Chapter 7

Innovation and the Quest to Feed the World

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7.1 Introduction

Our ability to feed a growing population has been the topic of government policy-makers, economists, NGOs, and most obviously the agriculture community for centuries. In this chapter, we explore the history of hunger relief efforts from communities, religious organizations, and governments and now toward private corporations and innovative agriculture startups. While global levels of hunger and malnutrition have dropped significantly in the last few decades, there are concerns that agricultural advancements and R&D spending are not enough to unlock the true agricultural potential of the millions of smallholder farmers in rural and developing nations. Government spending on agricultural R&D has decreased in the last decade and many of the large-scale NGO activities are now focusing on environmental and sustainability issues. A renewed focus by private corporations' CSR initiatives, coupled with NGOs and startup entrepreneurs, is offering a new approach to innovations in hunger relief.

7.2 Global Issues of Hunger and Malnutrition

Throughout history, agriculture innovation and hunger relief have always been closely connected. The advent of perennial agriculture led to the first permanent settlements over 10,000 years ago, creating the first reliable source of food (Diamond 1998). Agriculture supplied a more stable source of food and nutrients to the early hunter-gatherers and provided the foundation of tribal governance, work rules, tool development, and culture for early civilizations in the Middle East, Asia, and Africa.

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Structured, sustainable agriculture allowed civilization to take root and develop. Small tribal encampments became villages, then city-states, and eventually nations (Harari 2015).

The development of agriculture and subsequent agricultural revolutions allowed for accelerated population growth. Eventually it evolved from simply enabling population growth to reducing hunger resulting from population growth. As population centers grew, fewer people were involved in agriculture and farmers role shifted from self-sufficient harvests for their families to feeding all the members of the community. How to feed a growing planet has been an issue of public discourse for centuries, perhaps since Thomas Malthus wrote in 1798 that “the power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race” (Malthus 1798). Fortunately Malthus’s warning has not come to pass, thanks largely to various technological innovations (first mechanized farming tools, later nitrogen fertilizers, and subsequently the genetic improvement of crops which through the green revolution, the development of transgenic crops and other scientific progress has enabled dramatic increases of productivity in most crops) that have aided the “power of the earth” to meet the demands of a population that has increased eightfold since the eighteenth century. Recently, the issue of food security has come back into the spotlight (Fig. 7.1). After decades of relative stability, food prices have become more volatile, dramatically illustrated by the 2007–2008 global food crisis that saw riots in over 25 countries.¹

Fig. 7.1 Prevalence of undernourished in the world (2017). (Source: FAO 2018 The State of Food Security and Nutrition in the World. DC Donnan analysis)

¹ <https://www.theguardian.com/environment/2010/oct/25/impending-global-food-crisis>

Today (2018), hunger has been dramatically reduced around the world. According to FAO “State of Food Security and Nutrition 2018,” out of a world population of well over 7.6 billion, only approximately 821 million are undernourished (FAO, IFAD, UNICEF, WFP and WHO 2018). This is a dramatic decrease from 30 years ago when over a 1 billion people were considered hungry and malnourished worldwide. Even with a slight increase in global undernourished population in recent years, hunger has been reduced from 20% of the world population to 11% today (Fig. 7.2). If we look deeper, we find that most hunger and malnourishment exist in areas where access to nutritious food is limited for a variety of reasons. External forces such as drought, insect damage, transportation availability, and geopolitical conflict are much greater influencers of food access than agricultural productivity. We currently are producing enough food to feed the world; it is just not evenly distributed.

That still leaves us with the question of how to feed the future population as we continue to witness continued, although slowing, global population growth. Current estimates predict that the global population will increase to over 10 billion people by 2050, an increase of 2.5 billion or 35%. There is no linear relationship between population growth and the necessary increase in food calories. Resources like land, water, soil are finite. But we can improve their effectiveness by increasing our agricultural productivity or yield (Figs. 7.3 and 7.4). The unknown variables are human diet, climate, and access.

Fig. 7.2 Number of malnourished people in the world (millions and %). (Source: FAO 2018 The State of Food Security and Nutrition in the World. DC Donnan analysis)

Fig. 7.3 Increase in agricultural output required (to meet projected demand). (Source: The future of food and agriculture, FAO Rome 2017 DC Donnan analysis)

Fig. 7.4 Growth in land and labor productivity (1961–2005). (Source: OECD Library Global and US Trends in Agricultural R&D in a Global Food Security Setting 2012 DC Donnan analysis)

As population groups become more affluent, they eat more processed food and increase their protein consumption to replace plant-produced proteins. As a result, we find the 35% increase in population will require almost 100% increase in crop production to meet the shifting diet and nutritional needs.² Climate has always had a significant impact on agriculture from regional droughts to early frosts and excessive rains destroying entire harvests. Access is still the most significant contributor to famine and hunger. Globally we produce enough food but due to lack of infrastructure, geopolitical conflicts, and spoilage, we are unable to efficiently get it to those in need.² Finally, as a society, we do not utilize our food resources well. Food

waste is a significant issue. It is estimated that between 25% and 30% of all harvested food is wasted either through cultivation, transportation, processing, and consumer plate waste. Managing and reducing food waste can go a long way to closing the food gap between agricultural production and population consumption.²

7.3 The Long History of Hunger Relief

Charity and feeding the hungry have always been part of human society. It was first referenced in biblical times in both Christian and Jewish scriptures.³ Throughout history hunger relief was a localized event focused on the less fortunate members of a community. As civilization evolved, the task of feeding the poor migrated from communities to churches and religious organizations and then to larger-scale government institutions. In the Ottoman Empire, the development of public soup kitchens – which handed out free food to the needy in a combination of patronage, hospitality, and charity – and food banks evolved in collaboration with the churches (Cohen 2005).

