FIT FOR THE FUTURE — THE OPPORTUNITY FOR AQUACULTURE
INTRODUCTION

Fish consumption is growing faster than all other major animal protein sources. Aquaculture already accounts for 50% of the fish consumed as food across the world.

The aquaculture industry has expanded exponentially in recent decades, embracing the latest technology, innovation and genetic development to meet the increasing global demand for animal protein. Now, as we realise the extent to which our global human activity has altered the planet’s ecological systems and the impact this has on the people who depend on it, businesses are under increasing pressure to address the challenges inherent in our current food supply.

As an industry built on innovation, the aquaculture sector is uniquely placed to lead business in the development of more sustainable food animal production, adapting to meet not only the immediate challenges at the forefront of aquaculture industries, but also in driving improvements to long-term issues that are only beginning to emerge, as exemplified in the table on the following page.

### TOP AQUACULTURE INDUSTRY CREDENTIALS

<table>
<thead>
<tr>
<th>Current credentials</th>
<th>Short-term opportunities</th>
<th>Long-term adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environment</strong></td>
<td>• Offset demand for wild caught fish and associated impacts</td>
<td>• Low impact to local habitat through fully managed effluent controls</td>
</tr>
<tr>
<td><strong>Ethics</strong></td>
<td>• Sale of high quality and accessible animal proteins to global consumers</td>
<td>• Worker welfare and safety of staff at all stages of supply chain</td>
</tr>
<tr>
<td><strong>Economics</strong></td>
<td>• Local employment opportunities in coastal communities</td>
<td>• Food industry leaders in fully-traceable species and origin (mitigate food sourcing fraud)</td>
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<tr>
<td></td>
<td></td>
<td>• Inputs optimisation and business margins that offer re-investment return</td>
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### Business benefits of working with FAI Farms

- Increase brand, product and market value by addressing key input, quality and reputation risks
- Improve transparency in line with increased citizen, retail, NGO and regulatory demands
- Demonstrate commitment to sustainability, raise standards and drive improvements in alignment with best-practice

A CHANGING CLIMATE FOR FOOD BUSINESS

Food producers are uniquely placed to respond to the many challenges facing humanity. On land and at sea, food businesses are often most vulnerable to these impacts. Impacts include — planet warming, dramatic loss of biodiversity, soil health depletion, eutrophication and fresh water scarcity. FAI is committed to working with farmers and industry to create a more resilient and healthy food system that is fit for the future.

Across the world, people are becoming increasingly interested in knowing where their food comes from, how it was produced and by whom. Food companies up and down the supply chain are under scrutiny to ensure they are addressing the impact their production practices are having on people, animals and the environment. For businesses willing to take the lead, this scrutiny represents incredible opportunities for differentiation and market reward.

FAI’s mission is to help food producers and retailers capture this reward and drive meaningful improvements for people, animals and the environment. Through better measures and practical advice we ensure that companies’ actions continue to contribute towards better environmental, economic and ethical (refer to our 3E framework on the following page) outcomes across their supply chains.
**OUR 3E SUSTAINABILITY APPROACH**

Sustainability is not a destination, instead it is a continuous journey focused on meeting our own needs — without jeopardizing the ability of future generations to meet theirs.¹

FAI partners with companies and organisations that genuinely wish to embark on a journey of sustainable change. We help them focus on what matters the most, what’s good about their practices today and how they can make it better now, tomorrow and in the future.

FAI’s 3Es — **Economic**, **Ethical** and **Environmental** approach to sustainability provides a clear route and framework for understanding and quantifying the key issues and challenges within food systems as they change over time.

The scope of this exercise can include a company’s entire production and sourcing footprint, or a particular key raw material, category, sector or geographic location. Before embarking on a programme of action, we ensure priorities are embedded and aligned with business objectives, validated by science and cross referenced against key stakeholders’ views.

