Lazard Insights

Setting the Table for 10 Billion: The Need for Sustainable Agriculture

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Summary

- Agriculture's central role in food production is responsible for a sizable share of greenhouse gas emissions and poses a unique challenge to this essential sector.
- Current projections imply that the world's food systems will have to produce over 50% more calories by 2050 just to keep pace with global population and income growth.
- Meeting this challenge will create an investment opportunity set that goes well beyond conventional notions of agriculture.
- We believe companies that provide exposure to solutions at the intersection of agriculture and sustainability may be rewarded by the market in the long term.

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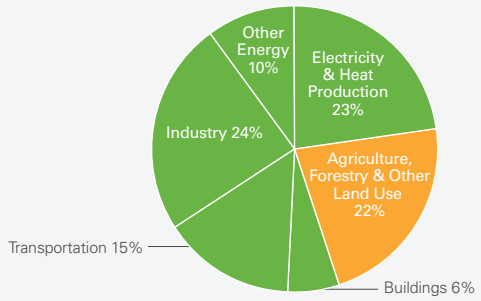
Among the primary sources of greenhouse gas emissions driving climate change, agriculture ranks right up there at the top—contributing almost a quarter. In common with the other sources, it must undergo radical transformation if we are to survive and thrive through the 21st century (Exhibit 1).

Exhibit 1
GHG Emissions by Sector



As of 2019
Source: IPCC

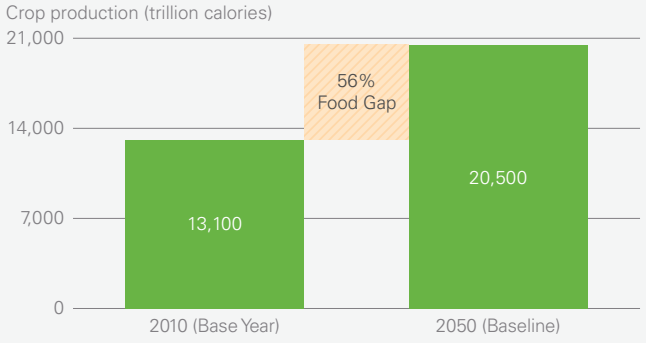
These emissions "culprits" will all undergo revolutionary transformations—disruption, to use the term currently in fashion. However, very few people think of agriculture as a sector where leading-edge innovation takes place, and we agree that the fundamental inputs of agricultural practices—land, water, weather,

and seed—pose a greater challenge on the disruption front than the inputs of some of the other sectors. Moreover, the complexity of the food system is poorly understood by people accustomed to getting whatever they need whenever they need it at the grocery store. Even so, agriculture will need to evolve towards greater productivity to feed a growing global population, while also becoming more resilient to increasingly extreme and volatile weather. This will require "sustainable intensification," aided by new technologies. Agriculture may not be the first thing most people think of when they think of innovation; nevertheless, we expect the pressure of feeding the world to bring about compelling advances in the field in the coming years.

The Food Gap

The challenges—both of feeding the world and curbing emissions—will mount as the population grows. By 2050, the world's headcount should reach 9.7 billion, according to the United Nations, growing by the equivalent of the current US population every five years. Moreover, progress in the developing world means that incomes at the aggregate level are rising as the population grows. Extrapolating from history, rising incomes are generally related to demand for more resource-intensive meals—meat in place of beans. Taking the population and income trends together, the food supply chain will have to produce an estimated 56% more calories in aggregate to bridge the gap between a 2010 base-year production and estimated demand in 2050 (Exhibit 2).