Another example of community outreach on a global scale occurred in 1847, during the height of the Irish Potato Famine; a Choctaw community in Oklahoma, USA, who had been forcibly removed from their ancestral land during what came to be known as “The Trail of Tears,” pooled its money to help feed starving families across the Atlantic, raising \$170 (\$5,000 in today’s currency) to donate to the people of Ireland. In 2015, Ireland erected a monument called Kindred Spirits to pay tribute to the Choctaw people’s generosity. Irish schools still use this history lesson to teach the spirit of true selflessness.⁴

After World War I, large-scale, government-state-funded hunger relief became more prevalent as shipments of foodstuffs were organized to feed the needs of refugees and inhabitants of war-torn regions. Federal food assistance programs arose during the Great Depression when excess wheat production was diverted to feed the poor and less fortunate peoples in the United States.⁵ In the 1940s, the newly established United Nations (UN) became a leading player in coordinating the global fight against hunger. The UN has three independent agencies that work to promote food security and agricultural development. The first, the Food and Agriculture Organization (FAO), created in 1943, is a specialized food and agriculture agency tasked with eliminating hunger, food insecurity, and malnutrition; reducing rural poverty; enabling more efficient food systems; increasing resilience to disasters;

²<http://www.fao.org/tempref/docrep/fao/meeting/018/k6021e.pdf>

³<https://www.nationalgeographic.com/foodfeatures/feeding-9-billion/>

⁴<https://www.irishtimes.com/news/ireland/irish-news/choctaw-generosity-to-famine-ireland-saluted-by-varadkar-1.3424542>

⁵<http://nrs.harvard.edu/urn-3:HUL.InstRepos:8846747>

and making agriculture, forestry, and fisheries more productive. The second, the *World Food Programme* (WFP), established in 1961 as a joint FAO/UN joint venture, provides emergency food aid and humanitarian services. The third agency, the *International Fund for Agricultural Development* (IFAD), formed during the food crisis of the early 1970s, is tasked with providing improved technologies and production methods to the poorest nations of the world (Shaw 2007).

Most hungry and malnourished peoples live in rural areas and earn their livings by working on small-scale farming, fishing, or forestry. Almost 75% of these farms, around 375 million, are smaller than one hectare in size and provide barely enough food for the family to live. Programs that helped rural families in times of crisis were often extended to become permanent relief operations. While assisting in immediate hunger and nutrition efforts, these programs did little to improve the long-term viability and sustainability of the rural poor.

After decades of hunger relief programs, a shift in policy emerged in the 1980s. Leading food donor nations became weary of providing excess foodstuffs to other food deficit nations. It was becoming evident that the wholesale export of charitable grains and foods to developing nations was hurting their ability to develop their own sustainable agriculture economy.⁶ A new “market-based” approach started to emerge that emphasized self-sufficiency and building infrastructure to support local farmers and sharecroppers. Food aid shifted from exporting food to providing the necessary funds and expertise to develop agricultural food systems within countries and regions (Fig. 7.5). While governments led this shift, the newly emerging

Fig. 7.5 Financial flows to low-income countries (US\$ Millions). (Source: The future of food and agriculture, FAO Rome 2017 DC Donnan analysis)

⁶<https://www.weforum.org/agenda/2015/10/does-foreign-aid-always-help-the-poor/>

multiregional and global corporations started to become involved since they owned the production and distribution infrastructures need to provide access to food.

7.4 A Shift in Values: The Emergence of Corporate Social Responsibility (CSR)

As governments of developed countries reduced food relief efforts in emerging economies, corporations began to see an opportunity for growth through expanded markets. In lieu of reduced government intervention, corporate social responsibility (CSR) programs began to develop, designed to benefit the triple bottom line of economic, social, and environmental stewardship. The failure of Enron, WorldCom, and Tyco led to an increased mistrust of corporations and their ability to work toward the public good (<https://hbr.org/2009/06/rethinking-trust>). As a result, governments and NGOs pushed to solidify the need for better corporate oversight and a rethinking of responsibilities to consumers and the society. CSR initiatives are to some degree a result of the need for large corporations to regain public trust and provide better environmental and social stewardship.

CSR initiatives in the food and agriculture sector often started as environmental sustainability efforts to improve all aspects of the supply chain from farming practices to the use of renewable and biodegradable packaging. As consumers became more aware and vocal about environmental issues, large corporations saw the need to communicate positive results in environmental and sustainability activities. Large corporations have embraced CSR programs as they try to shake the image of “Big Business” and become more socially aware. Large agri-food companies also see CSR initiatives as a direct response to more persistent activism by NGOs focused on social justice topics. In a landmark 2011 Harvard Business Review article, Michael Porter and Mark Kramer argued that a new definition of values creation was emerging in the capitalist system (Porter and Kramer 2011). The concept of shared values was focused on a more sustainable capitalism by ensuring that limited resources such as land, energy, environment, and labor were considered in the overall strategy of profit optimization. As they sought to improve their firms’ reputations, the resolution of societal problems, once the realm of governments and NGOs, became a focus for large multinational corporations who realized they could create economic value by creating societal value through a more efficient use of resources and reconceiving products and services.

Today, according to a recent KPMG survey, over 93% of the top 250 global companies report CSR initiatives.⁷ As they began to value CSR as an indicator of good corporate governance and business growth governments, stock exchanges and regulators are helping drive global corporations’ participation in CSR initiatives. In

⁷<https://assets.kpmg/content/dam/kpmg/be/pdf/2017/kpmg-survey-of-corporate-responsibility-reporting-2017.pdf>

Fig. 7.6 UN sustainable development goals. (Source: United Nations Sustainable Development Goals)

September 2015, the UN developed a list of 17 Sustainable Development Goals (SDG) (Fig. 7.6), including poverty reduction, environmental stewardship, and prosperity through the elimination of hunger, clean water and sanitation, good health and well-being, and improved life on land and below water, detailed in 169 specific outcome goals targeted to be completed by 2030.⁸ Over 43% of the global top 250 companies connect their individual CSR initiatives to the UN SDGs which require governments, academia, private companies, and NGOs to work collaboratively in new and innovative ways.

For food manufacturing companies and retailers, the historic focus on taste and consumption growth has been augmented by a prioritization of consumer nutrition and well-being. Following the 2015 World Health Organization's guidelines on sugar and salt reduction in processed food (World Health Organization 2015), reformulated products were introduced by several large global food companies in 2016.⁹ In agriculture, CSR programs have expanded beyond a focus on environmental sustainability to encompass social impact through reduction of slave labor, small farmer economic improvements, rural development, and the health of migrant farmworkers. Leading food and agriculture companies embrace a comprehensive definition of CSR that covers many of their customers' social, economic, and environmental concerns (Box 7.1). As consumers from developed countries became more aware of social injustices in the agricultural business, exporting companies realized the

⁸ <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>

⁹ <https://www.nytimes.com/2016/11/30/business/nestle-reformulates-sugar-so-it-can-use-less.html>

benefits that attention to the living conditions of workers brings to their businesses (Ortega et al. 2016).

