

THE FUTURE OF FOOD IN ASIA AND ITS IMPACT ON PEOPLE & PLANET

October 2021

At first glance, food might not be the most obvious way to make an environmental and social impact, but consider that agriculture is the process of converting natural resources into food. In the First Agricultural Revolution (c. 10,000 BC), human civilization transitioned from foragers – nomadic hunter-gatherers that roamed the land in search of food – to farmers – permanent settlers that practiced agriculture for food. Estimates place the global population then at c. 2 million people,¹ equivalent to the current population of Houston or Brisbane. Today, there are 7.8 billion people on Earth and forecasts predict incremental population growth of 1 billion people by 2030.² The food and agriculture industry is responsible for over one-quarter of global greenhouse gas emissions.³

Food is central to our existence and represents an unparalleled opportunity to improve our environment and the lives of some of the most impoverished people in the world. We believe that investors who are looking to make a positive impact with their capital should look to the food and agriculture sector, particularly in Asia.

Capital deployed in the Asian Food and Ag sector has high potential for positive impact

The global food and agriculture industry currently contributes 26% of the world's total greenhouse gas emissions.⁴ Within the food and agriculture industry globally, Asia is the single largest contributor, accounting for 44% of emissions.⁵ Because of chronic under-investment in Asia's food supply chains in the past,⁶ there are significant opportunities to realize meaningful environmental gains simply by implementing global best practices and available technology in food production practices in the region. We believe that the marginal dollar invested in the Asian food sector can have a

disproportionately large positive ESG impact.

Feeding Asia sustainably presents a big and important challenge for the world. Asia is home to nearly half the global population but possesses only 20% of the world's agricultural land.⁷ Asia is a net importer of food, with imports tripling over the last two decades.⁸

Beyond environmental impact, agriculture supports the livelihoods of 65% of low-income working adults.⁹ Globally, the sector provides employment for around 850 million people.¹⁰

1 PBL Netherlands Environmental Assessment Agency, History Database of the Global Environment.

2 United Nations, World Population Prospects (2019).

3 Poore and Nemecek, Reducing food's environmental impacts through producers and consumers (2018).

4 Ibid.

5 United Nations, FAOSTAT.

6 PwC, Rabobank & Temasek, The Asia Food Challenge: Harvesting the Future (2019).

7 Rabobank, Asia-Pacific: Agricultural perspectives (February 2016).

8 PwC et al., The Asia Food Challenge.

9 Andres Castaneda, Dung Doan, David Newhouse, Minh Cong Nguyen, Hiroki Uematsu, Joao Pedro Azevedo with Data for Goals Group, "Who Are the Poor in the Developing World?" World Bank Group: Poverty and Equity Global Practice Group, Policy Research Working Paper 7844 (October 2016).

10 Derived from labor data available from The World Bank's Open Data Platform.

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Nutrition is another important aspect of social impact. Animal protein consumption in Asia on a per capita basis is less than one-third of consumption levels in the US.¹¹ Particularly in developing economies, growing dietary diversity beyond staple foods is crucial. While staple foods are a good source of energy, they can lack nutrients necessary to stave off disease and nutritional deficiencies.

Asia is at the heart of the global challenge in the food and agriculture sector. Its population will account for nearly half of global population growth over the next decade.¹² At the same time, the middle class in Asia is expanding rapidly, and will steadily increase per capita consumption of food, including more environmentally intensive food products like animal proteins, to a level that will eventually approach other developed nations like the US. How can the world feed a growing Asia while mitigating the environmental impact of producing and consuming more food?



The food sector in Asia has historically suffered from chronic under-investment for two principal reasons:

- **High industry fragmentation.** Sub-scale operators are unable to leverage industrial scale best practices and technology to improve yields, leading to high carbon intensity (i.e., high levels of greenhouse gas emissions per unit of food produced). They also tend to have poor waste management practices, creating a self-reinforcing negative environmental impact.
- **Limited institutional capital formed around the food sector relative to the overall size of the industry.** Global food and agriculture assets under management sit at just \$130 billion.¹³ Consider that in Asia alone, annual spending on food is expected to double from the current \$4 trillion (2020) to \$8 trillion (2030E), and the Asian food sector is estimated to require incremental investments of \$800 billion above existing levels over the next decade in order to satisfy consumer demand and build a safe, secure and sustainable food supply chain.¹⁴

These are problems that private equity investors are well suited to solve. Investors have many options as to where to deploy capital and are increasingly conscious about how their investment dollars will impact people and the planet. We believe that the food sector in Asia is highly attractive, not just from the perspective of potential financial returns, but also from the perspective of having an outsized positive ESG impact per dollar invested.

