Investing for impact in the food and agriculture sector in Africa and South Asia

Insights from evidence and our experiences investing in the sector

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We are pleased to publish this evidence review on investments in the food and agriculture sector.

Since our founding in 1948, we have supported over 400 companies in the sector using a mixture of direct equity, funds and debt as well as through the non-financial value we bring through our networks, expertise and technical assistance.

As a development finance institution, we have a dual mandate; to support business growth that lifts people out of poverty, and to make a financial return, which is then reinvested to further improve the lives of people in Africa and South Asia. Over the past year, we have worked with a multidisciplinary team at Wageningen University & Research, a leading institution in the space, to refresh our understanding of the evidence and better understand the impact of our investments. We are grateful to the Wageningen team for constructively challenging our assumptions and helping us to improve our impact framework.

This report highlights the main insights from the evidence and outlines key opportunities for investors who, like CDC, are looking to align their financial returns with impact returns.

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**Introduction**

The food and agriculture (F&A) sector is key to our development agenda and contributes to many of the UN’s Sustainable Development Goals, either directly or indirectly. We invest across the F&A value chain – from agricultural inputs such as seeds and fertilisers, farming of food and non-food crops, to processing and distribution. We also invest in enabling infrastructure that is important for the F&A system to flourish.

A large body of literature exists on the role of agriculture for development. We have not tried to capture this in its entirety but have rather focused on the evidence that is most relevant for private sector development and can help CDC and other investors in their investment decision-making to optimise for impact.

Based on this review, our framework is focused on three long-term impact goals:

- **Economic opportunities**: Through our F&A investments, we aim to scale responsible businesses, enhance productivity and improve market access and linkages for rural communities and farmers, leading to more and better-quality jobs and livelihoods, stronger agricultural economies and inclusive economic growth.

- **Nutrition and food security**: We seek to increase the availability and accessibility of agricultural goods and put more nutritious food on the market, with the longer-term goal of improved food security and nutritional outcomes in our focus geographies.

- **Environmental sustainability**: We want our investments to contribute to greenhouse gas emission reductions, minimise food waste and loss, increase resource efficiency and improve natural resource management, with the long-term goal of protecting natural capital and transitioning to net zero and resilient food systems.

The team at Wageningen University & Research conducted a rapid assessment of the literature to ensure our Food and Agriculture Impact Framework (see Fig. 1 below) and investment activity is informed by the latest and best-in-class findings, as well as engaged with external stakeholders including sector experts, academics, investors, grant makers and businesses.
Before describing the evidence base and assumptions underpinning this framework in more detail, the review identified three overarching points:

- First, any F&A investment needs to be considered as part of a *dynamic and inter-linked system*. A systems perspective helps to step away from linear thinking about causalities, and allows for interdependencies, reverse causalities and trade-offs. Any investment will bring change and needs to be analysed for both direct and indirect impacts as well as impact risks.

- Second, while the evidence may support a certain approach to investing for impact generally, what works in one place may not work in another and context-specificity is key. It is therefore important to assess and monitor the impact of each investment individually, both pre-investment through impact due diligence and post-investment through impact monitoring and management.

- Third, it is important to consider the *wider enabling environment* needed to support any investment. There may be deficiencies in the regulatory and legal framework at a market or country level, for example, or other constraints that need to be addressed for F&A systems to function properly. Private sector parties need to collaborate with other stakeholders to optimise the impact performance of their investments.

In the subsequent sections of this report, we will summarise the evidence for each of our three ultimate impact objectives in turn and share experiences from our portfolio.
What is CDC’s approach to impact?

Sector impact frameworks are aligned with CDC’s overarching Impact Framework. In line with the Impact Management Project’s dimensions of impact, we analyse the impact of each investment in terms of:

- What is the type of impact?
- Who ultimately benefits in terms of people and planet?
- By how much in terms of scale and depth?
- What is the likelihood the impact will be different than expected (impact risks)?
- What is our role in achieving the impact (contribution)?