Nestlé, www.nestle.com, is a company that has a 150-year history in the food industry. Its global reach and involvement in everything from chocolate to water and nutritional foods have given it the opportunity to work with agricultural operations throughout the world. Nestlé has had a checkered past regarding social responsibility and environment stewardship, and they have been the focus of activist's scorn and intense media scrutiny.¹⁰ Nestlé's response is to increase their commitment to society and nutrition demonstrated through their creating shared value (CSV) program that works on the individual, community, and planet level on programs in sustainability, nutrition, water, and rural development. In their 2017 report, Nestlé outlines one of its initiatives to empower the next generation of farmers. The Farmer Connect Program helps new young farmers to get the necessary training and mentoring to succeed as prosperous farmers. The benefit to Nestlé is to develop a strong farmer base that will provide a reliable, low-cost, high-quality source of supply for their products.¹¹

Box 7.1 Launching Collaborative Corporate Social Responsibility Initiatives: The Consumer Goods Forum¹

The Consumer Goods Forum¹² (CGF) is an international industry association that represents the leading consumer goods retailers and manufacturers globally. With member companies such as Nestlé, Walmart, Coca-Cola, and Procter & Gamble, the CGF strives to drive positive change through and on behalf of its members. The CGF mission is focused on four pillars and seven strategic initiatives. Two of its key strategic pillars are Social and Environmental Sustainability and Health & Wellness.

The CGF provides a global platform for collaborations between members and NGOs, governments, public health authorities, and other relevant actors to discuss areas for program acceleration and change. For many companies, it is difficult to engage with the variety of NGOs, governments, and agencies on a one-to-one basis. Through the CGF initiatives, the member companies can engage with leading NGO organizations such as the World Wildlife Fund, Greenpeace, International Labor Organization, and United Nations Industrial Development Organization. The CGF provides a more unified forum of engagement as well as a strong communication vehicle for its members to show their motivation and persistence toward their CSR goals. Each of the strategic initiatives is led by co-sponsors from the consumer product manufacturing companies and retailers.

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¹⁰ <https://www.bloomberg.com/news/features/2017-09-21/nestl-makes-billions-bottling-water-it-pays-nearly-nothing-for>

¹¹ https://www.nestle.com/sites/default/files/asset-library/documents/library/documents/corporate_social_responsibility/nestle-in-society-summary-report-2017-en.pdf

¹² www.theconsumergoodsforum.com

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Under the Health & Wellness mission of the association, the members through their board of directors have made joint commitments on behalf of their organizations:

- By 2016: Make company policies public on nutrition and product formulation.
- By 2016: Implement employee health and wellness programs.
- By 2018: Industry-wide implementation of consistent product labeling and consumer information to help consumers make informed choices and usages.
- By 2018: Stop marketing communications to children under 12 for food and beverage products that do not fulfil specific nutrition criteria based on scientific evidence and/or applicable national and international dietary guidelines.

Unlike hunger relief organizations, the CGF is clearly a business-oriented association with the benefit of its members paramount. But they see the clear focus on both employee and consumer health and wellness as a mandate for change. The shift from a charity focus objective to a business and consumer focus benefit has reoriented the nature of the strategies and initiatives. Each company member is free to engage in their own way to develop CSR goals and focus on consumer health through nutrition, fair wages, or safety. This provides a broader approach to the issues of feeding the world through a more holistic approach to well-being, nutrition, and consumer health.

The CGF expects its members to be transparent in both their communications and their reporting. They host webinars, led by members who are looking to share their expertise and best practices on these subjects, and produce resources such as guidelines and toolkits to support members in the implementation of these actions. They also openly discussing them at key industry events like the Sustainable Retail Summit.

¹Consumer Goods Forum website, www.theconsumergoodsforum.com, and member interviews

7.5 Feeding the World: A Renewed Focus on Innovation

At the same time the CSR movement has brought positive change in global sustainability and social justice, we have seen a steady decline in the funding available for agricultural research – particularly by leading governmental organizations. Throughout the nineteenth century, agricultural research and development expenditures were on the rise as new developments in crop and animal science dramatically improved land yields and labor efficiency. The United States was the largest contributor to agricultural research with the establishment of land grant universities (in the Morrill Acts of 1862 and 1890), state agricultural experiment stations (SAES),

Fig. 7.7 Public agriculture research as a percentage of total public research. (Source: <https://www.ers.usda.gov/webdocs/publications/89114/err-249.pdf?v=43244>. Heisey, Paul W., and Keith O. Fuglie. Agricultural Research Investment and Policy Reform in High-Income Countries, ERR-249. U.S. Department of Agriculture, Economic Research Service, May 2018 Agricultural Research Investment and Policy Reform in High Income Countries, USDA May 2018, DC Donnan analysis)

and public-private research partnerships. After the 1960s, many developed nations saw a shift in research to focus more on the environmental impacts of agricultures, food safety, and energy uses of agriculture and away from traditional yield and output improvements (Pardey and Alston 2012).

While government-sponsored R&D has been in decline, there has been a more dramatic increase in private agricultural R&D investments (Fig. 7.7). In 2000, over 55% of agricultural R&D spending in developed countries was through private organizations, an increase of 44% from 1981. In contrast, in developing nations only 6.4% of R&D expenditures are from the private sector with major disparities between regions and countries. The lack of domestic large-scale agricultural companies has been part of the reason for the low proportional investment. But the abundance of small and local farm operations makes large-scale agricultural research and investments more difficult. Most developing nations, apart from Brazil, China, and India, are falling behind in agricultural investments, creating a larger gap between the advanced and developing nations' agricultural capabilities.

Further complicating the reduced investments by developing nations is the nature of agricultural innovation itself. Most improvement technologies used for small-holder farms are either mechanical or chemical applications, both of which tend to be protected by intellectual property rights and patents. This often makes the specific technology application cost prohibitive to smaller farmers in developing nations. Being coupled with the new focus by developed nations away from agricultural productivity toward environmental protection and food safety means that many of the newer innovations may be less applicable to developing economies. This is

Fig. 7.8 Slowing US public R&D spending for agriculture. (Source: <https://www.ers.usda.gov/webdocs/publications/89114/err-249.pdf?v=43244>. Heisey, Paul W., and Keith O. Fuglie. Agricultural Research Investment and Policy Reform in High-Income Countries, ERR-249, U.S. Department of Agriculture, Economic Research Service, May 2018 Public USDA CRIS data series OECD Library Global and US Trends in Agricultural R&D in a Global Food Security Setting 2012, OECD, Agricultural Research Investment and Policy Reform in High Income Countries, USDA May 2018 DC Donnan analysis)

most apparent with larger food and agriculture companies that have adopted the UN SDGs as part of their CSR strategies. Of the 169 targets embedded in the UN SDGs, only 15 are directly related to hunger and poverty eradication.¹³ The focus and capital commitment needed to meet the SDGs will redirect funding away from hunger and poverty programs to environmental and sustainable goals such as deforestation, sustainable seafood, and carbon footprint. The gap in agricultural yield and farm output will not be closed with traditional approaches to R&D and investment funding, but will require a new approach to agricultural innovation, particularly for developing nations to close the agricultural productivity gap they experience.