11 United Nations, FAOSTAT.

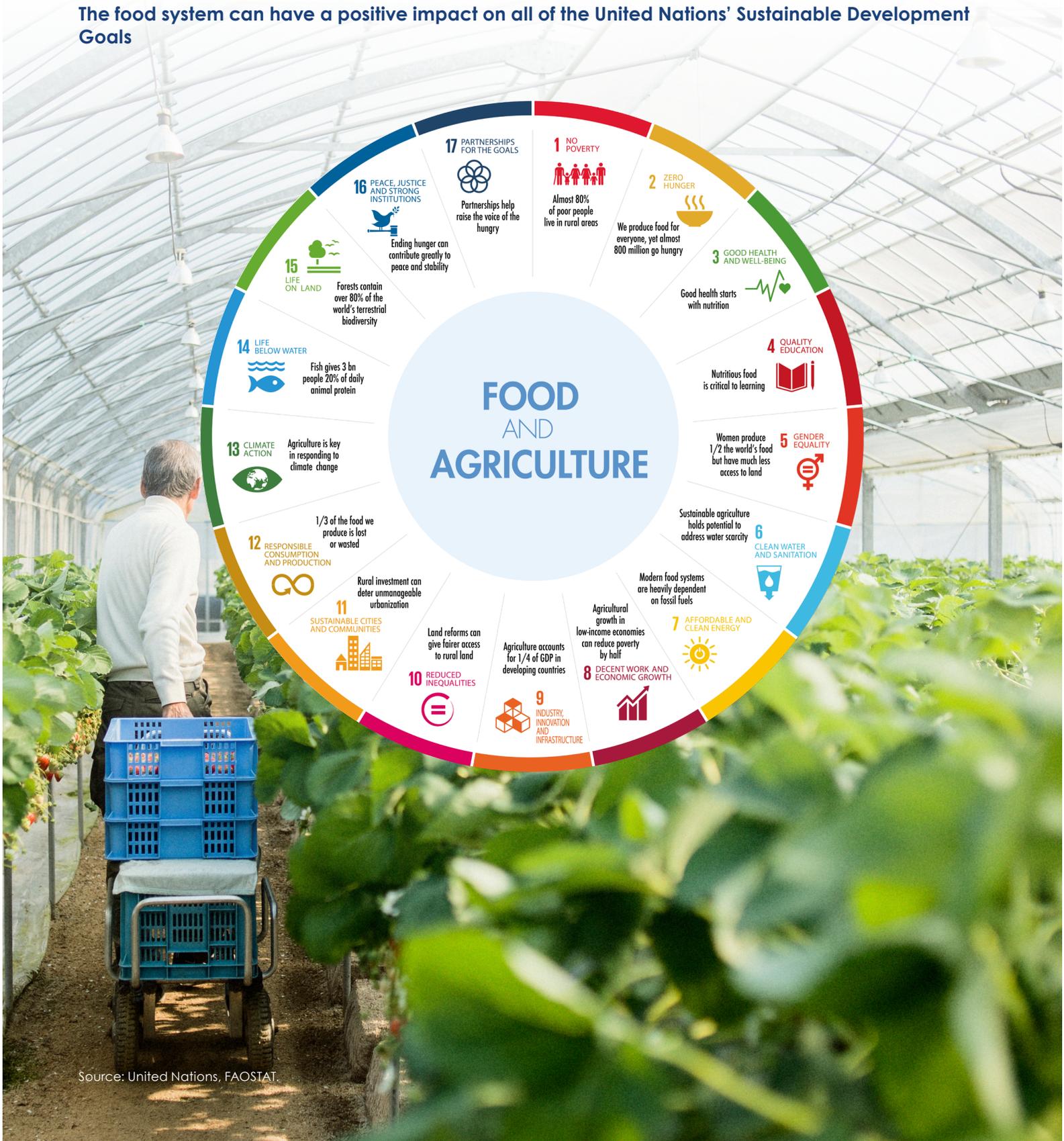
12 United Nations, World Population Prospects (2019).

