

# Feeding the world sustainably – challenges and opportunities

## Investment Opportunities from Feeding the World Sustainably

The world is facing vast challenges, both from environmental- and social perspectives. During the last 100 years, agricultural activities have been able to feed 3.7x as many people, despite only expanding croplands by 40%<sup>1</sup>. This has been possible due to a rapid increase in the intensity of agriculture and a 90x increase in the use of fossil fuel<sup>2</sup>. While this outcome is positive from a social perspective, it has come with cost that has been paid by nature. Looking to the future, the global population is expected to expand from 8 billion people today to 10 billion by 2050. A 25% increase in population, combined with economic growth leading to a demand for more complex foods, means that food demand will grow by 56% over the same period<sup>3</sup>. What remains clear is that the world cannot apply the same approach to feeding the world in the future as it has done in the past, and especially if we simultaneously seek to reach net zero and avoid further biodiversity losses. Instead, the world needs innovative solutions that will enable it to produce more food with a lower environmental impact. This paper provides insights into how we can feed the world sustainably and identifies compelling investment opportunities that are likely to arise as a result. From an investor perspective, the companies that can deliver effective solutions to these challenges will be in an advantageous position to create value.

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## Digitalization of agriculture

One of the most exciting prospects within sustainable agriculture is the application of technology to increase efficiency of farming practices. Agriculture remains one of the least digitalized industries, and in many parts of the world, farming practices remain astonishingly similar to how they were carried out a century ago. Over the past decade, this has started to change with the application of leading-edge technologies that enable much better-informed decisions and efficiency. An example of this within precision agriculture is the combination of machinery and vision technology that provides for a more efficient application of inputs, including fertilizer and herbicide. Specifically, vision technology,

<sup>1</sup> Smil, Vaclav. Harvesting the Biosphere. <https://vaclavsmil.com/wp-content/uploads/TWFR-JanFeb2016-Harvesting-the-Biosphere.pdf>

<sup>2</sup> United Nations

<sup>3</sup> United Nations



combined with artificial intelligence and machine learning, eliminates the need for broadcast spraying uniformly across an entire field by distinguishing within 200 milliseconds (or the blink of an eye) between a viable corn- or soybean plant, for example, and a weed, and then only applying a precision application of herbicide to the intended target. The benefit to the farmer is a massive reduction in herbicide usage and input costs by up to 70 or 80%, while maintaining 100% weed control<sup>4</sup>, which is good for profitability, yields and the environment. Such advancements are crucial since 52% of agricultural land today is deemed moderately to severely degraded<sup>5</sup>. In the US, this means that one third of fertilizer applied to crops each year is applied to compensate for the ongoing degradation of soil fertility, costing farmers in excess of \$500 million<sup>6</sup>.

In a similar vein, the agricultural sector is responsible for 70% of total freshwater consumption globally and remains extensively dependent on the availability of rain. Looking to the future where rising temperatures are expected to lead to less frequent and more unpredictable rainfall, the agricultural sector requires significant investment into the digitalization of irrigation systems that can ensure the optimal application of water. Such leading-edge irrigation systems are crucial, as they can generate a 40% savings compared to traditional systems, resulting in both substantial savings for farmers and lower environmental impact. These systems are already in high demand today since 40% of global cropland is exposed to water scarcity<sup>7</sup>.

From an investor perspective, the companies that deliver precision agriculture and digitalized irrigation solutions will be well positioned for the coming decades. Not only will there be high demand for these solutions that should enable significant revenue growth, but selling software enabled solutions with an outsized positive impact on yields and productivity can also expand financial margins and lower capital intensity. The combination of higher growth, expanding margins and lower capital intensity positions the leading companies in the industry for decades of strong value creation.