Over the last several decades, the United States, historically the leader in agriculture research, has reduced the growth of its investments in agricultural and crop research, further amplifying the reduction in available agricultural innovation to developing nations and smallholder farmers (Fig. 7.8).

As government investments have been reduced, the private sector has seen an opportunity to invest in profitable research and development projects. Through much of the twentieth century, private equity and venture capital firms invested in new business opportunities and potential growth business operating models. In the

¹³ <http://businesscommission.org/our-work/valuing-the-sdg-prize-in-food-and-agriculture>

late 1990s and early 2000s, a boom in venture funding emerged, foreign investment in the startups during the dotcom boom and Internet bubble. By 2017, venture funds financed close to \$150 billion in investments in new technology startups, nearly reaching market highs not seen since the Internet bubble in 2000.¹⁴

Compared to technology-led industries, the agriculture industry is still underserved by the technology community and venture capital investors. The agricultural community relies mostly on chemical and mechanical technologies for the majority of their innovations in plant yield, productivity, and cost efficiency. Digital technologies did not easily adapt to the rough and dirty environment of farm-level applications. The digital age initially reached agriculture using GPS systems on tractors to aid in seed and fertilizer applications. Precision farming, which allows more precise application of agricultural protection chemicals and nutrients, is now delivering significant value. Technologies such as automation, decision support systems, and agricultural robots are rapidly being adopted on many of the large-scale farms. The connection of smart sensors through the Internet of Things (IoT) gives farmers valuable information, including soil moisture, nutrient levels, the temperature of produce in storage, and the status of farming equipment. Self-driving equipment connects with satellite imagery to apply fertilizer automatically and relay nutrient information to a farmer's mobile computer. Agtech is still small in comparison to other technology investments, but it is disrupting the agri-food industry by applying new innovative and sometimes counterintuitive technologies on the farm and throughout the food processing industry.

In comparison to the burgeoning \$84 billion technology-led investments in 2017, the Agtech and FoodTech investment market is still relatively small. According to AgFunder 2017 Investment Report, the food and agriculture venture investments – comprised of over 990 deals and 1,487 unique investors – totaled \$10.1 billion.¹⁵ With a 29% increase in investment growth, Agtech deals are getting larger and attracting more prominent investors.

Currently, Agtech investments occur in three broad areas:

1. *Digital Innovation* capitalizes on the latest advancements in hardware and software to create a new system of farming relying on computing power and connectivity. Soil sensors measure ground moisture. Drones collect data and imagery, providing specific and precise crop analytics. Cloud-based advanced analytical solutions process this data to provide growers with direct recommendations. As Randall Barker, Managing Director of FarmLink, states, “There’s an obvious convergence about all these technologies that can be connected and solved for in a data science approach. It’s all about taking the complexity of biology, weather, and math and making it work.”¹⁶

¹⁴ <https://pitchbook.com/news/articles/a-record-setting-year-2017-vc-activity-in-3-charts>

¹⁵ <https://research.agfunder.com/2017/AgFunder-Agrifood-Tech-Investing-Report-2017.pdf>

¹⁶ <http://www.middle-east.atearney.com/documents/10192/7853238/Innovation+in+Agriculture-the+Path+Forward.pdf/4e2d0e75-eea6-42e4-bc6d-6a75450ad8bf>

2. *Biotech Innovation* incorporates scientific techniques to improve plants, animals, and microorganisms. It includes a broad array of solutions, ranging from genetically engineered plants and animals, improved tools such as CRISPR (an improved genome-editing technique with potential in yield improvement, crop protection, ecology, and conservation), and microbial technologies targeting bacteria. Virginia Ursin, Biotechnology Prospecting Lead for Monsanto Company, notes, “18 million farmers globally are growing biotech crops. Ninety percent are in the developing world as smallholder farmers and this technology has made agriculture profitable and has decreased problems with pesticide poisoning. We cannot go back to agricultural practices that will increase the footprint of agriculture. We must decrease the footprint. Sustainable intensification and genetic optimization are essential parts of that.”
3. *Process Innovation* introduces new farming techniques that address constraints on farmers’ productivity and environmental sustainability (see Box 7.2 for a good example on food preserving). Vertical farming combined with hydroponics/aquaponics allows agriculture to flourish in areas without natural soil. Drip irrigation technology uses sub-surface low-pressure piping to deliver water directly to crop roots, resulting in both better yields and preservation of water resources. Desalination removes salts and minerals from saline water for freshwater uses. Efficient technologies, such as drip irrigation and desalination, are some of the tools that Israel has used to produce a surplus of 20% more water than it consumes. Aaron Mandel, Co-founder and Chairman, WaterFX and HydroRevolution, believes that solar desalination can create an affordable, sustainable water source in water-scarce regions. “We need to focus on redesigning the entire sustainable water model from the ground up,” Aaron notes. “WaterFX focuses on leveraging what is happening in the energy industry and applying it

Box 7.2 Connecting Farmers with New Preservation Technologies: HERE Foods¹

The farm to label market connects local farmers with brands and value-added products beyond the basic agricultural commodities. Farmers are always looking for ways to promote their crops and minimize the seasonal volatility that is inherent in commodity products. One example of this relationship is HERE.CO, a Chicago-based company that makes juices, spreads, and salad dressing with ingredients sourced from local farmers. Founded in 2017 by entrepreneurs Nate Laurel and Megan Klein, the company has developed a network of over a dozen indoor and outdoor farms in the Chicago and Midwest US market to provide various fruits and vegetables to its processing plant. The products are sold in over 400 retailers in the Midwest markets under the HERE brand.