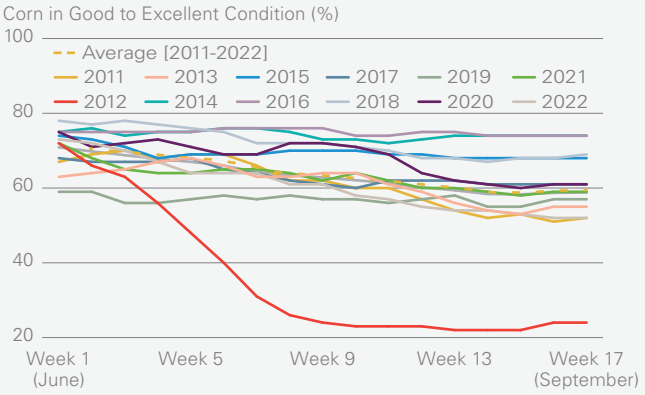
Exhibit 2
Projected Food Demand Is a Critical Challenge for Sustainable Agriculture



As of July 2019
Source: World Resources Institute

The dependence of crops on climate may well complicate the task. One quick example will illustrate the impact severe weather has on harvests and on agricultural economics. A drought in the US Corn Belt in 2012 resulted in a poor harvest, with corn conditions declining to the extent that only 20% of corn was judged good-to-excellent, well below the decade's average (Exhibit 3). With corn conditions being a determinant of yield, overall corn yields fell 16% from the year before. This fall was all the more dramatic because yields had become more stable since the mid-1990s, growing at an upward trend of 1% a year between 1996 and 2011. As a result, the 2012 yield drop translated to 1.6 billion fewer bushels of total corn production relative to the prior year, which in turn corresponded to a decline of about $3 billion in production value.[1]

Exhibit 3
The Corn Quality Crash of 2012



As of 23 September 2022
Source: Bloomberg, USDA

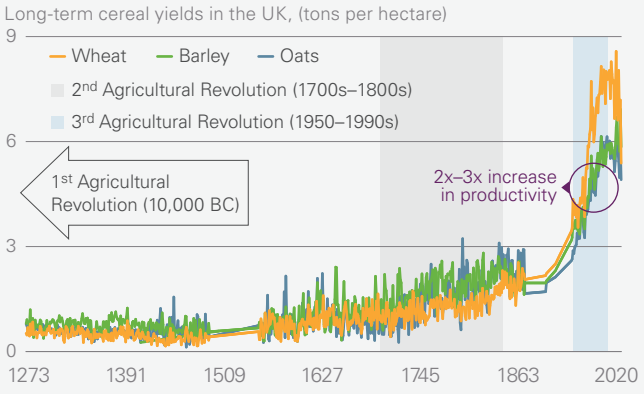
As the climate changes, such extreme events are expected to occur worldwide with even greater frequency. Beyond changing rainfall patterns that may result in droughts, floods, or merely unpredictable seasonal rainfall that poses a challenge to farmers, weeds and pests are likely to expand their ranges.

The Next Green Revolution

Agriculture, according to its historians, has gone through three great revolutions (Exhibit 4). The first dates back to the dawn of recorded time, to the domestication of plants and animals. The second began in the 18th century with the introduction of land rights and crop rotation. Crop yields increased gradually but steadily along the course of these revolutions.

The third revolution—known as the Green Revolution—came in the middle of the 20th century with the technological response to fears of a "population bomb" that would lead to chronic famine. Farm mechanization, advances in irrigation, and high-yielding seeds triggered an unprecedented spike in yields in a matter of a few decades. This productivity increase led to food security for

Exhibit 4
Past Agricultural Revolutions



As of 31 December 2020
Source: Bernstein, Our World in Data, Broadberry et al. (2015), Brassley (2000), UN FAO

millions of people, especially in places like India and Mexico, and had it not happened, the problems we would be facing today would be far worse.

We believe the challenge of feeding 3 billion more humans in the coming years and pressures exerted by a changing climate are already spurring the next revolution.

Innovation in Farms, Food Systems, and Forests

Over the 12 months ending in the first quarter of 2021, so-called AgTech companies raised $7 billion. In 2019, multilateral development banks contributed $3 billion to agriculture and forestry climate financing. Since 2017, about 50 VC-backed startups pursuing solutions for cell-based alternatives to meat have been founded.