In addition, we analyse how this impact is achieved through short-term outputs and medium-term outcomes including:

- The direct impact of our investments;
- The indirect impact of our investments, e.g. through economic enablers; and
- The impact of our investments on shaping and catalysing markets.
Economic opportunities

1.1 Development challenge

The majority of people living in poverty reside in rural areas and rely on agriculture for their livelihoods. Despite high urbanisation rates, most of them will likely remain rural by 2030. Agriculture is a major source of income and accounts for approximately 70 per cent of total employment in low-income countries globally. Over the next 15 years, about 1.6 billion people in low- and middle-income countries will be reaching working age. Food systems will contribute a significant share of jobs, through both wage- and self-employment, in these countries (Townsend et al. 2017).

At the macro level, increasing agricultural production in Africa is important for economic growth and stability. Total food production in sub-Saharan Africa has been growing at a slow rate and the continent still relies on imports for approximately one third of consumed calories (AfDB 2016). Falling commodity prices have also created a need for many countries whose economies depend on natural resources to diversify exports and foreign exchanges earnings.

1.2 Key insights

F&A investments lead to business growth and productivity enhancements of investee companies. Development finance institution (DFI) investments in the F&A sector tend to create more jobs than other sectors in the economy

According to a 2013 study by the Overseas Development Institute, DFI investments in the agriculture sector support the most employment due to the labour intensity of the sector. They tend to create direct and indirect employment impacts and have a significant effect on labour productivity. However, such investments might not always contribute as much to long-term economic development compared with more capital-intensive sectors – which may on average lead to fewer additional jobs but have more potential for long-term structural transformation and create employment opportunities outside the agriculture sector.
Investors can optimise their job creation impact by targeting more labour-intensive sectors

At our portfolio level, we are already incentivised to invest in less developed economies and more labour-intensive sectors through our ‘Development Impact Grid’, a screening tool that helps us assess every investment for its potential to create jobs. In a similar way, investors looking to maximise direct job creation within F&A portfolios can prioritise investments in subsectors that are more labour intensive and hard to mechanise. Depending on the business model, this can be assessed through comparing the number of jobs created per hectare or per dollar of revenue, for instance. At the same time, companies that are competitive and productive can accelerate value chain modernisation and contribute to agricultural transformation.

Investing in later, or ‘downstream’ stages of the value chain, such as processing facilities, could stimulate employment and have wider economic effects

For example, Africa currently exports almost 70 per cent of the world’s raw cocoa, but only 16 per cent of ground cocoa, which is typically worth 2-3 times more per ton (AfDB 2016). However, evidence on the economic impacts of investments in later stages in the value chain is much scarcer than for primary production or farming. Investors can help address this evidence gap by measuring the impact of these investments and sharing lessons.

Large firms tend to have higher productivity growth than smaller firms

Cross-sector research shows that large firms tend to have higher productivity growth than small firms (Ayyagari, Demirgüç-Kunt & Maksimovic 2018). They are able to exploit economies of scale, invest more in research and development and are able to attract human capital. They also typically support higher quality and more stable jobs than small firms. The study does not however not distinguish these findings by sector.

Outgrower schemes can lead to better farmer incomes

There is a significant body of literature on outgrower relationships. Analysis by the World Bank confirms that, for marketing interventions such as farm-group arrangements, results are mostly positive on yields, crop prices, profits and value of production. Positive results are mostly due to improved access to modern inputs, farming technology and wider markets, which in turn result from participating in value-chain or contract activities (World Bank 2011).

A systematic review of contract farming by Ton et al. (2017) shows positive income effects for smallholders in contract farming arrangements, covering 26 empirical instances of contract farming in 13 developing countries. The type of contracts however varied widely, with firms providing different service packages to farmers. For contract farming arrangements to survive over time, firms need to offer farmers above-local market prices to keep the arrangement attractive and to prevent farmers from dropping out. However, the authors caution that unsuccessful schemes are systematically underreported and that studies typically focus on cases where initial start-up problems were already overcome, potentially leading to selection bias.