What makes this business unique is that it combines the use of a local network of farmers with advanced food preservation technologies. High-pressure pasteurization (HPP) is a cold pasteurization technique that is applied to

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finished packages to kill yeast, mold, and bacteria. Once the juice or spread is packaged, it is placed in a hydrostatic pressure vessel and subjected to over 87,000 pounds per square inch of pressure.

The HERE model works as follows:

- **Farmers:** HERE has direct relationships with local farmers. As a result, they earn more income, gain exposure, and enjoy predictable price and quantity parameters. By developing unique and exclusive supply arrangements with the farmers, the company can receive very fresh ingredients, reliably.
- **Community:** The HERE model decreases food miles, using less resources. With each purchase, money gets reinvested in the consumer's local community.
- **Retailers:** The locally sourced products deliver a unique value proposition to retailers, expanding local products beyond the produce department.
- **Consumer:** HPP products are unique tasting (very fresh and intense flavors), fresh (local ingredients), healthy (clean label and plant based), convenient, and trusted. By applying scale and vertical integration, they can do this at a competitive price point.

By building a community of farmer/suppliers and providing a value-added approach to local produce, HERE hopes to be able to replicate their Midwest model at other locations in the United States and potentially abroad.

¹<https://fieldandfarmer.co/>

to water. Water is just a form of energy. If we have a sustainable, affordable, scalable source of energy, we can actually produce as much water as we need.”

While the new startup entrepreneurs in Agtech/FoodTech show promise, they are still only scratching the surface on the global issues of technology access and feeding those in need. Most startups focus on a commercially viable business model while investors are targeting a profitable exit. Better collaboration is needed between the small startups, venture funds, governments, and corporations to develop innovative, sustainable, and most importantly scalable solutions that can be applied broadly in a global environment. Of concern are the 2.5 billion people that live on the 500 million small farm households in most of the developing economies. Their ability to access innovative agricultural and food solutions is critical to the objective of feeding the planet.¹⁷ For many of these smallholder farms, access to water, improved crop yields, access to capital, and easier delivery to markets are critical resources. Several startups and agriculture innovation have started tackling these perplexing issues:

¹⁷<https://foodsecurityindex.eiu.com> › DownloadResource

- *Nicaragua*: The 22 vegetable farmers making up the Tomatoya-Chaguite Grande co-operative worked with TechnoServe to improve access to markets for their vegetables and sell directly to supermarket chains.¹⁸ They introduced drip irrigation and staggered their plantings to increase the number of harvests per year.
- *USA*: Robert Egger founded the DC Central Kitchen and L.A. Kitchens as culinary teaching, waste food reclamation, and feeding centers for low-income citizens. The combination allows L.A. Kitchens to train low-income people in kitchen skills often while using wasted and discarded foods. Working with non-profit AARP and the Los Angeles City, L.A. Kitchens has flourished under the “buy local” program for several retailers.¹⁹
- *Vietnam*: Metro Cash & Carry works with local vegetable farmers to improve farm yields and employ better agricultural management including crop rotation and improved fertilizer management. The result is improved quality and food safety for the retailer and improved income for the farmer.
- *Nigeria and Kenya*: Hello Tractor is working with over 22,000 farmers, giving them access to low-cost farm equipment rentals using smartphones to access and rent out equipment. Considered the Uber of farming tractors, the smartphone application connects supply and demand. The app lets tractor owners find other farmers in need and rent out their equipment economically.²⁰
- *West Africa*: Easy Solar is a for-profit enterprise with a social mission of making clean energy affordable to off-grid communities in West Africa. It finances easy-to-use, high-quality solar devices to farmers not serviced by the existing electrical grid. Since launching in 2016, Easy Solar has provided electricity to over 40,000 people.²¹
- *Bangladesh*: HarvestPlus is an international NGO focused on biofortification of crops to fight global malnutrition. Most Bangladeshis eat rice, but childhood zinc deficiency and its associated stunting affect 40% of the children. PRAN, a food distribution company, worked with HarvestPlus to supply zinc-fortified rice to farmers and then bought the harvested rice through their distribution system. Over 120,000 participating farmers were able to grow a profitable crop and reduce malnutrition.²²
- *India/Africa*: Digital Green is a unique partnership among technology companies (Oracle, Google, Microsoft), governments (India and Ethiopia), and NGOs (Bill & Melinda Gates Foundation, USAID). Smallholder farmers are given access to data capture and analytics to improve the overall yields and quality from their farms. Digital Green brings technology startups together with practical imple-

¹⁸ <https://www.weforum.org/reports/realizing-new-vision-agriculture-roadmap-stakeholders>

¹⁹ <https://www.latimes.com/food/dailydish/la-dd-la-kitchen-food-waste-20150817-story.html>

²⁰ <https://www.fastcompany.com/3048780/an-affordable-smart-tractor-for-african-farmers-and-their-tiny-farms>

²¹ <https://www.forbes.com/sites/mfonobongnsehe/2018/04/18/30-most-promising-young-entrepreneurs-in-africa-2018/#14e009377474>

²² <https://www.harvestplus.org>

mentation opportunities to prove and scale the technology applications across regions and globally.²³

By aligning incentives based on profits and CSR goals, private businesses are now becoming more involved in localized initiatives to improve farming practices and introduce new technologies to local and small-scale farmers. In some cases (Boxes 7.3, 7.4 and 7.6), they facilitate the access of small farmers to markets and market information and increase their likelihood of commercial success. Technology startups are tackling the issues of hunger and food waste in increased numbers. The entrepreneurial founders of these companies see the elimination of hunger and the improvement of smallholder farmers as being of great benefit – societally and economically. They use their knowledge of crowdsourcing, mobile telephony, and localized initiatives to develop programs that can easily scale using digital technologies. This offers a fundamental new approach to public-private partnerships (PPPs) as the small-scale entrepreneur can tackle larger issues on a smaller scale and then replicate results. In addition to the tech entrepreneurs, private companies and NGOs are working together, creating innovative financing tools and technology transfer mechanisms to meet the needs of the smallholder farmers.

Box 7.3 Connecting Small-Scale Farmers in India: Crofarm and Retail Stores¹

The farm economy in India accounts for 18% of the GDP and provides employment for 50% of the country workforce. While large, it is also unorganized with small-scale rural farmers selling through local village mandis that procure the produce from farmers and then sell it through a series of middlemen eventually delivered to retailers. This results in a fragmented and disjoint supply chain with wide variations in process and income paid to farmers. While India is the second largest producer of vegetables and fruits in the world, almost 25–30% of the products get wasted due to spoilage from poor transportation and cold storage. For Reliance Retail, India's largest retail enterprise, the fractured supply chain results in excessive spoilage and poor quality of the fruits and vegetables delivered to its stores.