Our multi-disciplinary team of farmers, veterinarians, data analysts, scientists and aquaculture experts are experienced in delivering sustainable improvement in supply through harnessing leading practice, sharing knowledge and conducting leading R&D and innovation projects. Together we help our partners confidently embark on a three stage programme of continual improvement:

- Set the benchmark
- Measure progress
- Drive improvement

Examples of our work and ways that you can work with us are outlined below, with a focus on a critical short-term risk — promoting antibiotic stewardship — and an emerging sustainability opportunity — improving animal welfare.

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¹ Adapted from World Commission on environment and development, 1987.
LOCATIONS & PARTNERS

1. England
Multi-species farm, consultancy office and R&D site, Oxford.

2. Brazil
Multi-species farm, tilapia hatchery, consultancy office and training facilities, Jaboricabal.

3. US
Consultancy office, New York.

4. Norway
Software development and consultancy office, Oslo.

FAI provide great insights from farm-level all the way to business strategy.

Stefan Follmann
Head of QA
KFC Europe

WHO WE WORK WITH
Some of FAI’s key clients:
IMPROVING ANIMAL WELFARE AND ANTIBIOTIC STEWARDSHIP

ANTIBIOTICS

Antibiotic use in aquaculture poses an immediate risk to human health. Antimicrobial resistance (AMR) is a challenge of global significance to human health, resulting in increasing mortality and growing pressures on health-care systems across the world.

Whilst antimicrobial use in humans is considered to be the main driver of AMR, the contribution of medicine use in food-producing animals, including in aquaculture, is now widely acknowledged.

Antibiotic stewardship is the most poorly managed of all critical business risks facing the 60 largest producers of meat, poultry, dairy and aquaculture.\(^2\)

Complex links that lead to the potential spread of resistance between animals and humans include — direct contact, environmental contamination and the food chain. Risk of AMR is made worse by widespread overuse and mis-use (particularly of highest priority critically important antibiotics [HPCIA] to human medicine) of antibiotic treatments in many aquaculture production systems.\(^3\) 77% of companies assessed by investor risk analysis group FAIRR, were found to have inadequate policies and/or have no measures in place to reduce antibiotic use.

In some regions, aquaculture companies rely on excessive use of antibiotics to maintain production, leaving the sector highly exposed to global efforts to fight antibiotic resistance.\(^2\)

A MEANINGFUL APPROACH TO DATA USE

Currently, much can be done to improve the practice of recording and reporting standardised data of antibiotic use in the global aquaculture sector.

Better data will allow for new insights on the issue and comparisons of performance between regions, species and production systems. FAI’s approach to data is to collect outcome measures that offer the highest resolution and quality, that are practical to collect and relevant for the purpose. Data is put to use, not collected for data’s sake. Our partners retain all ownership of their own data. Our role is to analyse the data so that the impacts of an issue like antibiotic use are understood in the broader ethical, environmental and economic context. Similarly, improvement practices are considered within this broader framework, increasing the opportunity for successful uptake and sustainable change.

\(^2\) Shallow Returns, FAIRR 2019.

\(^3\) World Health Organisation (WHO), 2018. Critically important antimicrobials for human medicine, 6th revision.
FAI’s framework for responsible antibiotic use promotes practical and evidence-based solutions to ‘Replace, Reduce and Refine’ the use of antimicrobials. The 3R approach is sufficiently flexible to allow tailored stewardship programmes to be developed for individual species, production systems and farms across the world.

**Replace** the need for antibiotic use, primarily through comprehensive disease prevention, including improvements to husbandry and management, nutrition, genetics, vaccine use, biosecurity and quarantine procedures, and better access to knowledge and technology.

**Reduce** overall antibiotic use without compromising health and welfare through improved diagnostic testing and standardised methods for recording and reporting antibiotic usage in aquaculture. Collating this ongoing data is essential to inform better practice and support targets for improvement. FAI’s Antibiotics Tracker software is being used globally to support this initiative (see Case Study: McDonald’s Tracker for Responsible Antibiotic Use, page 14).