The evidence on how F&A companies can effectively improve outcomes for smaller producers is however mixed

The evidence on how companies can successfully build more inclusive supply chains is mixed. Dalberg and Wageningen Centre for Development Innovation (2018) conducted an exploratory study into 16 different approaches and their effects on smallholder income as well as broader outcomes. Three of these approaches, including outgrower schemes and contract farming, were found to raise incomes by more than 50 per cent across contexts. However, looking beyond farmer incomes, the review did not identify any approaches that performed strongly across four of their selected criteria: a step-change in income, sustained over time, and reached male, as well as female farmers at scale. Across the most successful interventions and case studies identified, the researchers noted four critical success factors: bundling services, connecting deeply with farmers, customising interventions and partnering with governments, civil society actors and peers.

70%

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Outgrower schemes tend to reach a relatively limited number of small-scale farmers, and often not the poorest – this requires innovative approaches and capacity building

In a recent World Bank evaluation of private sector interventions, the agribusiness case studies found that it is easier to integrate relatively larger farmers in the supply chain (World Bank 2019). Innovative financing solutions and capacity building are key to reach smaller farmers. Likewise, the literature on outgrower relationships also indicates that the number of small-scale farmers who are able to take advantage of global market opportunities is small relative to the total number of small-scale farmers at 2-10 per cent (Gneiting and Sonenshine 2018). Likewise, Ton et al (2017) indicate that the poorest farmers are rarely participating in contract farming arrangements.

There are persistent gender gaps in F&A systems – adopting a gender lens is vital to achieve more equal economic opportunities for women

Women have unequal access to and control over productive assets and incomes despite contributing a significant share of agricultural labour (DFID 2014). Economic transformation offers new opportunities for entrepreneurship, wage labour and social empowerment, but women often benefit less from these than men. Successful country-specific solutions have focused on addressing the most important barriers or enhancing women’s participation in markets that they are already active in (DCED 2017). Case studies show that companies are often not aware of gender dynamics, which can lead to missed opportunities as well as impact risks (CSR-Asia 2017).

Impact investors can support the replication of successful inclusion models and practices by sharing lessons learned

This requires investors to set up effective monitoring systems and capturing and sharing lessons, both on successes and failures. Technical assistance will likely play an important role in this. This includes being more transparent about the living wage gap by monitoring the wages and farm incomes related to their investee companies compared to living wage levels in the country.

Case study: Supporting economic opportunities in Malawi

Jacoma Estates is an agribusiness which manages over 1,600 hectares of land in the north of Malawi, growing and sourcing macadamia nuts, bird’s eye chilis and paprika for export. The business currently employs just under 1,000 people, of whom more than one third are women.

The company also works with over 5,200 neighbouring smallholder farmers, connecting them to export markets and supporting them with agri-inputs and technical assistance to enhance their productivity and meet quality standards required for exporting.

In 2016, we made an $8 million investment in Jacoma to help the company grow, create more jobs and expand its outgrower scheme. Jacoma contributed $1.3 million to the local economy since 2016 by buying from smallholders and is introducing traceability to individual farmers, which has attracted interest from multinational companies. The business plans to share irrigation infrastructure with nearly 700 smallholders, boosting their resilience to volatile weather conditions and climate change.

The company has introduced local processing for its macadamia nuts and spice products which helps to capture more added value in-country compared to exporting unprocessed goods, as well as supporting export diversification and the development of a competitive macadamia export industry.
Nutrition and food security

2.1 Development challenge

Good nutrition is essential for sustainable development. It contributes to cognitive and human development, higher labour productivity as well as better health and earnings later in life. The world is however experiencing a “triple burden of malnutrition” due to both under- and overnutrition (Townsend et al. 2016). These challenges are particularly relevant for the countries where we invest, as an increasing population, rising incomes, changing demographics and urbanisation will increasingly create a need for more and better-quality food.