13 Global AgInvesting, Rankings & Trends Report (2019).

14 PwC et al., The Asia Food Challenge. Excludes required investments in the downstream food sector (e.g., retail and foodservice).

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The food system can have a positive impact on all of the United Nations' Sustainable Development Goals



Source: United Nations, FAOSTAT.

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PROTERRA'S FRAMEWORK FOR POSITIVE IMPACT WHEN INVESTING IN THE FOOD SECTOR

At Protterra Investment Partners, we have been investing in the Asian food sector for over a decade and have always held the view that we have an important duty to do so responsibly, striving to produce quality and safe food while minimizing environmental impact and supporting local communities. We have always integrated ESG considerations into our investment process. While screening for ESG red flags is an important part of our pre-investment due diligence process, we believe that alone does not go far enough.

Consequently, we try to advance positive impact on the ecosystems in which our portfolio companies operate. Investing in the food sector has the potential to create positive change on different scales, from individual lives and local communities, to sweeping global planetary impacts.

In the Asian Food Strategy, we have formulated a framework around how we think about and measure the meaningful and positive effects that our investments and portfolio companies can have along three main pillars:



1. Environment and Climate

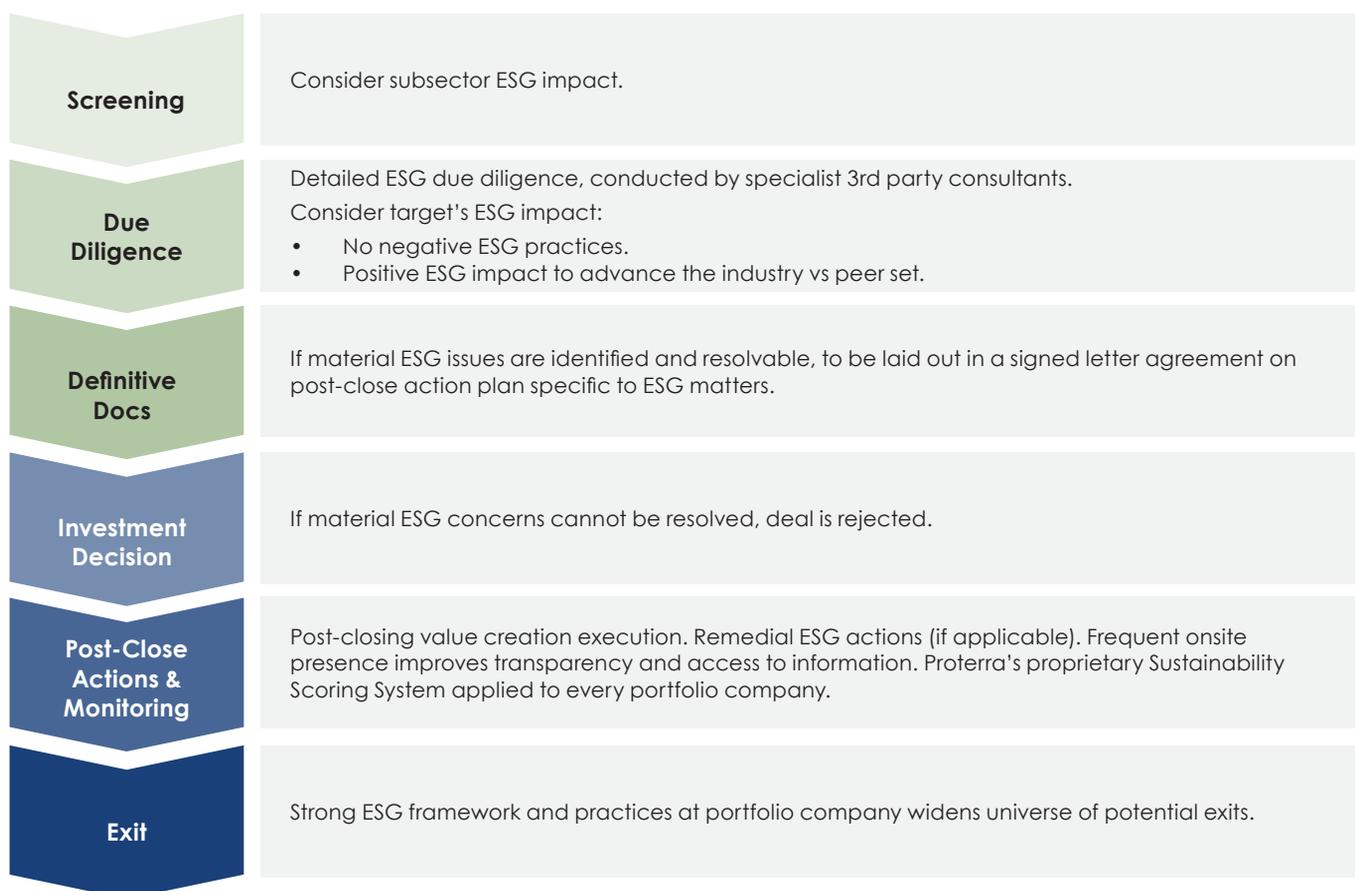


2. Lives and Livelihoods



3. Sustained Economic Development

ESG integration into the investment process



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1. Environment & Climate

FOOD CONSUMPTION & SUSTAINABILITY

There has been an explosion of interest in sustainable food options in Western developed economies. Novel food categories like plant-based alternatives are gaining mainstream traction from people beyond vegetarians and vegans. The new wave of novel proteins has been developed to even more closely imitate animal proteins, but continue to be priced at a meaningful premium.

Plant-based minced beef alternatives are priced between 2.5x to 4x the price of frozen minced beef, with the premium in Asia being even higher than in the average American grocery store.¹⁵

We believe there is an important role for investors who can leverage their deep expertise and understanding of food supply chains to scale these sustainable food products, significantly reducing the cost of production and the selling price so that they become more accessible to consumers – not just in Asia but also around the world.

FOOD PRODUCTION & CARBON INTENSITY