**Refine** the use of antibiotics where treatment is required, through development of effective diagnostic testing and administration routes (alternatives to oral administration), administration of the correct dosage, for the right duration and using the appropriate equipment.

Crucially, this framework provides an immediate means to protect antimicrobials deemed ‘highest priority critically important’ for human health (including 3rd and 4th generation cephalosporins, fluoroquinolones, macrolides and glycopeptides). Our approach is designed to protect and promote animal health and welfare, productivity and farmer livelihoods as well as the collective health of people and the environment.

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Antimicrobial resistance (AMR) is amongst the most pressing challenges facing humanity. As one of the world’s largest food companies — McDonald’s is committed to using their scale for good, to influence industry change and highlight opportunities for the responsible use of antibiotics in food animal production.

McDonald’s partnered with FAI to develop a tracker to record antibiotic use in the broiler flocks processed for McDonald’s. McDonald’s understands that antibiotics are an important tool in safeguarding the health and welfare of the livestock within their supply chain — and more importantly, that healthy animals assure McDonald’s customers of safe food.

The McDonald’s antibiotic tracker monitors the supply-wide picture of antibiotic usage over time to determine how usage is trending and what factors may be influencing this. Identification of reducing trends of antibiotic use indicate best practice opportunities in this pre-competitive issue that can be captured and shared with other producers. Additionally, highlighting increasing trends indicates areas for McDonald’s to work collaboratively on supplier-relevant initiatives to reduce, replace and refine antibiotic usage in their supply chain.

This approach allows McDonald’s to engage objectively and openly with their supply chain partners to bring about positive change and supports McDonald’s increasing transparency around this critical issue to better inform their customers and external stakeholders.

The Antibiotic Tracker captures the following antibiotic measures within McDonald’s supply chain (in those markets identified in McDonald’s Policy for Antibiotic Use for Broiler Chickens):

- Total usage of all antibiotics (mg/kg)
- The usage of antibiotics defined by the World Health Organization as Highest Priority Critically Important to Human Medicine (HPCIA)³
- Usage of antibiotics in the first 7 days, which will serve as an indicator of prophylactic treatment practices using antibiotics without disease diagnosis

Our work with FAI is ground-breaking in the sense that for the first time, we will have independently managed data at a global scale representing diverse production systems, climates and breeds that will inform a sustainable approach to responsible antibiotic use, balancing animal health and global concerns surrounding AMR.

Bruce Feinberg
Senior Director Global Protein Quality Systems
McDonald’s Corporation

FAI’S ANTIBIOTIC INITIATIVES IN AQUACULTURE

FAI are working alongside diverse supply chain partners and global industry bodies to implement a 3R’s approach to antibiotic stewardship. By driving engagement and direction on this pre-competitive issue, we are able to offer concrete steps for our industry partners — to move further towards responsible antibiotic use, including:

**Antibiotic policy review and implementation**
- Implement antibiotic policies at the fore-front of actionable and achievable practice
- Supported by practical producer-facing workshops to enable sustainable change

**Establish responsible antibiotic reporting**
- Measure existing usage trends against targets
- Interrogate data to harness best practice opportunities
- Cloud-based platform and dedicated support team to securely and easily manage antibiotic data collection, consolidation and review
- Supported by FAI-led expertise to disseminate knowledge of antibiotic stewardship

**Driving innovation in antibiotic stewardship**
- Build on policy updates and increased supply chain understanding to drive replacement, reduction and refinement in antibiotic use
- FAI is a leader in applied research and industry-led innovation in the area of responsible antimicrobial use

**Business impact**
- Demonstrate resolute commitment on critical issues whilst ensuring ongoing protection of animal health and welfare and producer livelihoods
- Increase brand and product value by marketing responsibly reared fish
- Enables brand transparency in accordance with increasing citizen, regulatory, retailer and NGO demands
- Approach aligned with current and emerging international initiatives
ANIMAL WELFARE

FISH WELFARE — AN EMERGING SUSTAINABILITY RISK

Throughout the last decade, the issue of farmed fish welfare has raised increasing public and scientific concern and has become a key focus for animal welfare campaign groups.