Malnutrition can be broken down into three types (Malabo Montpellier Panel 2017):

- Some 820 million people – the majority in sub-Saharan Africa (1 in 4 people) and South Asia (1 in 6 people) – suffer from undernourishment. They do not have access to sufficient calories for their physiological needs, which can lead to the health problems of stunting and wasting. It is estimated that the world needs to close a food gap of 56 per cent, equivalent to 7,400 trillion calories per year, to be able to feed nearly 10 billion people by 2050 (World Resources Institute 2018).

- Worldwide more than 2 billion people have micronutrient deficiencies with an intake of vitamins and minerals that is below a healthy threshold. The most common deficiencies are iodine, vitamin A, iron and zinc, while pregnant women are especially vulnerable to low levels of calcium, vitamin D and folate.

- Often considered a high-income country problem, overnutrition is increasingly becoming an issue in low- and middle-income countries, especially in urban areas. In Africa, the number of overweight children under five has increased by nearly 24 per cent since 2000, while almost half of the children under five who were overweight or obese in 2019 lived in Asia (World Health Organisation 2018).
2.2 Key insights

The private sector has an important role in increasing the production and distribution of nutritious foods

This includes both naturally nutritious foods (for example, proteins or fruits and vegetables) as well as foods which contain added micronutrients (for example, biofortified staple foods and condiments). There is strong evidence that such investments can lead to improved nutritional outcomes (MQSUN+ 2018; Jenkins, Byker Shanks and Houghtaling 2015). Before pursuing an investment, a baseline assessment can help an investor understand the expected nutritional impact of an investment, for example, through using publicly available data or through collecting primary data. For example, investing in a company that increases local access to protein is expected to have more nutritional impact in a country where protein intake is low.

What is ‘nutritious food’?

Nutritious food is defined as “food that, in the context where it is consumed and by the individual that consumes it, provides beneficial nutrients and minimises potentially harmful elements”, according to the Global Alliance for Improved Nutrition (GAIN).

Improving food security and nutritional outcomes will however not be achieved by increasing agricultural production alone

There are four elements that need to be in place to improve food security outcomes (FAO 1996; FAO 2008):

- The availability of food is determined by food production, stock levels and net trade. Investors can monitor this through company data such as tonnes of food produced and sold.

- People’s access to food depends on their incomes, expenditure, markets and prices. Investors can observe this through market research and by comparing prices with income levels.

- Utilisation of food refers to the ability to consume food safely and properly. This includes proper preparation, processing, cooking and storing of food for nutritional, psychological and social wellbeing, in line with the culture and community surrounding a household, along with knowledge of health and hygiene to reduce the risk of sickness from foodborne illnesses.

- The fourth factor of food stability is about maintaining food availability, access and utilisation over time. This can be interrupted for transitory reasons (such as natural disasters, drought, civil conflict, price hikes, unemployment), seasonal reasons (the regular pattern of growing seasons affecting food supply) or chronic reasons (e.g. poverty preventing ongoing access to adequate food).

Uptake of nutritious products requires demand creation, proximity distribution networks and cooperation

Reaching people with nutritious products can be challenging for companies, especially when consumers reside in more remote and less densely populated areas. Developing innovative and low-cost last-mile distribution networks, for example through a community sales force, can help in reaching remote communities. Creating demand involves raising awareness among consumers and marketing nutritious products. The private sector can cooperate with government and civil society initiatives to improve awareness on the benefits of nutritious products. This could include helping to develop guidelines for healthy and sustainable diets, for example (HLPE 2017).
Food safety is also key to improving nutrition and food security, and the private sector plays a central role in assuring this

“There is no food security without food safety,” according to the FAO, referring to the impact of foodborne diseases on developing country consumers. Most of these diseases are the result of consuming fresh, perishable foods sold in informal markets. While urbanisation will spur growth in modern retail, the informal sector is expected to retain a large share of the market. The burden of foodborne illness is also expected to rise as consumption of risky foods increases and value chains lengthen and broaden (Grace 2015).