Improving the efficiency of food production in Asia is low hanging fruit. The high degree of fragmentation in much of Asia has led to sub-scale operations, in turn leading to low and inefficient feed conversion ratios, poor food safety and quality, high levels of waste in the supply chain, and poor farming practices. This is a key reason the average farm in Asia has high carbon intensity, emitting a higher amount of carbon into the environment per unit of food produced.¹⁶

While the megatrend is to move towards ever more sustainable sources of food, it remains a practical reality that large segments of the Asian population, particularly groups that are only just entering the middle class, will continue to consume animal proteins at an increasing rate per capita.

The average Chinese citizen currently consumes only 5.5 kg of beef per annum, relative to 37.2kg consumed by the average American.¹⁷

Appreciating this reality, it is critical for the global movement to pursue greater sustainability in farming and food production practices. In McKinsey's analysis of the emission reduction targets laid out for the global food and agriculture industry in connection with the Intergovernmental Panel on Climate Change's 2018 report and its warning around the impact of global warming of 1.5° Celsius above pre-industrial levels, farming efficiency improvements account for 20% of the proposed solution.¹⁸

Proterra's measurable impact on carbon intensity

Proterra's past investments in Asia have had measurable success in improving carbon intensity in food production. Across several portfolio companies that engaged in upstream food production, we have estimated carbon emission savings of over 330 million kg of CO₂-equivalent emissions per year, simply by implementing global best practices and technology that creates best-in-class operations relative to the industry average.¹⁹ That is equivalent to the carbon capture of 404,000 acres of forest per annum, or taking 71,800 US passenger cars off the roads each year.²⁰

¹⁵ Proterra analysis of retail prices.

¹⁶ United Nations, FAOSTAT.

¹⁷ United Nations, FAOSTAT.

¹⁸ McKinsey & Company, Agriculture and climate change: Reducing emissions through improved farming practices (April 2020).

¹⁹ Proterra engaged a third-party ESG consultant to estimate this carbon impact based on information provided by portfolio company management teams.

²⁰ Based on conversion rates calculated using the United States Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator.

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2. Lives and Livelihoods

COMMUNITY IMPACT

Beyond environmental implications, the food and agriculture sector is an important contributor to livelihoods. There are an estimated 450 to 500 million smallholder farmers in the world, supporting as many as 2 billion people who live in smallholder farm households.²¹ The vast majority of smallholder farms (approx. 380 million) are in Asia.²² An important challenge as the world re-thinks large scale reform of the global food ecosystem towards a more sustainable future is to take into account how we can be inclusive of the billions of people whose livelihoods are inextricably tied to the legacy food system.