## Eliminating food waste

In order to feed the world sustainably, the world does not merely need to grow food more sustainably, it also needs to start wasting less. Currently, the world is wasting a staggering 30% of all the food produced, which by itself would nearly be sufficient to feed the additional two billion people by 2050<sup>8</sup>. On the other hand, if the world continues to waste 30% of every incremental piece of food produced, then it will not need 56% more food, but rather 80% more. From an economic perspective, food loss today is equivalent to \$1 trillion of lost potential, whilst from an environmental standpoint, the wasted resources from this production equates to 4.4 gigatons of greenhouse gas emissions<sup>9</sup>.

The food waste issue is different in developed and developing countries. In developing countries, much of the challenge stems from insufficient levels of refrigeration, minimal availability of farming technology, and poorer farmers being forced to harvest early due to lack of food and money. In

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<sup>4</sup> Ruigrok T, van Henten E, Booij J, van Boheemen K, Kootstra G. Application-specific evaluation of a weed-detection algorithm for plant-specific spraying. *Sensors*. 2020;20:7262. doi: 10.3390/s20247262.

<sup>5</sup> Nature-based solutions in agriculture: The case and pathway for adoption (<https://www.fao.org/3/cb3141en/cb3141en.pdf>)

<sup>6</sup> Simpkins, Kelsey, "Soil Degradation Costs US Corn Farmers a Half-Billion Dollars Every Year," CU Boulder Today, Jan. 12, 2021. < <https://www.colorado.edu/today/2021/01/12/soil-degradation-costs-us-corn-farmers-half-billion-dollars-every-year> >

<sup>7</sup> Liu, Xingcai, et al, "Global Agricultural Water Scarcity Assessment Incorporating Blue and Green Water Availability Under Future Climate Change," AGU, April 23, 2022. < <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2021EF002567>

<sup>8</sup> United Nations

<sup>9</sup> Rezaei, Maryam, and Liu, Bin, "Food Loss and Waste in the Food Supply Chain," FAO, July 2017.



developed countries, the challenge ultimately comes down to buying too much and throwing too much away. One of the most promising technologies to curbing food waste is the application of enzyme technology in food production. Enzymes are biological solutions that can make food products like bread stay fresh for longer, which leads to longer shelf life, and ultimately less food being thrown away.

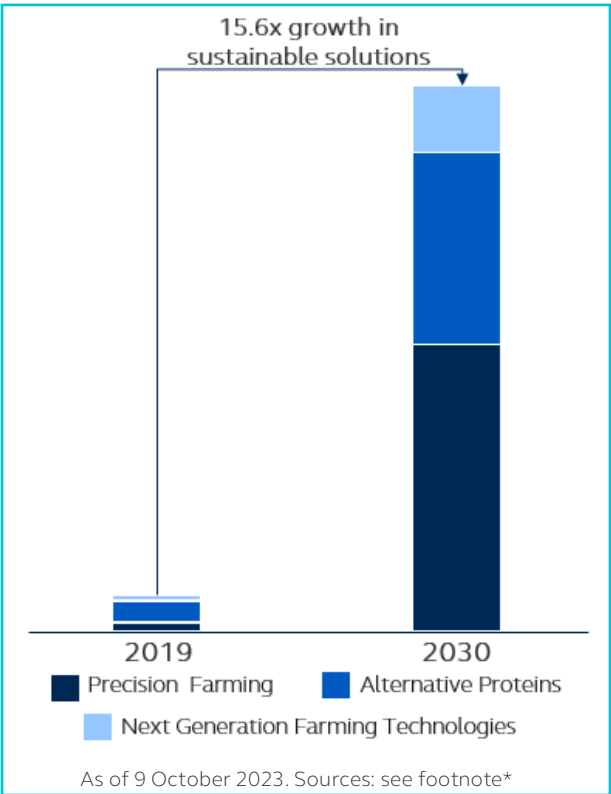
From an investor perspective, the opportunities from expanding the availability of farming technology and refrigeration to developing countries, as well leading-edge technologies like enzymes, are vast. Research shows that the market for solutions to curb food waste is set to reach \$64 billion by 2030, which equates to a 5.7% compound annual growth rate (CAGR).