Animal welfare is both a science-based and a value-based concept — drawing on animal’s physical and behavioural needs as well as social acceptability. Considerable work has been carried out to understand the welfare requirements of farmed mammals and birds, however much less is understood about the welfare requirements of individual fish and the crustacean species commonly farmed in aquaculture. Whilst the focus on improving health and productivity outcomes has given us understanding of the myriad physiological needs of fish, we are only now beginning to realise the behavioural requirements necessary for good fish welfare.

A 2019 survey of over 9,000 consumers across nine major European markets confirmed that fish welfare is of interest to consumers. 79% of respondents stated that fish welfare should be protected at the same level as other food animals and indicated they would like to see information on fish welfare on the label of all fish products.4

Ensuring good fish welfare not only improves economic outcomes for food businesses through mitigation of brand risk and improved brand perception, it also delivers financial returns linked to improved health and growth potential achieved through better production practices. As such, fish welfare represents a growing risk area to aquaculture businesses, with improvement opportunities across the entire production value chain.

Aside from ethical concerns, recent studies show a link between strong company performance on welfare and financial out-performance, indicating the risk of poor fish welfare to company performance.5


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### Production Value Chain

| Hatchery | • Disease challenges  
| | • Genetic selection  
| Grow-out stage | • Appropriate stocking density  
| | • Treatment practices  
| | • Provision of environmental enrichment  
| Transport | • Crowding and handling  
| | • Transport conditions/time  
| Slaughter | • Stunning and slaughter method  
| Retailer | • Increasingly stringent welfare policies  
| | • Prohibition of key procedures  
| | • Information requirements  
| Consumer | • Evolving public demand  
| | • Higher welfare expectations  

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CASE STUDY

M&S WINNER OF AQUACULTURE AWARDS FOR ANIMAL WELFARE

The leading UK food retailer, Marks and Spencer, received the 2019 Aquaculture Award for animal welfare in recognition of their Welfare Outcome Measure Programme, developed and delivered by FAI.

As a forward leaning company interested in driving continuous improvement across their supply chain — M&S have pioneered this approach in their sourcing of farmed Atlantic salmon, sea bass and sea bream, shrimp and trout.

Welfare outcome data such as mortality, the presence of disease, injuries and body condition of the fish, is collected on an ongoing basis from individual production units across growth stages and provides information about how fish experience, or are impacted by, different farming systems in the M&S supply chain.

Taking an outcome measure approach enables M&S to work alongside their suppliers to better understand risk areas and undertake improvement initiatives where they are most needed. The strength of this approach is to help mainstream the management of welfare as part of the day-to-day activity of business through informed data collection. In the face of increasing citizen, regulatory and NGO scrutiny of animal production practices, an outcome measures approach enables increased transparency and brand integrity.

A focus on outcomes is an effective way to move beyond standard supply chain assessment, assurance and certification. We are increasingly using this approach to better understand and act upon the issues faced in our supply chains and to deliver the increased food transparency that our customers demand.