The private sector plays a key role in improving food safety in response to public and market demands. The private sector can help improve food safety standards through innovation and technology, labelling and standards, monitoring and surveillance, together with institutions and policies designed to improve food safety governance and control along food supply chains.

The private sector can have a direct positive impact on nutrition outcomes through improving workforce nutrition

Agricultural companies typically have large rural workforces. Workforce nutrition can have a positive impact on a company’s bottom line due to reduced employee absence, increased employee retention as well as improved staff morale and performance (MQSUN 2018). But research in this area is still scarce.

The private sector can also have negative effects on food security, nutrition and health outcomes, either in domestic markets or overseas when exporting. One example is breastmilk substitutes. There is an International Code of Marketing of Breastmilk Substitutes designed to tackle the irresponsible marketing of breastmilk substitutes which can be damaging to the health of young children (Fanzo et al 2018). In addition, research in Asia shows that when multinational food and beverage manufacturers enter developing markets, they often invest in ultra-processed foods which contain high levels of fat, salt and sugars such as soft drinks and snack foods (Baker and Friel 2016). And while supermarkets can bring greater availability of safer and more diverse foods, they also contribute to the increased consumption of ultra-processed foods.

Case study: Improving access to affordable sources of protein

With its monthly supply of 18 million table eggs, 800,000 day-old chicks and extensive distribution network, KEL Foods is providing a much-needed source of affordable protein for Malawi’s population. The average Malawian currently eats only 1.1 kilograms of eggs per year compared with 6.6 kg for South Africans and 15.6 kilograms in the United States (FAO 2017).

We invested in KEL Foods in 2017 to help improve access to, and increase the supply of, naturally nutritious food for domestic and regional markets. The majority of KEL Foods’ production is distributed through its national retail network in Malawi. The company also produces, distributes and sells animal feed.

Our investment has supported the company’s growth strategy. KEL Foods currently employs over 1,000 people – 18 per cent of them women – as well as providing training for small-scale farmers in poultry management. The investment is expected to stimulate the local economy and KEL Foods sources all its maize and soya locally.

We are working with KEL Foods to develop and implement a comprehensive health, safety and environmental management system, including working towards international standards.
Environmental sustainability

3.1 Development challenge

The F&A sector relies on natural ecosystems more than any other sector but is at the same time a major driver of climate change and environmental degradation. For instance, agriculture is responsible for 70 per cent of freshwater use, takes up almost half of the world’s habitable land worldwide and produces approximately 24 per cent of global greenhouse gas emissions. Moving to a sustainable food system by 2050 is essential for sustainable development and will require major changes in the way we produce and consume food (Lipper et al 2017).

The regions where we invest – Africa and South Asia – are already and will continue to feel the impact of climate change disproportionately because of relatively large agricultural sectors and reliance on rain-fed agriculture, whilst their per capita contribution has been relatively low. Farmers increasingly have to deal with the physical climate risks associated with a changing climate, such as drought, floods and storms. There is widespread consensus that climate change will reduce global crop yields, affecting between 35 million people and 1.8 billion people if temperatures rise by 1.5ºC and 3ºC, respectively (IPCC 2018). For more detail regarding CDC’s climate strategy, please see here.

Meanwhile, there is strong evidence that biodiversity is increasingly under threat (FAO 2019c). Biodiversity is indispensable for food security, sustainable development and many important ecosystem services on which food systems depend.