At Proterra, our investment activities in the Food Strategy have resulted in the direct creation of over 8,000 new jobs at portfolio companies – most of these jobs are in rural areas of Asia.²³ Furthermore, our portfolio companies provide strong support for community programs, particularly in the rural communities where they have operations.

Advancing Education in Indonesia

One in six school-age girls miss school during menstruation due to limited sanitation facilities on campus, leading to higher absenteeism and school drop-out rates.²⁴ In 60% of public high schools in Indonesia, toilets are unisex, with no separate facilities for boys and girls.

FKS, which is a large vertically integrated food company in Indonesia, initiated the School Sanitation Program, constructing new and sex-segregated sanitation facilities in schools in Cilegon, where FKS has operations, benefiting nearly 2,000 students. The net enrolment ratio (i.e., the proportion of children enrolled at the schools relative to the total number of children in the community in that age cohort) increased by 17% after the upgrades were made.

Direct Engagement with Rural Farming Communities in Thailand

NR Instant Produce, a global food manufacturer of sustainably produced foods with a focus on ethnic, plant-based and functional foods, launched a farmer engagement program to achieve three principal goals:

1. Provide farmers with a sustainable living.
2. Cut out middlemen from the supply chain.
3. Increase safety and quality of the raw material inputs sourced by the company.

As part of the program, NR helps to build the irrigation systems, sources the right seeds for the crop, and pays the farmers a salary before their crop is harvested. In addition, agriculture specialists are dispatched as part of the educational program for the participating farmers to improve agricultural practices.

NR's farmer outreach program was initially piloted in Kanchanaburi in Thailand, and today supports 1,500 farmers in Thailand.

²¹ Dalberg Global Development Advisors, "Inflection point: Unlocking growth in the era of farmer finance" (2016).

²² Ibid.

²³ Estimated based on information provided to Proterra by portfolio companies.

²⁴ UNICEF, Menstrual Hygiene Management In Indonesia (February 2015).

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Sustained Positive Impact on Livelihoods of Smallholder Farmers Across India

Dodla Dairy is a dairy processing and branded consumer products company in India. There are an estimated 100 million dairy farmers in India, most of whom have two to three dairy cows that they rely on for their livelihoods. Through its procurement and processing network across India, Dodla Dairy purchases raw milk from over 100,000 smallholder farmers across over 6,500 villages that rely on their dairy animals for their livelihoods. Dodla then transports the raw milk to chilling plants, transports the chilled milk to processing plants, then sells the processed milk products across India.

Dodla pays around 77% of the farmers in their supply chain directly (i.e., without a middleman taking a cut) every 10 to 15 days, and helps to facilitate credit provision to these smallholder farmers from regional banks. A separate program that provides cattle feed to the farmers in their network and organizes education programs to help these smallholder farmers prevent common ailments for their cattle.

Proterra invested in Dodla Dairy in 2012, and over the course of Proterra's ownership, the company built 25 new chilling centers and five processing plants that increased the company's capacity and reach across India. Proterra exited its investment in Dodla Dairy via a sale to TPG's The RISE Fund in 2017.²⁵

HEALTH AND NUTRITION

Our food companies serve over 250 million consumers per annum.²⁶ As Asia continues to consume more proteins, our portfolio companies in the upstream food production sector have managed to produce over 5.4 million metric tons of protein since inception,²⁷ employing global technology and best practices that allow them to do so in highly efficient ways while maintaining an intense core focus on food safety and quality.

What is frequently taken for granted in developed economies is often not widely practiced or available in many parts of Asia.



²⁵ Based on information provided by Dodla Dairy and publicly available investor reports.

²⁶ Proterra's estimates calculated based on data provided by portfolio companies and average per capita consumption of different types of food produced.

²⁷ Based on data provided by portfolio companies.

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Investing Behind the Shift from Wet Markets to Supermarkets in China

China is the world's largest producer and consumer of chicken eggs, accounting for around 35% of global production with an estimated market size of \$45 billion.²⁸ 90% of eggs consumed in China are purchased as “unpacked eggs”²⁹ – these are eggs sourced from small scale farms, distributed loose in baskets and sold predominantly in wet markets.