Steve McLean
Head of Agriculture and Fisheries Sourcing
Marks and Spencer
<table>
<thead>
<tr>
<th>Environment</th>
<th>Ethics</th>
<th>Economics</th>
<th>Industry criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Climate change</strong></td>
<td><strong>Animal welfare</strong></td>
<td><strong>Production inputs</strong></td>
<td><strong>Market restrictions (traceability, food safety, eco-labelling)</strong></td>
</tr>
<tr>
<td>- GHG emissions associated with feed</td>
<td>- Biosecurity &amp; disease outbreaks</td>
<td>- Seedstock quality &amp; SPF broodstocks</td>
<td>- Market ranking</td>
</tr>
<tr>
<td>- Energy consumption &amp; fossil fuel use on farm</td>
<td>- Mortality levels</td>
<td>- Cost of production &amp; affordability</td>
<td>- NGO global tier scoring</td>
</tr>
<tr>
<td><strong>Biodiversity</strong></td>
<td><strong>Antibiotic use</strong></td>
<td><strong>Production outputs</strong></td>
<td><strong>Local industry infrastructure</strong></td>
</tr>
<tr>
<td>- Aquatic biodiversity impact due to feed sourcing</td>
<td>- Injury &amp; deformities</td>
<td>- Production losses</td>
<td></td>
</tr>
<tr>
<td><strong>Nitrogen/Phosphorus</strong></td>
<td>- Environmental stressors — stocking density, temperature, O2</td>
<td>- Product quality</td>
<td></td>
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<tr>
<td>- Water pollution from effluent &amp; clean-out operations</td>
<td>- Catching and slaughter method</td>
<td>- Waste at farm</td>
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<tr>
<td><strong>Pollution</strong></td>
<td></td>
<td>- Labour costs</td>
<td></td>
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<tr>
<td>- Soil and ground water salinisation</td>
<td></td>
<td>- Feed costs</td>
<td></td>
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<tr>
<td>- Feed waste</td>
<td></td>
<td>- Energy costs</td>
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</tr>
<tr>
<td></td>
<td><strong>People welfare</strong></td>
<td><strong>Production inputs</strong></td>
<td><strong>Market restrictions (traceability, food safety, eco-labelling)</strong></td>
</tr>
<tr>
<td></td>
<td>- Staff working conditions &amp; rights to work</td>
<td>- Seedstock quality &amp; SPF broodstocks</td>
<td>- Market ranking</td>
</tr>
<tr>
<td></td>
<td>- Worker income, equality &amp; wellbeing</td>
<td>- Cost of production &amp; affordability</td>
<td>- NGO global tier scoring</td>
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<tr>
<td></td>
<td>- Workforce skill &amp; education</td>
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<td></td>
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<tr>
<td></td>
<td>- Community impact &amp; engagement</td>
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<tr>
<td></td>
<td><strong>Production outputs</strong></td>
<td></td>
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<td>- Waste at farm</td>
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<td></td>
<td>- Product quality</td>
<td>- Waste at processing</td>
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</tr>
<tr>
<td></td>
<td>- Local industry infrastructure</td>
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**Outcome Measures**

- Energy efficiency (kWh used/tonne shrimp produced)
- Energy from renewable source (%)
- Fishery ingredient feed inclusion rate (%)
- N & P effluent load/ton of shrimp produced/annum
- Benthic Classification (total site)
- Redox/pH
- Mortality at end of production stage (%)
- Medicine and non-medicine use (no. & type of treatments)
- Injuries (% fish)
- Deformities (% fish)
- Sea lice damage (% fish)
- Stocking density during peak production (kg/m³)
- Staff annual retention/unplanned redundancy (%)
- Staff directly contracted (%)
- Staff that have undergone certified training within the business (%)
- No. work related injuries reported per total workforce
- Labour costs
- Feed costs
- Energy costs
- Market ranking
- NGO global tier scoring
FAI AQUACULTURE PROGRAMMES

FAI works with companies up and down the food chain that are ready to embrace positive change. Together we frame the current focus on animal welfare as a unique opportunity for differentiation, market reward and future proofing for sustainable food production. Our services include:

**FAI PRODUCT AND OFFERING**

<table>
<thead>
<tr>
<th>Impact Summary</th>
<th>Description</th>
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</table>
| **Brand risk review and standards development** | • Sustainability scoping and brand standards positioning (incl. BBFAW and FAIRR scoring)  
• In-depth standards review and gap analysis against industry practice  
• FAI-hosted workshops to build internal awareness and shape strategic thinking  
• Knowledge sharing and training opportunities to support best practice uptake |
| **Outcome measures in aquaculture** | • Use of practical and relevant outcome measures to quantify risks and opportunities  
• Identify leading practice and foster targeted best practice uptake  
• Cloud-based system to securely and easily manage unified data collection, consolidation and review  
• Verified reporting demonstrates ongoing improvements to customers, NGO's and regulatory bodies |
| **Innovation in fish welfare** | • Multi-partner 3E initiatives to address key sustainability issue requiring novel solutions  
• Utilise FAI track record in leading sustainability research, authoring animal welfare and sustainability papers for peer-reviewed publication  
• Key focus areas for fish welfare: animal behaviour and monitoring, genetics, transport and slaughter |