3.2 Key insights

Climate mitigation, adaptation and resiliency strategies are needed in the F&A sector to respond to climate change and secure future sustainable development

Climate adaptation involves adjusting to climate change and its effects – through reducing the reliance on rain-fed agriculture and introducing drought-resistant seeds, for example. Climate mitigation is about reducing or avoiding emissions to limit future temperature rises. Climate-resilient pathways are development trajectories that combine adaptation and mitigation in a complementary way. Whilst there is a lot of evidence on the current status of climate change and associated risks, there is less evidence on the effects of specific climate resilience interventions, particularly socio-economic effects on farmers or companies (Denton et al 2014).
Different parts of the F&A value chain require different climate mitigation approaches - in developing countries these need to be balanced with other objectives described in previous sections

The agricultural stage is the most GHG-intensive stage of the value chain and different approaches need to be taken to reduce carbon dioxide, methane and nitrous oxide emissions. Technological mitigation approaches can help reduce emissions, optimising nutrient use, improving productivity, minimising waste, and reducing the carbon intensity of fuel inputs. Although these actions are necessary, they may be insufficient to bring overall emissions within environmental limits. Beyond the ‘farm gate’, value chain emissions can be brought down further through renewable energy deployment and resource efficiency, which can also bring business benefits. Using biomass-to-power or solar on site, for example, can often cut operational costs for businesses while improving the reliability of service if electricity supply from the national grid is unstable.

At the consumer level, a growing body of evidence suggests that if we are to achieve substantial reductions in food-related emissions, we must address not only how we produce and distribute food, but also what we eat. A dietary shift away from GHG-intensive foods such as meat and dairy products is particularly relevant for developed countries, but it could pose a nutritional challenge for developing countries where the intake of proteins is still low. For any given mitigation measure, decision makers need to consider the extent to which it moves us away from, or towards, a more resilient and healthy system of food production and consumption (Garnett 2014).

The private sector can contribute to climate adaptation through supporting or scaling up the most promising innovations

Dinesh et al (2017) have identified “10 best bet innovations for climate adaptation in agriculture”, which can help to achieve food security under a changing climate, while also delivering co-benefits for environmental sustainability, nutrition and livelihoods. These are:

1. Sustainable agroforestry to diversify farms and enhance resilience
2. Sustainable aquaculture to enhance nutrition and diversify incomes
3. Stress-tolerant varieties to contribute to climate change adaptation
4. Improving smallholder dairy to enhance incomes and improve climate resilience
5. Alternate wetting and drying in rice systems
6. Solar-powered irrigation to expand access to affordable irrigation and enhance resilience
7. Digital agriculture ranging from tailored advice to shared value with millions of other farmers
8. Climate-informed advisories to enhance production and resilience
9. Weather index-based agricultural insurance for countries and farmers
10. Scaling up financing for climate change adaptation in agriculture

Food loss, especially at the early and middle stages of the food value chain, is a major issue in developing countries

Whilst in high-income countries food waste typically occurs at the consumer level, in low-income countries it is more prevalent in the early and middle stages of the food supply chain: during harvesting and post-harvest. Post-harvest losses, i.e. those that occur at the handling and storage stages of the value chain, account for roughly a fifth to a third of all food loss and waste in developing countries. At all stages of the value chain it can be a major contributor to methane emissions. Food loss and waste are however not solely environmental issues but also affect economic and food security outcomes.

The private sector can contribute to climate adaptation through supporting or scaling up the most promising innovations.

What is ‘climate-smart’ agriculture?

Climate-smart agriculture is an approach to transform and reorient agricultural systems to effectively support development and ensure food security under climate change. It aims to tackle three main objectives (FAO, 2019):

1. Sustainably increasing agricultural productivity and incomes
2. Adapting and building resilience to climate change
3. Reducing and/or removing greenhouse gas emissions, where possible

Food loss and waste are not solely environmental issues but also affect economic and food security outcomes.
Reducing food loss and waste offers a win-win opportunity for companies while contributing to broader impact outcomes

The World Bank, FAO and others have shown that investment in reducing food loss can be cost effective and yield good returns for companies, especially when food commodity prices rise (Lipinski et al 2013). Investments and practices that reduce food loss can result in operational efficiencies and deliver positive financial paybacks for companies, according to research into more than 1,000 food-based businesses across 17 countries (Hanson and Mitchell 2017). Successful strategies include better matching of forecasts of supply and demand between manufacturers and retailers, improved manufacturing processes, reprocessing food that does not meet the cosmetic specifications, changes in food packaging and labelling, stock reduction and increased product shelf life, improving supply chain management, and improving post-harvest storage and handling throughout the supply chain.