In 2016, two entrepreneurs, Varun Khurana and Prashant Jain, established a business called Crofarm to find a solution to the issues of farmers supply of fresh fruits and vegetables to retailers. They had previously worked for Grofers, an online grocery delivery service that operates in 13 cities in India. There they saw the disjoint nature of the farm to retail supply chain for perishable products such as vegetables, fruits, and exotics. After Grofers they spent time with local farmers in Haryana, Uttarakhand, and Uttar Pradesh to understand the issues faced by the farmers trying to sell their products.

From this knowledge and their understanding of retailer needs, they developed a series of applications to link farmers directly with retailers and bypass

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²³ <https://www.digitalgreen.org>

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many of the small village mandis. The applications help farmers select the crops that will fetch the best prices and are in demand as well as connect each farmer to more buyers. By providing better price visibility, the farmers can select the best buyer and time and place to sell. All transactions are digital allowing for quick payment transactions. Crofarm generates revenue through commission, starting from nearly 5% of the price in case of less perishables like potato and onions. It makes a commission of around 15% of the price of green vegetables and 20–25% in case of fruits.

The Crofarm network now connects over 10,000 farmers with leading retailers in India such as Reliance Retail, Grofers, Big Basket, Jubilant FoodWorks, Big Bazaar, and Metro Foods. They have secured cold storage to preserve the fruits and vegetables that require refrigeration. It has also developed an application to connect farmers directly with consumers and utilizes demand prediction algorithms using artificial intelligence and machine learning.

Because of these initiatives and applications, the farmers in the Crofarm network have access to more buyers and better prices. This has helped improve their standard of living while at the same time providing consumers with fresher and higher-quality vegetables and fruits.

¹With \$1M Topline, Crofarm marches toward eliminating middlemen between farm and retail <https://entrackr.com/2018/02/crofarm-eliminate-middlemen-farmer/>. Crofarm website www.crofarm.com

Box 7.4 Connecting Coffee Farmers in Ethiopia: Ethiopian Commodity Exchange¹

In 1984 famine struck Ethiopia with extreme shortages of food and grain crops in the north part of the country and resulted in more than 400,000 deaths. In 2002, another famine occurred after bumper agricultural crops in 2000 and 2001 forced prices to record lows. How could this boom-bust scenario be stopped so that the population would not starve and how can both buyers and sellers of crops be protected against drastic price and volume swings.

Prior to the formation of the exchange, buyers and sellers would often meet locally to exchange product for negotiated prices. Often the buyers would not get payments without significant delays and the buyers were always at risk of poor-quality product or shortages in weight.

The Ethiopian Commodity Exchange (ECX) was established in 2008 as a mechanism to bring farmers and buyers together to trade coffee and sesame seeds and assure both timely delivery and payment. The ECX was established

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with seed funds from the Ethiopian government and USAID and was operated as a public-private enterprise. Quickly the ECX was a success as it provided better market information, standardization of products, and standard contracts. The ECX promotes the following services:

1. Market integrity, by guaranteeing the product grade and quantity and operating a system of daily clearing and settling of contracts.
2. Market efficiency by operating a trading system where buyers and sellers can coordinate in a seamless way based on standardized contracts.
3. Market transparency by disseminating market information in real time to all market players.
4. Risk management by offering contracts for future delivery, providing sellers and buyers a way to hedge against price risk.

The information transparency provided the ability to track coffee movement from farm to buyer organization in an efficient manner, promoting better transportation planning and inventory management. Trucks were able to be scheduled, rather than just being available when they happened to show up at a warehouse. This was particularly important since there was a shortage of delivery trucks in Ethiopia and any inefficiencies were costly. All this resulted in lower costs of supply chain as well as improved crop yields from reduced spoilage.

Behind the ECX is a market information system that ties the various trading systems together. This includes electronic tickers at 200 market sites across the country for disseminating information; farmers' access to mobile phones to disseminate market information via text; a fully automated telephone system which allows traders to access market information 24 hours a day, 7 days a week; and the ECX website that provides real-time data for all commodities traded. The rapid progress of technology was manifested by the increased penetration of mobile phone technology in the nation. Between 2008 and 2016, the number of mobile phones increased from under 2 million to over 50 million for a population of 102 million people.

For all the benefits that the ECX proposed, today it is still primarily an export exchange for spot pricing of two primary crops – sesame and coffee. More works need to be done to find a better platform for smallholder farmers to access a larger portion of the overall commodity profit pool.

¹Ethiopian Commodity Exchange website, [http://www.ecx.com.et/
http://www.2merkato.com/news/alerts/5008-ethiopia-mobile-subscribers-reached-53-million](http://www.ecx.com.et/http://www.2merkato.com/news/alerts/5008-ethiopia-mobile-subscribers-reached-53-million)

7.6 How Profit and Nonprofit Can Work Together

Very high levels of investments are needed to use agriculture to solve the issues of malnutrition and rural poverty, but direct investments have been lacking. With limited government resources available, a new model of collaboration among governments, NGOs, and corporations is being sought to improve agricultural productivity and food access. Governments eager to show progress on social programs have encouraged private sector companies through incentives and taxation breaks to enter program investments. Public-private partnerships (PPPs) were utilized in developing countries to solve large infrastructure issues related to the energy and water sectors. In many cases these PPPs were focused on concessions on contracts and leases and independent energy producers. Many communities and NGOs are skeptical about the true intent of PPP initiatives and whether they were just another means to ultimately privatize public infrastructure. In agriculture, PPPs must operate differently than the water or energy sector since the participants are often independent farmers rather than utilities or infrastructure projects. Agricultural PPP programs, while successful, have had to face several hurdles (FAO 2016):

1. Access to specialists in agriculture, land use, and technology. These usually are supplied by the private sector, but for ongoing success, these skills must be transferred to the community.
2. Access to capital and credit. Often this is the role that the government can play or financial institution with micro loans and farmer credit.
3. Poor infrastructure will inhibit the transportation and storage of food items. Basic road and storage systems must be considered before the program can start.
4. Land rights are often not well understood in many developing nations. Land acquisition and land leasing must be part of the program.