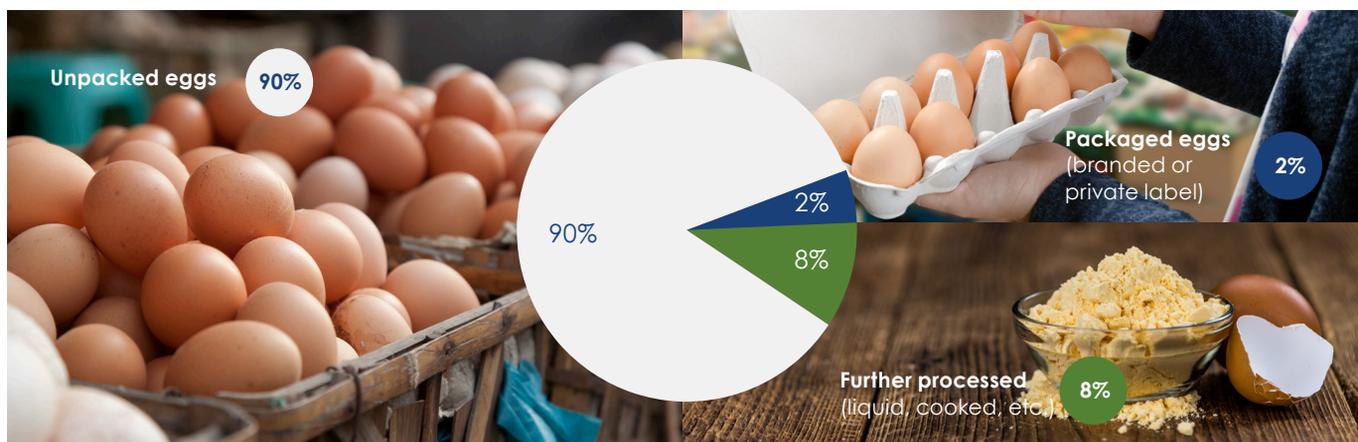
As part of local regulators' efforts to improve the safety of food products sold in China, many small wet markets with lax sanitary practices in Tier 1 and Tier 2 cities have been forced to shut down, and there is a continued shift away from traditional wet markets to modern retailers. In addition, Chinese lawmakers extended the liability (both financial and criminal) of retailers for food safety violations of products they sell, which results in retailers facing significant regulatory consequences for selling unpackaged eggs without adequate food safety assurances.²⁹

Proterra co-founded Phoenix as the majority shareholder in 2018, in partnership with an experienced management team. The company produces branded packaged eggs under its premium Yellow Swan brand, employing best-in-class food safety practices in the industry, with an omnichannel distribution strategy across modern retail and e-commerce channels.

Phoenix has gone over and above the minimum food safety requirements imposed on egg products by regulators. For example, under China's national standards for chicken eggs, there are no restrictions on *Salmonella* levels. *Salmonella* is a type of bacteria that can sometimes be found in eggs, and can infect and sicken people if tainted eggs are not completely cooked through. Phoenix introduced a new national food safety standard in China with cooperation from Japanese food scientists for its Yellow Swan branded edible raw eggs, ensuring that Yellow Swan eggs are *Salmonella*-free.



Egg Volume Share by Format



²⁸ Proterra's analysis of the chicken egg sector in China.
²⁹ See China's revised Food Safety Law, enacted in 2015.

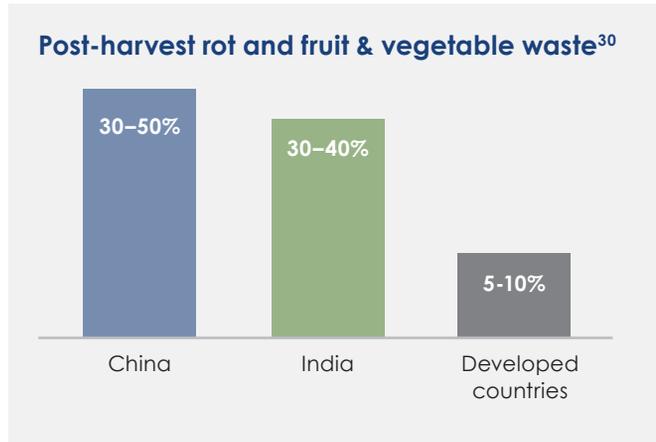
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3. Sustained Economic Development

INFRASTRUCTURE

The Asian food sector has long suffered from chronic under-investment, which contributes to a suite of problems – from high levels of food waste in the supply chain to lack of access to high quality and affordable food.