Food loss and waste remains an under-researched topic

An FAO study (2011) revealed that there are major data gaps in the knowledge of global food loss and waste. Despite these significant numbers, only 5 per cent of agricultural research worldwide focuses reducing post-harvest losses while 95 per cent focuses on increasing crop production. Impact investors can also contribute to closing the evidence gap by sharing lessons from investments and practices that successfully reduce food losses in developing countries. As part of CDC’s online ESG toolkit, we have developed a Waste Guidance Note, including for the agribusiness sector.

Case study: Supporting climate action and a ‘just transition’ in West Africa

Growing demand for wood products in Africa has led to increasing rates of deforestation over the past decade. Miro Forestry is a sustainable forestry company with plantations in Sierra Leone and Ghana. The company is expanding its plantations to 30,000 hectares to meet the growing demand for timber in the region. The company employs approximately 2,000 workers directly, a number which is expected to double over the coming years, mostly in rural areas where there are few alternative formal employment opportunities.

The company contributes to climate mitigation by removing carbon through tree planting and providing a sustainable source of local timber. At least 10 per cent of the land it manages is kept under permanent conservation.

We first invested in Miro in 2015, supporting the recovery of Sierra Leone’s economy following the Ebola outbreak, and have subsequently made follow-on investments to help fund the company's long-term business plan. We've also worked with the Miro team to develop a gender action plan to improve the representation, mobility and job quality of women in the workforce.
Trade-offs and risks to impact

Finally, any F&A investment will be part of a wider inter-linked, dynamic and interactive system and cannot be viewed in isolation. It can create positive impacts in some areas, and zero – or even negative – impact in others. It is important to identify and weigh up the potential trade-offs and impact risks to analyse the net effect on the wider food and agricultural system and develop risk mitigation strategies where possible, including through working with investees towards international environmental, social and governance standards.

In each of our three impact areas – economic opportunities, food security and nutrition and environmental sustainability – trade-offs and interactions can arise both between and within them. Here are some examples:

Interactions between different impact areas could for instance include:

- **Economic vs nutritional outcomes:** Some food items can have a negative impact on nutrition and health outcomes, but at the same time create economic opportunities throughout the value chain. An example is tobacco production which, though detrimental to health for overseas consumers, provides livelihoods for many smallholders in a country like Malawi.

- **Environmental vs nutritional outcomes:** All four elements of nutrition and food security – availability, access, utilisation and stability – will likely be impacted by climate change through its predicted effect on agricultural production, food prices and markets and other parts of the food system (IPCC 2014). There has been research into how to assess trade-offs by geography and food type – such as the EAT Lancet reference diet which limits resource-intensive foods (Willett et al 2019). Climate change is also expected to bring new forces into play by increasing foodborne diseases. Rising air temperatures could lead to an increase in infections from bacteria in food (Grace 2015).
Trade-offs can also arise within impact areas, often arising from interactions between the scale and depth of impact. For example:

- **Economic opportunities – job creation**: Investments in primary agriculture and food processing can support more employment in the short run, but these investments may not contribute as much to long-term structural economic transformation compared with other sectors of the economy (ODI 2013).

- **Economic opportunities – supplier income**: Outgrower schemes can have potential for income improvements with a limited group of farmers. It’s less clear how to achieve income improvements for larger groups of smallholder farmers as described earlier in this report. This can sometimes create a trade-off between depth and scale, i.e. supporting a few farmers with deeper income improvements or many farmers with smaller improvements.

- **Environmental sustainability - climate adaptation and mitigation**: Climate adaptation and mitigation can generate co-benefits but can sometimes also introduce trade-offs. With rising temperatures, farmers are likely to need more irrigation and cooling – such as food refrigeration. This will however lead to higher demand for energy and scarce natural resources, which shows the interactive link between climate change responses and sustainable development strategies.
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