PPP contract relationships are more complex in this sector as farming communities are much more fragmented and lack a unified voice, requiring more community involvement and communications.

While many examples of public-private partnerships exist, they are not as simple as they may seem. For private companies to work with NGOs, they need a knowledge transfer framework, financing, resource availability, and the ability to navigate through local regulatory and government rules. Governments must make the process more navigable by redesigning tax incentives, financing rules, regulatory requirements, and access to public resources.

Typically, the roles of the public agency and/or NGO in the PPP programs are as follows:

- Creating a supportive regulatory environment with appropriate incentives for private sector investment and inclusion of smallholders
- Developing program concepts in alignment with national socioeconomic and sector development priorities
- Designing detailed program guidelines and transparent partner selection criteria
- Promoting the incorporation of risk sharing/mitigation in the design process

- Managing evaluation and selection processes for partnership proposals
- Coordinating negotiation and contract signing
- Ensuring regulatory compliance, including the enforcement of land rights
- Providing funding with assistance of larger for-profit companies
- Linking private partners to local public institutions and services
- Providing technical and managerial assistance
- Monitoring and evaluating the partnership at both the national and local government levels

For private businesses, the roles include:

- Developing business plans with thorough financial and market analysis
- Contributing funding or in-kind resources as agreed
- Leading implementation of partnership activities and delivering results
- Providing professional management
- Securing markets for end products and procuring raw materials from farmers through contract farming agreements
- Providing technical assistance and business management training for FOs
- Disseminating inputs and technology
- Linking farmers to business development services (BDSs) such as financing and third-party certification
- Supporting the monitoring of partnership activities

Companies and NGOs have discovered several reasons to partner:

- **Creating business value and environmental benefits.** A business-NGO partnership can result in measurable business and environmental benefits such as reduced costs, reduced risk, new market development, and enhanced brand value along with reduced environmental impacts in the company's product line, operations, or supply chain.
- **Raising the bar on environmental performance.** Innovations arising from partnerships can create competitive advantage for a business as well as establish a new standard of environmental excellence for others to build on.
- **Leveraging skills and perspectives not available in the organization.** Partnering with an NGO can help a company address issues that it may not have the expertise, skills, or resources to manage on its own. NGOs also provide a valuable outside perspective. For the NGO, a partnership can provide a testing ground for the effectiveness of its approach to an issue.
- **Building respect and credibility.** When a partnership between a trusted NGO and a well-known company delivers tangible results, it improves the image and credibility of both organizations.
- **Providing independent validation.** NGO participation can provide independent "third-party" validation of a company's claim of environmental and social benefits from a project.
- **Helping achieve a long-term vision.** While most leading companies and organizations have long-term goals and visions, they often are preoccupied with short-term priorities in their day-to-day operations. A partnership project designed to

address a long-term issue can help provide the external push needed to realize long-term goals.

In some situations, partnerships may not be practical. If the need is immediate or is one that can be achieved independently, a partnership might not make sense. Similarly, an NGO may determine that a partnership is not the best way to achieve a policy goal or social outcome. In general, if a company or NGO can accomplish its goals on its own, there may be no need to partner.²⁴

For a private company, a PPP partner will have specific goals in their core areas of focus. By better understanding these goals and the NGO's motivations, a company can make sure that it is both meeting its own objectives and satisfying the needs of its partner. Similarly, an NGO should look for corporate partners that share similar social and environmental values (see Box 7.5). Ultimately companies will need to demonstrate a business case for an initiative and NGOs can help frame the benefits and costs such that the company can achieve both. Many PPPs start out as pilot programs used to demonstrate new technologies or techniques and can be scaled once the benefits are understood.

When working with smallholder farmers, the ownership of the final operating model and business must be transferred to the farmer. This may be difficult to achieve since the ownership also implies risk. Both the NGO and the private company need to be able to mitigate the risk during the pilot phases prior to the scale up of the initiative. This may require additional farmer training, assumption of the initial technology investments, and modifications to the contracts and agreements to allow more flexibility in operations. As the project moves from pilot to scale, the PPP should allow for shifts in conditions to enable creative financing, supply contracts, and inclusion of additional commercial partners. All of these will be required to achieve scale and replicability in other regions.

The Institute of Medicine – Building Public Private Partnerships in Food and Nutrition Workshop is one of the best resources for agriculture-based PPPs (IOM 2012). These text and workshop materials cover the full range of governance and operating rules for companies and NGOs to work together. The workshop covers all aspects of how to choose business partners and how to manage expectations through the initiatives.

Some corporations treat hunger relief and agricultural innovation in ways that do not involve their CSR initiatives. By focusing on profitable economic and social change, the initiatives try to provide an opportunity for seed financing, skills training, and expertise to be transferred to farmers and regional economic systems (Kaplan et al. 2018). This approach is analogous to venture capital and startups. A larger corporation realizes that single-use funding or shared expertise is not enough to develop a sustainable economic and supply system for local farmers. They focus on a well-thought-out business plan, coupled with seed capital and supply chain partners (suppliers and customers) to ensure the sustainability of the new business

²⁴ <http://gemi.org/resources/GEMI-EDF%20Guide.pdf>

Box 7.5 Solving Food Waste and Feeding the Hungry: Feeding America and Starbucks

The concept of food banking was developed by John van Hengel in Phoenix, AZ, in the late 1960s. Van Hengel, a retired businessman, had been volunteering at a soup kitchen trying to find food to serve the hungry. Van Hengel established St. Mary's Food Bank in Phoenix, AZ, as the nation's first food bank. In its initial year, van Hengel and his team of volunteers distributed 275,000 pounds of food to people in need. Word of the food bank's success quickly spread, and states began to take note. By 1977, food banks had been established in 18 cities across the country. Today Feeding America is comprised of over 200 regional food banks that feed over 46 million people in the United States, making it the largest hunger relief agency in the United States.

What started as a small, single store in Seattle's historic Pike Place Market, Starbucks Company has grown into a global leader with 24,000 stores in 70 countries. Starbucks's mission is "to inspire and nurture the human spirit – one person, one cup and one neighborhood at a time." Howard Shultz, the CEO of Starbucks believes that an economic mission must be balanced with a strong social mission as well. "As a business leader, my quest has never been just about winning or making money. It has also been about building a great, enduring company, which has always meant striking a balance between profit and social conscience."