**IMPACT SUMMARY**

- Opportunity for economic improvement through addressing welfare outcomes impacting product quality, input cost or environmental impact Raise standards across all production units in alignment with industry leading practice
- Mitigate risk through early issue detection and demonstrating improvement
- Enable brand transparency in accordance with increasing citizen, retail, NGO, and regulatory demands
- Increase brand recognition and market value for discerning customers

FAI is a World Class leading edge company with the necessary expertise to drive our animal welfare strategy forward.

Sandy Corbett  
Woolworths South Africa

BBFAW: Business Benchmark on Farm Animal Welfare.  
FAIRR: Farm Animal Investment Risk and Return.
FAI Farms is part of Benchmark plc.

Working in aquaculture, the fastest growing segment of the food industry, we focus on tackling the main challenges such as disease, quality, profitability and sustainability.

Our aim is to be aquaculture’s leading provider of solutions in genetics, health and specialist nutrition.
Being close to our customers is key

We have large-scale production facilities in seven countries, covering the main aquaculture regions, supported by a network of R&D and commercial operations in an additional 20 countries.

Our mission is to enable food producers to improve their sustainability and profitability.

We bring together technology and fundamental biology to deliver products and solutions that support farmers throughout the growth cycle. We do this by improving the genetic make-up, health and nutrition of their stock — from broodstock and hatchery through to nursery and grow out.

By optimising the genetics, health and nutrition of our customers’ stock, as well providing them with the knowledge to determine livestock performance and understand disease threats, we can increase the productivity and sustainability of their business.

We know that biological control is key to the performance, productivity and long-term growth of our clients’ businesses.

Malcolm Pye
CEO, Benchmark
**BENCHMARK OFFERING**

**OUR TECHNOLOGY**

- **Eggs, breeding (parent stock) animals for salmon, shrimp and tilapia**
- **Genetic improvement services to a broad range of industry players across 12 species**
- **Probiotics**
- **Vaccines and medicines**
- **Enrichment diets**
- **Hatchery diets**
- **Sea lice treatment**
- **Purification system**

**OUTPUTS**

- **Employees**
  - Our growth and continued success is down to the hard work, talent and dedication of every member of our team. Our people strategy ensures that we offer rewarding careers where employees are motivated and inspired to make a difference.

- **Customers**
  - Investment in our products and services has a high return relative to the substantial costs resulting from major disease challenges. Our offering drives consistency in supply and supports the long-term growth and sustainability of our customers’ business — improving yield, quality and animal health and welfare.

- **Shareholders**
  - We are securing the technology at the heart of the ‘blue revolution’ — driving shareholder value as the industry grows.

- **Environment**
  - We care for our planet by operating our business responsibly and by developing sustainable solutions that tackle some of the key environmental challenges in our industry. For example, Benchmark’s CleanTreat® purification system eliminates the discharge of medicinal bath treatments into the ocean and the development of modern probiotics and vaccines is reducing the need for antibiotics.

**Advanced Nutrition**

Specialist feed promotes growth and immunity.

**Animal Health**

New vaccines prevent disease and targeted treatments manage disease outbreaks.

**Knowledge Services**

Our offering includes industry education through accredited courses, training, conferences and publications and data and consultancy solutions.

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*For marine species and shrimp*
COMMITTED TO THE SUSTAINABLE DEVELOPMENT OF THE AQUACULTURE INDUSTRY

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