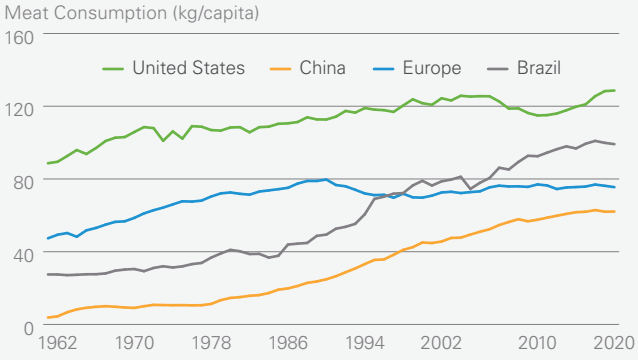
The agriculture opportunity set goes well beyond the narrow, standardized industry classifications of agricultural products, fertilizers and crop protection chemicals, and farm machinery. It begins with the food supply and encompasses the proteins of the future, human and animal nutrition, and even food waste. It extends to the idea of photosynthesis as the best carbon capture technology. Examples include biofuels from certain crops, as well as materials produced following sustainable forestry practices along the timber value chain, including sustainable packaging and the use of wood pulp residue instead of fossil fuels to create plastics. It embraces information technology and mechanical engineering used in the growing field of precision agriculture and in farm automation, both of which are necessary for agriculture to become more productive while using less fertilizer, water, and energy.

We expect many of the most useful—and profitable—advances to come not only from tightly targeted venture capital investments but also from publicly listed companies with the financial resources to sustain incremental development, the footprint to scale commercially, and the research prowess to execute. We look to utilize the full spectrum of solutions provided by public equities to address the challenges of sustainable agriculture.

The Fate of the Entrée—a Diversified Protein Basket

Put it all together, and it's clear that set against 2050's potentially daunting food deficit are the massed forces of human ingenuity and capital markets, which have surmounted challenges of similar magnitude as recently as the previous generation's population bomb. One example is already taking shape in the $1.4 trillion global meat market.[2] While the taste for beef, chicken, and pork is leveling off in the developed markets, it is growing in the emerging

Exhibit 5
Are We Approaching Peak Meat?



As of 31 December 2020
Data is based on food supply from FAO's food balance sheets. Data from 1961–2013 is flagged by FAO as old methodology and post-2013 is labeled as new methodology. No transformations were made to the original data.
Source: FAO

markets as the middle class populations there come to represent an increasing share of the total population (Exhibit 5). However, globally there are projections of meat demand hitting a peak, which may represent a classic case of disruptive pressure.

So, animal protein will always have a place somewhere on the world's dining table as one of many items in a diversified protein basket, which translates into a full spectrum of investment opportunity. Specialty chemical companies are producing feed additives that reduce methane emissions from livestock, reduce the need for antibiotics, and generally improve the efficiency of feed

conversion. Farming salmon, which has a lower carbon footprint than raising animals for beef, pork, or chicken production, should occupy a growing share of the protein menu. We anticipate that price competition and more definitive data on the nutritional value of plant-based meat alternatives may pose competitive challenges but their reduced resource intensity is a clear positive. Further out on the technological scale are efforts to cultivate meat, growing animal meat in a controlled environment based on animal cells. In other words, the scope of possible investment ranges from technology and inputs along the cell-based and plant-based meat value chains to products at the cutting edge of animal feed to more conventional salmon farms. An investment framework that utilizes all the tools available to solve a problem is a sensible approach.

Investing in the Planet's Future

To sum up our view, the evolution of agriculture, both in the inputs of the industries involved and in how society mixes and deploys the outputs, offers a wide scope for the long-term investor. We believe that overcoming the challenge of future food supply in an equitable manner over the next generation is so critical that companies that provide an exposure to solutions at the intersection of agriculture and sustainability will be rewarded.

Notes

1 Yield growth estimated from 1996/97 to 2011/12 marketing years. Loss in corn production value (nominal dollars) is estimated using 2011/12 and 2012/13 marketing year data for yield, production, and average farm prices from the USDA World Agricultural Supply and Demand Estimates (WASDE). Source: USDA, Gro Intelligence

2 Source: Barclays

Important Information

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