### Artificial intelligence (AI), machine learning and drone technology in agriculture

Given that agriculture remains one of the least digitalized industries, technology-related solutions and enhancements will be crucial to feeding the world sustainably. As noted earlier, precision technology is already having a material impact on the world’s ability to produce more food with a lower environmental impact. This trend will likely continue in the future as these technologies are increasingly adopted by farmers around the world. In addition, many solutions that are having a positive impact today represent emerging technologies that are still in the early stages of deployment. However, these solutions can have an outsized impact in the future. AI and machine learning are already having an impact in sectors such as manufacturing and biotechnology, but they are yet to be adopted on a grand scale in agriculture. That dynamic is likely to change in the future, and as it does, the potential positive impact is immense. Another promising opportunity is the use of drones to continuously monitor plants in the fields, including signs of disease or decay. In those cases, AI holds the potential to identify what may be wrong, and then suggest solutions from data bases containing best practices from around the world. Continuous monitoring means that the AI-enabled solutions can evaluate and learn from the effectiveness of the solutions provided to the problem and suggest alternative actions more quickly if needed, which can lead to higher yields and significantly reduced waste due to less spoiled crops.

### The rise of plant-based protein

Plant-based proteins like beans, lentils, and tofu have been an integral part of cuisines around the world since the dawn of time, but in recent decades, plant-



\*Croptracker: Drone Technology in Agriculture. Statista: Share of global artificial intelligence in agriculture market by farming type in 2019 and 2024. Global Newswire: Global Alternative Proteins Market. Grand View Research: Vertical Farming Produce Market Size, Share & Trends Analysis Report. BCC Research: Global Markets for Precision Farming.



based proteins have evolved into a complex global industry where protein sources including peas, soy, and oats are being used to create new products, including patties for burgers, fa-con to substitute bacon, and oat milk instead of regular milk, which in the US has grown 25x since 2018 (<https://the-ethos.co/oat-milk-outpacing-dairy/>). The rise of plant-based protein has been driven primarily by changes in consumer preferences, as well as people turning vegan, both of which are often associated with younger people. In the United States this is evident by the fact that 5-7% of Americans below the age of 39 are vegan, while only 1-2% of Americans above the age of 59 are vegan. As these younger people become a larger share of the consumer base, their preferences and buying habits will likely result in significant demand growth for plant-based proteins. Currently, plant-based options constitute only 1.3% of total meat consumption, and 15% of total milk consumption; however, they are set to reach \$290 billion in sales by 2035<sup>10</sup>. From an environmental perspective, plant-based proteins also represent tremendous potential given the environmental impact of eating plant-based proteins compared to meat is substantially more efficient. One reason for this is the fact that a kilogram of beef requires roughly 25 kilograms of feed, while poultry is significantly more efficient at 3.3 kilograms of feed per kilo of meat.

From an investor perspective, the prospects of plant-based meat are vast. This will be both for the companies producing and selling plant-based protein, as well as companies in the supply chain delivering the solutions to make plant-based products flavourful and with the intended texture. In this regard, enzymes are also likely to play a material role. Adding enzymes to plant-based meat contributes to both desired texture and taste, but unlike artificial additives, including some E numbers, they are not present in the final product. This is valuable for health-conscious consumers that seek to avoid food products with additives on their labels. Furthermore, since plant-based protein products often include low-cost plant-based inputs, like soy and oats, and sell them at price points similar to their animal-based alternatives, the prospects for profit margins for companies selling plant-based products remain highly attractive.

## Where do we go from here?

What remains clear is that the world will require a multitude of innovative solutions to sustainably feed a future global population of 10 billion people. Precision farming and leading-edge technologies based on AI and machine learning will play a key role, but the world also needs to start wasting less food. Plant-based protein holds vast potential from an investor perspective, both for the companies selling the products and the supply chain and will likely grow substantially in the future as younger consumers increasingly demand alternatives to traditional food products. The challenge of feeding the world sustainably will undoubtedly be a significant investment driver for the companies that deliver innovative solutions to make it possible over the coming decades.

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<sup>10</sup> <https://gfi.org/marketresearch/#milk-market>



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