Investment in physical infrastructure is an important aspect of contributing to sustained economic development in much of developing Asia. Without developed infrastructure, logistics costs remain high, which disproportionately disadvantages the rural poor, while inefficient transportation leads to greater losses in transit, thereby reducing food availability.



Extensive Supply Chains Across Indonesia

Proterra invested in FKS, which operates an end-to-end supply chain across Indonesia, importing agricultural commodities from around the world, processing the raw material, and leveraging its logistics network to distribute its products to customers. It has an extensive warehouse footprint with over 1 million metric tons of warehousing capacity. FKS has also invested in automated port infrastructure which allows ships carrying grains to be unloaded and transported directly to storage facilities, avoiding potential contamination from people, dust, water, and other foreign materials.³¹



Grain discharge using Continuous Ship Unloader and Food Grade Crane and Hopper at the port to a closed conveyor belt that runs straight to storage facilities. This prevents any possible contamination from people, dust, water and other foreign materials.



³⁰ PwC et al., The Asia Food Challenge.
³¹ Based on information provided by FKS.

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Proterra's portfolio companies in the Food Strategy have invested over \$445 million into physical value-added food processing infrastructure and over \$150 million into physical supply chain infrastructure in the food sector over the past decade. These investments will have long-lasting economic impacts on economic growth and lives – people who are part of the upstream supply chain, as well as downstream consumers of food.

Physical Infrastructure Creates Direct Impact on Livelihoods

At Dodla Dairy, \$26 million was deployed to build 25 chilling centers and five milk processing plants to increase the company's reach and capacity. These investments led to the company growing its reach to purchase raw milk from 25,000 additional smallholder farmers.³²

TECHNOLOGY

Food production methods in most of developing Asia often do not employ the best of existing technology available globally, most frequently due to a lack of scale. Many of our past investments employ best-in-class equipment and technology available in the market, combined with specialist expertise from around the globe, to build a food production or processing business at scale.

Using Precision Agtech to Produce Herbicide & Pesticide-Free Nutraceutical & Medicinal Crops

Proterra is a founding and majority shareholder of Simply Fresh, the largest covered environment agriculture farm in India. The company utilizes precision agtech to grow crops in climate-controlled greenhouses (automated retractable roofs and walls), supported by AI-driven irrigation and fertigation (the practice of applying fertilizer to a crop via an irrigation system) systems, with a proprietary data system that tracks the plant's lifecycle and optimizes nutrient intake at each stage of growth.

As a result, the crops produced are fully traceable, free of pesticides and herbicides, and consume less than 10% of the water used in traditional farming.³³

The traceability and pesticide and herbicide-free nature of the crops mean that they can be sold at a premium over traditionally grown crops to nutraceutical companies. The technology also allows crop production to be climate change resilient. Investments in water recycling infrastructure makes the facility a zero-discharge facility and ensures zero contamination risk for the crops.



³² Based on information provided by Dodla Dairy and publicly available investor reports.

³³ Based on information provided by Simply Fresh.

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Comparison to traditional farming methods³⁴

	Simply Fresh	Traditional Farming
 Crop Cycle	20 crop cycles	1-3 crop cycles
 Yield	15 X	1 X
 Water Use	95% savings	0% savings
 Heavy Metals & Pesticide	No heavy metals & pesticides	High levels of heavy metals & pesticides
 Quality	Always consistent	Least consistent
 Nutrition	Precision intake of nutrition at every stage	No additional nutrition

COMMITMENT TO CONTINUING TO IMPROVE OUR APPROACH TO A POSITIVE ESG IMPACT IN OUR INVESTMENT ACTIVITIES

Since inception, Proterra has focused our investment approach to have a positive ESG impact as a core value. As investors in the Asian food sector, we endeavor to deploy our limited partners' capital in ways that have the potential to generate attractive returns while not compromising on our belief that we can and should bring a positive impact through our investment activities. We also strive for continuous improvement in how we influence operational practices at our portfolio companies when it comes to ESG, and often our expectations are more onerous than the typical industry practice.