In addition to its coffee and tea products, Starbucks locations sell ready-to-eat foods from their refrigerated counters. Many of these foods are made daily and packaged for a grab and go format. However, at the end of the day, any prepared food that had not sold had to be discarded to maintain the high quality and freshness that Starbucks wanted. Starbucks decided to start a program to donate its ready-to-eat prepared meals from each of its Starbucks stores in the United States to local foodbanks and hunger relief agencies. To be able to scale this effort across the nation, Starbucks decided to work with Feeding America to coordinate nightly pickups of prepared foods and distribute it to the food banks and relief agencies that were working with Feeding America.

The Starbucks FoodShare™ program provides over five million meals to families and individuals served by the Feeding America network. As the program is rolled out to all the company-operated Starbucks stores, the goal is to provide as much as 50 million meals by 2021.

The challenge with the initiative was the coordination of nightly pickups at over 7600 stores and the goal to be in and out of each store in 5 minutes so as not to disrupt the store operations. This required the coordination of hundreds of local food pantries to pick up the packaged foods in refrigerated trucks each day. This allowed the food pantries to pick up sandwiches and other prepared foods nightly and have them ready to be distributed to customers the following morning.

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Jane Maly, Program Manager, Global Social Impact, saw many unanticipated benefits from the program, “In speaking with Food banks, we quickly learned that their concerns primarily revolved around running an overnight shift, seven days per week to pick up food at Starbucks stores. It took a few innovative leaders in the food bank network to address the concerns through a pilot test, which ultimately demonstrated the advantages of operating the program overnight. For example, there are very few vehicles on the road at night, the stores are usually empty of both customers and employees, and the overall logistics of picking up donations are much more efficient.”

Based on the success of the FoodShare program and a few passionate people, technology innovators and food startups are now using crowdsourcing and mobile apps to connect restaurants and food donors that have excess fresh food with the food banks, pantries, and agencies in need. Several startups have already been launched across the United States to fulfill this important need.

Source: Feeding America website, www.feedingamerica.org; Starbucks website, www.starbucks.com

Howard Schultz, Joanne Gordon, *Onward: How Starbucks fought for its life without losing its soul*, 2011;

Interview with Jane Maly, Global Social Impact, Starbucks Coffee Company

Box 7.6 Better Life Farming Alliance

Better Life Farming works together with smallholders to help them on their journey to grow their farms into commercially viable and sustainable farming businesses.

Better Life Farming is an alliance of leading private sector companies providing holistic and innovative solutions that enable smallholders to unlock their farming potential. By connecting global expertise with local insights and partners, Better Life Farming offers solutions, each customized to fully address smallholders’ needs at scale. Bayer has partnered with the IFC, Netafim, and Swiss Re Corporate Solutions to form the Better Life Farming alliance, specializing in investments in developing areas and providing holistic and innovative solutions that enable smallholders to sustainably produce more food and improve the livelihood of rural communities. Each organization brings their strengths and expertise to the Alliance to deliver the most value possible to smallholder farmers:

Bayer: Bayer is a global enterprise with core competencies in the Life Science fields of health care and agriculture. Its products and services are designed to benefit people and improve their quality of life. Bayer is committed to the principles of sustainable development and to its social and ethical responsibilities as a corporate citizen.

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IFC: A sister organization of the World Bank and member of the World Bank Group, IFC is the largest global development institution focused on the private sector in emerging markets. IFC works with more than 2,000 businesses worldwide, using capital, expertise, and influence to create markets and opportunities in the toughest areas of the world.

Netafim: Netafim is the global leader in precision irrigation for a sustainable future. With 29 subsidiaries, 17 manufacturing plants, and 4,500 employees worldwide, Netafim delivers innovative, tailor-made solutions to millions of farmers, from smallholders to large-scale agricultural producers, in over 110 countries.

Swiss Re: Swiss Re Corporate Solutions provides risk transfer solutions to large- and mid-sized corporations around the world. Its innovative, highly customized products and standard insurance covers help to make businesses more resilient, while its industry-leading claims service provides additional peace of mind. The Food and Agriculture Business team provides a comprehensive array of innovative risk transfer solutions, like crop shortfall covers, weather index, and revenue hedges, to clients along the agricultural supply chain. It also serves farmers directly through corporate agribusinesses and other distribution partners.

By bringing together a group of partners with distinct specialties and skill-sets, the BLF alliance provides a comprehensive approach that covers planting seeds, precision irrigation, crop protection, finance, and insurance – all tailored to the specific local and cultural needs of those who farm less than two hectares of land.

Starting in 2016, initial Better Life Farming pilots were launched in areas with high potential for increased productivity in India and Southeast Asia (the Philippines, Thailand, Vietnam, and Indonesia).

India

In Uttar Pradesh, India, the pilot focused on the green chili crop as it is an important cash crop that can provide a consistent income. The project started with 20 farmers in 2016, and since then the BLF alliance has collaborated with more than 1500 smallholder farmers across various villages in the region. In addition, another pilot focusing on smallholder tomato growers was initiated in 2017.

Farmers in India who have joined the program have had tremendous growth, experiencing up to double their previous yields and tripling their incomes.

The Philippines

In the Philippines, the pilot focuses on rice and has sought areas where smallholder rice farmers significantly contributed to the local economy and there was a significant yield improvement potential. The Philippines project started with 40 farmers and 69 hectares of land. From July 2017 to November 2017, that grew to 300 farmers.

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Smallholders who enrolled in the program gained an incremental yield of 57% and a net income 2.7 times higher than the base. BLF aims to partner with 1,767 farmers through 2018, continuing to find ways to increase the agricultural inputs and provide finance for their growth.

Source: <https://www.betterlifefarming.com/>

venture. As the initiative grows and replicates, a second round of financing is often needing to help capitalize the expansion. In both technology and agriculture start-ups, the same finance and business planning approach is used to inject capital at various stages of development to help progress the initiative and ensure suitable management. This is a longer-term endeavor and requires a multiyear commitment of time and resources.

7.7 Final Remarks

With the evolution of CSR initiatives, coupled with the growth of agricultural start-ups and venture funds, the role of agriculture and hunger relief has dramatically changed in the last several decades. A new focus on sustainable growth, capabilities development, and innovative approaches for smallholder farmers has created an environment of continuous innovation that has replaced many of the donation-based hunger relief initiatives of the past. In the next decade, we should see more socially minded entrepreneurs that will work with NGOs and private businesses to solve the issues of smallholder farming and provide the opportunity to introduce both digital and agricultural innovation at the local level to further the quest to feed the world.

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