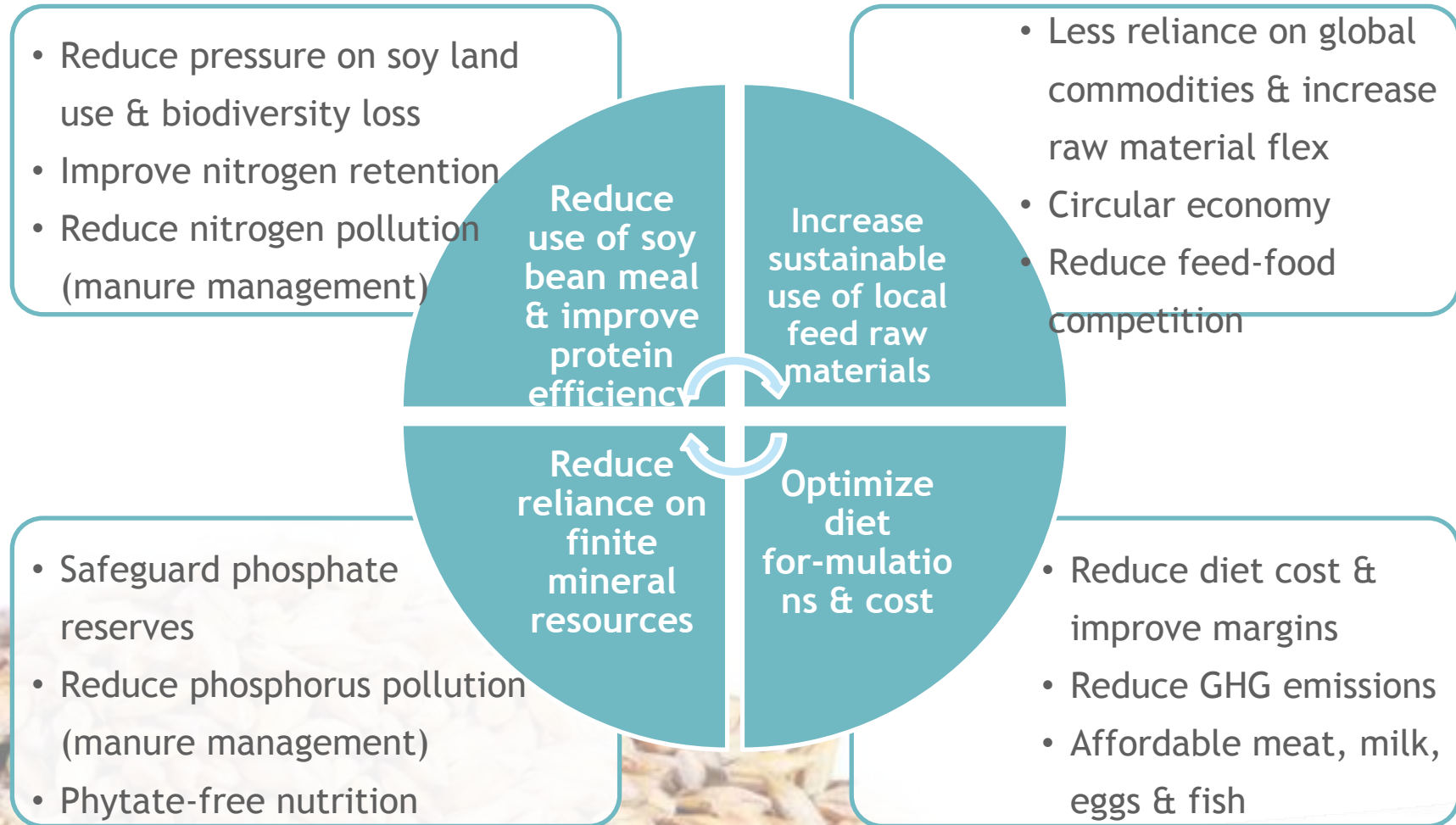
# Efficient use of natural resources - improving protein & calorie retention and mitigating emissions



- Nutritional value of crops declining (+ANFs) & with poor sustainability record (soy)
- Need for improving the digestibility of mainstream feed raw materials
- Need for upgrading lower digestible, local feed raw materials & by-products (broadening raw material base). Reducing feed-food competition
- Reduce emissions: nitrogen & phosphate pollution (manure management); CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>

30% of livestock-consumed DM is derived from residues & by-products from the agri-food chain. By-product consumption is expected to grow as the population increases & more processing takes place