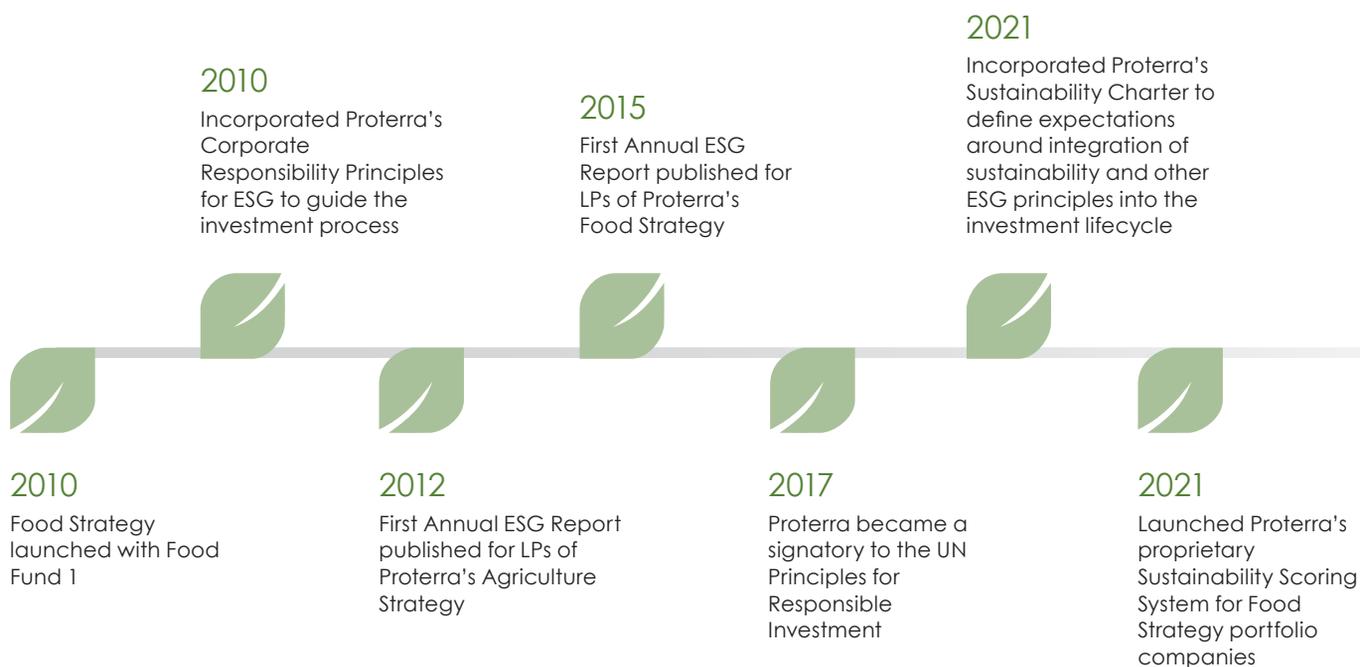
Over time, that has meant implementing additional processes to measure and report on non-financial ESG metrics to our limited partners, committing to organizations like the United Nations Principles for Responsible Investment.

We have also implemented a proprietary Proterra Sustainability Scoring System for all portfolio companies in our Food Strategy, where each portfolio company is scored on a range of ESG measures on an ongoing basis. Measuring these results systematically provides a framework for our teams to make progress with continuous improvements on ESG measures at portfolio companies over time.

³⁴ Based on information provided by Simply Fresh.

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Evolution of Proterra's ESG approach



The time to act is now

The Intergovernmental Panel on Climate Change's 2021 report reminds us all of the intensifying pace of climate change caused by human activity. The time to act is now. We believe allocating institutional capital towards the Asian food sector and deploying it responsibly is an important means to truly move the needle on the impact that humans have had on the planet. We need to implement better ways to affordably feed the 5 billion people in Asia³⁵ with lower carbon emissions intensity per unit of food produced.

Food seems to have begun to capture the zeitgeist of the climate discussion. We believe discussion needs to result in concrete action in the most populous region of the world. We take pride in the positive differences we've made in the Asian food sector so far, but a lot more needs to be done.

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35 Population estimate by 2030 based on United Nations, World Population Prospects (2019).

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