# Efficient use of natural resources via enzyme technology



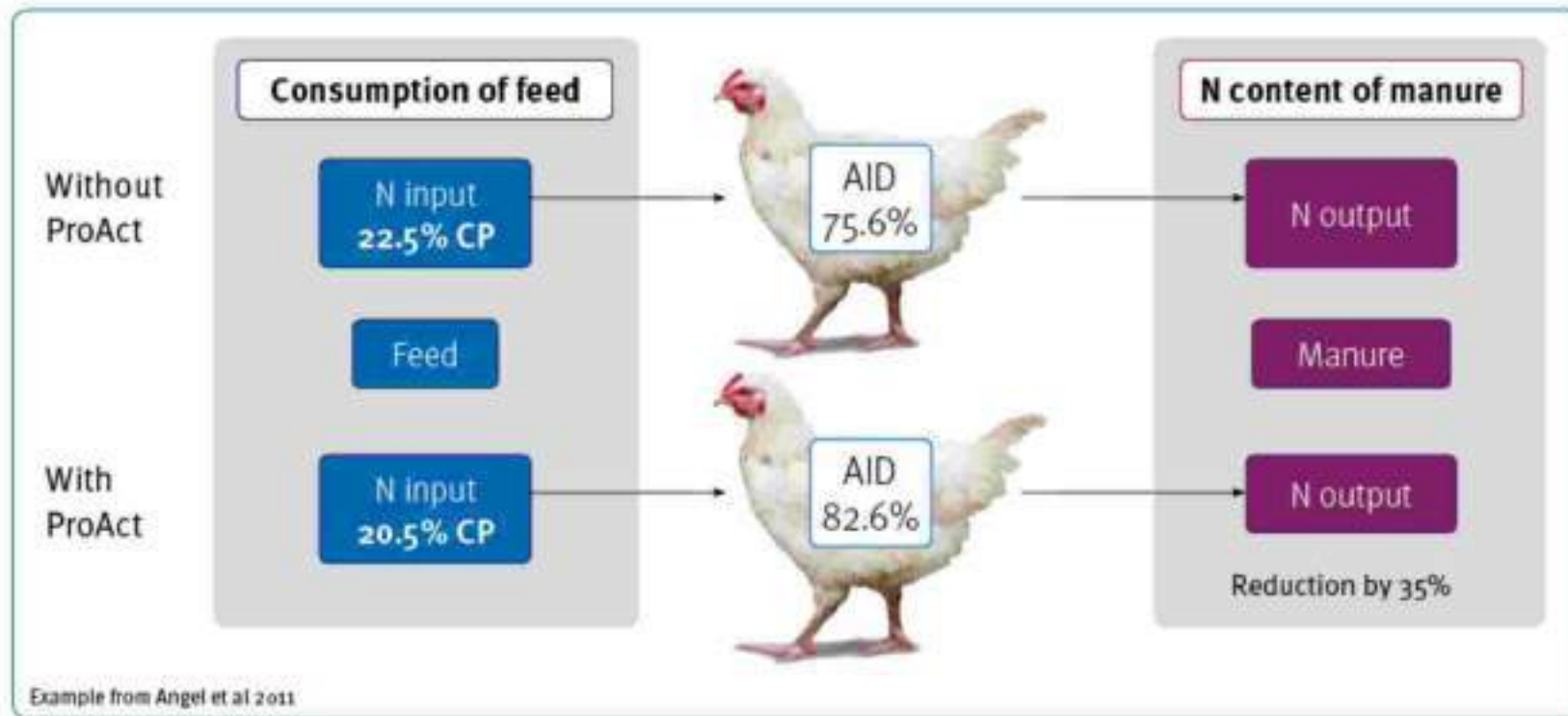
Our broad DSM feed enzyme portfolio delivers innovative and effective solutions to extract more nutritional value out of today's feed ingredients.

The depth and breadth of our enzyme portfolio has been designed to address the varied needs of our customers, while tackling the societal issues of sustainable livestock production.



# Feed protease reduces protein use & nitrogen emission

## Key for operating within planetary boundaries



Nitrogen flow to the environment is a major issue for some farming operations.

Nitrogen flow is monitored and in some geographies, boundaries are set.

Livestock production within planetary boundaries is receiving increasing focus throughout the value chain and associated stakeholders.

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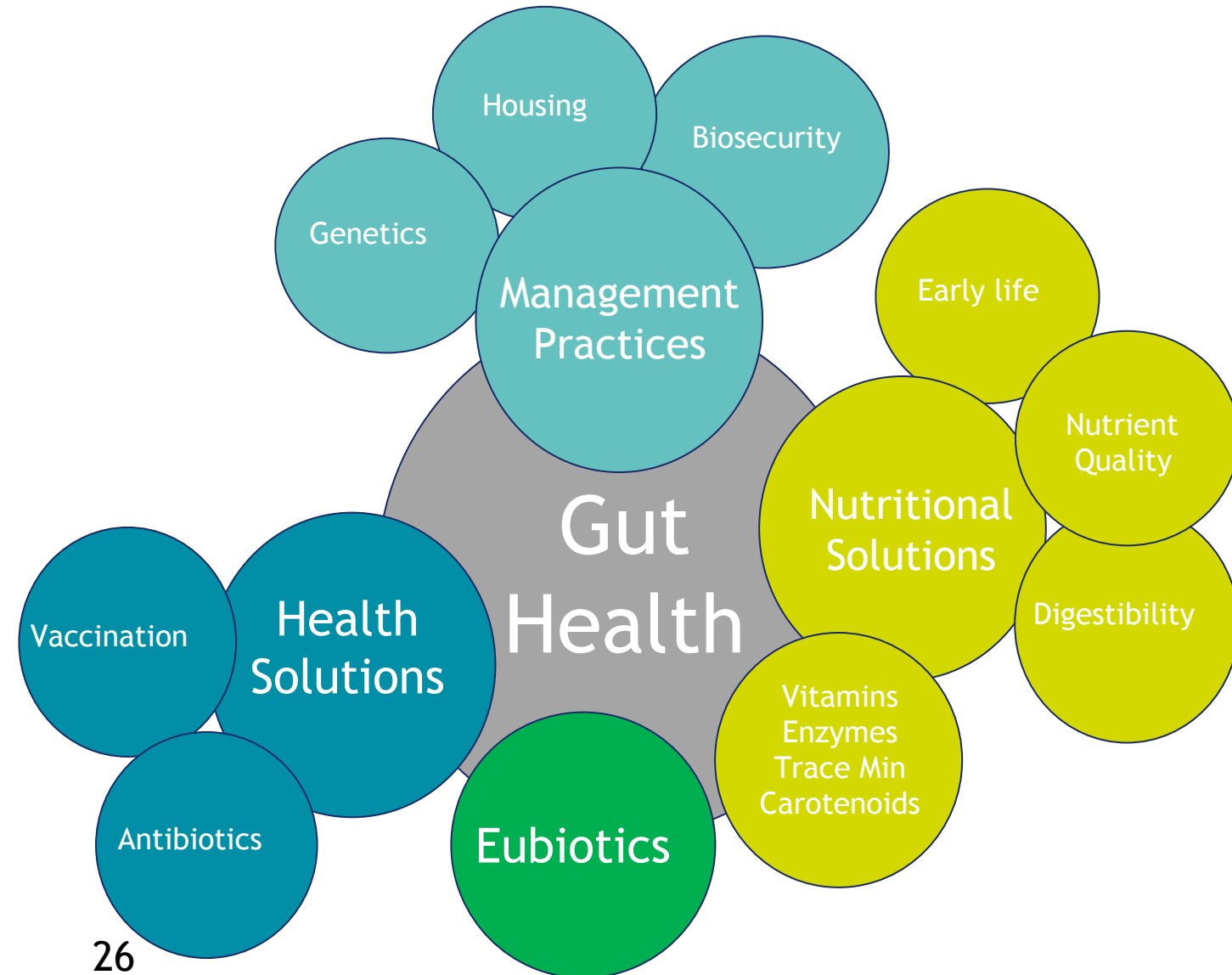


Lifetime performance



We work at species and country level to make tangible, measurable impacts

# AGP-free nutrition: re-thinking & adapting all aspects of animal protein production



## Strong market drive to reduced use of antibiotics in animal production

- Avoidance of AGPs in animal protein production requires a holistic approach including adaptations in management systems, nutrition and health practices
- With our broad expertise in micronutrients and in nutrition generally we are very well positioned to close the vacuum created by avoiding antibiotics
- We have a comprehensive and promising innovation pipeline to close gaps & enable the change in industry practice



# Targeting bacterial cell wall debris: Novel approach supporting AGP-free nutrition



**Novel feed enzyme improves broiler performance by reducing gastro-intestinal imbalance caused by bacterial cell wall debris**

- Bacterial cell wall debris (peptidoglycans) is ubiquitous in the gut.
- Peptidoglycans can act as intestinal antagonists and stimulate mucin secretion.
- Imbalance between the production and disposal of bacterial cell wall debris can compromise gastrointestinal function (e.g. reduction of gut motility, bacterial overgrowth).
- DSM developed a novel feed enzyme degrading the peptido-glycans of the bacterial cell wall debris, improving broiler FCR by 4 pts (Yegani, 2018).
- Improved gastrointestinal functionality has a value beyond direct impact on performance, e.g. animal welfare.
- Market launch in 2018 (North America, Latin America).



# Our DSM nutrition mission

## Healthy diets for all within planetary boundaries



We want to contribute to healthy, enjoyable and accessible food and nutrition solutions for all, produced and consumed respecting the limits of our planet



In doing so, we work with our partners to nudge consumers towards healthy and sustainable diets, dealing fairly with all stakeholders involved



DSM is committed to promoting equitable access to healthy food and nutrition, to using and enabling low carbon technologies and to protecting the earth's resources

**Thank you for your kind attention.**